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THE IMPACT OF CIRCULAR ECONOMY IMPLEMENTATIONS IN THE FINNISH TEXTILE INDUSTRY

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I hereby declare that I have compiled the thesis/paper independently and all works, important standpoints, and data by other authors have been properly referenced and the same paper has not been previously presented for grading.

The document length is 11,107 words from the introduction to the end of the conclusion.

Antti Ilmari Leivo ……

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ABSTRACT

In today's world sustainability is a constant in conversations and actions. The textile industry is one of the largest polluters in the world, it is also an industry where circular economy initiatives and implementations have seen results that create a promise of sustainability of production in the future. This work will examine the Finnish textile industry and how the circular economy can impact it with the help of the following research questions: "What circular economy practises have been applied by Finnish textile companies?" "What have been the benefits of these circular economy practices to companies?" "What are the desired future development in circular economy implementation within the textile industry?" And "What are the main issues and challenges of further implementation of circular economy?" The research data was gathered using a qualitative methods approach, with semi-structured interviews conducted with two people working within the Finnish textile industry in different positions, and with a questionnaire sent via email to people working in textile companies in Finland. What these interviews gave insight into was how far circular economy has been implemented within the textile industry of Finland, the data collected gave answers to the general knowledge of circular economy in Finland, circular business models such as prolonging the product life and resource recovery were highlighted as the next steps in Finnish circular textile production. Several companies were mentioned that already operate almost entirely within circular business models. Nevertheless challenges for the circularity within the Finnish textile industry were mentioned, they revolved around recycling processes especially the chemical processes required to separate fibers and the recycling supply chain. Other developmental points mentioned was the required implementation of circular design in oder to create textiles with longer lifespan, cooperation and communication between companies to achieve goals faster, and current consumer purchasing behaviours.

Keywords: Circular economy, Finland, Interviews.

INTRODUCTION

During the last decade people have realised, acknowledged and protested against the pollution of the planet. Many industries have seen a wave of change coming their way because of their earlier production methods and the ensuing waste it created. The textile industry is known as one of the most polluting industries and the most producing industries with estimates of higher production rate and growth every year (Koszewska 2018). Because of the massive amount of resources that the textile industry uses to produce goods a term called circular economy has been attached to the industry (Christensen 2020), the reuse and recycling of textiles have seen a large increase in the last five years (Sandin *et al.* 2017) In it's most basic form the circular economy model sees the "loop" closed, meaning that clothes, textiles, materials are returned to the producer and re-used to create new products, ending the "end-of-life" concept (Kirchherr *et al.* 2017). The circular economy approach has been relevant to Finland from 2015 when the European Union revealed their plan of circular economy implementation, a year later in 2016 the Innovation fund of Finland (SITRA) released their roadmap towards a circular economy implementation in Finland. SITRA gave Finland a 9-year detailed plan to implement this approach and make it work. European Union has also released more detailed plans and initiatives annually that give information regarding the transition towards sustainability and strategies to achieve a more sustainable production (Furferi *et al.* 2020)

Because the term circular economy is still relatively new to the average consumer, especially when looking at the entire span of waste created by textile industries. Thus this work aims to bring forth knowledge of the impact circular economy generates when implemented correctly into the textile industry, focusing on Finland. The author, a Finnish national, an advocate for a sustainable tomorrow and genuinely interested in circular economy, saw this as the right subject to investigate and analyse.

When thinking of the textile industry as a whole the term waste might signify thoughts of excess clothing that is thrown away or poor materials being used to make textile products but the textile industry creates waste on many different sectors which affects the nature of our planet as well as its inhabitants (Behera *et al.* 2021). To Start-up companies that deal in green textile productions have been founded globally and Finland is no exception, companies such as InfinitedFibre and Spinnova have sought to create optimal solutions for recycled fibre that requires significantly smaller amounts of water in their process to create sustainable clothing. Both of these companies have been able to sell their re-created fibres into mainstream retailers such as Jack & Jones and H&M.

The term circular economy is often heard alongside textiles producers because many textile and clothing companies alongside entire countries have pledged to implement this approach to their production, this work aims to find out the impact of this circular economy implementation in Finland specifically in the Finnish textile industry.

Based on this research problem the following research questions have been set:

- What circular economy practices have been applied by Finnish textile companies?
- What have been the benefits of these circular economy practices for companies?
- What are the desired future developments in circular economy implementation within the textile industry?
- What are the main issues and challenges of further implementation of circular economy?

For the collection of the data the author decided to pursue qualitative methods and plans to conduct interviews with people working within the textile industry in Finland. Targeted interviewees

consists of an expert interview with Helena Soimakallio, the sustainability director of Teknologiateollisuus, and another expert interview with Piia Nurmi, who is a lecturer at the Turku University of Applied Sciences and the leader of research teams in Telaketju coalition which specialises in circular economy business models. The interview with Helena Soimakallio will focus more on circular economy in general to gain even more perspective on circular economy in various industries in Finland, including the textile industry.

To support the data a questionnaire created using Google Forms was sent to various people working in textile companies and organisations via email to conduct some form of an email interview. To gain knowledge so that the author was able to conduct interviews on this matter the author read various articles, studies and book chapters on circular economy in general and various articles and pre-existing research on circular economy focusing solely on the textile industry, textile industry business models and recycling models.

The chapters of this thesis are numbered and will each have subsections of information. The first chapter of the thesis will discuss the theoretical frameworks of circular economy while the subsections look into the principle rules and existing business models of circular economy and what models of circular economy exists in Finland. The second chapter focuses on the methodology of the thesis, with the subsections focusing on data collection and data analysis and the third and final chapter will discuss the findings of the research by answering the research questions with the data gained from the interviews conducted by the author and conclusion.

1. CIRCULAR ECONOMY IN THE TEXTILE INDUSTRY

This chapter focuses on the theoretical aspects of circular economy, what it is and what different stages it consists of, by looking at the principles and current models which have been implemented into the textile industry globally and in Finland and what models could be possible to implement in the future.

1.1. Circular economy principles

The term circular economy was created as an alternative to the traditional linear economy, it has been applied in various stages to many different industries to generate a more sustainable line of production, this is often referred as closing the loop. Many countries have also imposed circular economy initiatives on their respective industries, European Union alongside the European Commission has detailed plans and deadlines for member countries to gain traction in driving the circular economy-based production ahead. Although hard to define what circular economy means word-for-word many scholars and researchers have concluded that the centre of circular economy revolves around the preservation of nature and resources (Velenturf *et al.* 2020). With a clear focus on reducing overall waste and recovering resources (Dissanayake 2020) Even with these definitions circular economy could be more potently described when focusing on a single industry and applying the definitions in their production methods.

In an operating circular economy, there are five principles that govern the operational development and efficiency, the first of them being resource validation and appliance, meaning that the levels of renewable resources and non-renewable resources should be overseen and reducing the non-renewable resources in production (Elia *et al.* 2017). The second and third principles focus on adjustments made in waste management, how to minimize and prevent waste in production by using different strategies that work towards resource optimisation. The remaining two operational principles oversee more durable good production and diminish the overall production quantities of products made with non-renewable materials.

