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“Integrating sustainability in fashion supply chain management: an integral socially and environmentally responsible circular fashion model.”

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Executive summary: This study investigates the main environmental and social challenges involved in fashion supply-chain management and explores potential sustainable solutions to be integrated in every step of the supply-chain. Firstly, the paper gives an introduction to the current social and environmental planet crisis, followed by a literature review of topics related to sustainability, business, fashion supply chain management and social and environmental challenges in the supply chain system. The outcome of the literature review is a model proposal for a ‘sustainable supply-chain management model’. A Delphi study conducted with fashion industry and corporate social responsibility professionals allows the researcher to explore the model further and understand the existing limitations of incorporating sustainability in fashion supply-chain management.

Key concepts: business, sustainability, corporate social responsibility, the fashion industry and sustainable supply chain management.

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ABSTRACT

This study investigates the main environmental and social challenges involved in fashion supply-chain management and explores potential sustainable solutions to be integrated in every step of the supply-chain. Firstly, the paper gives an introduction to the current social and environmental planet crisis, followed by a literature review of topics related to sustainability, business, fashion supply chain management and social and environmental challenges in the supply chain system. The outcome of the literature review is a model proposal for a 'sustainable supply-chain management model'. A Delphi study conducted with fashion industry and corporate social responsibility professionals allows the researcher to explore the model further and understand the existing limitations of incorporating sustainability in fashion supply-chain management.

AIMS AND OBJECTIVES

The aim of this paper is to identify, describe and propose a sustainable supply chain management model based on sustainable strategies. The researcher pursues the following objectives:

- ✓ To give an insight into the negative social and environmental challenges involved in every stage of the fashion supply chain process.
- ✓ To conduct theoretical and practical research in order to establish different sustainable solutions that fashion brands can incorporate in their supply chain management models, and to investigate in depth which stages of the fashion supply chain have the highest social and environmental impact, and the existing limitations of incorporating this model in the current fashion supply chain system.

SECTION 1: INTRODUCTION

The earth (air, water and land), the only provider of environmental resources, is coming to an end, generating significant alterations on human and natural structures (Hestermaan, 2013).

The World Economic Forum presents 2019 as a year of complex and interconnected economic, environmental, geopolitical, societal and technological risks (World Economic Forum , 2019). Out of the 10 biggest risks for 2019, five are environmental (extreme weather events, failure of climate change adaptation and mitigation, natural disasters, man-made environmental disasters and biodiversity loss and ecosystem collapse) and two are societal (large-scale involuntary migration and water crises) (World Economic Forum , 2019).

Likewise, the Stockholm Resilience Center provides a science-based analysis presenting nine planetary boundaries and defining their safe operating space (Will Steffen , 2013). This research manifests that biochemical flows and biosphere integrity are the riskiest challenges (dangerous level of serious impacts), while climate change and land-system change are progressively increasing and will soon be reaching a high-magnitude level of risk (Will Steffen , 2013).

Global warming is a consequence of greenhouse gas emissions produced by human activities (Nasa Global Climate Change , 2019). Reducing these emissions could potentially create new industrial opportunities, jobs and prosperity, while ensuring a sustainable economic growth (Arthus-Bertrand, 2010). It is necessary to maintain and even reduce the present warming rate and take immediate action so as to avoid extreme consequences (Intergovernmental Panel on Climate Change , 2019). Not only is climate change an environmental risk, but a challenge for economic development (United Nations Environment Programme, 2019).

But still, even if the world is facing an enormous crisis, these risks do not seem to be tackled by the collective (United Nations Global Compact , 2015). Even though human activities are the main cause of the current planet crisis, there is a global failure on the maintenance of the Earth system and, still, population growth is projected to raise to 10 billion in 2050 (United Nations Environment Programme, 2019).

It is all an interconnected system, where environmental challenges affect health and socio-economic development of human societies, provoking extremely negative social conditions, reason why they should not be treated as external (World Economic Forum , 2019). As Stern mentions in (Arthus-Bertrand, 2010:9):

“There is no longer any doubt that human faces are changing the face of the Earth”

Soon, human and physical geography will be transformed. The number of natural disasters only continue to grow (United Nations Environment Programme, 2019).

