

**CONSUMER PERCEPTIONS OF THE  
ENVIRONMENTAL SUSTAINABILITY OF THE  
CLOTHING INDUSTRY AND TEXTILE FIBRES**

**Jyväskylä University  
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**ABSTRACT**

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Title Consumer perceptions of the environmental sustainability of the clothing industry and textile fibres	
Subject Corporate environmental management	Type of work Master's thesis
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<p>Abstract</p> <p>The clothing industry is undergoing a major transformation due to the environmental problems it causes. Environmental impacts of the industry and sustainable consumption are well covered topics, but research gap on consumer perceptions of the sustainability of the clothing industry or textile fibres exist. In particular, the role of textile fibres in the purchasing decision and consumers' understanding of the environmental impact of different textile fibres is unclear.</p> <p>This quantitative study examines consumer perceptions of the sustainability of the clothing industry, focusing on environmental impacts. In particular, textile fibres and their understanding and significance for consumers are examined. In addition to traditional textile fibre materials, new alternative textile fibres, such as wood fibre, are included in the study. The influence of background variables on responses is examined as well.</p> <p>Consumer perceptions of the environmental sustainability of the clothing industry and textile fibres were surveyed through an online survey in May 2020. The survey was answered by 1,580 respondents from five different countries with different socio-demographic background variables. The research has been carried out in collaboration with Spinnova Oy.</p> <p>The results show that respondents associate many environmental problems with the clothing industry. Textile fibre is perceived to influence significantly on buying decision when purchasing clothing. In addition, there are differences between different textile fibres and their sustainability; plant-based waste was seen 'quite sustainable' and crude oil 'not so sustainable' textile raw material. Most textile fibres were seen 'somewhat sustainable' when the total sample size was considered. However, some differences were found when looking at different background variables; cotton was perceived a very sustainable material among great share of French and Americans, among Finns and Swedes not so much. In addition, Finns found wood fibre more attractive than other respondents. However, the background variables did not play a major role in explaining the different perceptions. More research on the subject is needed.</p>	
Keywords Sustainability, clothing industry, textile fibres, sustainable consumption, environmental impacts	
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## TIIVISTELMÄ

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<p>Tiivistelmä</p> <p>Vaateteollisuus on suuressa murroksessa sen aiheuttamien ympäristöongelmien takia. Vaateteollisuuden ympäristövaikutuksista ja kestävästä kulutuksesta löytyy tutkimustietoa, mutta kuluttajien näkemys vaateteollisuuden tai tekstiilikuitujen vastuullisuudesta on vähän, jos ollenkaan tutkittu aihealue. Erityisesti tekstiilikuidun merkitys ostopäätöksessä sekä kuluttajien ymmärrys eri tekstiilikuitujen ympäristövaikutuksista on epäselvä.</p> <p>Tässä kvantitatiivisessa tutkimuksessa perehdytään kuluttajien näkemyksiin vaateteollisuuden vastuullisuudesta, keskittyen ympäristövaikutuksiin. Erityisesti tarkastellaan tekstiilikuituja ja niiden ymmärrystä ja merkitystä kuluttajille. Tutkimuksessa on mukana perinteisten tekstiilikuitumateriaalien lisäksi uusia vaihtoehtoisia tekstiilikuituja, kuten puukuitu. Lisäksi taustamuuttujien vaikutusta vastauksiin tutkitaan.</p> <p>Kuluttajien näkemyksiä vaateteollisuuden ja tekstiilikuitujen vastuullisuudesta tutkittiin online-kyselyn avulla toukokuussa 2020. Kyselyyn vastasi 1580 kuluttajaa viidestä eri maasta eri sosiodemografisilla taustamuuttujilla. Tutkimus on tehty yhteistyössä Spinova Oy:n kanssa.</p> <p>Tulokset osoittavat, että vastaajat liittävät monet ympäristöongelmat vaateteollisuuteen. Lisäksi tekstiilikuidun koetaan vaikuttavan merkittävästi ostopäätökseen vaatteita ostaessa. Eroavaisuuksia eri tekstiilikuitujen ja niiden vastuullisuuden välillä löytyy myös; kasviperäinen jäte nähtiin kestäväenä tekstiilimateriaalina ja raakaöljy ei niinkään. Suurin osa tekstiilikuiduista koettiin 'jonkin verran kestävinä' kokonaisotantaa tarkastellessa. Kuitenkin eroavaisuutta löydettiin eri taustamuuttujia tarkastellessa; puuvilla koettiin kestävämpänä materiaalina ranskalaisten ja amerikkalaisten kuin suomalaisten ja ruotsalaisten keskuudessa. Lisäksi suomalaiset kokivat puukuidun houkuttelevampana kuin muut vastaajat. Taustamuuttujat eivät kuitenkaan nousseet suureen rooliin erilaisia näkemyksiä selittäessä. Lisää tutkimusta aiheesta tarvitaan.</p>	
Asiasanat Kestävä kehitys, vaateteollisuus, tekstiilikuidut, kestävä kulutus, ympäristövaikutukset	
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# 1 INTRODUCTION

## 1.1 Background and purpose

No human being can avoid seeing or feeling the impacts of the textile industry. There are several positive and negative impacts as a result of producing textiles. First of all, textile industry provides us clothing, our everyday necessity and joy. In return, several global environmental issues can be attached to textile industry such as, climate change, overuse of water and plastic pollution. At the moment polyester, other synthetic fibres and cotton dominate the market as they cover 87% of fibres produced (Textile Exchange, 2019). All of them have several negative impacts on the environment and using these few fibres cause harms also for example for biodiversity. As the textile production volumes are increasing due to the fast fashion phenomenon and growing population, sustainable solutions and textile fibres are needed more than ever.

Purpose of this study is to research consumer perceptions of the sustainability of the clothing industry and textile fibres, concentrating on the environmental issues. A better understanding of consumer perceptions and purchasing decision factors help to create better stakeholder communication. This thesis is written in collaboration with Spinnova Oy, at a Finnish sustainable textile fibre innovation company. Spinnova has developed technology for making a textile fibre out of wood and waste without using harmful chemicals (Spinnova Ltd., 2020). The fibre is fully recyclable, microplastic free and produced without waste or side streams. Spinnova's raw material commitment is to only use FSC or PEFC- certified wood or waste raw materials that would otherwise contribute to climate change. Spinnova's objective is to globally commercialize the fibre products in collaboration with textile brands and industrial partners.

When understanding what markets want, it is possible to answer their needs with better products and better information and create awareness around the topic. This paper concentrates especially on textile fibres and their environmental sustainability since consumer perceptions on different textile fibres and raw materials have not yet been researched in a larger scale. Some studies exist that concentrate on consumer perceptions on recycled fibre materials or some certain type of clothing fibres (e.g. military clothing). This paper seems to be one of the first attempts to cover multi-country perceptions in regard to all of the most common textile fibres and raw materials and their sustainability. Additionally, perceptions toward new alternative textile fibres are researched. To set the context accordingly, the whole clothing industry is discussed since textile raw materials - and their innovation - are strongly related, and at the same time dependent on development of the overall sustainability of the clothing industry.

My interest in this area has developed during the past years. Personal concern about the depletion of natural resources and the loss of biodiversity is growing. I think sustainability can be achieved by designing and producing

sustainable products on a larger scale. In addition, I see the role of communication remarkable when creating a more sustainable future. My background is in sales and marketing and I think communication is one of the best tools to change the world and its power has been underestimated, or at least, underused.

This research is quantitative, and data was bought from a third-party operator: Norstat Finland Oy. Data was collected from five different countries: Finland, Sweden, Germany, France and the United States of America. From every country, there are over 300 participants from various backgrounds. This sampling provides relatively comprehensive insight for developing business strategies and stakeholder communication.

## 1.2 Structure of the study and research questions

This paper will provide information about the environmental sustainability of the clothing industry and textile fibres. It is examined if some textile materials are considered more sustainable than others and which factors consumers link to sustainable products when purchasing clothing. Furthermore, it is researched how different background factors correlate with certain perceptions.

In the first chapter the background and aim of the study are introduced. In chapter two global textile industry is discussed together with the environmental impacts of different textile fibres and estimated future of clothing industry and textile fibres. Following chapter three analyses current knowledge of sustainable consumer behaviour in the clothing industry. The fourth chapter introduces methodological choices; research design, survey creation and piloting, and data analysis. The fifth chapter introduces findings followed by discussion and conclusions.

Research questions are formed for the need to fill current research gap on consumer perceptions of the sustainability of the clothing industry and textile fibres. As the research has been carried out in collaboration with Spinnova Oy, objectives for developing business strategies and stakeholder communication are taken into account in the research task. The research, and therefore research questions, concentrate merely on environmental sustainability of the clothing industry and textile fibres due the scope of the topic and strategic reasons.

The research questions can be specified as following:

### **Research question:**

How consumers assess the environmental sustainability of the clothing industry and textile fibres?

### **Sub-questions:**



How sustainable and attractive are new alternative textile fibres considered in consumer context?

Which kind of factors help a consumer to identify a sustainable product when purchasing clothing?

How background variables influence respondents' estimation of the sustainability of the textile fibres?

## 2 CLOTHING INDUSTRY AND TEXTILE FIBRES

In this chapter clothing industry and textile fibres are discussed. Different textile fibres and their characteristics and environmental impacts are reviewed in order to gain a holistic understanding of the issues and possibilities related to textile fibre raw materials. At first global textile fibre market is introduced to set the context, then environmental issues are discussed to understand the impacts accordingly. Lastly, future scenarios of the industry are presented.

### 2.1 Clothing industry and global textile fibre market

In this chapter the current state of the clothing industry is discussed shortly, followed by an introduction to different textile fibre raw materials used in the industry. Also, fibre characteristics are outlined to provide comprehensive understanding of the fibres used in global textile fibre market.

Nowadays clothes are much more than just a mandatory practicality, they are an important expression of individuality. This is made easy due to the 'fast fashion' phenomenon; new styles and clothes are available all year round with quite low prices (Ellen MacArthur Foundation, 2017). It seems that consumers do not understand the true cost of apparel products, which means that environmental costs are not considered (Vehmas et al., 2018). Consumers see garments just as an industrial product rather than a part of nature, the disconnection from nature is greater than for example in the food industry (Joy & Peña, 2017). According to Ellen MacArthur Foundation (2017), most of the fast fashion produced is disposed of in under a year; garments are sometimes only used once or twice and considered garbage afterwards. Hence, industry practices and consumer behaviour both have a significant impact on the sustainability of the textile and fashion industry.

Current global fibre market is monopolized. Polyester and cotton are by far the most used textile fibre raw materials, and at the same time they are unsustainable at many levels (Joy & Peña, 2017). Cotton used to be the dominant material still a few decades ago, however, plastic-based fibres, especially polyester, have taken a great part of the market share (Ellen MacArthur Foundation, 2017). Polyester and other synthetics cover 63% of the global fibre market, cotton 24%, manmade cellulosics fibres (MMCF) 6%, wool 1% and other natural materials also called plant-based fibres 6% (Figure 1) (Textile Exchange, 2019). As the yearly amount of fibre produced is significant, 107 million mt., sustainability of all sorts of fibre matter. In the last 20 years, fibre production has more than doubled and if businesses continue as usual, it might reach 145 million mt. in 2030, this equals one third more than today as can be seen in Figure 2 (Textile Exchange, 2019). Even if the increase would not be as high as estimated, it seems unlikely to stay on the same level due to increasing population and

consumption. This means new ideas and practices are needed for answering a growing demand.

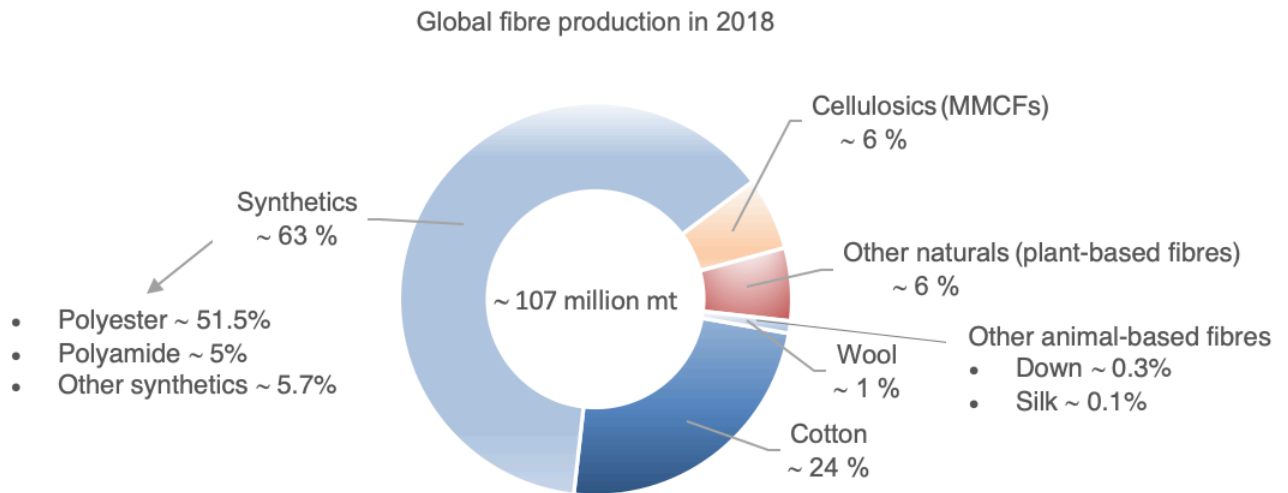


Figure 1: Global fibre market (Textile Exchange, 2019).

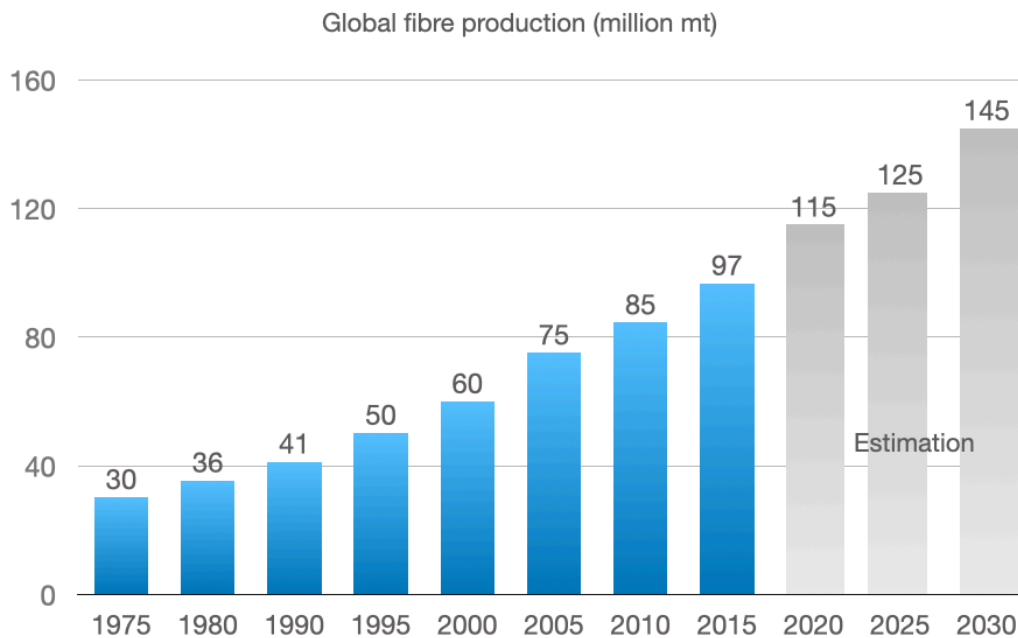


Figure 2: Global fibre production (Textile Exchange, 2019).

To be able to develop the industry or the fibres further, knowledge and understanding is required. Taxonomy of textile fibres and materials is one option for processing information. However, taxonomy of fibre materials varies; for example, hemp can be considered a natural material, a plant-based fibre or a bast fibre. Any of these groups can include fibres with different properties and with a varying impact on the environment. To estimate the environmental impact of a certain fibre type requires gazing into all of the phases, from feedstock to manufacture and from the using phase to after use. (Ellen MacArthur Foundation, 2017). Textile Exchange in their Global Fibre market report (2019) classifies fibres as following: plastic-based fibres also known as synthetics, plant-based natural fibres, animal-based fibres and materials, and man-made cellulosic fibres. Different fibre characteristics and their usage reasons are introduced next.

Plastic-based fibres are normally produced from oil and cover two-thirds of the textile feedstock. Polyester is by far the most produced fibre having a share of 52% (Textile Exchange, 2019), followed by nylon and acrylic (Ellen MacArthur Foundation, 2017). Elastane appears in many garments, however the volumes are quite low compared to other materials (Ellen MacArthur Foundation, 2017). Reasons for polyester being the most popular fibre are its durability, softness and crease-resistance, in addition, it is quite cheap (Ellen MacArthur Foundation, 2017). Also, other synthetics are adaptable and multi-purpose, and they do not take a long time to dry when wet (Ellen MacArthur Foundation, 2017).