Circular economy has been brought to light more and more during the last decade, many industries recognise the potential of cost reduction of recycling and re-using materials but also the viewpoint of the consumer. The collective mind of a consumer is a driving force in bringing changes towards a more sustainable industry standard (Patwa *et al.* 2020) Sustainable solutions in different industries are an attraction to a consumer so in a perfect setting a company could implement a sustainable approach and business models whilst experiencing economic growth.

Glancing at the textile industry known to be a large waste producer consuming large amounts of energy, water, and other natural resources (Islam 2021) Focusing on the textile industries, circular economy can still be defined in many ways but the centric ideas relevant to textiles revolve around producing and reproducing, emphasising on recycling of materials while searching for ways to handle old textiles and creating new product from them. Many circular economy initiatives have promoted the re-use of cotton and polyester to create "new clothing" out of old materials. It has been noted by many researchers of textile recycling that the recycling part is working especially in Europe, but the issue remains that out of the recycled textiles only a small quantity is made into new products (Circle Economy 2018). The circular textile economy could be transcribed as being a system that tries to restore natural capital by re-using natural materials in a continuous production of goods for consumers (Hemkhaus *et al.* 2019).

When looking at the principles of which circular economy within the textile industry depends on it centres around minimizing the use of resources whilst maximising the effort to recycle and then re-use these resources (Velenturf *et al.* 2020). These principles can be divided into three categories which are waste elimination, product circulation and nature regeneration.

One of the most well-known concepts within the framework of circular economy in the textile industry is the three R: s, they stand for Reduce, Reuse and Recycle, This framework although well-known has drawn criticism that alone the 3R: s do not work, this has prompted different researchers to insert additional R: s into the framework. The additions implemented are called Recover, Redesign and Remanufacture. (Srinivas 2021).

1.2. Circular economy business models

In the current climate many companies have strived to operate under a more sustainable business model, this creates a change from the traditional definition that a business model is the framework

on which the organisation is able to create, deliver and capture value (Euchner *et al.* 2019). Circular economy has many different models that can be applied into businesses, these models work to minimize waste and environmental impact while creating value. Focusing on reductions of material and energy usage, recycling of materials and the re-usability of products created (Bressanelli *et al.* 2022). Circular economy models continue to evolve and circular economy itself grows as more companies adopt different models to become more sustainable (World Economic Forum 2022). As many corporations and nations have pledged to alternate their approach to a more sustainable one the transition towards circular business models is currently happening in many different stages. Applying circular economy within an existing business model creates questions and forces research on how to best apply it within large existing companies, furthering this research will help future companies to adopt circular economy business models with less trouble (Lewandowski 2015).

The World Economic Forum dissected the circular economy business models into five key areas (World Economic Forum 2022). Each of these business models could be adapted into polluting industries to start them on a path towards a more sustainable production approach, especially new companies emerging with the parameters of circular economy business models that have been set forth and found working.

The first model is referred to as circular inputting which emphasises recycling of materials used in production, with this model producers could be able to cut down costs of production and total waste created since they are using recycled materials instead of new materials, this business model aims to remove the waste transportation process and supports the waste transformation process, making an asset out of the waste your production creates. This model while greatly in action within the textile industry where excess textiles are gathered and re-used in many different products could also be applied to many industries that generate waste and ship it away to countries with processing infrastructure. With models like this in place the number of textiles sent to landfills could be cut down greatly (Green America 2020). Textile waste being a large issue on landfills,and even with natural fibres the decomposition rates of textile waste found within landfills is estimated to take almost a century (Patti *et al.* 2020).

Their next two models are called sharing and the usage of product as a service. These models have similar ideas, sharing is focused on giving an asset or a product to a consumer eliminating the need to purchase a new one, this model can be applied to many different products such as tools and machines, currently this sharing model is gaining ground with high end fashion products,

providing expensive designer wear for rent (Harvard Business Review 2021). Within textiles the sharing model could refer to any textile product to be rented to a consumer, with companies such as ReWear who create sustainably sourced workwear could rent their sustainably sourced textiles and expand their already existing market using this model (Coscieme 2021). While product as a service would entail selling a service to a consumer or a business for a limited time, both models could be applied to many different industries such as textiles, agriculture, or construction.

The last two models are called the product usage extension, also known as product life extension. This model works to eliminate using new resources to create products so often, this can be done by example repairing the existing product. No one product is able to withstand the test of time until forever but with the usage of high quality sustainably sourced materials the usage of the product can be lengthened and after the products life it could be recycled to become a new product (Peippo *et al.* 2021).

Resource recovery focuses on recovering materials and the energy put into production, and then re-purposing these materials in a reproduction. Many industries have put recovering resources as a priority especially textiles where it is estimated that a single person produces 15 kilograms of textile waste annually (McKinsey 2022). The challenge in recovering textile resources is that many textile products have used a blend of different materials and colourings, making the processing of textile waste difficult, solving this issue has seen merit from Sweden and Finland where government funded research teams have seen success in separating cotton and polyester in recycled textiles (Research Institute of Sweden 2022).

Alongside the definition of the World Economic Forum, many researchers and organisations have added or made their own definitions of circular economy within a business model such as the OECD or created their own principles governing the potential circular economy business model implementation like the Board of Innovation did. The Board of Innovation created three different principles of which a circular economy business model should be drawn from, these are to source operational material from the economy itself, not to use virgin materials, to create value from adding value to existing products and to generate valuable inputs for businesses.

1.3 Circular Economy Models and The Textile Industry

The textile industry itself is a massive component of the economy worldwide (Furferi *et al.* 2020). As with any large industry the effects of production are hard on the nature and its resources, because of the textile industries depend on resources that are non-renewable, actions must be taken now to ensure that the production and resource usage become more sustainable (Mayer 2018). That being said there is potential to include many aspects of circular economy business models within the textile industry, to implement these models' companies would have to be willing to invest time and capital into a sustainable future and because of the popularity of sustainable choices and green initiatives it also serves as an opportunity for growth and development of sustainable methods that can help and set an example for the entire industry.

Within the textile industry the circular economy models focus on extending the product life, recovering and re-utilizing resources and implementing a circular supply model which sees the input materials of production changed into sustainable alternatives such as re-used polyester and cotton fibres. These models give a great example of the better-known models implemented within the textile companies, with large corporations within the textile industry implementing models like these with their own parameters and goals of development. A common problem found in textile supply chains is the lack of sustainable design (Jia *et al.* 2019). Many textile companies worldwide have adopted parts of circular economy business models into their production and retail operations. Still there are estimates that under 2% of the textiles produced end up being part of a circular economy chain and re-made into new textile products (Ellen MacArthur Foundation 2021).

Young companies from all over the globe have emerged to tackle the waste caused by textile companies such as Re: NewCell of Sweden, while this company does not manufacture textiles themselves for retail purposes they specialise in sustainability, Re: NewCell uses only textile waste to create their product Circulose and sell it to textile companies so that they can manufacture their own textiles sustainably. Rough estimates are that in the upstream process of textile production which governs the raw material processing and production alongside fabric development and textile assembly protocols causes upwards of 60% of total emissions in the textile industry (McKinsey 2021). This issue is tackled by Re: NewCell which created an alternative product that requires less water in production and emits less.