Some of the biggest social challenges developed from the crisis as presented by the United Nations Global Issues Overview are: poverty, hunger, bad health and water scarcity (United Nations, 2019). 800 million people in the world suffer from hunger, and for decades, water has been a source exposed to overexploitation (Arthus-Bertrand, 2010). As presented by the World Bank and the International Monetary Fund, social poverty will be difficult to eradicate due to some external forces: inequality, shift in the traditional model of growth, demographic change, urbanization, climate change and global conflicts (World Bank and International Monetary Fund , 2018).

The ecosystem change is jeopardizing human futures, and humans only continue to aggravate it (Hestermaan, 2013). There exists no doubt that environmental and social change is caused by anthropogenic drivers, there is no time to waste, and as seen in the cost benefit analysis conducted by the World Economic Forum (2019:59) “spending on disaster recovery is almost nine times higher than on prevention”.

It is for this reason that the United Nations presented in 2015 the 2030 Agenda and the Sustainable Development Goals, a global blueprint for sustainable development which gathers 17 key environmental and social areas to take action (United Nations, 2019). There is a need for humans to develop a radical adaptive and conscious capacity to take action on a public, private and civil level, and to understand the Earth as an integrated system (Nasa Global Climate Change , 2019; Intergovernmental Panel on Climate Change , 2019).

Meanwhile, the fashion industry is, today, one of the most contaminating industries in the world while facing a rapidly growing demand (Global Fashion Agenda & The Boston Consulting Group , 2018). Examples of the negative social and environmental cost of the fashion industry are: the pollution involved in the process of making clothes, the violation of workers rights, the use of unsustainable materials, and the end of clothing life in landfills (KPMG & HSBC , 2019).

These social and environmental pressures do almost obligate businesses to change the way they operate. So as to survive, fashion companies will need to adapt to the new paradigm shift surrounding them (The Business of Fashion & McKinsey & Company , 2019; KPMG & HSBC , 2019). The fashion industry must see this fact as a major opportunity to secure a successful future, and to look for disruptive ideas that change

the way they operate (Accenture & H&M Foundation, 2017). A whole-system thinking is needed, and this implementation has to start by a solid strategy and a dedicated corporate governance, so as to later on be fully integrated in the fashion system (Global Fashion Agenda & The Boston Consulting Group , 2018).

An integrated system change involves logistics and supply chain management, in order to achieve competitive advantage by minimising the social and environmental impact of the fashion company (Khalili N. R., 1995). Even though the scale and complexity of many supply chains, companies have to work in in order to make significant impact in the areas of human rights, fair trade, and environmental development (United Nations Global Compact , 2015).

It is for this reason that the purpose of this research paper is to develop a model that explores sustainable solutions for every stage of the fashion supply chain. It is divided into the following sections: introduction, literature review, primary research and conclusion and recommendations. The Delphi Study technique is used in order to explore the proposed model in depth and understand possible limitations.

SECTION 2: LITERATURE REVIEW AND BACKGROUND RESEARCH

2.1. Towards a defining era: Business and Sustainability

2.1.1. Balancing a restricting demand with insufficient resources

Following the law of supply and demand, economic growth in the industrialized world results in a higher production of waste and intensification of pollution rates which affect human-development and has environmental consequences (Hesterman, 2013; Khalili N. R., 1995). Porter and Kramer argue that the capitalist system is under alert, being businesses the principal cause of social, environmental and economic degradation (Porter & Kramer, 2011). It is therefore logical to assume that within the current system economic growth and the increase in social and environmental issues are correlated (Hesterman, 2013). As demand grows, impact grows (Hawkins, 2006).

As seen in the planet boundaries presented by the Stockholm Resilience Center, the planet is not limitless, and its economic growth carrying capacity is coming to an end while there is a restricting demand for insufficient resources (Will Steffen , 2013; Hesterman, 2013). Three planet earths will be needed if consumption continues to increase progressively (Hawkins, 2006). All sectors have to make their best use of the limited resources (World Bank and International Monetary Fund , 2018). The 'Limits to Growth' study conducted by Meadows forewarned that by 2072 the planet's growth limit would become evident resulting in uncontrollable consequences (Meadows, 1974).