Plant-based natural fibres are, for example, cotton, jute, kenaf, coir, flax, sisal, ramie, kapok, abaca and hemp. Cotton is by far most used, others are less common when compared to mainstream materials, by varying reasons, for example, price or hand-feel. Cotton has several benefits which explain its popularity; it is absorbent, non-allergenic, lightweight, strong, and offers good drape (Ellen MacArthur Foundation, 2017). Flax, hemp and jute are bast fibres and specially used in warm temperatures due to their fast-drying abilities, additionally, they are durable, soft and absorbent (Ellen MacArthur Foundation, 2017). Same time, bast fibres cost a bit more than cotton or polyester and for example, hand feel of hemp might be slightly coarse and its cultivation is banned in many countries due to the narcotic abilities (Ellen MacArthur Foundation, 2017). However, legalization of industrialized hemp has been improved last time in 2018, and there is more research ongoing around the industrializing hemp (Lee, 2019).

Animal-based fibres include wool, silk and down, in addition, leather is used for some garments and especially for footwear but as such it is not fibre. Animal-based materials sustainability has been discussed due to the concerns about animal welfare and environmental impacts of livestock raising (Textile Exchange, 2019). Same time animal-based materials have several benefits, for example, leather is durable, breathable and water resistant. Most of the leather used for clothing purposes come from bovine, followed by sheep and goat (Textile Exchange, 2019). Wool is most often from sheep and it is warm, strong

and breathable material, which is easy to dye and has great moisture-wicking features (Ellen MacArthur Foundation, 2017). It requires less washing than many other fibres and it can be recycled with quite good quality (Ellen MacArthur Foundation, 2017). However, wool is a relatively expensive material like other animal-based fibres as well. Silk is an appreciated material, which has a soft feel and good moisture-wicking abilities, however, growing silkworms is labour-intensive and often considered unethical due to the treatment of silk moth (Ellen MacArthur Foundation, 2017). Increasing concerns about the treatment of animals apply to down as well (Textile Exchange, 2019). 70–90 percent of the down production comes from China and duck being the main animal for producing down, followed by geese (Textile Exchange, 2019). Advantages of using down are its good quality of trapping air, being light, easy to compress, long-lasting and breathable (Pasteris, 2015).

Manmade cellulosic fibre are for example viscose, lyocell, acetate, modal and cupro (Textile Exchange, 2019). The group is named according to the processing methods, which is more similar to synthetic fibres than natural plant-based fibre methods. This group covers both virgin and recycled manmade cellulose. The raw material is quickly growing high-cellulose plants such as bamboo or eucalyptus, as well cotton has quite high cellulose content (Textile Exchange, 2019). Most common manmade cellulosic fibres are viscose and lyocell, which both have soft hand feel and silky appearance (Ellen MacArthur Foundation, 2017). Prices are often higher than cotton or polyester.

Every category and even every fibre type have less and more sustainable options. The Textile Exchange (2019) calls the latter as the preferred option and defines these as fibres and materials with improved social and environmental impacts, such as material, environmental certificates, low-resource use, traceable systems and new innovative fibres which support biodiversity. There is a growing need for these preferred fibre materials. As this industry is huge, changes needed are as huge.

To summarize, only few types of fibres are being used to produce tremendous amounts of textiles, mainly clothing, even though a great variety of different textile fibre materials exists. Although polyester and cotton have several good features, their massive usage is mainly a consequence of their low cost. Many other fibre materials have multiple good characteristics, however, higher price hamper competitiveness due fast-fashion phenomenon. Clothes are considered almost as disposable goods which is extremely resource intensive. Transitioning to a slower circle and to a greater diversity of fibres being used, especially the usage of preferred fibre materials, would consequently lead to a more sustainable industry.

## 2.2 Environmental impacts

The most common and harmful impacts of the textile industry will be introduced in this chapter (plastic pollution, chemicals, waste, water use and CO<sub>2</sub> emissions). Even though certain environmental impacts cannot be solely connected to certain fibres or production phases, most textile materials have their main sustainability issues and other characteristics. These will be discussed shortly with overall environmental impacts of the industry.

The current clothing system is extremely wasteful and polluting since it operates in an almost linear way, also described “take-make-dispose”. A lot of water, chemicals, energy and other resources are needed to produce raw material, spin them into a fibre, and weaving and dyeing fabrics (Nikolina, 2019). Most of the textile production is based on virgin materials and only 1 % of ready-made clothes are recycled into new clothes (Nikolina, 2019; Textile Exchange, 2019). A great part of clothes is made from non-renewable materials (Ellen MacArthur Foundation, 2017). This linear system not only consumes resources but pollutes and degrades the natural environment and its ecosystems at a local and global scale (Ellen MacArthur Foundation, 2017).

Plastic pollution is a widespread environmental problem of our time. Microplastics (synthetic polymers <5 mm) have been recognized as remarkable pollutant in freshwaters, terrestrial and atmospheric ecosystems, but especially marine environment seems to be a major sink for them (Belzagui et al., 2019). Microplastics have several negative impacts, they are changing the global environment and causing negative effects on wildlife (Zhang et al., 2019). Microplastics vary in shape, size and material and are derived from a wide range of sources including synthetic fibre from clothing (Xu et al., 2018). According to Zhang et al. (2019), distribution and biological effects of microplastics are still debatable issues due to the limitations on current research methods and environmental risk assessment. In addition to environmental issues, recent studies are concerned about microplastics effects for human health (Chen et al., 2019; Mishra et al., 2019; UK House of Commons, 2016). Plastic pollution relates especially on plastic-based fibres which are normally produced from oil and are non-renewable (Ellen MacArthur Foundation, 2017). These synthetic fibres are not biodegradable and the plastic shed to the environment remain there for a long time (Ellen MacArthur Foundation, 2017).

Chemicals are other great environmental problem of the clothing industry. The process from fibre to finished textile is long and each step of the process uses different chemicals for different purposes, leading to heavy overall use of the chemicals in the textile industry (KEMI, 2013). Reasons for using chemicals are their major advantages, such as water or stain repellence, performance-enhancing coatings or treatments, or a wide choice of colours (Ellen MacArthur Foundation, 2017). All kinds of textile materials are using some sort of chemicals. Only in the manufacturing phase of textiles are several stages where chemicals might be used such as; washing and scouring fibre, bleaching, mercerizing and dyeing of yarn and cloth, printing and finishing of cloth and

garment and washing of treated yarn, cloth, and garment (World of Chemicals, 2020). Chemicals have their adverse effects as well. Some of the chemicals seem to have a negative impact on the environment and human health and there are multiple chemicals in use which are classified as substances of very high concern (KEMI, 2016). Harmful chemicals spread to the environment during clothing production, use, and after-use phases (Ellen MacArthur Foundation, 2017). Some chemicals by themselves are not harmful, but their extensive use might disturb the balance of ecosystems, for example, heavy use of nitrogen as a fertilizer might cause eutrophication on water bodies (CFA & BCG, 2017). It is shown that some chemicals are carcinogenic or hormone disruptive and cause damage in the ecosystems where they end up, normally via factory effluent (Ellen MacArthur Foundation, 2017).

It is estimated that the textile industry's main damage to the environment is wastewater allowed to drain into the water bodies, which accounts for 80% of industry's total emissions produced (Lellis et al., 2019). Especially current natural fibre production uses a great number of pesticides and fertilizers (KEMI, 2013). In addition, cotton has a chemical-heavy dyeing process (Ellen MacArthur Foundation, 2017). Polyester has a lower chemical load than cotton and other natural fibres, however, polyester production uses heavy metals, some known as carcinogens (Ellen MacArthur Foundation, 2017). Lot of chemicals are needed in leather manufacture and great share still seems to be discharged to water bodies (Shegani, 2014). Also, chemicals and sometimes bleaching agents are needed in wool manufacture, and some of these are discharged to the environment (Ellen MacArthur Foundation, 2017). Viscose production as well is criticized for releasing highly toxic wastewater into the environment (Ellen MacArthur Foundation, 2017).

The current clothing system creates enormous amounts of waste. The global textile industry is rapidly developing a sector (Wysokinska, 2019). Clothes are often disposed of after use instead of taking them back to use (Ellen MacArthur Foundation, 2017). Due to the fast-fashion phenomenon clothing production has approximately doubled in the last 15 years and the average rate of wearing a garment has decreased by 36%, especially in high-income countries (Ellen MacArthur Foundation, 2017). Low-income countries still have a higher rate of clothing utilisation (Ellen MacArthur Foundation, 2017), however, most probably this is going to change when income rates rise. Already now, every year USD 460 billions worth of usable clothes are thrown away by consumers who for different reasons do not want to wear them, and most of these garments end up to landfill or incineration (Ellen MacArthur Foundation, 2017). Consumers are not alone creating textile waste. It is estimated that during fabric and garment production on average 25% of produced fibre gets spilt out of original supply chains for a variety of reasons (Reverse Resources, 2020). Some of these materials are used, but great share is incinerated, dumped or somehow downcycled (Reverse Resources, 2020). The issue is that the current model seems to bring immediate profit and changing to a circular model requires system-level change, which requires renewal and resources (Ellen MacArthur Foundation, 2017). Waste problem occurs to all textile materials

which are disposed, but especially to the most used, cheapest and poorly manufactured fast-fashion garments often made of polyester and cotton. Polyester and other synthetics being most significant waste producer due their high production amounts.

The clothing industry is a major water consumer. Production of raw materials is the most significant water use phase of clothing production (CFA & BCG, 2017). Furthermore, loads of freshwater is used for the manufacture of clothing, especially for dyeing and finishing processes (Ellen MacArthur Foundation, 2017). In addition, more water is used in the consumer use phase as they wash their clothes (CFA & BCG, 2017). Globally the freshwater use has not exceeded its limit (CFA & BCG, 2017), but especially cotton, which needs a huge amount of water to grow, is grown at water-scarce regions where the water stress state is near-permanent (Ellen MacArthur Foundation, 2017). For example, in India 100 million people do not have access to drinking water and at the same time the water used to grow cotton in the country covers 85% of the daily water needs of the entire population (Sustain Your Style, 2020). It is estimated that the fashion industry's water use will increase by 50% by 2030 if new innovations are not developed (CFA & BCG, 2017). Water use also causes dramatic environmental issues, as an example the desertification of the Aral Sea; these kind of changes have huge impacts on our ecosystems (Sustain Your Style, 2020). Even though cotton is a major water consumer, as for its benefit it can be recycled mechanically into new cotton or chemically into lyocell or viscose (Ellen MacArthur Foundation, 2017). This is important since according to the estimations in the future water resources are not enough for both cotton production and securing clean drinking water (CFA & BCG, 2017). As a benefit of plastic-based fibres they do not use that much water in the production and processing (Ellen MacArthur Foundation, 2017).

The clothing industry is responsible for 10% of the global carbon emissions (The Conscious challenge, 2019). It is more CO<sub>2</sub> emissions than international flights and maritime shipping combined (Ellen MacArthur Foundation, 2017). Furthermore, it is estimated that the industry's CO<sub>2</sub> emissions will increase by more than 60% by 2030 (CFA & BCG, 2017). Processing of the clothing causes most of these emissions, however, the use of clothing and production of raw materials also generate CO<sub>2</sub> emissions (CFA & BCG, 2017). Additionally, some carbon emissions are produced while transporting millions of garments purchased each year (The Conscious challenge, 2019). A great number of clothes are produced in China, Bangladesh, or India, where coal is used as the main energy source, which creates lots of carbon emissions (The Conscious challenge, 2019). These areas are particularly vulnerable to climate change and rising sea levels (CFA & BCG, 2017). Increased emissions increase climate change and shifting climate patterns, which have dramatic impacts on ecosystems (CFA & BCG, 2017). The carbon footprint of a clothing piece largely depends on the material used (The Conscious challenge, 2019). Especially the manufacture of polyester and other synthetic fabrics produce loads of carbon emissions due to the extraction of crude oil and energy-intensive processes (Claudio, 2007). Many other textile materials such as viscose, lyocell, cotton (dyeing process) and bast



fibres (spinning process) also use some energy-intensive processes (Ellen MacArthur Foundation, 2017) , which often means larger carbon footprint.

Some other environmental issues caused by the clothing industry are land erosion, poor soil quality, and rainforest destruction (The Conscious challenge, 2019). The clothing industry is responsible for degrading soil in different ways such as overgrazing animals producing textile material, using heavy chemicals to grow cotton and causing deforestation by unsustainable forest maintenance (The Conscious challenge, 2019). Unsustainable, wood-based raw material production causes rainforest destruction, and yearly thousands of hectares of rainforests are cut down and replaced by quickly growing trees for textile material use (The Conscious challenge, 2019). These impacts on land, soil and forest present a major threat for the ecosystems and contribute to global warming. Most of the environmental issues caused by the clothing industry also affect negatively on human health, such as chemical use.

Environmental impacts of different fibres vary remarkably as every fibre material has its benefits and downsides. Ranking different fibre materials in order is difficult due to complex processes. Understanding the bigger picture is important in being able to make sustainable choices. However it might be challenging since producing clothing has multiple steps such as fibre production, spinning, fabric production, dyeing & printing and clothing production; main environmental impacts of every production phase are marked in the Figure 3 (Karthik & Gopalakrishnan, 2014). In addition, impacts of transportation, usage phase and after use phase should be considered. In addition to industry's influences, consumers influence on the environment is great because of the water, energy and chemicals used in washing, tumble drying and ironing, and due to microplastics shed into the environment while doing laundry (Nikolina, 2019).

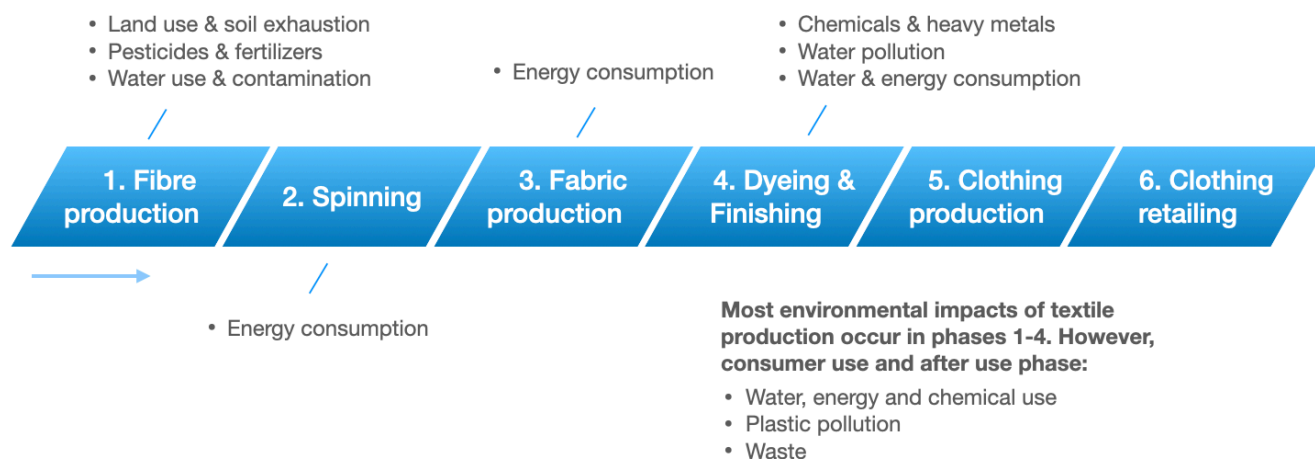


Figure 3: Textile production process and main environmental impacts (adapted with changes from Karthik & Gopalakrishnan, 2014)

### 2.3 Estimated future of the industry

In this chapter future scenarios of the clothing industry are introduced. Estimated future of textile fibres is touched upon, however, clothing industry as a whole is being discussed since possible different pathways of industry are strongly interlinked.

To achieve a more sustainable future requires moving from focusing on only few types of fibres to a wide variety of alternative fibres with low-resource intensity (Joy & Peña, 2017; Textile Exchange, 2019). Improvements are needed at every level of practices and also with the most used fibres; cultivation and production impacts needs to be reduced (Joy & Peña, 2017). Textile fibre innovation and development cannot be separated from the overall development of the clothing industry. Systemic thinking and circular economy are key matters to achieve a sustainable textile industry, however, there is not just a single pathway towards this (Textile Exchange, 2019). This complex problem requires questioning of current practices and the norm, and collaboration over familiar boundaries; designers, engineers, marketing departments and all others related need to plea the case (Niinimäki, 2013).