The product life extension models focus on extending the lifespan of the product, with this model textile manufacturers and retailers can create more value to the product. By extending the usage

of the product the company can increase the value of said product before it is discarded or re-used. To create a longer product life for a textile product companies need to use quality materials in production to create products that will last, and especially if the company is using raw materials in order to produce goods it should be a main focus that the product itself has a long product life (Korhonen *et al.* 2018). Many large textile companies have utilized recycling methods to create new clothing lines and this way extending the life of the product. In the textile industry this business model is seen in many places, the best example would be retailers where certain clothing bears a mark of "recycled" or "created from re-used materials". Large retailers such as Sweden's Hennes and Mauritz AB also have made it possible for customers to repurpose their old apparel with recycling boxes that are seen globally in their retail locations, this a part of their circular economy implementation and their "lets close the loop" initiative (HM Group Sustainability Discourse 2021). A rival corporation Inditex also implemented a recycling initiative in their Zara locations worldwide, accepting clothing from all manufacturers to be recycled into charitable foundations and re-purposed into their sustainable clothing collections. (Zara Sustainability Report).

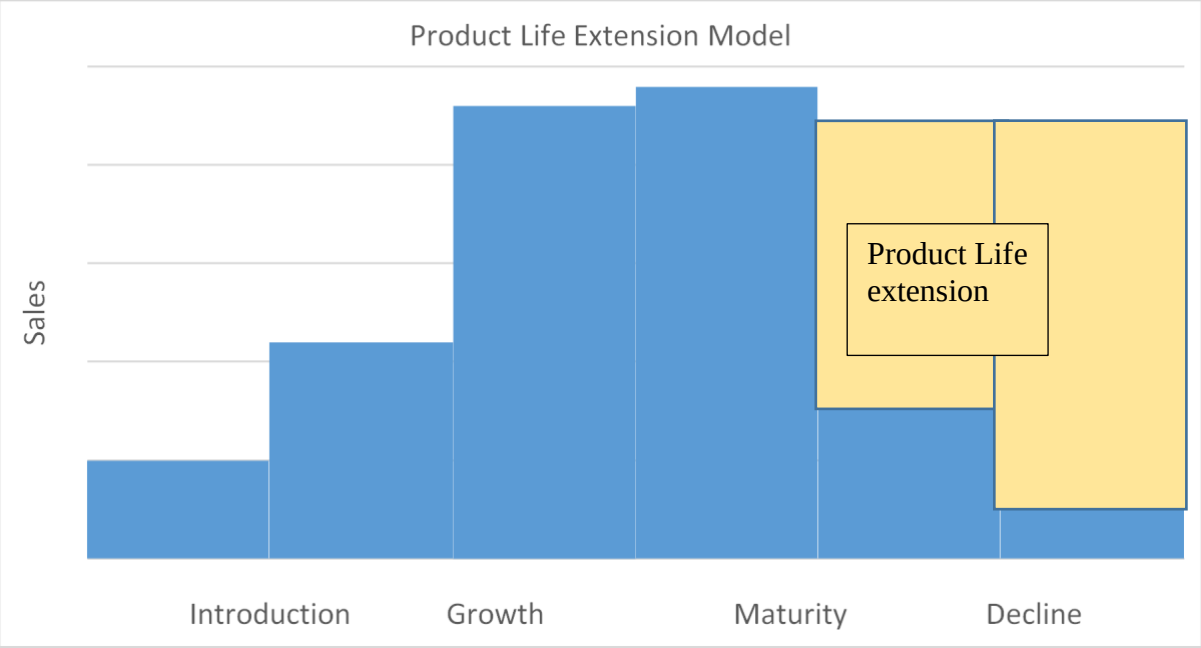

Figure 1. The product life extension model. Source: author's design.

Resource recovery business model centres around reducing the need to always implement new materials into the production of goods, this model works with the product life extension model in

the textile industry. By re-purposing these products that are near their product life's end the organisation in question is recovering resources rather than using new ones. A company called Blue Jeans Go Green is an American pioneer of resource recovery, their company seeks jeans and jean fabrics from landfills, donations and recycle collections and strives to re-purpose the cotton originally used for the jeans and to create new products from it. This model of resource recovery is a key component in the transition towards a more sustainable future because textile waste is a major component of overall waste in landfills, by enabling more recycling boxes within retail stores and second-hand retailers such as vintage clothing shops alongside implementing new technologies that specialize in breaking down old textiles into usable fibres organisations would be able to drastically lessen the amount of textile waste created annually. There are multiple start-up companies alongside older companies from the United States and Europe which have developed chemicals that enable processing textiles and held successful trials periods, because of these successes in small quantity textile processing large companies such as Hendrix and Mauritz AB have financed their further operations on a larger scale. These companies such as Sulzer have had success in separating different fibres used in textiles so that they can be re-purposed, studies have shown that very damaged cotton textiles can also be converted into glucose with chemical treatment using acid hydrolysis (Sanchis-Sebastia *et al.* 2020).

Circular supply model governs the previously mentioned models, both recovering resources and extending the product's lifespan are key parts in a fully operating circular supply model. This model focuses on replacing the material inputs of the circle with recovered and or renewable options. In this model it is emphasized that products do not leave the circle, they are recycled, re-used, and then recycled again emphasising the entire value of the material (Lahane *et al.* 2020). Achieving a circular supply model is relatively easier for a new company because they can set their entire premise to be within the circular economy models, to an existing company implementations of this business model will require costly inputs and large scale changes.

1.4. The current Finnish textile industry and companies

Finland is seen as a pioneer in Europe for circular economy implementations, Finland was the first country to create a roadmap as a guide on how to achieve these circular economy goals nationally. When the European Union first unveiled their 2015 plan of circular economy it took Finland a year to create the roadmap towards circular economy, and in 2020 the Finnish Institute of Textiles and

Fashion created their own roadmap towards a carbon-neutral textile industry by the year 2035. While the most advances have been made in industries such as technology and metal recycling, Finland recognises the textile industry as a large waste producer and the industry itself has been able to implement circular economy business models into their production, both Finnish found textile companies and international organisations that operate in Finland in terms of production and or retail.

Currently the goal is to make the Finnish textile and fashion industry carbon-neutral by the year 2035. To make the roadmap work the society of Finland needed to adjust and innovate towards a more sustainable future (Hosseinian *et al.* 2021) It is also a global problem within the textile industry that the industry itself is global, it is a rarity that a country producing textiles would also completely provide the materials required for the production, many textiles themselves are produced outside of countries that retail them. This has led to the founding of new companies that hope to help in "closing the loop". Finland is a country much like the rest of the Nordics where the textile production is not the leading industry, nevertheless the consumption rates in all Nordic countries have risen during the last decades and in Finland the textile consumption has more than doubled from two decades ago (Dahlbo *et al.* 2016).

Even before the introduction of the roadmap, there have been companies such as Touchpoint, who have been operating with a circular economy ideology TouchPoint was founded in 2008, TouchPoint operates in plastic waste and textile waste creating sustainable workwear from it. Newcomers such as InfinitedFibre found a way to create premium textile fibres from waste, naming their repurposed and durable fibre Infinna and have sold it to many large textile companies. Because of the breakthrough of Infinite Fibre global conglomerates such as Wrangler and Patagonia have shown interest in the Finnish start-up. To achieve the goals set towards sustainability developing new companies and existing large corporations need to innovate and operate together within the textile industry (McKinsey 2021).