On the other hand, so as to be healthy societies, businesses still need to maintain their profit-making role and economic growth is needed in order to provide significant improvements in social and environmental matters (Blackburn, 2007; Hesterman, 2013; Porter & Kramer, 2011; Savitz & Weber, 2014).

There exists therefore an ethical dilemma: how far does profit-making go? and does the current economic theory need to be redefined? (Thomas, 2015). The philosophy of some economists like Milton Friedman in his book 'Capitalism and Freedom' and other publications argue that the only role of businesses is to increase their profits in a free competition market and that businesses use social responsibility solely for self-interest (Friedman, 1962).

But, today and in the last decades, considering the global macro context, social responsibility has become a key issue when considering business responsibilities and

strategies, being almost no longer voluntary, but a legal requirement (Thomas, 2015). But, is it possible to practically combine business and ethics? (Freeman, 2010).

In 2006, Porter and Kramer discussed the importance of Corporate Social Responsibility, defining it as a source of opportunity and competitiveness (Porter & Kramer, 2006). They explored the necessity of creating a “shared value”, generating simultaneous benefits for the business, the society and the environment (Porter & Kramer, 2006). They agreed that business success and social well-being can go together (Porter and Kramer, 2006). Corporate Social Responsibility does not have to be seen as a cost, and corporate success should be seen more far than profit-making (Porter and Kramer, 2006). This shared value requires the implementation of the sustainability principle philosophy through the whole company (Porter and Kramer, 2006). The goal is to find alternative models that deliver financial, social and environmental value, since economic growth can no longer be the only purpose (Hawkins, 2006; Williams, 2014).

2.1.2. Sustainability, CSR (Corporate Social Responsibility), TBM (Triple Bottom Line) and Circular Economy

Henceforward, the concept of sustainability is explored, followed by three strategic concepts related to responsible business management:

2.1.2.1. Sustainability

The definition of **sustainability** was presented by the United Nations in the Brundtland Commission as the: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Blackburn, 2007:3). Sustainability refers to the “2R”: resources (rational use and management of the world’s economic and natural resources) and respect (for humans and other living beings) (Blackburn, 2007).

2.1.2.2. Corporate Social Responsibility

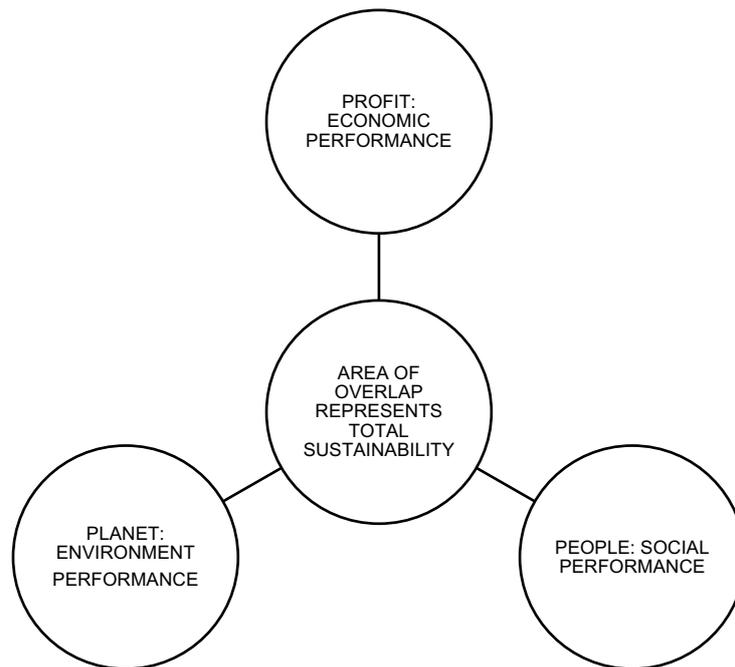
The concept of **Corporate Social Responsibility** began in the 1950’s, but it was not until 1990 when it came to be an important issue (Williams, 2014). The economist Howard Rothman Bowen was a pioneer in understanding the power that businesses had to fight social issues (Bowen, 1953). CSR is considered to be a behavioral characteristic of companies that aim to resolve social matters without expecting any kind of compensation or advantage out of it (Williams, 2014). According to Hawkins, in order to implement CSR in the heart of business management there are for key integrated areas considered (Hawkins, 2006). First of all, a good **corporate governance** establishes the