As we know, the volume of textiles produced is increasing and there are preferable fibres to fill the gap, however, comparing to the conventional fibres the volumes are still pretty low (Textile Exchange, 2019). One important group of preferred fibres is recycled materials, which support the idea of the circular economy (Textile Exchange, 2019). According to Textile Exchange report (2019) circular economy is one of the greatest megatrends in the textile industry, among with sustainable development goals, bio economy and microfibres. In bio economy especially biobased polyester is considered to play an important role when looking for renewable alternatives to fossil-based polyester (Textile Exchange, 2019). There are several factors which influence the sustainability of biobased polyester; feedstock of biobased material might be an issue if it causes biodiversity loss or competition with food agriculture (Textile Exchange, 2019). Microplastics continue to be a huge issue as amount estimated to be released in to the ocean by 2050 is 22 million mt according to Textile Exchange (2019). Sustainable development goals (SDGs) are 17 universally agreed goals to tackle environmental, social and economic issues. While SDGs address critical operational company risks they provide many business opportunities and actually around all mentioned megatrends have developed different kinds of initiatives, campaigns, research and innovative solutions (Textile Exchange, 2019) and most probably development will continue in the future.

In addition to megatrends, there are other estimations how the clothing industry will develop and how long the changes will take. A recently done study by C&A foundation (Daheim et al., 2019) reflects future perspectives in the fashion industry. The aim of the study is to make the sector contribute and debate on the future of its sustainability since according to the study, there is still much unclarity what should be done and when and what are best strategies and pathways. Especially industry's opportunities, pathways and how far away

the industry is from net-positive sustainability were studied in C&A foundation study (Daheim et al., 2019). The study discovered several concepts to fostering sustainability in the fashion industry and also estimated concepts of how the industry would remain after the change. Concepts are introduced next. Many of these concepts are related to each other and some are required to happen before other steps can happen. The first concept is 'increased global awareness', followed by 'fibres and processes innovation'. Sustainability reporting, worker-driven initiatives, high concentration/cooperation (among different industry players), extended producer responsibility and wages in the fashion industry were all discussed as crucial concepts for the industry to gain a more sustainable future. The study estimated that in the future resale/second-hand models, circular economy, clothing as a service and automation revolution will be established concepts in the industry. Additionally, consumer-level sustainability index (verified information provided), the majority of clothing is locally produced and tax regulations for increasing sustainability concepts are needed. The Figure 4 below illustrates all the discussed concepts.

Introduced concepts describe well how extensive the change needs to be and every player from the sector is accounted for. Every expert participating to the study gave "earliest time to mainstream" estimation for all concepts when they could become mainstream and depending on the concept reaching mainstream could happen in 5 to 16 years if enough actions are taken. With current efforts, net-positive sustainability is not estimated to happen according to the experts. In the Figure 4 below the timeline for the concepts can be found. Most of the founded concepts could become mainstream in 10 years and global awareness already in 5 years' time. Innovations related to fibres and processes are estimated to bloom in 8 years. Longest time will take to produce a majority of clothing locally (+16 years). Other concepts are estimated to become mainstream around 9-12 years. All the estimations are possible outcomes if the sector will take strong additional efforts for current practices.

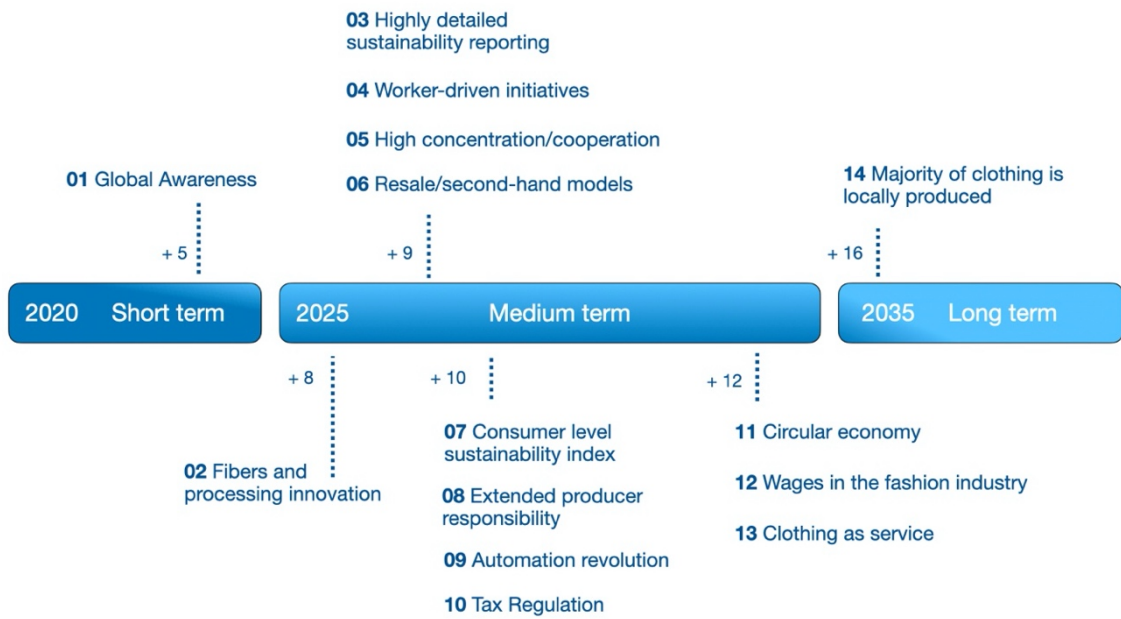


Figure 4: Timeline for sustainable fashion industry concepts (Daheim et al., 2019)

Especially fibres and processing innovation is by now fully ongoing and according to Textile Exchange (2019) solutions are already here and it is time to accelerate the growth of preferred fibres and materials.

Daheim et al. (2019) analysed most promising pathways towards this systemic change and most critical things were found: global awareness, education and regulation push. Especially global awareness is considered to be a key factor for other concepts to develop further. Secondly, political frameworks were greatly emphasized; such as taxes, laws and procurements have a major impact on accelerating and enabling sustainable change. Thirdly, education is an important factor in continuous development and creates a bridge: “between what is mainly a bottom-up approach of increased global awareness and the top-down approach of changed political priorities” (Daheim et al., 2019, p. 7). According to Daheim et al. (2019) different level players have crucial roles on transforming knowledge and skills for the use of current and next generation of citizens and consumers, designers and decision-makers. Daheim et al. (2019), concludes that sustainable clothing industry can be achieved through global coalition by industry (e.g. coordinated core message and transparency), cooperation and bottom-up communication (e.g. with communities and influencers) and changing the culture (e.g. business practices and policies).

The C&A foundations study (Daheim et al., 2019) does not clearly separate different players and their roles in the change. Looking at the concepts, it seems that the producers and the clothing companies have a great responsibility, and according to Książak (2017) companies are more and more held responsible for their supply chain and issues related to it. At the same time consumers role in the change is being discussed. In a study made by Boston Consulting

Group and Global Fashion agenda (CFA & BCG, 2017, p. 36) over 90 senior sustainability managers from global clothing industry were asked: "To whom would you attribute the major responsibility for driving the industry towards more sustainability?" And they answered that consumer is number 1. According to these sustainability managers, there are three main barriers for achieving more sustainable industry: consumers' willingness to pay, missing regulation and missing collaboration (CFA & BCG, 2017). These go quite hand in hand with the three pathways suggested by experts in C&A foundation study (Daheim et al., 2019).

As long as the responsibility roles are unclear for the industry players or internally in the company, it might be more challenging to create the change. Desore & Narula (2018) have researched corporate responses towards sustainability issues in textile industry and claim that there is a gap on research what are the managerial perceptions towards new technologies and processes. According to the authors, it is crucial to understand firms' motivational factors and barriers to implementation, however, managers' own ethical commitment, values, desires and attitudes towards the company and its' sustainability strategies are not researched enough. Although there is evidence that manager's commitment and attitude have an important role when adopting environmental management practices and decision making (Sharma & Narula, 2020). Desore & Narula (2018) also claim that in the future more research is needed on the role of collaboration between industry partners and other members in the supply chain and additionally, attention should be paid to the differences between multinational companies and domestic firm practices. Meaning that while steps towards sustainability are taken, more knowledge about the best practices should be gathered.

As future always, future of the clothing industry is unknown, however, different kind of estimations and pathways to obtain more sustainable industry exist. Different concepts fostering sustainability, such as fibre and process innovation or circular economy, are strongly related and dependent on the overall development sustainability of the clothing industry. In order to achieve a more sustainable clothing industry, great additional efforts on current practices are needed from industry practitioners and consumers. Additionally, more research for understanding perceptions of different players in the industry is needed, as seen that managerial perspective is not well understood. Consumer perceptions and behaviour is discussed more detailed in next chapter.

### 3 SUSTAINABLE CONSUMPTION OF CLOTHING

This chapter concentrates on green consumerism especially in terms of clothing and current research on sustainable consumer behaviour. As the current research is limited on textile fibres, this chapter merely concentrates on sustainable consumption of clothing.

#### 3.1 Green consumption

In this chapter sustainable consumption and, in particular, consumption habits related to clothing are discussed. Additionally, the current understanding of consumer perceptions towards green consumption will be introduced.

Already in 1970 humans used for the first time more resources in a year than nature can provide (Early & Murray, 2019) due to the second industrial revolution. Industrialization has led us to the situation where our consumption habits are not sustainable. Sustain is comparable “to uphold” or “to maintain” and, when considering our industrial world, “sustainability means establishing those principles and practices which can help to maintain the equilibrium of nature, in other words, to avoid causing irreversible damage to the Earth’s natural resources” (Karthik & Gopalakrishnan, 2014, p. 153).

Challenge at the current society is that a successful company is often defined by the volume of production and sales. Sustainability and sustainable consumption are quite regularly seen as the opposite to this and believed to decrease profitability (Karthik & Gopalakrishnan, 2014). At the same time consumers are appreciating ecological options more than before and sustainable brands are gaining more popularity and overall an environmental lifestyle is increasing (Vehmas et al., 2018; Wiederhold & Martinez, 2018). Due to this companies have changed their strategies and different kinds of environmental claims are a common sight in current society. They are meant to help consumers to identify a product with minimal negative environmental impacts (Karthik & Gopalakrishnan, 2014). Regarding textile products, previously purchasing clothing was mainly based on style, comfort and aesthetic appearance, but nowadays eco-friendliness is considered also as a remarkable factor (Karthik & Gopalakrishnan, 2014). A sustainable textile product can be defined, for example, with renewability, carbon footprint or other resources used and chemical load to grow/process a product (Karthik & Gopalakrishnan, 2014).

Drivers towards sustainable clothing industry are the same as in the other sectors; different stakeholder groups and environmental catastrophes or company values, which support the existence of the company (Książak, 2017). According to several studies (CFA & BCG, 2017; Peng Tan et al., 2016; Zhao et al., 2013) consumers and their consumption habits are the main driver on a change towards a sustainable clothing production. Technology, policies and social initiatives do matter as well, however, the influence will not be strong

without the change in consumers (Zhao et al., 2013). For example, in the OECD (Convention on the Organisation for Economic Co-operation and Development) countries consumers are responsible for more than 60% of final consumption (Peng Tan et al., 2016). The clothing industry is creating for example, eco-fashion labels to answer the demand, however, eco-products still do not sell too well (Osburg et al., 2019; Vehmas et al., 2018) and the gap between environmentally friendly intention and purchasing eco-products still exists (Joy & Peña, 2017; Norbaya Yahaya et al., 2018; Osburg et al., 2019; Vehmas et al., 2018; Wiederhold & Martinez, 2018).

Consumers are not a unified group and there are a number of motives to buy clothing, such as practical, emotional and social motives. Practical shoppers buy mostly for need, but emotional and social motives can be anything from 'retail therapy' to social pressure (Ellen MacArthur Foundation, 2017). Social and emotional motives also include attitudes toward sustainability. Globally a growing number of consumers demand more sustainability information from clothing companies, and for example in China, consumption habits are going through a change as consumers hope to impact positively on environment and make a good impression on other people (Vehmas et al., 2018). The so-called slow-fashion concept has also become more popular, which refers changing a mindset from quantity to quality; the invested product is appreciated by the consumer and it is manufactured within increasing social values and the common good (Vehmas et al., 2018). There is also evidence that green purchase intention and green purchasing are positively related with subjective wellbeing (Jian Xiao & Li, 2010). According to literature it seems that spending on others, such as charity, increase life satisfaction and happiness (Jian Xiao & Li, 2010).

At the same time overconsumption is a huge problem and a study made by Greenpeace (Wahnbaeck & Yen Roloff, 2017) reveals that in Europe and especially in China great amount of consumers buy more clothes than needed. Fast fashion, online shopping and social media are driving to overconsumption and especially young, high-income women shop even more than what makes them happy (Wahnbaeck & Yen Roloff, 2017). The main motivation for shopping is gaining excitement, satisfaction and confidence, additional reasons are stress release, killing time and to relieve boredom (Wahnbaeck & Yen Roloff, 2017). However, in the Greenpeace study around half of the East Asian shoppers reported that the excitement is gone within a day and they even hide their purchases from others due to possible accusations of wasting money or other negative reactions (Wahnbaeck & Yen Roloff, 2017). A third of East Asian respondents felt even more emptiness and unfulfillment afterwards (Wahnbaeck & Yen Roloff, 2017). According to Fletcher (2014), habitual clothing shopping which is done due to the societal pressure to constantly reformulate identity has been linked to psychological insecurity and rising levels of mental illness. According to Wiederhold & Martinez (2018) consumers interested in sustainable fashion face a variety of influencing factors and they feel a great share of pressure between their values to behave ethically correct and their social needs to pursue self-esteem and obtain acceptance.

Environmental knowledge means “general knowledge of facts, concepts and relationships concerning the natural environment and its major ecosystems” (Kwong Goh & Balaji, 2016, p. 631). Often consumers lack knowledge on how their behaviour impacts on the environment; for example, it is not clear how the garment is made or how much resources are needed to produce it. (Vehmas et al., 2018). According to Vehmas et al. (2018), some young consumers do not link sustainability and fashion together even though sustainable clothing concept is appreciated. Almost all clothing is produced in developing countries and proper information about conditions is often missing (Vehmas et al., 2018). Vehmas et al. (2018) proposes that lack of media coverage might be one of the reasons for poor awareness and better communication of the benefits of sustainable clothing should be increased, as clothing sustainability is too complex for consumers to be able to choose well.

In current society unfavourable associations towards sustainable consumption exists as well; some consumers have negative perceptions towards stereotyped “greenies” which can affect on purchase behaviour (Peng Tan et al., 2016). In addition, one topical issue on sustainable clothing among consumers is scepticism towards industry’s environmental claims; concerns of false and misleading information is growing (Kwong Goh & Balaji, 2016; Wiederhold & Martinez, 2018). Consumers worry that firms wish to improve their sales and reputation by greenwashing and reckless environmental behaviour, causing a negative effect towards green product purchasing (Kwong Goh & Balaji, 2016). To tackle this issue, companies should provide adequate information about the environmental claims and consider it as educating consumers and enhancing the company’s environmental image (Kwong Goh & Balaji, 2016).

To pull it all together, consumer attitudes are undergoing a transformation, as eco-friendly behaviour is more appreciated and traditional consumption habits are questioned. However, at the same time many consumers have distorted image of consumption due to for example, social media and fast-fashion phenomenon. Additionally, false or even negative perceptions about sustainable consumption exist. This can be considered great business possibility for sustainable companies, who are able to educate consumers and change their consumption habits.

### **3.2 Sustainable consumer behaviour**

This chapter goes through theory related to different factors and behavioural theories explaining sustainable consumer behaviour. As theory related to sustainable consumption of clothing is limited, sustainable consumer behaviour overall is discussed as well.

Significant efforts have been made to understand drives for green consumption but often the results are inconsistent and thus ambiguous (Peng Tan et al., 2016). Especially the attitude-behaviour gap has been researched but clear reasons for it has not been found (Moser, 2016; Osburg et al., 2019; Vehmas et



al., 2018). Methodological issues, situational influences and other individual characteristics have been analysed to understand the gap, without clear outcome (Osburg et al., 2019). It seems clear that there are multiple factors influencing and explaining individual behaviour. These factors can be divided for example, into internal (e.g., environmental knowledge, motivation, the possibility to impact, attitudes and values) and external (e.g., economic, institutional, social and cultural) factors (Wiederhold & Martinez, 2018). According to Vehmas et al. (2018) especially individual characteristics could provide more information in the future as there is evidence that consumers do not always behave according to their values and purchasing decisions are often irrational.

Some of the most influencing factors have been tried to determine and according to Biswas & Roy (2015) price and environmental knowledge are considered to be the major determinants for purchasing green products. Also, according to Vehmas et al. (2018) price seems to be one factor. Zhao et al. (2013) adds that income correlates positively but not significantly with purchasing behaviour. Several other studies have found that environmental knowledge correlates positively with pro-environmental behaviour as well, however not always, and it seems that the relationship between awareness and behaviour is far more intricate (Kwong Goh & Balaji, 2016; Peng Tan et al., 2016; Zhao et al., 2013). Liobikiené et al. (2016) brings up that subjective norms and information interaction and the trust in green products are remarkable factors influencing on green purchasing behaviour.