To achieve carbon neutrality by the year 2035, the STJM (Finnish Textile and Fashion) has outlined factors that affect Finland's emissions they stated that in order to get to the goal previously mentioned, it is important for textile producers to focus on material usage, by replacing raw cotton and polyester with recycled cotton and polyester there would already be a significant difference in overall textile emissions. Clearly outlining that the processing of materials is a key part of overall emissions (Finnish Textile and Fashion 2022). Another clear cut to emissions would be to double the product life of already existing products, it is estimated that if the lifetime of a textile product

were doubled on all departments Finland would be able to cut down 46% of their overall textile related emissions.

Swedish retail giant Hennes & Mauritz AB has many locations throughout Finland, while each of these locations includes their recycling box supporting their circular economy initiative it is more important to note that Hennes & Mauritz AB has invested 30 million euros to Infinited Fibre and an unknown amount in Re: NewCell and have signed a retail purpose contract with Infinited Fibre to include their recycled textile fibre Infinna in their line of clothing. Being one of the most well-known textile retailers in the world Hennes & Mauritz has brought forth every effort to generate an impact on circular economy policies and financed various start-ups specialising in sustainability, all the while pledging their own material supply chain to be completely recycled or renewable by the year 2030. (HM Sustainability Disclosure 2021).

When looking at the existing companies of the Finnish textile industry that operate in either fully sustainable setting such as Pure Waste, a Finnish textile company which specialises in turning only recycled material into new clothing has received financing from Nordic Environment Finance Corporation to further their goal to be able to sell quantities of their recycled fabrics and yarn to other companies who are willing to take the necessary approach of becoming sustainable. It is more common that the materials recovered by recycling initiatives are of inferior quality (Sandin *et al.* 2017) But Pure Waste among others has found success in creating quality textiles from recycled goods. One of Finland's largest textile producers Finlayson implemented a circular economy model in 2017, at the time it was estimated that this was one of the first utilizations of circular economy business models towards home textile recycling. By utilizing resource recovery, they enabled customers to return their old products to be repurposed by the company in exchange for discounts if the customers wanted to purchase new textiles. Another large company in Finland that utilizes resource recovery is the aforementioned TouchPoint.

Marimekko one of the most globally known Finnish textile companies and a pioneer in Finnish fashion has adopted elements of lengthening the product life of their textile products, by using quality materials from which part is recycled Marimekko is able to produce textile products that offer a longer product life. Marimekko made their initial circular economy adaptations in 2015 when they collaborated with an online seller of used textiles called, We Started This, together they sourced old clothing from Marimekko's previous collections and former clothing of retail location personnel to create a new collection of recycled quality clothing. Marimekko aims to continue this

in the future and has made the product life extension one of their key initiatives. (Marimekko Sustainability Review 2021).

A true pioneer in material recycling and circular economy utilisation in Finland is a company called Globe Hope. Founded in 2003 Globe Hope is known for utilizing textile waste alongside durable, sustainable designs to generate lasting and unique products. By going against the industry standards Globe Hope has been able to make a name for itself producing various accessories from recycled materials such as car seatbelts which they converted into handbags. Circular Design is named one of the key initiatives in the plan to make textiles sustainable in Finland by the year 2030 (Suomalainen 2020).

2. METHODOLOGY

2.1. The research methodology

The creation of one's own research and compiling it with existing knowledge is a cornerstone of any academic research activity (Snyder 2019). The vast amount of knowledge available makes the development of research questions easy and hard at the same time, finding an own angle on matters that have been studied can prove itself difficult but simultaneously rewarding, knowing that the research done is truly your own.

Within business and management there has been an outlining of five different philosophies that revolve around research (Saunders 2009). Of these philosophies Interpretivism was used as a research philosophy for the thesis because of the small sample and generally qualitative approach elements of this philosophy. Interpretivism seeks to find in-depth answers to the study in question (Alharahsheh 2020) To pursue the wanted outcome and data qualitative were used to collect data. The qualitative research method is a great tool to investigate a persons complex experiences from within that subject (Miles *et al.* 1994) For this thesis, the data was collected through interviews conducted with Finnish experts in the field of circular economy who have specialised in recycling methods and the textile industry utilizing qualitative research methods alongside an additional questionnaire which was sent to various people working within the textile industry via email. An interview being traditionally a more superior way to gain narrative data than a questionnaire (Alshenqeeti 2014). Nevertheless the author utilized both qualitative and quantitative research methods because the questionnaire would be easier to complete by a certain respondent than an interview. The choice made to conduct a semi-structured interview was to enable the interviewees to give in-depth information and speak freely. Interviews are also fundamental to gain understanding of the interviewee's ideologies and experience (Mann 2016). A semi-structured model of an interview also allows a flexibility to the interview itself, especially to the phrasing of the questions. Qualitative data creates an open-ended perspective on data itself, being an opposite of quantitative data which revolves around straight numbers (Castleberry 2018)

2.2. Collecting the data

The first interview took place on the17th of November via Microsoft Teams, this interview was held with Helena Soimakallio of Teknologiateollisuus, a non-profit coalition of technology industries in Finland. The language of the interview was Finnish to make the conversation more fluid and relaxed. The reason for this interview was Helena's great knowledge of circular economy in various industries of Finland and also Teknologiateollisuus initiatives regarding circular economy in the textile business. The questions revolved around circular economy in Finland and circular economy implementations regarding the Finnish textile industry with an introductory question regarding Helena's job title and organisation. A clean MS Word file was used to capture the audio into text while the interview was happening, a reason for this is that having a text ready after the interview meant that translation and phasing would be more efficiently done. The interview lasted 52 minutes.

Second expert interview was conducted on December 1st with Piia Nurmi, a lecturer in the University of Applied Sciences in Turku and also a project coordinator of the Telaketju network which specialises in circular economy within the textile industry of Finland. This interview was also conducted in Finnish. This interview was essential to gain further knowledge regarding the Finnish textile industry and the various circular initiatives Piia had been a part of. The author wanted to gain a wider perspective on circular economy implementations within Finland before the expert interview with a specialist within the textile industry's parameters in order to fully understand the various business models that could be impactful now and in the future.

To collect more data a questionnaire was created using Google Forms, the questionnaire targeted a group of 10 respondents via email and received 7 responses. All of these responses were used for the analysis. The targeted people were working within the textile industry, in project management, sustainable roles and in retail. The author sent emails to potential respondents first and tried calling to the people who did not react to the initial email explaining the topic of the research and research questions. The reason google forms was chosen was because of its capabilities in different types of question models and the author had previously used google forms. Google forms along with other web-based survey platforms are merited as being even more truthful than meeting an interviewee in person (Narayanaswamy *.et al* 2016).