framework, rules and organizational culture (mission, vision and values) from which the company is going to act **responsibly** (Hawkins, 2006; Khalili N. R., 1995). One of the main drivers towards corporate governance in a business is also a good transformational leader, who lays the foundation from an **authoritative** perspective (Blackburn, 2007). A leader with new skills and knowledge that follows the 4 “I’s”: idealized influence, inspirational motivation, intellectual stimulation and individual consideration (Khalili, 1995: 64; Harvard Business Review, 2011). Finally, **accountability** mechanisms and effective methods to measure sustainable performance such as indicators, goals, reporting and stakeholder engagement are also crucial (Blackburn, 2007; Hawkins, 2006). In addition, as Freeman explored in 1984, companies need to take a stakeholder approach, and reconceptualize the way in which they incorporate them in their management process, aiming to strengthen the relationship between them (Savitz & Weber, 2014; Freeman, 2010). Leaders are no longer alone, and they have to consider all their stakeholders that are part of: the inevitable relation, the necessary relation and the desirable relation (Podnar & Jancic, 2006).

2.1.2.3. Triple Bottom Line

Moreover, the environment can also be taken into consideration in management (Williams, 2014). The concept of the Triple Bottom Line was firstly introduced in 1994 and further developed in 1997 by the author John Elkington, a pioneer in environment and social aspects of the capitalist system of the 21st century (Elkington, 1998). Triple Bottom Line (TBM) refers to the equal incorporation of economic, social and environmental matters when measuring the company’s success (Savitz & Weber, 2014). For a business incorporating the TBM model, the capital signifies: natural assets, social advantages and economic infrastructure (Savitz & Weber, 2014). Hence, it is in the social column that Corporate Social Responsibility can be integrated (Savitz & Weber, 2014). Having analyzed the state of the planet, this strategic framework provides long-term stability for companies that want to operate now and within the next generations as seen in Figure 1 (Savitz & Weber, 2014; Fernie, 2015).

Figure 1. People, planet, profit



Source: Adapted from Fernie and Grant, 2015: 183

2.1.2.4. Circular Economy

This idea was introduced by Kenneth Ewart Boulding already in 1966, whom criticized the open system economic model and proposed a closed system, where all the outputs that result from consumption would be recycled and used as inputs for production (Boulding, 1992). Circular economy is understood today as a disruptive model in response to waste and the planet's limited resources (KPMG & HSBC , 2019). In this method, the product follows a circular path 'recycle, reduce, reuse' moving away from the traditional linear model 'take, make, dispose' (KPMG & HSBC , 2019). It all has a circular logic. The Ellen McArthur Foundation (2019) defines three descriptive principles of circular economy: designing using renewable resources and controlling the limited resources, maximizing the utility of products and materials and keep them circulating and, finally, eliminating environmental externalities by regenerating the natural system. This economic model connects the dynamic material flow system with the ecological system and the economic system (Ellen Mc Arthur Foundation , 2019). This model results in resource productivity, which generates savings and in consequence economic growth, and could generate in Europe a net benefit of € 1.8 trillion by 2030 according to a study (Ellen McArthur Foundation , 2017). Circular economy represents a powerful opportunity to the economic and environmental aspects of businesses (Ellen McArthur Foundation , 2017).