Attitude towards sustainable consumption matters as well. Several research results indicate that the role of attitude predicts remarkably environmentally friendly purchase behaviour (Kumar et al., 2016; Sun et al., 2018; Zhao et al., 2013). It is suggested that attitudes determine actual behaviour only if all influencing factors and conditions are favourable (Kumar et al., 2016; Zhao et al., 2013). According to Vehmas et al. (2018), certain characteristics enhance a positive attitude towards environmentally friendly consumption, such as status enhancement, altruism, consumer effectiveness and happiness. It is also found that some personality traits affect positively on attitudes toward sustainable consumption, such as agreeableness, extraversion, conscientiousness and openness to experience, however, the strength of the significance was often dependent on age and gender (Sun et al., 2018).

Differences on attitudes towards sustainable clothing between gender have been studied and depending on the study, some divergence has been found, according to Vehmas et al. (2018) men do not consider sustainable fashion as stylish and unique as women do. In turn, Savita and Kumar (2010) did not find any significant difference among gender on attitudes towards environmentally-friendly products, however, the study did not concentrate merely on clothing. Savita and Kumar (2010) found that people living in rural areas position less positively towards environmentally friendly products than urban area residents. Age might also influence on attitudes, according to Vehmas et al. (2018) older generation estimate themselves behaving more ethical than the younger consumers, however, it was not amplified in the study how perceptions appeared in practice.

Among all age groups reuse of clothing, or at least the idea of it, has increased and among young generation swapping clothing and donating to charity is getting more popular as it makes it easier to be fashionable and change styles more often (Vehmas et al., 2018). Cultural differences have been also studied and for example, a higher price is interpreted differently; in the UK it refers higher quality and in France, higher status and results apply also in the consumption of second-hand clothing (Vehmas et al., 2018). Prevalence of second-hand clothing consumption has been researched also in other countries; in the USA it is many times more common than in China, however, the differences are evened out remarkably among young consumers (Vehmas et al., 2018). Liobikienė et al. (2016) researched cultural differences in the EU and claims that culture itself has not a significant influence on green purchase behaviour. However, the authors agree that cultural dimensions are related to factors which influence directly on the green consumption, such as subjective norm and level of knowledge and confidence in green products.

Peng Tan (2016) adds that purchasing sustainable products may be perceived too challenging or difficult (e.g. requires expertise/knowledge or availability is poor). Wiederhold & Martinez (2018) agree that availability plays an important role in ethical purchasing behaviour and it is being practised only when necessary infrastructure is available. Availability, however, is not enough for purchasing ethical, additionally, consumers need some sort of tangible reward or justification for higher prices, otherwise ethical alternatives are rejected (Wiederhold & Martinez, 2018).

Communication also influences behaviour. It was found that when ethical information about the product is offered and noticed in the purchasing situation, sustainable consumption is more likely to occur (Osburg et al., 2019). However, increased communication on ethical or environmental issues might not alone solve the problem, in addition, it could be beneficial to highlight for example, high-quality of the garment since personal fashion needs, price and quality of a product are considered influencing purchase decision more than social and emotional values (Vehmas et al., 2018).

Vehmas et al. (2018) have researched effective communication on the sustainable fashion industry and according to them, it's good to use multiple channels and pay attention to the timing of the posts and to the shopping experience. (Vehmas et al., 2018). In addition, it would be beneficial to communicate with short and creative messages and pay attention to visuals and non-verbal forms (Vehmas et al., 2018). It is also important that communication includes relevant research and trends from the industry, compelling products or services, consistent values and feedback possibilities (Vehmas et al., 2018). Influencers should not be forgotten; in addition to celebrities promoting a brand, designers, advocates and entrepreneurs should be involved (Vehmas et al., 2018) to possibly gain more comprehensive and consistent brand image. Additionally, eco-labels and certificates add credibility and reduce consumer scepticism towards green products (Kwong Goh & Balaji, 2016).

Various behavioural theories have been used for analysing pro-environmental behaviour (Liobikienė & Poškus, 2019; Wiederhold & Martinez, 2018).

Most commonly these theories are based on Ajzen's behavioural models: theory of reasoned action and the related theory of planned behaviour (Wiederhold & Martinez, 2018; Zhao et al., 2013). According to the theory of planned behaviour, attitude, intention, social norms (e.g, perceptions of social pressure) and perceived behavioural control explains human behaviour (Wiederhold & Martinez, 2018). Theory of planned behaviour seems to be quite a good predictor of sustainable consumption (Wiederhold & Martinez, 2018; Yadav & Pathak, 2017) although still not being perfect and even the authors of the theory accept it is not flawless (Liobikienė & Poškus, 2019). Multiple modifications to these theories have been done (Liobikienė & Poškus, 2019; Wiederhold & Martinez, 2018) but it still seems that there is no theory or model which could explain consumer behaviour properly. Wiederhold & Martinez (2018) criticize that great share of consumer behaviour cannot be explained by these behavioural models as they assume that individuals act rationally, and no individual, social or institutional barriers are considered in the theories. Wiederhold & Martinez (2018) researched the main factors influencing the attitude-behaviour gap in the sustainable fashion industry and regarding to the analysis, they found the following barriers: price, transparency, availability, environmental knowledge, consumption habits, image and sluggishness. Even if consumer would be willing to purchase sustainable clothing and have a positive attitude towards the idea, it might require for example, too much effort.

To conclude, several internal and external factors influence attitudes and purchase decision when buying sustainable products. Environmental knowledge, which can be increased especially with effective brand communication, influences positively and significantly on purchasing green products. However, the company should be aware of especially their own customers' possible barriers which creates attitude-behaviour gap.

## 4 METHODOLOGICAL CHOICES

In this chapter, the research design, survey creation process and data as well as the collection method are presented.

### 4.1 Research design

In this study a quantitative approach is used. Quantitative research systematically studies phenomenon by using statistical, numerical data (Watson, 2015) and the researcher has an important role in converting the data into knowledge (Hair, 2015). The quantitative method tries to identify and confirm connections and trends from the data set, which can be generalized to larger populations (Hair, 2015; Heikkilä, 2010). For this reason a quantitative approach is suitable, especially for larger samples. Before the collected data can be analysed, it must be edited and coded, sometimes even transformed into a different format and researcher should be aware of the best practices according to his/her study (Hair, 2015). Quantitative data consists of variables, and it is up to the researcher to choose the most suitable analysing methods for the variables in his/her study (Allen et al., 2009).

One great benefit of a quantitative research is its ability to test theories by creating hypotheses and doing statistical analyses (Watson, 2015). Quantitative research questions can also concentrate on explaining the reasons for a certain phenomenon or finding solutions on the studied issue (Heikkilä, 2010). In quantitative research, it should be determined if research involves hypothesis testing or descriptive analysis (Hair, 2015). Descriptive analysis requires large sample as the aim is to represent trustworthy, specific results, which can be generalized (Heikkilä, 2010). For example, opinion polls and various statistical surveys can be descriptive studies (Heikkilä, 2010). In this study, hypotheses are not created as the analysis is not directly based on theory. Instead, descriptive analysis is done, which is, however, based on theory and literature and theory gives instructions into the analysis.

### 4.2 Survey creation and data collection

The data was gathered by Norstat, a multinational company, which core business is to collect and analyse data. Online survey data collection took place in May 2020. Data was gathered for Spinnova and the author was responsible for creating the survey and organising data collection in collaboration with Norstat.

The first draft of the survey was created by the author. Before creating the first draft of the survey a discussion with the chief commercial officer and the head of communication from Spinnova was held. Based on the discussion,

survey themes were chosen, and draft was done. Theory gave instructions for conducting the questionnaire. However, the draft was modified as Spinnova had additional wishes for the survey. The draft was made in English and it was piloted within a small group of Finns known by the author. The pilot round had 11 respondents known by the author, 9 females and 2 males ranging from age 24 to 57, however, most respondents being under 30. Pilot group included mainly individuals with no formal knowledge on the topic as they represent the target group of the research. However, some participants had more expertise about the topic, and they were able to give valuable feedback about the questionnaire.

Respondents were interviewed after they filled the survey and the test round showed that the topic was extremely challenging for respondents and due to this, they were not able to answer the questions properly. Respondents told that both the vocabulary and the topic itself caused difficulties and many responses were purely based on guessing. For this reason, the third draft was created, this time in Finnish to make sure that the language was not a barrier for understanding the questions. This version was tested again with 11 respondents (two respondents being same as on the first round) known by the author. Second pilot round had 8 female and 3 male respondents from ages 24 to 33. Again, respondents were interviewed afterwards, and the second round gave better results in a sense that respondents understood the questions and they did not base their choice on random. Some small modifications were done based on the pilot respondent interviews. After successful piloting, the survey was still modified slightly (e.g. related to technical aspects and vocabulary) based on Spinnova's and Norstat's comments. The survey questions can be found in Appendix 1.

Due to possible geographical differences in consumer perceptions, different countries were included in this study: Finland, Sweden, Germany, France and the USA. To gain comprehensive results, over 300 participants per country were studied. Master form of the survey was made in English and delivered to Norstat, which translated the survey to the respondents' mother tongue. Norstat was also responsible for the visual and technical implementation of the survey. Mainly multiple-choice questions were included, however, there were four open-ended questions in the survey as some questions had an option to answer 'something else' or respondents were asked to specify their response. Multiple-choice questions were asked for example, 'In your opinion, how sustainable are the following textile fibre raw materials'. Different materials and a scale from 1-5 (1=not sustainable at all, 5=very sustainable) was provided.

The total number of responses is 1580. Relevant number of responses to the open-ended questions in this thesis is 291. The respondents are from Finland, Sweden, Germany, France and the USA between the ages of 15 and 40. With the USA respondents the sample gives quite a good insight on the western consumers perceptions, although as such it is not generalizable. Additional background information, such as income, civil status and education are considered, only exception being education since it is unknown from the USA

respondents due to it is not included in the respondent profile and was not asked separately. The respondent profile table can be found on Table 1.

All answers were given anonymously, and the respondents were told the data was gathered by Spinnova and would be used for developing more sustainable business practices in the textile industry.

### 4.3 Data preparation and analysis

Data analysis in quantitative research involves the following steps (Hair, 2015). Firstly, conceptual framework and relationships are studied. Secondly, data is prepared for the analysis. Then, depending on the approach, descriptive analysis or hypothesis testing is done, followed by conducting an analysis. The last step is to evaluate findings to assess whether they are meaningful. This thesis follows the steps introduced above. Data was received as separate excels from Norstat and required quite a lot of preparation to be analysed in an SPSS program. Especially background variables were not directly comparable as different countries had, for example, different education systems and due to this reason required classification. Classification process is explained next.

Respondents were reclassified as following categories: age, education, income and civil status. Respondents announced their real age (between 15-40). Around half of the respondents were between 15-29 years old and another half between 30-40. Three groups were created: 15-20, 21-30 and 31-40. Civil status divided respondents in following five groups: living alone/single (with or without children in the household), married/partner without children in the household, married/partner with children in the household, living with parents and other/don't want to state. Some countries had additional options such as widowed and divorced/separated, but there were only a few and these were included in to living alone/single (with or without children in the household).

Respondents were regrouped in to three income groups: low-income, medium-income and high-income, based on their monthly or yearly announced income. In addition, fourth group I don't know/I don't want to state includes some respondents. Currencies and categories were different in every country and required data preparation. For changing currencies Bank of Finland's currency changer was used. All research countries belong to the OECD countries, however even in OECD countries middle-income thresholds varies a lot, normally being between 75% and 200% of the median national income (OECD, 2019). For each country middle-class threshold was reviewed (OECD, 2019) and respondents who met those values formed a medium-income group. Lower values formed a low-income group and vice versa for high-income group. There were ready-given income categories in the survey, which were not equivalent for newly formed categories, meaning that the respondent could belong to two groups. In these cases, the most suitable group was chosen. Especially both France and Germany had one income group which was really on a limit of two categories. In both cases further research of the countries' middle-class

(Kochhar, 2017) was done to choose the right category. Kochhar's (2017) working paper also studied Finland's and the USA's middle classes, and the results supported chosen categories.

Based on respondents announced education they were divided into two groups: academic and non-academic. Third group included other/I don't want to state. The academic group included higher education than the high-school level. However, the academic group might include respondents who graduated from vocational school or with other degree due to the used categories in the survey. USA respondents had not announced their education and they were excluded when education's influence was researched.

Classification always destroys information and for this reason the original data should be retained (Heikkilä, 2010). At the same time classification simplifies analysing and for some analysing methods classification is required (Heikkilä, 2010). Every category's each variable is also coded with numbers for analysing purposes (e.g. male=1). Few respondents did not express their education, civil status or income and these are not included in the sample characteristics. Additionally, respondents who answered 'don't want to state' are excluded from the study when certain variable's influence is studied (Table 1).

Most of the survey questions were Likert-scale questions (1=don't agree, 5=fully agree), which can be analysed either with parametric or non-parametric tests depending on the sample (Karjaluoto, 2007). It is not generally accepted which test should be used for ordinal data and Likert-scale questions; the debate is ongoing. For this study both parametric and non-parametric tests are applied. As the data material is reasonably large, parametric tests and crosstabs are used for descriptive statistics and comparison among different groups (e.g. country of origin). Median value is represented for some values.

A non-parametric Spearman correlation test is used to evaluate the correlation coefficient in order to determine the strength of the relationship (Heikkilä, 2010). The Spearman correlation is a bivariate analysis and especially suitable for ordinal scale where variables are ordered, although the difference level might be unknown (Hair, 2015). Also, correlation can be used for nominal variables if they are binary variables (only taking two values) (Heikkilä, 2010). According to Hair (2015, p. 378), "The Spearman correlation coefficient typically results in a lower coefficient but is considered a more conservative statistic". In this thesis the Spearman's correlation is used for searching associations among ordinal variables. Additionally, the Spearman's correlation is used for some binary variables (yes/no questions).

The Spearman test gives value for the strength of relationship between +1 and -1; closer to the value 0 means weaker relationship between the two variables (Akoglu, 2018; Hair, 2015). In this study following correlation coefficients are interpret such as (Akoglu, 2018):

± 1	perfect
± 0.7 - 0.9	strong
± 0.4 - 0.6	moderate
± 0.1 - 0.3	weak

However, for the interpretation of the scale other guidelines are possible as well (Akoglu, 2018; Hair, 2015). Hair (2015) gives one proposed option for guidelines, which is slightly less strict than the chosen guidelines for this study. Due to this, and the use of the Spearman's correlation, some slight relationships might not be detected from the data. However, this means that the detected relationships are more valid. The Spearman's correlation only provides correlation coefficient between values, not explanations for them (Heikkilä, 2010).

A great share of the background variables and questions in this survey are of nominal scale. Nominal scale variables describe the category into which they belong, but variables cannot be ordered, and values cannot be used to perform calculations (for example, gender) (Heikkilä, 2010). For this reason data-analysis for nominal variables is limited and is mainly restricted to counts, modes and percentages (Hair, 2015). However, chi-square is a non-parametric statistic test which can be applied to nominal variables (Hair, 2015; Heikkilä, 2010). Chi-square helps to detect dependency among variables (Heikkilä, 2010) and is used in this thesis to test a statistical significance among the nominal variables. Cramers'  $v$  and phi values help to interpret the strength of the relationship (Akoglu, 2018) and are used as a guidelines in this thesis. Due to the characteristics of nominal values, crosstabulations with count, expected count and percentage are main analysis methods for nominal values. Also, ordinal background variables are analysed with this same method so that the background variables and their significance to the responses are proportional to each other.

Statistical significance (p-value) is tested and marked with \*\* (Correlation is significant at the 0.01 level (2-tailed) or \* (Correlation is significant at the 0.05 level (2-tailed)). It's generally accepted that if p-value is less than or equal to .05 there is statistical significance, value 0.05 means that there is a 5% probability that our results might vary (Akoglu, 2018; Hair, 2015).

The open answered questions are only partly analysed in this thesis because the gathered amount of data was larger than expected and would have required more resources than considered for a thesis project. Additionally, open answers were received in respondents mother tongue and were not translated yet when conducting this thesis. For this reason, only Finnish responses were analysed (291 responses). Open-ended answers are analysed so that similar answers form a group and the main message is searched and identified.