Table 1. Questionnaire participants

Position in company	**Company**
1. Product Manager	Large textile retailer which operates globally
2. Project Manager	Coalition working in circular textile initiatives and recycling
3. Sustainability Specialist	Finnish government owned large company
4. Marketing Specialist	Completely sustainable apparel manufacturer from Finland
5. Account Manager	Successful recycled textile start-up from Finland
6. Chief Advisor of Sustainability	Non-profit governing Textiles and Fashion in Finland
7. Retail sales	A large Finnish textile company

2.3 Analysing the data

The data gained from the interview was thoroughly looked at, the author corrected any existing spelling mistakes before translating the text from Finnish to English. When translated the author listened to the interview and observed the entire data set since was crucial to try and see if anything had been lost. Some transcriptions lose key data or context when undergoing a change such as translation (Miles *.et al* 1994) After the translation the author divided the interview conducted with Helena Soimakallio to two parts, one which focused more on circular economy of Finland in general and the other part which focused on the Finnish textile industry and the circular economy actions within it. For the first and second interviews the author used narrative content analysis to seek and identify the key parts of the interviews that focused on the research questions.

To analyse the findings of the questionnaire the author used thematic analysis, a well-known method of researching people's opinions and knowledge from made surveys of qualitative data (Caulfield 2022). Thematic analysis was used to create summaries of the various responses of the questionnaire based on the theme of the questions.

3. EMPIRICAL FINDINGS

3.1 Findings from the interviews

The interviews conducted with Helena Soimakallio and Piia Nurmi began with an introductory question, after the initial greetings and a final ask of consent to use the interview answers for the research the first thesis-related question was regarding Helena's general knowledge on circular economy in Finland (Appendix 1) Helena explained her experience working with various projects that dealt with circular economy initiatives in many different industries of Finland such as logistics and metal recycling. Helena also had dealt with several European non-profit organisations that operate within circular economy. Helena stated that Finland was quick to act upon the European Union 2015 circular initiative and mentioned the roadmap created by SITRA. The first question relating to the research on the second interview with Piia was "What do you know about the circular economy of the textile industries of Finland?"(Appendix 2) Piia explained that being a part of the Telaketju network which operates within the parameters of The University of Applied Sciences in Turku she had gained a lot of insight over the years on circular economy initiatives within the textile industry working alongside various companies ranging from large multinational textile companies to new start-ups.

The second question of the interview with Helena was "How does Teknologiateollisuus as an organisation bring forth circular economy?" (Appendix 1) Helena stated that for four years now Teknologiateollisuus has focused on the three largest environmental challenges which are global warming, the overconsumption of natural resources and the depletion of existing nature. She stated that Teknologiateollisuus promotes knowledge of these ongoing environmental challenges while preparing circular economy alignments that help set up goals regarding sustainable development. She gave an example of an alignment regarding over usage of materials and promotion of material recycling and also an example of trying to source best ways to use recycled raw materials in re-production. She explains that bringing forth circular economy has many different parts to it, and it can be applied to different products but also in business models and business development plans.

The third question of the first interview and the second question of the second interview were similar in nature, the author asked, “What kind of circular economy initiatives have taken place in Finland during the last few years and what was the biggest initiative that comes to mind?” (Appendix 1) and “What kind of circular economy initiatives have you been a part of?” (Appendix 2) Helena mentioned that Finland is the first country in Europe to develop a national strategic circular economy program, this program according to her is to investigate and analyse our consumption as a nation of natural resources alongside all the different ways circular economy could be improved in Finland, she highlights the current government led by Prime Minister Sanna Marin which have driven forth the circular economy program. She explains that Teknologiateollisuus has conducted an internal expedition of their circular economy activities and hopes that this setting would find traction in other industries as well. Helena states that Finland has taken the regulations and innovations regarding circular economy from the European Union very well. She states that the circular economy implementations and successes that come to mind are Outokumpu’s steel recycling and their overall recycling methods in production are definitely a great success considering the steel recycling plant is the largest in Europe. Another initiative that has shown promise is the implementation of a digital passport into textiles to help cut down time on textile recycling, Helena explains that Teknologiateollisuus and Finnish Fashion and Textile industry are collaborating on this matter and the early tests have shown great results regarding the recycling distributions of textile waste, the passport allows the recycling machines to read the contents of the textile product and recycle it that way. Piia went into great detail on initiatives that had been successes such as partnering up with the sanitation department of Turku to collect waste textiles in 2014, one year before the European Union released their first detailed plan on circular economy initiatives for member countries, and the other example she thought of was one of their first projects with various corporations called Tekes, where the companies alongside the Telaketju network sought to develop the various processes of the value chain and to seek new ways to utilize used textiles. Alongside this project was aforementioned companies such as Pure Waste and Infinited Fibre. Piia briefly mentioned the Finix project which is one of the key detailers of the 2030 goal towards sustainable textiles, a project in which Telaketju is also a major contributor.

The third question of the second interview was “What are the largest challenges that face the circularity of the Finnish textile industry?” (Appendix 2) Piia explained that even though solutions to textile waste are developing continuously there is still the matter or excess textiles and excess textile waste, the flow of materials are still too great in terms of volume. To fix this issue she explains that lengthening the life span of textile products would bring in great results, she notes

that globally this issue is large compared to Finland since Finland is considered by many a trailblazer in circular economy implementations. Piia notes that the success Finland has gained also poses a challenge, Finnish researchers and companies do not pursue the credits they should with their success. To overcome this, we should strive for more cooperation, domestically and globally. She briefly also mentions that there has been a lot of development with the chemical recycling pilots in Finland but does not have the most up to date information regarding their development.

The fourth question was the same in both interviews "What would be the reasoning for Finnish textile companies to implement circular economy practices" (Appendixes 1 & 2) Helena states that there are many different angles from which this can be looked at, she begins by explaining about a growth within companies who are developing methods of recycling cotton fibres to add into their already existing repertoire of recycling. Piia explained that while companies have various motives but the central theme behind implementing circular economy practices would revolve around consumer preference and sustainability consciousness. She continues by saying that the textile production output is small in Finland compared to Europe but still relevant. Helena stated as well that the second angle is shared with companies and consumers, both have realised from studies that textile production takes a lot of energy and resources especially virgin fibre production which takes up a lot of water and natural resources adding this with the fact that many products have very short product life cycles She says that consumers and companies value sustainability, and by understanding the sheer energy cost and environmental cost has been enough for many companies to investigate circular economy options in Finland.

The fifth question of the interview was "What kind of barriers there are against the implementation of circular economy in Finland, both in textiles and in general?" (Appendix 1) Helena explained that because of the sparsely populated Finland recycling of some materials is difficult, in order to maximize movement of used resources such as glass and textiles, another problem related to this is the fact that some smaller villages on Finland would have these recyclable resources but not enough that it would be worth it financially for someone to collect. She continues that continuing or prolonging the product life would be the optimal situation and that business model should be looked at and applied to textiles and also other industries in Finland. She states that there is a weird stigma with recycled and re-purposed products and that she has heard and seen some corporations trying to create this presumption that the re-purposed product is in many ways inferior to the new product made from these virgin resources. She states that even though some consumers might also

be influenced by this mindset there is plenty of people in Finland especially in southern Finland that have educated themselves with production methods of textiles and because of this many people know about the massive use of water and hazardous chemicals and she sees this as a great start and is hopeful that in the following years the amount of re-purposed textile sales will continue to rise.