2.1.3. Discussion of business and sustainability

In brief, people, profit and planet are fundamental aspects to consider and the sustainability principle is an essential pillar to be incorporated in the heart of business management systems (Savitz & Weber, 2014). Economic, social and environmental aspects can be cohesive following Ekington's TBM model, where the social aspects are developed by integrating Corporate Social Responsibility strategies (Savitz & Weber, 2014). In addition, companies need to move towards eco-efficiency and still grow with limited resources. CSR, The Triple Bottom Line and Circular Economy lay the foundation for the development of sustainable strategies. Today, it is a defining era in which businesses have the power, and a shift has to be made in the business paradigm, creating a new economy system, a system that ensures both sustainable and economic growth (Khalili N. R., 1995; Arthus-Bertrand, 2010). As Blond mentions in (Arthus-Bertrand, 2010: 351):

“Now it is the time for solutions”

2.2. The fashion industry and the supply chain social and environmental challenges and solutions

2.2.1. General overview: market research

The fashion industry is one of the most important sectors in the global economy (Bubonia, 2017). According to Passport (2018) the Global Apparel and Footwear industry market value is of 1,696.2 billion dollars. A rapid growing and advanced industry which employs more than 70 million people worldwide (Passport Euromonitor , 2018; Global Fashion Agenda & The Boston Consulting Group , 2018). Moreover, consumption has changed with the era of fast fashion, and studies have shown that fast fashion will continue to outline the growth of the apparel industry for the following years (United Nations Climate Change , 2019; Passport Euromonitor , 2018). While prices keep decreasing, volume keeps increasing generating negative consequences for the planet (Passport Euromonitor , 2018). The raise in fashion consumption results in the raise of environmental and social stress (Global Fashion Agenda & The Boston Consulting Group , 2018). There is a paradigm shift undergoing in the fashion industry since the old system does simply not work anymore, being this a call for fashion brands to implement disruptive solutions (The Business of Fashion & McKinsey & Company , 2019). There is a need for a systematic change (Global Fashion Agenda & The Boston Consulting Group , 2018) (Brown, 2010).

2.2.2. The fashion supply chain

Already in 2010 Geoffrey B. Small said “fashion today is one of the industrial age’s biggest human failure” (Brown, 2010:7). The fashion industry is the third most polluting industry in the world, and action has to be taken in every phase of the supply chain (United Nations Environment , 2019). Fashion companies need to create a stronger focus on environmental management of their supply-chain systems (Fernie, 2015). The “Pulse Score” research conducted by the Global Fashion Agenda and The Boston Consulting group (2018) demonstrated that there has been sustainable performance improvement in the fashion industry, with the score being 38 out of 100, but claims that there is still much room for progress. The key is to renovate supply-chain for a better social and environmental impact, while strengthening the company’s strategy, maintaining consistency throughout all the messages and actions (Porter & Kramer, 2006; The Business of Fashion & McKinsey & Company , 2019). The fashion supply chain depicts all the activities involved in the business process of a fashion brand, from raw materials into products, so as to satisfy consumer demand) (Khalili N. R., 1995). On one hand, there are primary activities (all the activities involved in the production, distribution and use of a garment), and on the other hand, there are support activities (firm infrastructure) (Porter & Kramer, 2006). On the other hand, according to Fisher (1997), the supply chain can be divided into two phases: the physical function of product transformation and transportation, and the market mediation function (Fisher, 1997). The stages involved in the fashion supply chain are: extract and treatment of raw materials (material input), suppliers and manufacturing, distribution, retail and use (customer experience and end of life) as seen in Figure 2 (Khalili N. R., 1995) (United Nations Global Compact, 2015; Bubonia, 2017):

Figure 2. The fashion supply chain



Source: Adapted from United Nations Global Compact, 2015, p.30

Bubonia (2017) does also explore the stages involved in the fashion supply chain:

The Ellen McArthur Foundation (2017) claims that the fashion system is extremely polluting in all its stages and Quantis (2018) also agrees to this fact by emphasizing on the environmental emissions involved in every stage of the fashion supply-chain process,

from raw material to end of use. Additionally, the European Environmental Agency (2014) reflects on the inputs and impacts of the clothing life-cycle claiming that every stage from production of fibers until incineration and landfill involves an environmental challenge as, for example, land use, toxins, GhG emissions, air pollutants...

Furthermore, (Quantis, 2018) reflects on the impacts that the fashion supply-chain apparel system has on climate change, and establishes a projection for the following years emphasizing on the need for a sustainable supply-chain management. The projected climate change related impacts are only going to experience growth until 2030 (Quantis, 2018). The SSCM (Sustainable Supply Chain Management) aims to optimize its performance, incorporating solutions to the social and environmental challenges involved (Khalili N. R., 1995).