Table 1: Sample characteristics table

<b>Variable</b>		<b>n.</b>	<b>% of respondents</b>
<b>Country of living</b>	Finland	310	19.6
	Sweden	302	19.1
	USA	349	22.1
	France	308	19.5
	Germany	311	19.7
Total		1580	100
<b>Age</b>	15-20	211	13.4
	21-30	599	37.9
	31-40	769	48.7
Total		1579	100
<b>Education (USA excluded)</b>	Non-academic	483	39.4
	Academic	739	60.2
	Don't want to state	5	0.4
Total		1227	100
<b>Civil status</b>	Living alone/Single (with or without children in the household)	624	39.6
	Married/partner without children in the household	293	18.6
	Married/partner with children in the household	432	27.4
	Living with parents	166	10.5
	Other/Don't want to state	61	3.9
Total		1576	100
<b>Income</b>	Low-income level	506	32.1
	Medium-income level	653	41.4
	High-income level	200	12.7
	Don't want to state	217	13.8
Total		1576	100

## 5 RESEARCH FINDINGS

Research findings are represented in the following order, firstly results related to the textile industry and fibres on a general level are introduced. Then new alternative textile fibres are discussed in more detail, followed by background variables with a possible influence on perceptions.

### 5.1 Attitudes towards textile fibres and the industry

In this chapter results related to the consumer perceptions towards the sustainability of the textile industry and textile fibres are covered. In addition, findings related to textile materials' and other sustainability factors' influencing buying decisions are introduced.

Most respondents told that textile materials impact significantly or somewhat on their buying decisions (Figure 5). Rest estimated that textile materials do not really impact on their buying decisions by answering 'very little' or 'not at all' (Figure 5.).

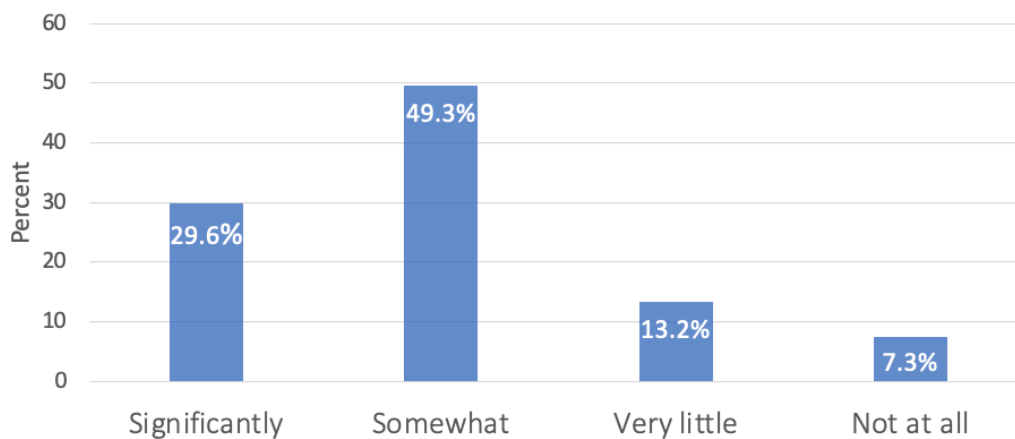


Figure 5: How much textile materials affect buying decision.

When respondents estimated different factors, which tells them about the sustainability of the product, textile material was estimated as the second most remarkable factor (Figure 6). In a scale of 1-5 (1=doesn't tell much, 5=tells quite a lot) textile material factor got a median value 4 'tells quite something' as 20.6% of respondents estimated it 'tells quite a lot' about sustainability 29.9% estimated it 'tells quite something' and 34.9% answered 'tells me somewhat'. The

rest estimated that textile material tells little (9.1%) or doesn't tell much (4.1%). The most important factor which tells about sustainability, according to all respondents, is that the Brand is known for its sustainability. It got a median value 4. Other factors got median value 3 and mean value of responses varied somewhat (Figure 6). The textile material is considered as the second most remarkable factor. The least informative factor about sustainability was considered High price level. When the factors were analysed by median value 'brand is known for sustainability' it was the only factor which was considered to 'tell quite something' in addition to 'textile material', other factors 'tell somewhat'. All responses have skewness and kurtosis value less than  $\pm 1$  (Something else - open question excluded).

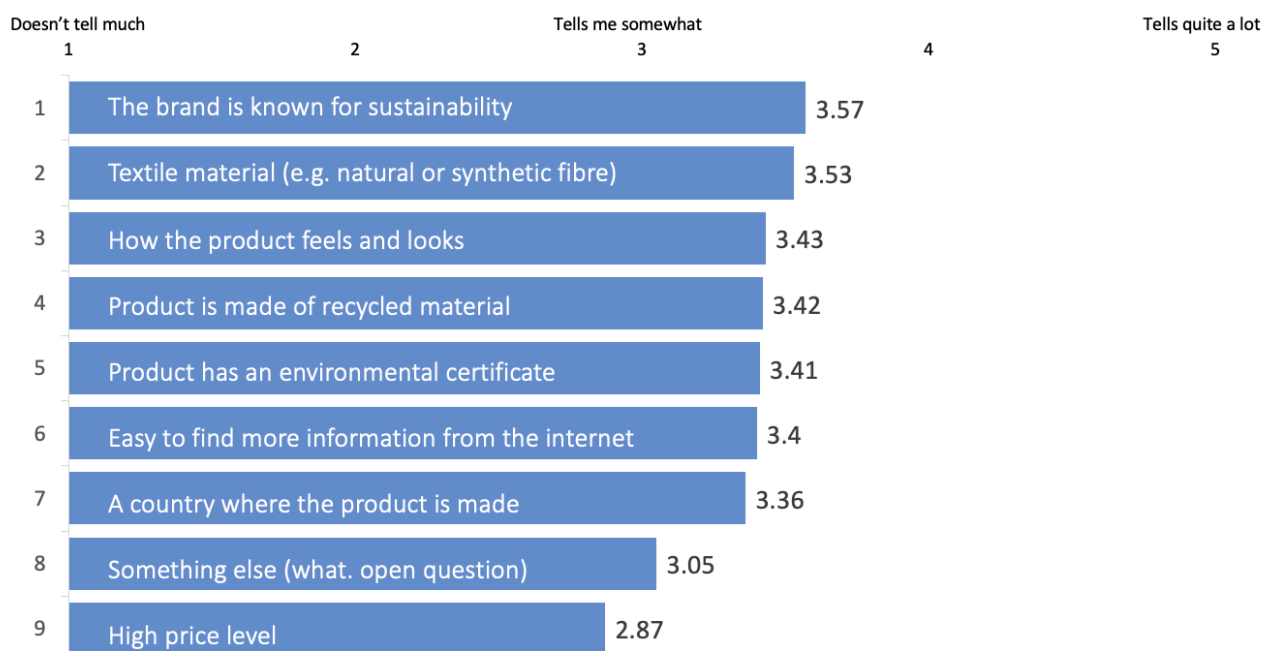


Figure 6: How much do the following factors tell about the sustainability of the product - mean value

For the something else -option 17 answers were gathered. They were partly overlapping with the given options, as answers were such as 'cotton' which would belong to the textile material category. Somebody emphasized organic cotton in their response. The brand and the retailer were mentioned a couple of times, as well as ads and product designs. Not one particular factor was highlighted in this open-ended question.

Next task for respondents was to estimate how sustainable they consider some traditional and new textile materials to be. In the questionnaire six different materials were listed (cotton, wood (fibre), crude oil, lamb wool, plant-

based waste and animal-based waste) and respondent could give a value from 1-5 (1=not sustainable at all, 5=very sustainable) (Figure 7). For plant and leather-based waste short explanation was provided as in the pilot round these were not understood (appendix 1). Among all respondents, plant-based waste was estimated as the most sustainable with a median value 4 and crude oil least sustainable with a median value 2. Other materials got a median value 3 and mean values varied only slightly (Figure 7). The median value of responses show that plant-based waste is considered as 'quite sustainable', crude oil 'not so sustainable' and other materials 'somewhat sustainable'. None of the fibres were considered 'very sustainable' or 'not sustainable at all'. All responses have skewness and kurtosis value less than  $\pm 1$ .

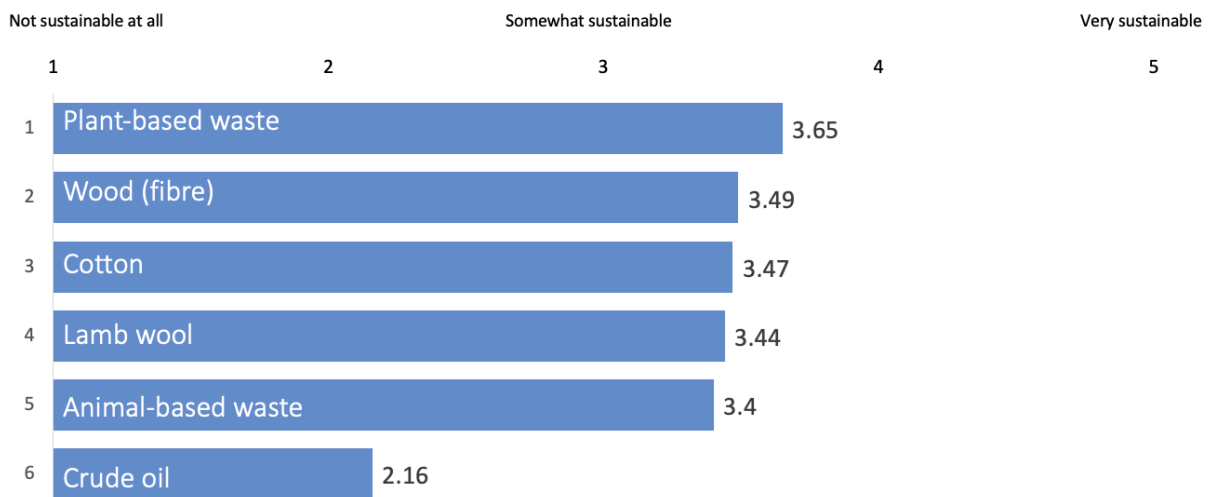


Figure 7: How sustainable are different textile fibre raw materials considered – mean value

Respondents also estimated which sustainability issues they associate with the clothing industry. Seven common, mainly environmental, issues were listed and respondents gave them a value 1-5 (1=not at all, 5=strongly) (Figure 8). Forest use as a sustainability issue was associated as the least harmful (median value 3) and harmful chemicals was associated as the most harmful (median value 4) in the clothing industry. Every other value, except forest use, had a median value 4 and the mean values varied somewhat (Figure 8). The median value of responses show that all of the listed sustainability issues are considered to be related to clothing industry 'quite strongly', except forest 'somewhat'. Results show that in the consumer context many of the current sustainability issues are associated with the clothing industry quite strongly. All responses have skewness and kurtosis value less than  $\pm 1$ .

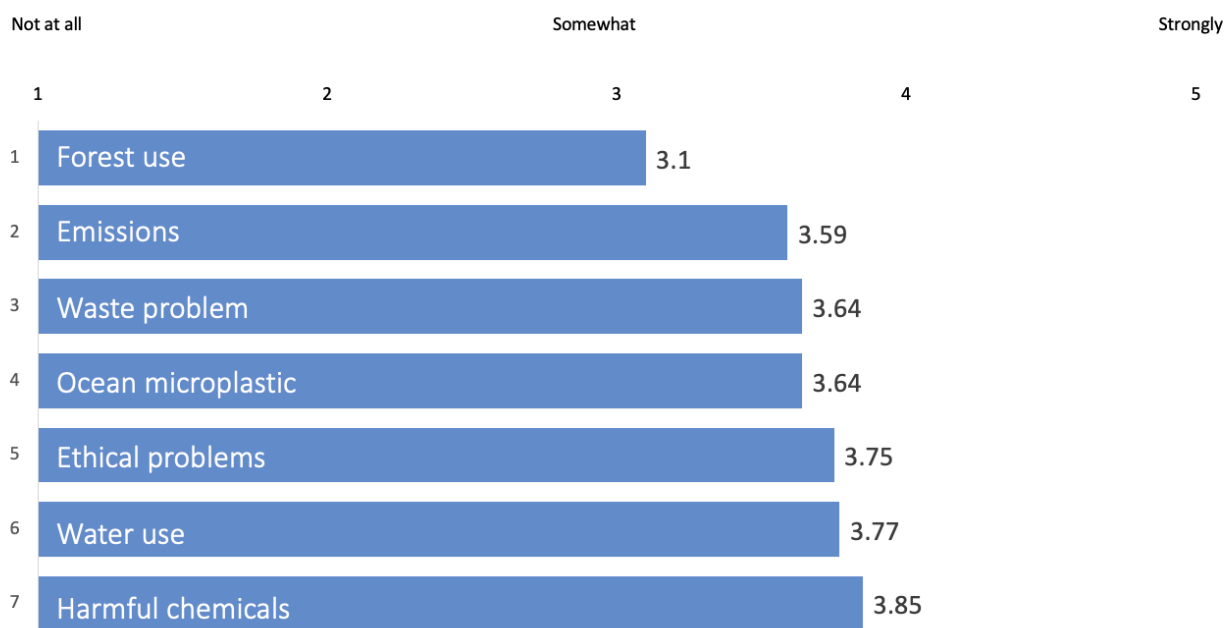


Figure 8: How strongly are different sustainability issues associated with the clothing industry – mean value

Overall responses show awareness. Sustainability issues are linked to the clothing industry and there is some divergence how the sustainability of different textile fibres is considered. Additionally, respondents are able to identify factors which tells them about the sustainability of the product, for example, a brand is known for their sustainability.

## 5.2 New alternative textile materials

In this chapter findings related to new alternative textile materials are introduced as respondents estimated their perceptions towards wood, plant-based waste and animal based-waste (mainly leather) textile fibres. Perceptions related to sustainability and interest to use (how appealing materials are considered to be) are covered.

From new alternative textile materials plant-based waste was considered as the most sustainable, followed by wood and animal-based waste with a slight difference (Figure 7). It was found that new alternative textile materials might be quite unknown for people as for example, most of the respondents had never heard or seen clothing made of wood and almost half had some concerns of using wood as a textile material (Figure 9). However, a bit more than half of the respondents considered wood fibre to be an appealing textile material (Figure 9). If respondents told that they have concerns of using wood as a

textile material, they were asked to specify with an open answer. Main concerns were:

1. Excessive wood use and harvesting	60 answers
2. Potential and properties of wood-based textiles	28 answers
3. Concerns over the origin of the wood	23 answers
4. Process; converting wood into textile fibre	15 answers
Total (valid answers)	126 answers

Almost half of the respondent's concerns related to 'excessive wood use and harvesting'. Many of the respondents in this category expressed their concern on the possibility that too much forest is being cut down. Also worries related to carbon balance and biodiversity were mentioned due to possible deforestation. Second category 'potential and properties of wood-based textiles' included comments on skin feel, durability, practicality and comfortability. These responses showed that wood as a textile fibre is quite unknown. Third category 'concerns over the origin of the wood' especially emphasized the concern about cutting down rainforests. Also, ethical matters were considered, for example working conditions in Asia.

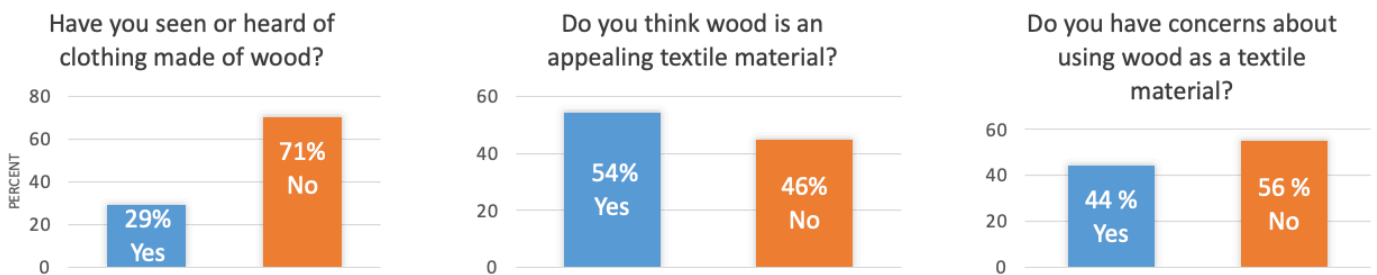


Figure 9: Wood fibre as textile material

Perceptions towards plant-based waste and leather waste were researched as well. Respondents were asked if they would want to use clothing or footwear made of plant-based and leather waste. Among most of the respondents, both textile fibres were considered as potential textile material, plant-based waste being somewhat more popular than leather-based waste (Figure 10). Great majority would be ready to use clothing or footwear made of waste-based textile fibres or materials.