The fifth question of the second interview was "What is the long-term goal of the Telaketju coalition?" (Appendix 2) The author specified by asking if there is a five-year plan in place or has Telaketju created their version of the roadmap much like SITRA did, to which Piia responded that they have collaborated with Finix and many other companies to create a plan for 2030. The goal of this plan is to implement sustainable value chains to textile companies and to create a truly sustainable textile system in Finland. The plan included utilising resources that are sustainable such as recycled cotton, prolonging product life by focusing on quality manufacturing and sustainable design in all textile production phases.

Regarding the sixth question "What kind of circular economy models has Teknologiateollisuus used?" (Appendix 1) Helena explained that she has been a part of many different projects in various industries and begins to explain about the collaboration between Teknologiateollisuus and The Finnish Institute of Fashion and Textiles, she explains the digital-product passport that has been tested in small quantities of recycling textiles, the passport enables the recycling machine to recognise the different resources of said textile and makes recycling less time consuming. She continues to explain that with the process of recycling textiles automized not only would the time be saved but the results could actually be more accurate since they have already had small trials with the digital passport which were successful, especially considering textiles with mixed fabrics you would know instantly after the initial process if you needed chemical treatments in order for separation or if the textile was 100% some material you could forward it immediately to a company who re-purposes textiles. She briefly mentions a project which also impressed her was the innovation of Kone Cranes and their initiative to restore various parts of construction machinery thus lengthening the product life period of these expensive machines.

Seventh questions of the two interviews were the same "Could you name a great example within the Finnish textile industry in terms of promotion or implementation of circular economy in a large scale?" (Appendix 1 & 2) Helena states the luckily in Finland there are many noteworthy companies that have succeeded in sustainable textile initiatives and business models, she mentions

Globe Hope and states that as far as she knows it is the oldest company in Finnish textiles that has always used recycled textiles in their production, she mentions Infinited Fibre as a person from that company had just given a speech at an event Helena was part of. She states that Infinited Fibre is going to be a large part of the Finnish textile morphing into circular movement in the near future. After a brief thought Piia named Pure Waste as the company that has excelled in her opinion, stating that looking at their business models which all revolve around circular economy models such as re-using resources and creating products with quality to ensure a longer lifespan and adding the fact that Pure Waste has had success in other countries as well.

Questions eight and six were the same in both interviews the question was "What needed to happen within the textile industry in order to make a big change regarding the overall waste it produces in Finland?" (Appendix 1 & 2) Helena explains that we need to understand the bottlenecks that come with the textiles in Finland first, she mentions that the first bottleneck is the fact that not everyone recycled their textiles, some people just leave it be in closets and garages so this lessens the supply of re-utilizing materials in new production and the second one is that the chemical treatments for textiles with different properties of materials are still not developed to their full potential, she explains that in the future it should be a standard procedure once these start-up companies from all over the world not just in Finland are able to create a safe and less energy consuming procedures to separate all kinds of materials from each other in textiles. Then she mentions that the industry is going in the right direction now, since big companies like Marimekko are doing sustainable initiatives, such as focusing on product lifespan extension which she thinks is an important cornerstone in making textiles more sustainable. She mentions that maybe the change needs to come outside the industry for example a company that would collect all kinds of recyclable materials and distribute them to recycling plants, doing this in different cities could be beneficial to get the textile waste that is in people's homes moving. Piia stated that consumers have the possibility to create significant change, by pursuing quality textiles that have a longer lifespan is a good first step according to her, overconsumption in textiles is a large issue globally and in Finland, she says that companies need to create textiles with circular economy design, focusing on quality materials that last long but she emphasises that to make a significant change it requires both the consumers and the companies. We discuss fast fashion chains and their sustainable initiatives and a second questions was made by the author "Is it in any shape possible that these fast fashion conglomerates would become sustainable?" Piia responds that even though companies like Hennes and Mauritz have made good efforts the production output is so large that it creates a paradox within itself, these companies use sustainable materials in production but produce too much,

nevertheless she hopes that even these massive companies could produce textiles with longer lifespan although this would affect the pricing and the collection output and therefore their business models. She mentions that because of the overconsumption habits of people these well-known fast fashion brands such as Hennez & Mauritz are not the largest problem anymore, it is these ultra-fast fashion brands like Shein.

The ninth question of the first interview and the eight question of the second interview were similar "is circular economy a trend used by textile companies in terms of promotion?" (Appendix 1) Helena mentions that she definitely has recognised that companies have used the angle of sustainability in order to gain sales and new customers but in Finland the companies usually have proof of their sustainable actions in the textile business. She mentions that this angle is used in different industries more effectively but in textiles she feels like Finnish sold products are more honest than not. The eight question of the second interview was as follows: "Are textile companies using circular economy as a marketing tool to create sales with false pretences?" (Appendix 2) Piia mentions that it is most likely that this happens but not so much in Finland, even though there are companies that promote their sustainable actions as greater than they really are. She explains that she had actually recently consulted her students on circular economy marketing and taken notice that a very few textile company uses "anti-purchasing" marketing in their sustainable outreach campaigns.

The ninth question of the second interview was "What circular economy initiatives should take place in the near future regarding textiles?" (Appendix 2) Piia explained shortly that the focus needs to be on consumer choices and companies need to create quality products, these two in conjunction can be one key to initiative sustainability within the textile industry. She also mentions the popularity of product as a service business model and that it could have a positive effect if the popularity keeps growing, but overconsumption and overproduction are the biggest issues at hand according to her.

The tenth question of the second interview "In your opinion what is the biggest challenge in making textile industry sustainable in Finland" (Appendix 2) Piia explains that similar questions have been asked from her in sustainability events and that she has a three-part answer: Dealing with the overconsumption habits of Finnish society regarding textiles, especially fast fashion apparel, focusing on the lifespan of textile products it needs to be longer and the materials should

come from recycled fibres that possess high quality and the third part is co-operation and communication with companies and different networks that all strive for the same sustainable goal.

The final question of both interviews was regarding "What is the true impact of circular economy implementation within the industries of Finland, especially the textile industry?" (Appendix 1 & 2) Helena explained this with a slide from PowerPoint first, during the interview she quickly shared her screen, and, on the slide, it had a statistic regarding the Finnish industries and over 50% of the respondents had acknowledged that circular economy is an opportunity in business development for them, this survey consisted of over 1500 companies in various industries of Finland. She goes to explain that understanding the true value gained and saved of the process of implementing circular economy business models here in Finland should create a ripple effect to other countries in Europe as well. The impact within the textile industries of Finland continues to be that Finland makes its case on being a pioneer not only in companies that only create textiles from sustainable and recycled materials but from also new companies such as Infinited Fibre which could potentially reach global audiences and help the largest textile businesses in the world. She ends with praising Finland as being a great country for trying out initiatives, circular based or any kind of other new things that could have positive result globally, she accredits this to the Finnish political guidelines as well as the people of Finland, she jokingly states that Finland is a laboratory of sustainable development, continuously trying out new methods. Piia states that one could say that a new industry has risen from Finland and that industry is the circularity of textiles, meaning that companies large and small have attracted international attention from their success within the circular economy initiatives in making the textile industry more sustainable. So, the impact it has on Finland is that Finland can continue pursuing sustainability and influence other countries with their initial success, Piia states that the real impact in the future is hopefully a positive impact on the world regarding textile waste and how to recycle it and process it more efficiently and hopes that Finland can play a part in dealing with the fast fashion's circular economy business model implementation. Both Helena and Piia agree on the fact that Finland has the opportunity to be amongst the first within these already implemented circular economy goals and a true pioneer that other countries look up to.