2.2.3. Environmental and social problems and solutions in the fashion supply chain

In order to reach a sustainable fashion supply chain, the social and environmental challenges of each stage need to be identified. This section of the literature will explore the main social and environmental challenges involved in the process, followed by proposed solutions based on literature research.

2.2.3.1. Stage 1: Raw materials

2.2.3.1.1. Problems

Two thirds of the environmental impact of the fashion industry happen in this stage, that involves the extraction of materials for clothes production (Global Fashion Agenda & The Boston Consulting Group , 2018). Following, the main **problems** encountered:

Natural fibers

Natural fibers are considered to have a lower environmental footprint than synthetic fibers, but still, their environmental footprint remains high (Muthu, 2014; Global Fashion Agenda & The Boston Consulting Group , 2018). The most relevant example is cotton. 43% of the worlds clothing production is made of cotton and this fiber is specifically problematical due to the large amount of water, land, pesticides and fertilisers it utilizes (Sajn, 2019). The current cotton production system is unbearable (World Wild Life Fund, 2019). 20,000 liters of water are needed to produce one kilogram of cotton, and only one pair of cotton jeans require 10,000 liters of water (World Wildlife Fund, 2019). A statistical study has demonstrated that 97% of the water that runs in the Indus River (the main river in Pakistán), is destined for cotton production (World Wildlife Fund, 2019). Cotton

production involves the inefficient use of both surface and ground waters (World Wildlife Fund, 2019). In addition, cotton farmers utilize a very high amount of pesticides (Roloff, 2018). These agro-chemicals pollute the water (rivers, lakes, wetlands) that results in the loss of biodiversity and ecosystems (World Wild Life Fund, 2019). The main producers of cotton are the United States, India, China, Egypt and Pakistan (Muthu, 2014). Still, according to the statistics by the European Clothing Action Plan (Gray, 2017), cotton is the fibre with highest consumption in EU countries as seen in Figure 3:

Figure 3. EU fibre consumption

EU fibre consumption clothing textiles	Tonnes (2015)	Fibre type
Cotton	2767450	Natural
Wool	579236	Natural
Silk	64357	Natural
Flax	128720	Natural
Viscose	579236	Cellulosic
Polyester	1029747	Synthetic
Acrylic	579236	Synthetic
Polyamide/Nylon	514874	Synthetic
PU/PP/EA	193077	Synthetic
Total	6435933	ALL

Source: Adapted from Gray (2017)

Similarly, the viscose and rayon fibers are regenerated cellulose fibers that involve the use of high amounts of chemicals and energy for their production, generating significantly high rates of pollution (Roloff, 2018).

Synthetic fibers

Synthetic fibers contain a large amount of micro plastics inside that when being used and washed end up in the ocean (Roloff, 2018). Both nylon and polyester are non-biodegradable synthetic fibers made from oil, that contribute to plastic and water

pollution and generate greenhouse gas emissions throughout their production (Natural Resources Defence Council , 2012).

Animal fabrics: cruelty and pollution

Yearly, millions of animals are killed only to produce fashion (People for Ethical Treatment for Animals , 2019). Animal fibers (leather, wool, cachemir or silk) raise both moral and environmental issues (Global Fashion Agenda & The Boston Consulting Group , 2018). Animals are slaughtered by farmers so as to produce a belt, a fur-jacket, or wool (People for Ethical Treatment for Animals , 2019). Also, production of animal fabrics involves a high amount of polluting chemicals (Stella Mc Cartney , 2019). Still, the production of fur and leather has increased enormously since 1990 (Bride, 2014).

Farmer workers

The habitat of people on undeveloped countries that relies heavily on agricultural production is converted into agricultural land (World Wildlife Fund, 2019). The problem is, as claimed by the World Health Organization (2019) that agro-chemicals and pesticides lead to the development of reproductive, immune-system, endocrine, nervoys-system and cancer diseases (World Health Organization, 2019). Farmers are constantly under chronic exposure to these pesticides, and not only the farmers, but also the rural population that lives surrounding the field gets largely affected, with children being at a higher health risk (World Health Organization, 2019).