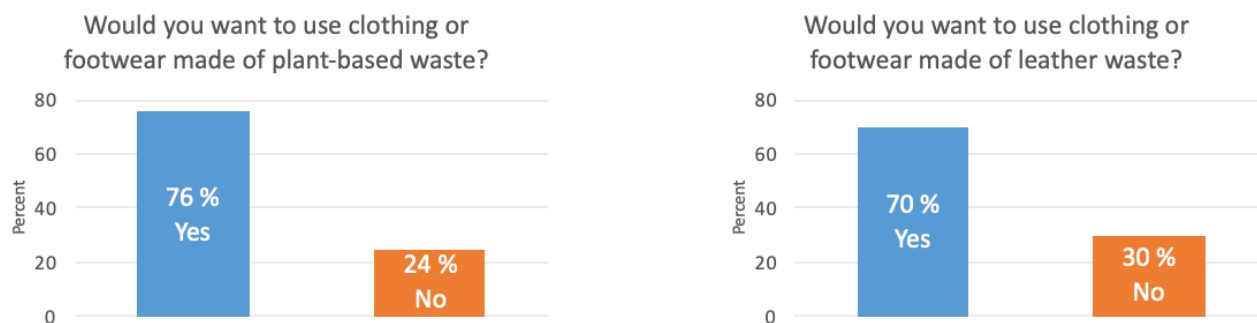


Figure 10: Plant-based waste and leather-based waste as textile material

If respondents were not willing to use waste-based materials, they were asked to specify why not. Main concerns or reasons to not to use plant-based waste were:

1. Sounds disgusting or unattractive	28 answers
2. I don't know/quite neutral attitude	11 answers
3. Concerns on durability/quality	8 answers
4. Production related issues	4 answers
5. Possible high price	2 answers
Total (valid answers)	53 answers

Many respondents considered plant-based waste somehow disgusting or unattractive. At the same time though, the responses revealed that most respondents had never seen a clothing or footwear made of plant-based waste for example, 'I imagine it to be disgusting' (free translation from Finnish). Some respondents did not have an opinion, but as they could not answer neutral, they answered 'no' and explained to have quite a neutral attitude towards the product. In the same category were respondents who just wrote 'I don't know'. Some respondents had concerns about the durability or if the garment would be comfortable. Few other responses about a possible high price level or production issues were mentioned as well. If respondents were not interested to use leather-based waste, they were also asked to specify why not. Main reasons to not to use leather waste were:

1. Animal welfare/ethical reasons	42 answers
2. Sounds disgusting or unattractive	17 answers
3. I don't know/quite neutral attitude	16 answers
4. Concerns on durability/quality	4 answers
Total (valid answers)	79 answers

Even though a percentage of the willingness to use plant-based waste and leather waste as textile material did not differ that much, reasons for it

varied more. The greatest concern by far for using leather waste was about animal welfare/ethical reasons. Most of these respondents said that they do not use leather in any form, or they are vegan. Someone was worried about the misuse of the concept and that the leather production would actually increase due to the need of the waste. As well as with plant-based waste, some responses revealed that leather waste was somehow considered disgusting or unattractive. At the same time almost as many respondent had quite a neutral approach or no opinion at all towards textiles made of leather waste. Few respondents had concerns about the product durability or quality.

Relationships between attitudes on different materials were studied. Results reveal that respondents who consider wood as an appealing textile material are also more willing to use clothing or footwear made of plant-based waste (0.386\*\*) and leather waste (0.247\*\*), however, relationships are considered weak. Association between willingness to use plant-based waste and leather waste is 0.327\*\* and shows that the willingness to use textiles made of plant-based waste somewhat correlates with the willingness to use leather waste textiles.

Even though most respondents are willing to use textiles or footwear made of wood, plant-based waste or leather waste, the words themselves do not always create positive associations. Especially the word 'waste' is rated low when asked which words are considered to solicit positive associations while making a decision to buy (Figure 11). Waste, waste straw and waste leather are all rated quite low in the list, as well as cellulose, which is a plant fibre especially occurring in wood. The words 'tree' and 'wood' have gained more votes for positive associations. Words natural, recycled and climate positive are considered to bring the most positive associations when purchasing clothing.



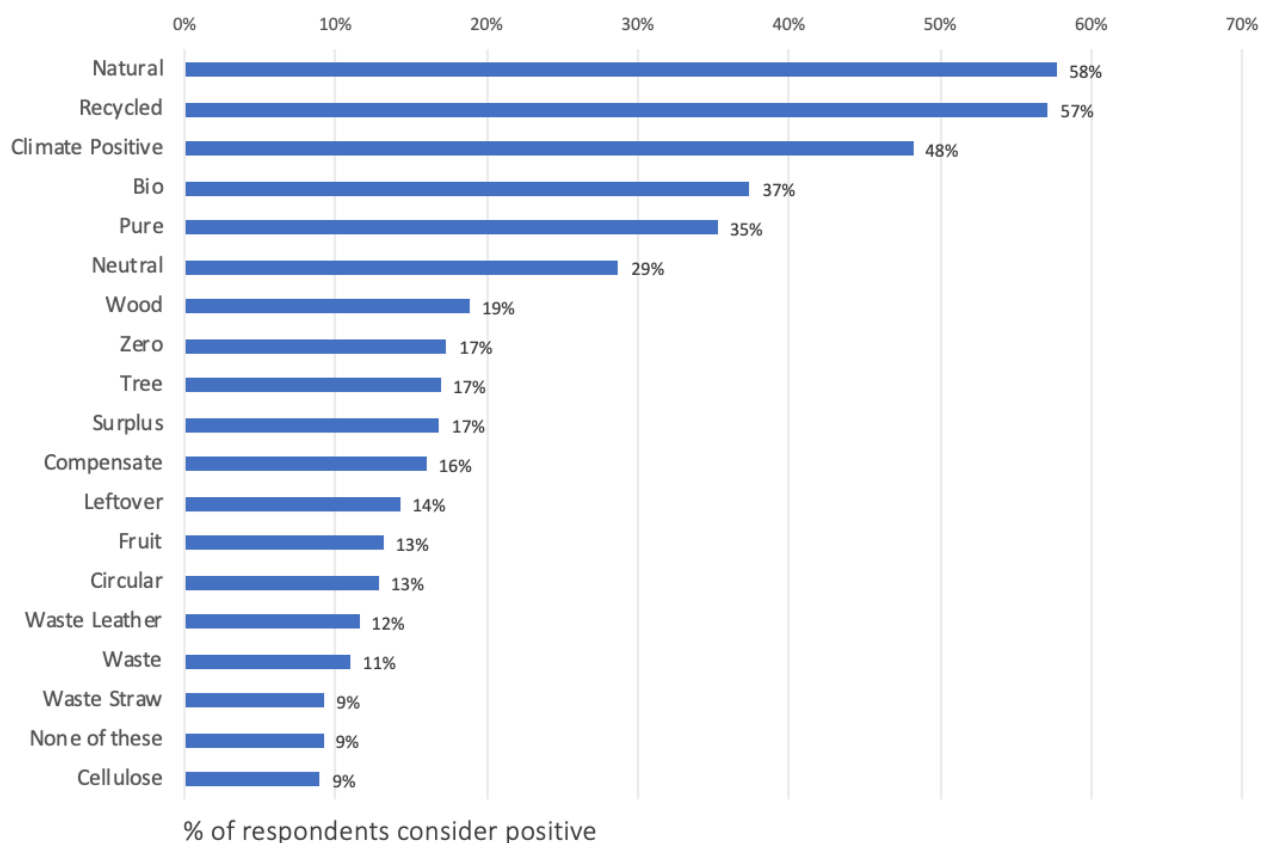


Figure 11: Words which solicit positive associations when making a buying decision

To conclude, new alternative textile fibre materials are an appealing option for most of the respondents, however, there is a lot of suspicion and lack of knowledge towards these materials. All of the new alternative textile fibre materials are considered more sustainable than crude oil.

### 5.3 Background variables influence

In this chapter findings about the influence of country of origin, gender, age, income, civil status and education are presented. Influence of background factors were researched towards textile fibres; how sustainable different fibres are considered to be and how attractive new alternative textile fibre materials are perceived. Additionally, textile materials influence on purchasing decision is reviewed. Statistically significant and most remarkable relationships are presented.

When observing respondents' estimations on how much the textile material affects buying decision, it can be seen that the country of origin seems to have some influence on the answers. In Germany 86.2% of respondents estimated that textile materials has an impact on buying decision (significantly or

somewhat) and in France the same percentage was 69.5%. Other countries had values in between those numbers. Between genders there seems to be some differences; 82.1% of females estimated the textile material to influence the buying decision while males had the percentage of 76.3. Higher income seemed to influence positively on the desire to pay attention to the textile material as 83.5% high-income respondents estimated that the textile material affects buying decision significantly or somewhat. Same percentage with the low-income group was 75.9% and with medium-income 82.6%. Also, education seems to have a positive influence as 82.8% of the respondents with an academic education considered textile materials affecting purchase decision (non-academic 77.2%). However, the difference is quite small. Within age group no remarkable differences were detected neither they were statistically significant.

From studied background variables the country of origin seems to have the greatest influence on how important textile materials are considered to be when purchasing clothing.

Next, results related to background variables influence for interest to use new alternative textile materials are introduced. Findings revealed that especially country of origin have some influence on perceptions towards new alternative textile fibre materials, however, also some other background variables seem to influence responses. Statistically significant and most remarkable relationships are presented next.

Crosstabulation shows that Finnish respondents consider wood somewhat more appealing than other respondents; Finland 64.5%, Sweden 59.3%, USA 52.1%, France 45.1% and Germany 53.1%. France is the only country where most of respondents do not consider wood to be appealing, among other countries it is vice versa.

Perceptions towards plant-based waste also differ among respondents from different countries. Willingness to use plant-based waste as textile material is much greater in Finland 80%, Sweden 83.8%, France 75% and Germany 79.7% than in the USA 61.9%. It seems that in Europe plant-based waste is considered more appealing. However, differences can be detected also among European countries as only 16.2% of Swedish respondents are not willing to use plant-based material and in France same percentage is 25%.

Similar trend can be detected with leather-based waste; European respondents seem to be more willing to use clothing or footwear made of leather waste than Americans where 61% of respondents answer yes, same percentage among Finns is 71.3%, Swedes 70.5%, French 75% and Germans 73%.

Leather-based waste also seems to divide opinions among other groups. Within income level and perceptions toward leather-based waste, a weak association was found as 75% of the respondents with high income were willing to use leather-based waste and same percentage was 68.2% with respondents with low-income. 72.9% of respondents with medium-income were interested to test textiles made of leather-based waste. Similarly, gender seems to slightly correlate with willingness to use leather-based waste as a textile material as males were more eager (73.3%) to try it than women (66.9%). No remarkable or statistically significant relationship was found with income or gender and interests

towards wood or plant-based textile material. Within education, academic respondents seemed to be more eager to use waste-based materials than non-academic respondents, as 68.9% of respondents with non-academic background and 74.7% of respondents with academic background were willing to use clothing or footwear made of leather-based waste. For plant-based waste percentages were 75.8% (non-academic) and 82% (academic).

In this study background variables, especially country of origin, seems to explain somewhat that do the textile materials affect buying decision or how appealing new alternative textile materials are considered to be.

Next, considered sustainability of all textile fibres is observed in more detail. Mean values for every textile fibre and their sustainability between different countries reveal that the difference seems to be greater among some traditional textile fibre materials (cotton, crude oil) than with new alternative textile materials (table 2). In Finland and Sweden cotton is considered less sustainable than in other countries and Finns and Germans consider crude oil less sustainable than other respondents (Table 2).

Table 2: Average of estimated sustainability of textile fibre by country of origin

	FIN	SE	USA	FR	DE
Cotton	3	3.22	3.54	3.88	3.68
Wood (fibre)	3.7	3.5	3.32	3.47	3.7
Crude oil	1.54	2.11	2.75	2.6	1.54
Lamb wool	3.55	3.61	3.24	3.37	3.55
Plant-based waste	3.82	3.67	3.43	3.38	3.82
Animal-based waste	3.42	3.35	3.31	3.51	3.42

Crosstabulation reveals more specific attitudes by country of origin. Only a share of Finns and Swedes consider cotton to be very sustainable and, especially in America and France, respondents remarkably consider cotton very sustainable (Table 3). Most common answer among every country is 'somewhat sustainable', except in France where most common answer is 'quite sustainable' (Table 3). 65.9% of French consider cotton quite or very sustainable and among Finns same rate is 29.3%

Table 3: Country \* cotton - crosstabulation

			Not sustainable at all	Not so sustainable	Somewhat sustainable	Quite sustainable	Very sustainable	
Country	Finland	Count	15	89	115	64	27	310
		% within Country	4.8%	28.7%	37.1%	20.6%	8.7%	100.0%
	Sweden	Count	9	57	123	84	29	302
		% within Country	3.0%	18.9%	40.7%	27.8%	9.6%	100.0%
	USA	Count	29	32	114	68	106	349
		% within Country	8.3%	9.2%	32.7%	19.5%	30.4%	100.0%
	France	Count	6	15	84	108	95	308
		% within Country	1.9%	4.9%	27.3%	35.1%	30.8%	100.0%
	Germany	Count	4	31	104	92	80	311
		% within Country	1.3%	10.0%	33.4%	29.6%	25.7%	100.0%
Total		Count	63	224	540	416	337	1580
		% within Country	4.0%	14.2%	34.2%	26.3%	21.3%	100.0%
p-value .000 **								

Crude oil divides opinions among different nationalities. In the USA crude oil is considered remarkably more sustainable than in other countries, followed by French respondents who considered it more sustainable than Finns, Swedes or Germans (Table 4). In both Finland and Germany more than half of the respondents consider crude oil as 'not sustainable at all', Finnish respondents being most critical towards this textile material (Table 4). In the USA 60.2% of respondents think that crude oil is somewhat, quite or very sustainable, in Finland only 9.4% think the same. In Sweden only a small share considers crude oil quite or very sustainable, however, around one third thinks it at least somewhat sustainable (Table 4).

Table 4: Country \* crude oil - crosstabulation

			Crude oil					Total
			Not sustainable at all	Little sustainable	Somewhat sustainable	Quite sustainable	Very sustainable	
Country	Finland	Count	176	105	25	3	1	310
		% within Country	56.8%	33.9%	8.1%	1.0%	0.3%	100.0%
	Sweden	Count	111	68	105	14	4	302
		% within Country	36.8%	22.5%	34.8%	4.6%	1.3%	100.0%
	USA	Count	84	55	120	43	47	349
		% within Country	24.1%	15.8%	34.4%	12.3%	13.5%	100.0%
	France	Count	69	63	114	46	16	308
		% within Country	22.4%	20.5%	37.0%	14.9%	5.2%	100.0%
	Germany	Count	182	60	53	13	3	311
		% within Country	58.5%	19.3%	17.0%	4.2%	1.0%	100.0%
Total		Count	622	351	417	119	71	1580
		% within Country	39.4%	22.2%	26.4%	7.5%	4.5%	100.0%
p-value .000 **								

Country of origin seems to influence also on the perceptions towards considered sustainability of other fibres, however, not as strongly as with cotton or crude oil. Animal-based waste did not share that many opinions, however, respondents from the USA were most divided with their opinions on scale 1-5 (not sustainable at all – very sustainable). Perceptions towards the sustainability of plant-based waste were more divided and it was considered more sustainable among Finns, Swedes and Germans than among Americans or French. In Germany 37.6% of the respondents considered it as ‘very sustainable’ and in France same percentage was 11.7%. Within lamb wool differences were smaller, however, among Finnish and Swedish respondents it was considered slightly more sustainable than with others. Finnish respondents considered wood as more sustainable than other respondents, as 60% of Finns considered it quite or very sustainable, same percentage was 47.3% with Swedes, 41.9% with Americans, 48.7% with French and 47.6% with Germans.

Relationships with fibres and age or income group were tested with the Spearman’s correlation and according to it age group and lamb wool (.117\*\*) have a weak relationship association. No other statistically significant and strong enough relationships were found between different textile fibre raw materials and age or income in the Spearman test. However, crosstabulation reveal that age group seemed to influence also other options at least somewhat and seems that younger respondents overall consider many fibre materials less sustainable than older respondents. As represented, especially lamb wool is not

considered as sustainable within young respondents as it is among older respondents (Table 6). Similar trends can be detected with all other fibres, however, differences are not as remarkable. One deviation can be seen with plant-based fibre as 27% of young respondents with age 15-20 consider it very sustainable, same percentage with 21-30 years old is 26,4% and with 31-40 years old 21.5%. However, the differences even when other options ('not sustainable - quite sustainable') are considered and also this fibre is considered less sustainable among young people than others. Seems that overall young respondents are more cautious of sustainability issues related to the textile fibre raw materials.