The questionnaire produced in Google forms held 8 questions in total, the first two questions were linear scale questions with number indications. These indications ranged from numbers 1-5 with 1 meaning no knowledge and 5 meaning good knowledge. Questions 3,5, and 7 were paragraph

questions. Questions 4 and 6 were multiple-choice questions and the respondent could write additional details. Question 8 was a short answer question.

The first question “Are you familiar with Circular Economy?” (Appendix 3) of the questionnaire indicated that all of the respondents were familiar with circular economy, the second question “Is Circular economy implementation an opportunity for the textile industry?” (Appendix 3) which was also a linear scale question also gained overall positive answers with every respondent indicating that circular economy implementation is an opportunity for the textile industry.

The third question was “Why would a textile company implement circular economy” (Appendix 3) this question gained various responses, of the seven respondents five wrote that because of waste related issues of the textile industry and citing sustainability of the future, the remaining two answers revolved around economic opportunity and growth for textile companies.

The fourth question “What is challenging for the circular economy implementation in Finland?” (Appendix 3) Had multiple choice options from choose from, these options were: Not enough interest, Not enough resources, No financial gain, Changing existing business models, Too much change, Too expensive for companies and other, what? Where respondents could write their thoughts. Of the multiple-choice questions four of the respondents marked “Not enough Interest” while “Not enough resources gained two” and the other choices either one or zero. On the section dubbed “other” five respondents wrote answers which were: Consumer adaptation, Consumer attitudes, Finland’s low textile production rates, Recycling processes and Potential Bureaucracy. The fifth question “Explain why it is hard to make textile industry more sustainable in Finland?” (Appendix 3) was a paragraph question where respondents could write freely their opinion on the matter, similarities between answers were found, three respondents wrote consumption habits as the issue for making textile industry more sustainable while three others had written that the existing textile production happening in Finland is not done on completely renewable materials, one respondent named Marimekko as an example that still uses virgin fibres in their production of goods. One respondent reasoned that currently Finland is on the right path towards a more sustainable textile industry but pointed that recycling initiatives and methods need to develop alongside the industry.

The fifth question was as stated: “Explain why it is hard to make textile industry more sustainable in Finland? “(Appendix 3) The responses mainly revolved around the fact that Finland has already

seen some success in sustainability and the fact that production rates are not large on a global scale, if production took place solely in Finland it would be simpler to impose restrictions. Two respondents outlined that consumer purchasing behaviour needs to change to gain sustainable impact in textiles.

On the sixth question “What do you see as the biggest issue within the textile Industry of Finland? “ (Appendix 3) Production of textiles was the most common answer, three out of seven respondents detailed that because Finland has found success in circular initiatives if the majority of textiles were hypothetically produced in Finland it would be more sustainable.

Question number seven was as stated “What is the impact of implementing circular economy to the textile Industry of Finland?“ (Appendix 3)The answers to this question varied but all shared similar characteristics, the answers consisted of Sustainability, positivity and trend setting on a global scale, Finland could and should strives to be a country which can be amongst the first globally that can make textiles more sustainable and thus lead the way as a pioneer in circular economy within textiles.

The last question was “Name a company that is succeeding in textile Industry with circular economy initiatives, implementations, business models etc “(Appendix 3)This question was made to see a connection with the expert interviews where both of the interviewees named companies such as Pure Waste and Infinited Fibre, from the respondents four named Pure Waste as the prime example, while Infinited Fibre was mentioned once, as was Globe Hope and Fida Second-hand stores.

3.2 Discussion

Based on the data gathered for the thesis, the implementation of circular economy in the Finnish textile industry has happened in various stages over the years. When looking at the effects of this implementation it is important to observe at all the effects it has had and will continue to have in the future. The theoretical framework explained the most common existing models found applied within the circular economy implementations in textiles. In the interviews the author sought to find similarities with the ideas behind these models explained above, and both of the interviewees and questionnaire participants mentioned product-life extension models as key to create a more sustainable textile supply chain, both interviewees shared the idea that textiles should be designed

to last. To implement a business model with focus on lasting and durable production of textiles there should be a policy requirement of quality in production of textiles (Coscieme *.et al* 2022) Based on existing and future research these kinds of governing policies regarding circularity in textiles might be possible. A noteworthy problem with the extension of product life is the ultra-fast fashion brands, the consumption of cheaper alternatives needs to be addressed to see if these short-lived textiles can also exists with the lengthened products (Dahlbo., et al 2016) Piia Nurmi said that these fast fashion and ultra-fast fashion companies create a paradox when they take part in these circular initiatives for example recovering resources by organising recycling boxes within their retail locations. The paradox being that even though they recycle the materials used in their production the rate of production is too great to have an impact on their sustainability.

Unexpected finding of the interviews was that recycling needs more work in Finland, from the interview with Helena it became clear that because of the scarcity of Finnish population there are a lot of recyclable textiles that do not get recycled because there is no collection, this was an important insight to gain perspective comparing to larger cities which possess the ability to drop old textiles in recycling boxes found in various department stores and retail locations. Recycling and re-utilizing textile product were mentioned as a great step towards circularity especially when paired with durable design. Using these two business models could impose significant savings to a company and a sustainable production method (Coscieme *et al.* 2022) Expectedly consumer behaviour was mentioned as a driving force behind consumption of cheaper textiles and also a possible difference maker in rising popularity of recycled textiles, the power of consumers was mentioned by both of the interviews as a great tool to impose on the manufacturers to create more lasting textiles.

A significant insight arose from both of the interviews, regarding Finland's already strong implementation of circular economy initiatives in various industries, being the first in Europe to create a detailed plan towards circular economy in all industries speaks of the unity and determination of Finland and its people. The knowledge of existing start-up companies and larger companies that already are focused on circular economy were mentioned, companies such as Infinited Fibre and Pure Waste gained a mention in both of the interviews and from the questionnaire. Proving that people are aware of these alternative companies that operate within circular economy parameters.

An unexpected finding was the fact that communication and cooperation is required more with circular economy initiatives. Helena stated in the interview that even though success has been found Finnish companies and people do not seek the credit they deserved from this. While Piia also stated that we have to learn how to communicate better and cooperate with companies from Finland and from all over the world.

On challenges that the circular economy implementations face the answers varied, the general consensus was that the challenges lie in both the industries and also the consumers. With industries not implementing business models that could help achieve more quality and sustainable products and consumers overconsuming on textile products. Consumption rates that have grown steadily in the Nordics (Dahlbo *et al.* 2016) were also mentioned but it is easy to underplay the textile consumption habits of the Nordics when the textile pollution is a global issue.