2.2.3.1.2. Solutions

Sustainable material mix and innovation

The eco-selection of fibers can lower enormously the environmental and social footprint of a garment and a positive fact is that the use of sustainable materials raised almost a 20% from 2017 to 2018 (Global Fashion Agenda & The Boston Consulting Group , 2018). There is an opportunity for fashion companies to generate innovative solutions to conventional natural and manufactured fabrics (Gullingsrud & Williams, 2017). The objectives of this innovation include: biodegradability, decrease of pollution, and sustainable impact (Gullingsrud & Williams, 2017).

Promotion of animal welfare: an animal fabric free industry

Pressure has to be applied to eliminate the worst animal fabric farmers from the industry (Bride, 2014). The promotion of cruelty-free fashion and moral statements has to increase (Stella Mc Cartney , 2019). Reducing the production of animal fabrics means saving animals (People for Ethical Treatment for Animals , 2019).

Organic farming

The objective of organic farming is to self-stabilize agricultural systems and to use biological and natural sources to keep the cycle of natural fiber production going (Gullingsrud & Williams, 2017). Organic textiles do therefore imply the reduction of social and environmental impacts in the fashion production generating high benefits as the reduction of: water consumption, water pollution, greenhouse emissions, toxic chemicals and the use of energy (Gullingsrud & Williams, 2017). Organic fibers are a sustainable alternative to conventional fabric production and are grown under standards of organic agriculture (Soil Association, 2019).

IPM (Integrated Pest Management)

Along with organic farming, the IPM strategy can largely reduce the amount of pesticides needed in fabric farming, reducing enormously the exposure to pest (Berg, 2019). An IPM (Integrated Pest Management system) involves (European Commission, 2019):

- Implementing non-chemical and ecological tools and methods for the prevention of the appearance of damaging organisms for the plants and the agricultural system (pest control).
- Keeping the use of pesticides only to an economically or ecologically justified level.

Some IPM strategies include: growing alternative plants so the pest can attack those instead of the main crop, or using animals that can use the pest as food (Gullingsrud & Williams, 2017). Implementing this management system in natural fiber farming could reduce enormously the use of pesticides (agro-chemicals) and consequently improve considerably the health of the farmers and the population surrounding the fields, decreasing the number of diseases and deaths resulting from this.

Recycled fibers

The goal is to cut down on virgin fibers (Gullingsrud & Williams, 2017). A solution is the shift towards circular materials substituting the traditional linear material flow model (Muthu, 2014). The world is full of raw materials in use that will be soon, thrown away (Stella Mc Cartney, 2019). Using recycled fibres is a way of giving a second life to fabrics that would otherwise be considered garbage (Gullingsrud & Williams, 2017). This would involve the decrease in consumption of raw materials and in consequence of its environmental footprint, and would involve giving a second life to wasted fabrics, following the process found in (Muthu, 2014), with waste coming from either the preconsumer, the postindustrial or the postconsumer stage. Fashion companies would have to collect textile waste, and extract the fiber, and thereafter the production process would be the same.

Traceability

To fight for transparency, fashion companies can create traceability schemes by partnering with companies that work with labelling and certification of sustainable raw materials (United Nations Global Compact, 2015). This enabler should be implemented through every stage of the supply chain but it should start in the raw material stage. Traceability enables companies to become more transparent and communicate the real-life scenario to consumers.

Traceability certifications are becoming the proof of good company sustainability performance (United Nations Global Compact, 2015). This traceability requires the involvement and collaboration of both actors and a high economic investment from the fashion company (the company and the raw material suppliers) (United Nations Global Compact , 2015).