Table 5: Age \* lamb wool - crosstabulation

			Lamb wool					Total
			Not sustainable at all	Little sustainable	Some-what sustainable	Quite sustainable	Very sustainable	
Age	15 - 20	Count	24	26	94	40	27	211
		% within Age group	11.4%	12.3%	44.5%	19.0%	12.8%	100.0%
	21 - 30	Count	35	69	218	160	117	599
		% within Age group	5.8%	11.5%	36.4%	26.7%	19.5%	100.0%
	31 - 40	Count	33	59	291	226	160	769
		% within Age group	4.3%	7.7%	37.8%	29.4%	20.8%	100.0%
Total		Count	92	154	603	426	304	1579
		% within Age group	5.8%	9.8%	38.2%	27.0%	19.3%	100.0%
p-value .000 **								

No statistically significant or remarkable findings were done in terms of education, gender or income and how sustainable different textile fibre raw materials are considered to be. Civil status also seemed to have some, but not too significant influence on how sustainable different fibre materials are perceived. Respondents having a civil status 'living with my parents' seemed to consider many fibres less sustainable than other respondents. A similar trend was detected within age groups/younger respondents and most probably there is some overlap among these respondents. However, with waste-based materials opinions were more divided and a greater share of respondents living with their parents considered these new alternative options more sustainable than rest of the respondents with other civil statuses.

To conclude, background factors might explain some part of the sustainability perceptions or behaviour as the results of this survey present. More research is needed to generalize findings; however, it is already great to consider these aspects and remember that background variables might have an influence how different textile materials are being perceived.

## 6 DISCUSSION & CONCLUSIONS

Here the results and related theory are discussed. In addition, evaluation of research and suggestions for future research are presented.

### 6.1 Addressing the research task

The purpose of this study was to research consumer perceptions of the sustainability of the clothing industry and textile fibres. Next the results are discussed.

#### 6.1.1 Green consumerism in the clothing industry

Theory suggests that often the consumers lack of knowledge on how their behaviour impacts on the environment and many consumers seem to have a false understanding about the environmental matters (Vehmas et al., 2018). At the same time the pro-environmental behaviour is increasing, and consumers have shown raising interest towards sustainable products (Vehmas et al., 2018; Wiederhold & Martinez, 2018).

Many of the sustainability issues, especially environmental issues, can be related to the clothing industry. As the results show, the consumers are also aware of these issues and associate them with the clothing industry.

Reasons for associations cannot be detected from this survey, however, one explanation might be that the consumers know that these issues exist, but the magnitude is hard to estimate as the issues are so complex. As the previous research presents many consumers have a low or even a false understanding about the environmental issues (Vehmas et al., 2018). Understanding the issues properly would require familiarization and yet clear answers are rarely provided. Most probably a great share of the consumers base their associations on news and other sources in media. Whichever is the case, consumers seem to be aware that there are environmental issues in the clothing industry.

It seems that the respondents are also aware that different kinds of textile fibres exist and that they have varying characteristics as a great share of respondents (79.35%) estimate that textile materials impact significantly or somewhat on their buying decision. However, it is hard to estimate what other factors influence buying decision when purchasing clothing as these other factors were not asked in this survey. As theory suggests, style, comfort and aesthetic appearance are also considered as important factors when purchasing clothing (Karthik & Gopalakrishnan, 2014).

As the results show, textile material is estimated to be quite a remarkable factor when purchasing clothing. When estimating product's sustainability, it seems to be a better sign of sustainability than for example, an environmental certificate. It might be, as the theory suggests that environmental certificates are considered as a sign of a trustworthy business, however, consumers are often

sceptical about green claims (Kwong Goh & Balaji, 2016). It is possible that some consumers consider certificates somewhat as green claims. For consumers it seems to be easier to trust a brand that continually emphasizes on sustainability or choose a certain textile fibre rather than start looking for sustainability information from here and there. It might be that consumers believe to understand at least somewhat what kind of impacts certain textile fibres have, however, this field would require more research.

A high price level instead cannot be considered as a remarkable factor as the other listed factors, however, as the theory suggests, there might be cultural differences on how the price level is interpreted (Vehmas et al., 2018). And even though sustainable clothing products are often more expensive than for example fast-fashion garments, there are also many brands with a high price level which are not that sustainable and consumers are probably aware of this.

Again, the difference among some listed factors (representing sustainability) is rather small (Figure 6) and the reasons can only be pondered by this survey. It might be that estimating the difference is considered difficult due to varying conditions, for example, the production country might give a hint about the sustainability practices, but it cannot guarantee anything as such.

When respondents estimated additional factors for interpreting sustainability, the 'something else' -option gathered only 17 answers, which is much less than the other open ended -questions. These few open answered responses might tell that all factors were listed or factors influencing are unknown or subconscious for the respondents.

The respondents estimated different words related towards sustainability and textile fibres and many associations are understandable. Word cellulose and words including 'waste' were rated to bring the least positive associations among all words. One explanation for this might be that cellulose and waste (as fibre) are quite unknown and for this reason do not solicit positive associations. It should be also taken into account that waste might often be associated with something dirty and disgusting due to how waste is being treated in current society. Words creating most positive associations (natural, recycled, climate positive) are most probably more known and better understood. The word "natural" is often emphasized in many other product categories such as food or make-up, which might add its attractiveness. And 'natural' is most probably associated with the word nature which presumably is considered positive among people. Climate issues are also emphasized a lot in the media and the word 'climate positive' itself contains a positive message. The word 'recycled' is interesting in a sense that it interprets something which has already been in use, but it is still considered much more positive than words including 'waste'. It seems that consumers have accepted the concept of recycling. Might be that the same might happen to the word 'waste' or it will be called something else if used as a textile material.

To conclude, consumers seem to be aware of the sustainability issues related to the clothing industry, however, the magnitude of the issues might not be clear. Many factors are considered to tell somewhat about the products sustainability when purchasing clothing. The textile material is considered to have



a big impact on the buying decision. And the words used can have a remarkable influence on purchasing decision when talking about sustainability. The respondents also seem to trust brands who emphasize on sustainability or are some other way considered sustainable. All of this is something that the brands and the clothing companies should be aware of, especially during times when social media transparency is emphasized, and consumer awareness is rising.

### 6.1.2 Sustainability of the textile fibres

One aim of the research was to better understand the consumers perceptions towards different textile fibre raw materials and their sustainability. Previous research from this field is really limited and this is one of the first attempts to fill the gap. In this paper some new alternative textile fibre raw materials are researched in addition to some traditional ones.

Estimating the sustainability of different textile fibre raw materials was considered challenging during the piloting phase as the respondents did not have proper knowledge about the sustainability of the fibres. This might explain why there weren't any remarkable difference between many of the fibres listed and many of them were considered 'somewhat sustainable'. Additionally, it might be challenging to choose a category for such a wide group as 'cotton'. As discussed in the theory section, every fibre has both less and more sustainable options (for example organic or recycled) and those were not detailed in this survey and this might influence on the responses as well.

Reasons for associations cannot be detected from this survey, but they can be discussed. Plant-based waste stands out and one explanation might be an ongoing discussion about dietary choices, where plant-based is emphasized as the more sustainable option. In addition, word waste might promote the feeling of lower consumption and production. Crude oil being the least sustainable material according consumers is not too surprising. Environmental issues related oil catastrophes for example, and non-renewable energy sources have been on the news regularly. Additionally, plastic waste and microplastics have been discussed repeatedly in the media and in general. However, in the survey 'emissions' are not rated as high as other sustainability issues related to the clothing industry (Figure 8), even though emissions from crude oil extraction and synthetic fibre production are significant (Claudio, 2007). As well, respondents consider waste problems and ocean microplastics (both issues especially related to polyester and synthetics) slightly less relevant than water use or harmful chemicals. Water use and harmful chemicals can be linked specially to cotton fibre, which according to the survey results, is considered remarkably more sustainable than crude oil.

All listed sustainability issues exist, so responses show awareness. However, responses also show inconsistency. As was found out on the piloting phase, it might be that consumers are not completely aware of the impacts or features of different textile fibres and materials. And as introduced in the literature review; lack of knowledge might be one of the factors influencing unsustainable behaviour even though aim or values would be different (Vehmas et

al., 2018). It might be that crude oil is understood to have negative impacts, or it is associated as unsustainable, but proper understanding of its' impacts is missing. The same may apply to all fibre raw materials and this might explain why several fibres are considered almost as sustainable.

Different concerns related to new alternative textile fibre raw materials reveal that respondents are aware of the global issues. For wood fibre, excessive wood use and harvesting was by far the greatest concern and might be explained by raising awareness towards the global situation. For example, Amazon fires had been strongly emphasized in the news some time before the survey was made. Many respondents were worried about the deforestation and the rainforests.

Respondents were quite willing to use clothing or footwear made of waste-based materials, however, concerns show suspicions towards this new option. As discussed earlier, word waste might evoke feeling of disgust due to its role in current society. The second largest category included quite neutral attitudes and respondents who really did not know why they were not interested to use this material. Explanation might be that the unknown may provoke a reaction of denial.

In leather-based waste more than half of the concerns related to animal welfare and the ethical reasons and respondents emphasized that they did not want to use leather in any form. These responses highlight personal values more than suspicion towards the material. However, rest of the answers related to leather revealed doubts probably due to the word waste or unknown factor as with plant-based waste.

From the results it could be detected that the respondents who consider wood as appealing textile material are also more willing to use clothing or footwear made of plant-based waste and leather waste. Reasons for these correlations were not researched in this thesis but it might be that these respondents are more eager to try new alternatives, or they appreciate natural origin. Additionally, respondents may consider any kind of waste being more sustainable choice which might increase the willingness to try it.

To summarize, new alternative textile fibre materials are an appealing option for most respondents, however, there are a lot of suspicion and lack of knowledge towards these materials. Plant-based waste is considered a more sustainable option than wood or animal-based waste, probably due to concerns on deforestation or animal welfare.

To increase the awareness around new alternative textile fibre raw materials better stakeholder communication is needed from the industry and from the companies working with these materials.

### **6.1.3 Background factors**

Several attempts to explain sustainable behaviour have been done, but the results seem to be inconsistent. Instead, it seems likely that several factors influence and explain consumer behaviour. In this paper following background

factors influence is studied: country of origin, gender, age, income, civil status and education.

In this study some relationships were found between mentioned background variables and sustainability perceptions on textile fibres. Considered sustainability of different textile fibres and attitudes towards new alternative textile materials were examined. Additionally, textile materials influence on purchasing decisions was studied. Founded associations are reflected on to the current theory and discussed here.

According to the literature, the differences on attitudes towards sustainable clothing between cultures have been studied and some divergence has been found (Vehmas et al., 2018). In this study the reasons for varying perceptions were not researched. However, it might be that in different countries sustainability issues are emphasized differently. Additionally, it might be that awareness and interests towards sustainability vary due to personal values or other reasons. Attractiveness of wood fibre among Finns might be result of strong forestry culture and discussions in media related to the sustainable use of wood.

Gender's influence on sustainability perceptions and sustainable behaviour is researched and according to the results, women find sustainable fashion more stylish and unique than men (Vehmas et al., 2018). In this study sustainable fashion as such was not researched, but results show that men were more eager to try leather-based waste as a textile material. One reason for this might be due most vegans being women and also concerns of animal welfare are more common among women which might influence on attitudes. Otherwise gender did not seem to have a great influence on the studied responses, and this might tell that the understanding of sustainability issues is mutual.

In the literature there is evidence that age influences attitudes towards sustainable consumption (Sun et al., 2018; Vehmas et al., 2018), for example older consumers estimate themselves behaving more ethical than the younger generation (Vehmas et al., 2018). In this study respondents were divided into three groups, ranging between 15-20, 21-30 and 31-40 years old. Sustainability behaviour was not studied, but according to this study age has some influence towards perceptions of the sustainability of textile fibres, as younger respondents more often consider different textile fibres less sustainable than older respondents. It might be that the younger generation is more critical towards green claims as they have grown at a time when greenwashing is discussed much more than in the previous decades. Additionally, nowadays trustworthy media source concept is more questioned due to 'fake news' and contradictory information. This might lead to information overload and disbelief.

The price is considered to be one of the most influencing factors for purchasing green products (Biswas & Roy, 2015; Vehmas et al., 2018) However, income seems to have some sort of, but not significant relationship with sustainable purchasing behaviour (Zhao et al., 2013). In this thesis results are in line with the theory as higher income seems to influence how much the textile materials have an affect on purchasing decision. It might be that higher income allows to consider more possibilities overall and this reflects on choosing textile materials as well. The income seemed to influence also on attitudes towards

leather-based waste, respondents with higher income being more eager to use this new material. Again, reasons are hard to estimate, but one explanation is that as leather is often slightly more expensive, it might be used more among the wealthier consumers, who wish to find more sustainable options for traditional leather products. Within education results were similar and it is possible that respondents are partly the same.

Founded results support the idea that there are multiple factors influencing sustainable consumption. However, in some cases background factors might explain some perceptions related to the clothing industry and the textile fibres. In this study especially country of origin seemed to have some influence on responses.

## 6.2 Evaluation and suggestions for the future research

Reliability and validity are significant factors of research. Validity refers to accurate measurement of a concept (Hair, 2015). The total lack of validity makes the study worthless. In a such situation, one actually examines something completely different from what is imagined or originally intended (Hiltunen, 2009). Carefully chosen target group and questions used in the questionnaire influence validity (Hiltunen, 2009). Reliability instead refers to consistency, meaning that similar results should be achieved if the study is repeated with similar conditions (Hair, 2015).

Validity and reliability of this research were evaluated. The study can be considered reliable as there is no reason to believe that the results would be inconsistent if the study is repeated. As explained in chapter 5.2, the questionnaire was planned with care and piloted twice. Questionnaire can be found as appendix 1. Additionally, data collection was done by Norstat Finland Oy, which has years' of experience on online survey data collection. Norstat was also responsible for technical implications of the survey. Validity of the study can be analysed by reviewing research questions and ensuring that they have been answered. This indicates that the research has focused on the right things. In this study the research questions have been answered. Additionally, the target group was carefully chosen, and even the distribution between gender, age and country of origin was emphasized. Total amount of respondents is 1580 and more detailed distribution of respondents can be found in Table 1.

Like every study, this study has its' own limitations. The sampling provides relatively comprehensive insight for developing business strategies and stakeholder communication, which was one aim of the study. However, results as such are not scientifically generalizable. In the future more research on consumer perceptions towards textile fibres is needed and sample sizes should be larger to be able to generalize results.

As this study is quantitative it tries to identify connections and trends which are generalizable (Hair, 2015). At the same time, it might limit a deeper understanding of the phenomenon, as it did in this study; reasons for responses

could not be detected from this survey. To be able to understand consumer perceptions more specific, for example, 'why a specific textile material is such a remarkable factor when purchasing clothing' or 'why harmful chemicals are associated with the clothing industry', further research is required with different research designs.

In addition to suggested research topics, influence of other internal and external factors about the perceptions of the sustainability of the clothing industry and textile fibres could be studied. For example, as Liobikiené et al. (2016) suggests, subjective norm is a remarkable factor influencing on green purchasing behaviour. The influence of a subjective norm could be studied in terms of sustainable clothing and textile fibres. Additionally, possible barriers influencing buying decisions (Wiederhold & Martinez, 2018) would require more research in terms of the clothing industry and the textile fibres.

There are also many other textile fibres than were included in this study and attitudes towards them are unknown. Especially in this current situation when change to preferred fibres is needed and ongoing (Textile Exchange, 2019), it would be important to have a better understanding on consumer perceptions towards other textile fibre materials on the market.

Overall the research on the textile fibres is limited; perceptions towards fibres or purchasing behaviour is not researched in a level that the results could be generalized. Additionally, perceptions towards sustainability of the clothing industry and reasons for those are neither yet well understood.