For future research, the author would recommend the following:

- Research on consumer behaviour with repurposed textiles;
- Initiatives from companies to normalize quality requirements on production;
- Co-operation with textile companies with sustainable production methods;
- More research on production volumes from recycled textiles gathered by the company producing them;
- More published studies from Finland regarding circular business models in textiles.
- Larger sample group studies regarding circularity in textiles

CONCLUSION

To conclude the research, the ideology of this research was to learn the impact of circular economy implementation within the Finnish textile industry. To support this aim, the following research questions were set:

- What circular economy practices have been applied by Finnish textile companies?
- What have been the benefits of these circular economy practices?
- What are the desired future developments in circular economy implementation within the textile industry?
- What are the main issues and challenges of further implementation of circular economy?

Regarding the research question “What circular economy practices have been applied by Finnish textile companies?” the research found that various recycling methods have been used to generate new textiles from old materials by larger Finnish companies such as Finlayson. Upon further investigation information regarding smaller companies which operate completely under circular economy business models was found, these companies generate their own fabrics and fibres from recycled materials utilising resource recovery and plan to sell their product to larger manufacturers. Product life extension design alongside chemical fiber separation are in the early stages of adaptation with companies focusing on more durable and lasting design and chemical separation trials are ongoing as of 2022.

On the second question “What have been the benefits of these circular economy practices?” The benefits revolve around economic opportunity and sustainability, because Finland reacted to the initial ruling by the European Commission in 2015 with urgency it gave life to various successful start-up companies such as Infinited Fibre which has received funding on a large scale from large textile companies, on the sustainable side Finland has invested into various industries circular implementations and thus is on the right path towards the dates set by the European Commission regarding circular economy. The economic opportunity also governs the customer base which is

constantly growing, people still have large consumption habits but circularity promoting products such as re-made apparell have seen increases in popularity so a company is able to capitalize on circular economy implementations while producing more sustainable textiles.

On the third research question “What are the desired future developments in circular economy implementation within the textile industry?” From the interviews it became clear that there are various developments that need to be addressed, one business model was mentioned more than others and it was the extension of the product life, by offering a textile product that lasts would work on both the production side of things as it would require quality recycled materials and circular design to work and on the consumer side where because of the quality of the product the consumption would slow down as well. Finland needs to develop more intense recycling of textile waste in the more rural parts of Finland, as stated in the interviews this is a nation that works together well and having the option to recycle textiles that can be re-made is an opportunity many would enjoy. The communication and co-operations between companies required development into the future, after interviewing two people who work in organisations that co-operate with many leading companies in Finland and in Europe it became clear that they credit the success of projects to collaborative actions and it needs to be implied more on circular economy initiatives.

The fourth research question “What are the main issues and challenges of further implementation of circular economy?” The general though behind the challenges was that production is happening outside of Finland, much like in many European countries the retail operations prevail over the domestic production rates. If textile production was happening in Finland entirely, there would be restrictions on the methods and overall the production rate would have improvements on its sustainability. The issues mentioned in the interviews revolved around the current consuming habits, where people overconsume textiles and throw them away. Fast and ultra-fast fashion companies produce too much because of the endless demand of cheap textiles. Another challenge was the existing recycling methods, they are not as efficient as they could be especially in fibre separation processes and fibre identifying processes. These issues are noted and it was found out from the interview that there are developments in recycling methods from Teknologiateollisuus which is part of a project that is generating a recycling passport for textiles which would simplify the initial separation of textiles based on their fiber materials.

Based on the answers of the interviews, questionnaire and literature reviewed Finland has succeeded in initial circular economy initiatives within the textile industry, material recycling and

re-usage are a part of many large corporations. There is room for improvement in collaborative actions between companies in terms of creating textile collections that are completely sustainable. The goal of becoming carbon neutral within the textile industry by the year 2035 seems an unlikely feat but the forthcoming of new start-up companies in Finland and the continuos global evolution of circular economy we are certainly on a right path towards a more sustainable textile industry.

This research aimed to gain more knowledge regarding circular economy in Finnish textile industry. This research examined the impact of circular economy implementation within the textile industry of Finland, because the research involved nine participants there are limitations on the research findings. To attain a better result on circular economy implementations of the textile industry a larger interview pool would be required and it could focus on only one segment of the textile industry for example circular design. It would also be of interest to examine the development of recycling methods within the textile business when chemical recycling methods have become even more common than today. To summarise, currently Finland is on the right track with circular economy implementations in many industries, the textile industry has developments that need to happen in order to make it more sustainable. These developments come in terms of circular business model adaptations that revolve around recycling methods and prolonging the life span of textile products.

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APPENDICES

Appendix 1. Expert Interview with Helena Soimakallio

Initial Introduction and ask of consent for data usage

Question 1. What do you know about the current circular economy of Finland?

Question 2. How does Teknologiateollisuus as an organisation promote circular economy?

Question 3. What kind of circular economy initiatives have taken place in Finland during the last few years?

Question 4. What would be the reasoning for Finnish textile companies to implement circular economy practices?

Question 5. What kind of objectives there are against the implementation of circular economy in Finland, both in textiles and in general?

Question 6. What kind of circular economy business models has Teknologiateollisuus used?

Question 7. What would you consider to be a great examples within the Finnish textile industry that have either promoted or implemented circular economy in a large scale?

Question 8. What needs to happen in order to make a significant change within the textile industry regarding the waste it produces?

Question 9. Is circular economy a trend used by textile companies?

Question 10. What is the impact of circular economy within the industries of Finland especially textiles?

Appendix 2. Expert interview with Piia Nurmi

Initial Introduction and ask of consent for data usage

Question 1. What do you know about the circular economy of the textile industries of Finland?

Question 2. What kind of circular economy initiatives have you been part of regarding textiles?

Question 3. What are the largest challenges that face the circularity of Finnish textile industry?

Question 4. What would be the reasoning for Finnish textile companies to implement circular economy practices?

Question 5. What is the long term goal of the Telaketju coalition?

Question 6. What would need to happen in order to make a significant change within the textile industry in regards to the waste it produces?

Question 7. Can you name an example of a Finnish textile company that has succeeded in circular economy business models?

Question 8. Is circular economy a trend used by textile corporations in terms of sales, marketing.

Question 9. What circular economy initiatives should take place in the near future regarding textiles?

Question 10. In your opinion, what is the biggest challenge in making textile industry sustainable in Finland?

Question 11. Last one. What is the impact of implementing these circular economy initiatives and business models to the textile industries of Finland?

Appendix 3. Email questionnaire questions

- Are you familiar with circular economy?
- Is circular economy implementation an opportunity for the textile industry?
- Why would a textile company implement circular economy?
- What is challenging for the circular economy implementation in Finland?
- Explain why It is hard to make textile industry more sustainable in Finland?
- What do you see as the biggest issue within the textile industry of finland?
- What is the impact of implementing circular economy to the textile Industry of Finland?
- Name a company that is succeeding in textile industry with circular economy initiatives, implementation, business model etc.

https://docs.google.com/document/d/1KvctFt2nAJPEJ8cuaqgt-TxrCPtzPriiZUcNczF1vPU/edit?usp=sharing

https://docs.google.com/document/d/1OQ3tKZjW3y5OlY0xqKwRC5qixunFhl9H8VzuQ_4p4Hw/edit?usp=sharing

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