## REFERENCES

- Akoglu, H. (2018). User's guide to correlation coefficients. *Turkish Journal of Emergency Medicine*, 18(3), 91–93.  
<https://doi.org/10.1016/j.tjem.2018.08.001>
- Allen, M., Titsworth, S., & Hunt, S. (2009). *Quantitative Research in Communication*. London, England: SAGE Publications Ltd.
- Belzagui, F., Crespi, M., Alvarez, A., Gutierrez-Bouz, C., & Vilaseca, M. (2019). Microplastics' emissions: Microfibers' detachment from textile garments. *Environmental Pollution* 248 (2019) 1028 - 1035.  
[Contentshttps://doi.org/10.1016/j.envpol.2019.02.059](https://doi.org/10.1016/j.envpol.2019.02.059)
- Biswas, A., & Roy, M. (2015). Leveraging factors for sustained green consumption behavior based on consumption value perceptions: testing the structural model. *Journal of Cleaner Production* 95 (2015) 332 - 340.  
<https://doi.org/10.1016/j.jclepro.2015.02.042>
- CFA & BCG. (2017). *PULSE OF THE FASHION INDUSTRY*. Retrieved from: [https://globalfashionagenda.com/wp-content/uploads/2017/05/Pulse-of-the-Fashion-Industry\\_2017.pdf](https://globalfashionagenda.com/wp-content/uploads/2017/05/Pulse-of-the-Fashion-Industry_2017.pdf)
- Chen, G., Feng, Q., & Wang, J. (2019). Mini-review of microplastics in the atmosphere and their risks to humans. *Science of the Total Environment* 703 (2020) 135504. <https://doi.org/10.1016/j.scitotenv.2019.135504>
- Claudio, L. (2007). Environmental Impact of the Clothing Industry. *Environmental Health Perspectives* 9 (2007) 448 - 454.  
<https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.115-a449>
- Daheim, C., Nosarzewski, K., Kołos, N., Prendergast, J., Schoon, C., Joester-Morisse, C., Glenn, J. C., & Gordon, T. (2019). The Future of Sustainability in the Fashion Industry A study commissioned by C&A Foundation. Retrieved from: <https://candafoundation.org/en/news/pdf/future-sustainability-fashion-industry-delphi-final-report-futureimpacts-ca-2019-v7.pdf>
- Desore, A., & Narula, S. A. (2018). An overview on corporate response towards sustainability issues in textile industry. *Environ Dev Sustain*, 20, 1439–1459.  
<https://doi.org/10.1007/s10668-017-9949-1>
- Early, C., & Murray, J. (2019). SDG12: Can sustainable consumption save capitalism from itself? Retrieved from: <https://www.businessgreen.com/feature/3083549/sdg12-can-sustainable-consumption-save-capitalism-from-itself>
- Ellen MacArthur Foundation. (2017). *Circular Fashion - A New Textiles Economy: Redesigning fashion's future*. Retrieved from: <https://www.ellenmacarthurfoundation.org/publications/a-new-textiles-economy-redesigning-fashions-future>
- Fletcher, K. (2014). *Sustainable Fashion and Textiles: Design Journeys*. New York, NY: Routledge.
- Hair, J. (2015). *Essentials of Business Research Methods*. New York, NY: Routledge.

- Hiltunen, L. (2009). *Validiteetti ja reliabiliteetti*. Retrieved from: [http://www.mit.jyu.fi/OPE/kurssit/Graduryhma/PDFt/validius\\_ja\\_reliabiliteetti.pdf](http://www.mit.jyu.fi/OPE/kurssit/Graduryhma/PDFt/validius_ja_reliabiliteetti.pdf)
- Jian Xiao, J., & Li, H. (2010). Sustainable Consumption and Life Satisfaction. *Soc Indic Res (2011)* 104:323–329. <https://doi.org/10.1007/s11205-010-9746-9>
- Joy, A., & Peña, C. (2017). Sustainability and the Fashion Industry: Conceptualizing Nature and Traceability. In book: *Sustainability in Fashion* (pp.31-54), chapter: 3. Publisher: Palgrave Macmillan. <https://doi.org/10.1007/978-3-319-51253-2>
- Karjaluoto, H. (2007). *SPSS opas markkinatutkijoille* (working paper N:o 344 / University of Jyväskylä). Retrieved from: <https://jyx.jyu.fi/handle/123456789/20844>
- Karthik, T., & Gopalakrishnan, D. (2014). Environmental Analysis of Textile Value Chain : An Overview Environmental Analysis of Textile Value Chain : An Overview. *Environ Dev Sustain (2018)* 20:1439–1459. <https://doi.org/10.1007/978-981-287-110-7>
- KEMI. (2013). *Hazardous chemicals in textiles-report of a government assignment*. Bromma, Sweden: Swedish Chemical Agency.
- KEMI. (2016). *Hazardous chemical substances in textiles -proposals for risk management measures, Report from a Government assignment*. Bromma, Sweden: Swedish Chemical Agency.
- Kochhar, R. (2017). LIS Working Paper Series Middle Class Fortunes in Western Europe. Retrieved from: [www.pewresearch.org](http://www.pewresearch.org)
- Księżak, P. (2017). The CSR Challenges in the Clothing Industry. *Journal of Corporate Responsibility and Leadership*, 3(2), 51. <https://doi.org/10.12775/jcrl.2016.008>
- Kumar, B., Manrai, A. K., & Manrai, L. A. (2016). Purchasing behaviour for environmentally sustainable products: A conceptual framework and empirical study. *Journal of Retailing and Consumer Services* 34 (2017) 1–9. <https://doi.org/10.1016/j.jretconser.2016.09.004>
- Kwong Goh, S., & Balaji, M. (2016). Linking green skepticism to green purchase behavior \*. *Journal of Cleaner Production* 131 (2016) 629 - 638. <https://doi.org/10.1016/j.jclepro.2016.04.122>
- Lee, M. (2019). The Legalization of Hemp - Food and Drug Law Institute (FDLI). Retrieved from: <https://www.fdpi.org/2019/02/the-legalization-of-hemp/>
- Lellis, B., Fávaro-Polonio, C. Z., Pamphile, J. A., & Polonio, J. C. (2019). Effects of textile dyes on health and the environment and bioremediation potential of living organisms. *Biotechnology Research and Innovation*, 3(2), 275–290. <https://doi.org/10.1016/j.biori.2019.09.001>
- Liobikienė, G., Mandravickaitė, J., & Bernatoniene, J. (2016). Theory of planned behavior approach to understand the green purchasing behavior in the EU: A cross-cultural study. *Ecological Economics* 125 (2016) 38–46. <https://doi.org/10.1016/j.ecolecon.2016.02.008>
- Liobikienė, G., & Poškus, M. S. (2019). The Importance of Environmental

- Knowledge for Private and Public Sphere Pro-Environmental Behavior: Modifying the Value-Belief-Norm Theory. *Sustainability*, 11(12), 3324. <https://doi.org/10.3390/su11123324>
- Mishra, S., charan Rath, C., & Prasad Das, A. (2019). Marine microfiber pollution: A review on present status and future challenges. *Marine Pollution Bulletin* 140 (2019) 188–197. <https://doi.org/10.1016/j.marpolbul.2019.01.039>
- Moser, A. K. (2016). Consumers' purchasing decisions regarding environmentally friendly products: An empirical analysis of German consumers. *Journal of Retailing and Consumer Services* 31 (2016) 389–397. <https://doi.org/10.1016/j.jretconser.2016.05.006>
- Nikolina, S. (2019). Environmental impact of textile and clothes industry. Retrieved from: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/633143/EPRS\\_BRI\(2019\)633143\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/633143/EPRS_BRI(2019)633143_EN.pdf)
- Norbaya Yahaya, S., Shafiqa Samsuri, M., & Azah Binti Abdul Aziz, N. (2018). Determinant of Sustainability Consumers Purchase Decision for Green Product. *International Journal of Academic Research in Business and Social Sciences*, 8(10), 1279–1286. <https://doi.org/10.6007/IJARBS/v8-i10/5298>
- OECD. (2019). Under Pressure: The Squeezed Middle Class. *OECD Publishing*. <https://doi.org/10.1787/689afed1-en>
- Osburg, V., Akhtar, P., Yoganathan, V., & Mcleay, F. (2019). The influence of contrasting values on consumer receptiveness to ethical information and ethical choices. *Journal of Business Research* 104 (2019) 366–379 <https://doi.org/10.1016/j.jbusres.2019.07.022>
- Pasteris, J. (2015). Down vs. Synthetic: Which Insulation is Right for You? Retrieved from: <https://www.rei.com/blog/camp/down-vs-synthetic-which-insulation-is-right-for-you>
- Peng Tan, L., Johnstone, M.-L., & Yang, L. (2016). Barriers to green consumption behaviours: The roles of consumers' green perceptions. *Australasian Marketing Journal* 24 (2016) 288–299. <https://doi.org/10.1016/j.ausmj.2016.08.001>
- Reverse Resources. (2020). White paper – Reverse Resources. Retrieved from: <https://reverseresources.net/about/white-paper>
- Savita, U., & Kumar, N. (2010). Consumer Attitude Towards Environment-Friendly Products: A Comparative Analysis. *IUP Journal of Marketing Management*, 9(1), 88-98. Retrieved from: <https://search-proquest-com.ezproxy.jyu.fi/docview/500829229/fulltextPDF/B4EA628656E04F6BPQ/1?accountid=11774>
- Sharma, A., & Narula, S. A. (2020). What motivates and inhibits Indian textile firms to embrace sustainability? *Asian Journal of Sustainability and Social Responsibility*, 5(1). <https://doi.org/10.1186/s41180-020-0032-8>
- Shegani, G. (2014). Study on Some Pollutants in the Leather Industry: A Case Study in Albania. *International Journal of Sciences: Basic and Applied Research*, 14(1), 115–124. Retrieved from:



- <http://gssrr.org/index.php?journal=JournalOfBasicAndApplied>  
 Spinnova Ltd. (2020). Sustainability | Spinnova. Retrieved from:  
<https://spinnova.com/sustainability/>
- Sun, Y., Wang, S., Gao, L., & Li, J. (2018). Unearthing the effects of personality traits on consumer's attitude and intention to buy green products. *Nat Hazards* 93, 299–314. <https://doi.org/10.1007/s11069-018-3301-4>
- Sustain Your Style. (2020). Fashion's Environmental Impact: Environmental Impacts of the Fashion Industry. Retrieved from:  
<https://www.sustainyourstyle.org/old-environmental-impacts>
- Textile Exchange. (2019). Preferred Fiber & Materials Market Report 2019. Retrieved from: [https://store.textileexchange.org/wp-content/uploads/woocommerce\\_uploads/2019/11/Textile-Exchange\\_PREFERRED-Fiber-Material-Market-Report\\_2019.pdf](https://store.textileexchange.org/wp-content/uploads/woocommerce_uploads/2019/11/Textile-Exchange_PREFERRED-Fiber-Material-Market-Report_2019.pdf)
- The Conscious challenge. (2019). Clothing & Pollution. Retrieved from:  
<https://www.theconsciouschallenge.org/ecologicalfootprintbibleoverview/clothing-pollution>
- UK House of Commons. (2016). *Environmental impact of microplastics*. London, England: House of Commons.
- Vehmas, K., Raudaskoski, A., Heikkilä, P., Harlin, A., & Mensonen, A. (2018). Consumer attitudes and communication in circular fashion. *Journal of Fashion Marketing and Management Vol. 22 No. 3, (2018) 286-300*  
<https://doi.org/10.1108/JFMM-08-2017-0079>
- Wahnbaeck, C., & Yen Roloff, L. (2017). Greenpeace: After the Binge, the Hangover G International Fashion Consumption Survey Insights into the Minds of Clothing Consumers. Retrieved from:  
<https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/2017-05-08-greenpeace-konsum-umfrage-mode.pdf>
- Watson, R. (2015). Quantitative research. *Nursing Standard (Royal College of Nursing (Great Britain) : 1987)*, 29(31), 44–48.  
<https://doi.org/10.7748/ns.29.31.44.e8681>
- Wiederhold, M., & Martinez, L. F. (2018). Ethical consumer behaviour in Germany: The attitude-behaviour gap in the green apparel industry. *International Journal of Consumer Studies*, 42(4), 419–429.  
<https://doi.org/10.1111/ijcs.12435>
- World of Chemicals. (2020). Chemicals Utilized for Textile Manufacturing - WorldOfChemicals. Retrieved from:  
<https://www.worldofchemicals.com/448/chemistry-articles/chemistry-of-textile-manufacturing.html>
- Wysokinska, Z. (2019). Innovative textiles industry and its future within the concept of circular economy - From the global to regional perspective. *Journal of Vasyl Stefanyk Precarpathian National University*, 6(3–4), 67–76.  
<https://doi.org/10.15330/jpnu.6.3-4.67-76>
- Xu, X., Hou, Q., Xue, Y., Jian, Y., & Wang, L. (2018). Pollution characteristics and fate of microfibers in the wastewater from textile dyeing wastewater treatment plant. *Water Sci Technol.* 2018 Dec;78(10): 2046 - 2054

<https://doi.org/10.2166/wst.2018.476>

Yadav, R., & Pathak, G. S. (2017). Determinants of Consumers' Green Purchase Behavior in a Developing Nation: Applying and Extending the Theory of Planned Behavior. *Ecological Economics* 134 (2017) 114–122.

<https://doi.org/10.1016/j.ecolecon.2016.12.019>

Zhang, S., Wang, J., Liu, X., Qu, F., Wang, X., Wang, X., Li, Y., & Sun, Y. (2019). Microplastics in the environment: A review of analytical methods, distribution, and biological effects. *Trends in Analytical Chemistry* 111 (2019) 62 - 72. <https://doi.org/10.1016/j.trac.2018.12.002>

Zhao, H.-H., Gao, Q., Wu, Y.-P., Wang, Y., & Zhu, X.-D. (2013). What affects green consumer behavior in China? A case study from Qingdao. *Journal of Cleaner Production* 63 (2014) 143 - 151.

<https://doi.org/10.1016/j.jclepro.2013.05.021>

**APPENDIX 1    Survey**

See next page.

**INTRO****“HOW DO YOU VALUE YOUR CLOTHING?”**

Spinnova is an innovation company that develops sustainable textile fibre out of wood and waste streams. Developing textile materials is crucial for brands and consumers.

We are keen to understand how consumers consider materials and sustainability when making buying decisions, and how you feel about new, innovative material alternatives.

Your opinion is very valuable to us! Thank you in advance for your input.

**Q1 SINGLE**

**Textile materials affect my buying decisions ..**

1. Significantly
2. Somewhat
3. Very little
4. Not at all

**Q2 GRID**

**How much do the following factors tell you about the sustainability of a product?**

**COLUMNS**

- 1 = Doesn't tell much
- 2
- 3 = Tells me somewhat
- 4
- 5 = Tells quite a lot

**ROWS ROTATE OPTIONS 1-8**

1. Textile material (e.g. natural or synthetic fibre)
2. How the product feels and looks
3. Product has an environmental certificate
4. A country where the product is made
5. Product is made of recycled material (e.g. recycled polyester or cotton)
6. High price level
7. Easy to find more information from the internet
8. The brand is known for sustainability
9. Something else, what? **(OPEN) KEEP POSITION**

**Q3.1 GRID**

**In your opinion, how sustainable are these the following textile fibre raw materials?**

**COLUMNS**

- 1 = not sustainable at all
- 2
- 3 = somewhat sustainable
- 4
- 5 = very sustainable

**ROWS ROTATE**

1. Cotton
2. Wood (fibre)

3. Crude oil
4. Lamb wool

**Q3.2 SINGLE**

**Plant-based waste (e.g. agricultural or food waste) that is usually disposed of by burning. With new technology, this waste could be utilized as textile fibre raw material. In your opinion, how sustainable is plant-based waste as textile fibre raw material?**

- 1 = not sustainable at all  
 2  
 3 = somewhat sustainable  
 4  
 5 = very sustainable

**Q3.3 SINGLE**

**Scraps from leather tanneries that are a problematic waste. With new technology, it could be utilized as textile fibre raw material. In your opinion, how sustainable is Animal-based waste as textile fibre raw material?**

- 1 = not sustainable at all  
 2  
 3 = somewhat sustainable  
 4  
 5 = very sustainable

**Q4 GRID**

**How strongly do you associate the following environmental issues with the clothing industry?**

**COLUMNS**

- 1 = Not at all  
 2  
 3 = Somewhat  
 4  
 5 = Strongly

**ROWS ROTATE**

1. Harmful chemicals
2. Water use
3. Forest use
4. Emissions
5. Waste problem
6. Ethical problems
7. Ocean microplastic

**Q5 SINGLE**

**Have you seen or heard of clothing made of wood?**

1. Yes
2. No

**Q6 SINGLE**

**Do you think wood is an appealing textile material?**

1. Yes
2. No

**Q7 SINGLE**

**Do you have concerns about using wood as a textile material?**

1. Yes
2. No

**Q8 IF Q7=1 OPEN**

What do you think is concerning about using wood as textile material?

**Q9 SINGLE**

**Would you want to use clothing or footwear made of plant-based waste?**

1. Yes
2. No

**Q10 IF Q9=2 OPEN**

Why would you not use clothing or footwear made of plant-based waste?

**Q11 SINGLE**

**Would you want to use clothing or footwear made of leather waste?**

1. Yes
2. No

**Q12 IF Q11=2 OPEN**

Why would you not use clothing or footwear made of leather waste?

**Q13 MULTI**

**Which words solicit positive associations when making a buying decision?**

- |                     |                                      |
|---------------------|--------------------------------------|
| 1. Surplus          | 11. Waste straw                      |
| 2. Fruit            | 12. Waste leather                    |
| 3. Waste            | 13. Bio                              |
| 4. Compensate       | 14. Zero                             |
| 5. Wood             | 15. Circular                         |
| 6. Pure             | 16. Leftover                         |
| 7. Neutral          | 17. Natural                          |
| 8. Climate Positive | 18. Recycled                         |
| 9. Tree             | 19. None of these (SINGLE EXCLUSIVE) |
| 10. Cellulose       |                                      |