2.2.3.2. Stage 2: Manufacturing

2.2.3.2.1. Problems

This process includes the production of the garment having already gone through the stages of: raw material extraction, spinning and weaving (Quantis , 2018). Following, the main **problems** are explored:

Income distribution

The free market creates competition and businesses are constantly decreasing their pricing, with main concerns being: production costs, average and marginal costs (Hestermaan, 2013). The problem appears when businesses cut corners for profit-making (Thomas, 2015). “Cheap labour” is a key fact considered to maximize margins and minimize costs in the value chain (Mezzadri, 2017). W. Arthur Lewis presented in 1954 the “dual-sector model”, a theory in which he explained the relationship between the capitalist sector and the subsistence sector, claiming that the economic development and growth of the capitalist sector comes from extracting labour from the subsistence sector. Statistics by The World Development (2018) represent the extreme differences and inequalities regarding Gross National Income statistics, and still, countries like Spain take advantage of countries like Bangladesh when producing fashion. What happens, is, that when being exposed to poverty, these countries fall in the “development trap” (Nurkse, 1955). This theory refers to the fact that low income and wages leads to low capacity of saving, which leads to a decrease in productivity, which again, leads to low income and wages (Nurkse, 1955). Fashion companies are worried about a speculative income, and it is for this reason that they create an unsustainable income and

expenditure method (Hestermaan, 2013). With globalization, the value chain is no longer local but global, and fashion companies are looking for the most affordable option in the manufacturing stage (Mezzadri, 2017).

Sweatshops and working conditions

As mentioned above, the labour conditions of people living under poverty are unacceptable (Arthus-Bertrand, 2010). Safia Minney (2011:12) says “the real cost of fashion is people”. The fashion industry not only looks for workers on countries living under poverty, but exposes workers to child labour, exploitation, sweatshops, unsafe conditions, no freedom of association and no employment security (Minney & Watson, 2011; Fernie, 2015). Today, fashion garment production is directly related to sweatshop labour (Mezzadri, 2017). Sweatshop labour refers to a system used in undeveloped regions that presents incredibly low working standards (Mezzadri, 2017). The most known sweatshop scandal was the Rana Plaza that happened the 24th of April 2013, an eight storey garment worker building located in Bangladesh that collapsed with the workers inside, causing 1,134 deaths (Safi, 2018). This was the fourth biggest industrial tragedy in history (Fashion Revolution Org , 2019). Still, today, garment workers are exposed to high levels of risk on a daily basis (Mezzadri, 2017). Blanchard (2017) presents in the “Who made my clothes fashion revolution podcast” a research study “The Garment Worker Diaries” conducted by Microfinance opportunities, that involved a weekly visit to garment workers during a year, located in Bangladesh, Cambodia and India, in total 540 workers (Garment Worker Diaries, 2019; Microfinance opportunities, 2019). Outcomes of the research demonstrated that:

- The same challenges that used to happen in the 70’s are still happening.
- Women garment workers are scared to fight for their rights (to get fired, killed or black listed from the fashion industry).
- The biggest issue for most garment workers is pay, still incredibly low, a long way from achieving an acceptable living wage. Uniformly wages are low along the whole sector.
- Most women operate in countries with very weak legislation to protect them.
- The hardest working conditions were in Bangladesh, where workers earned less than 0.95 USD per hour, and worked more than 60 hours a week.
- All of the visited workers were living under poor financial conditions.
- Workers were exposed to abuse by their supervisors.

On the other hand, child labour is also a big problem in the fashion industry, and it happens in consequence of sub-supplier contracts (Minney & Watson, 2011). The

suppliers a company hires might illegally sub-contract other suppliers, which the main fashion company has no control over (The Business of Fashion & McKinsey & Company , 2019). As stated by Chitrakorn in (Business of Fashion & McKinsey & Company, 2019, p. 63):

“An apparel company might think that they only have 1,000 to 2,000 suppliers, but the reality is they have 20,000 to 50,000 when you count all the sub-suppliers.”

Lack of transparency

Radical transparency is expected by consumers and external companies (McKinsey, 2019). There is a trust deficit, and if brands do not deal with this, consumers are going to ask themselves what companies have to hide (McKinsey, 2019). Consumers demand better practice (Minney & Watson, 2011). Consumers want radical transparency (The Business of Fashion & McKinsey & Company , 2019). 52% of Millennials agree that they research about the background of their garment before the purchasing decision, and they put specifically attention to fair labour standards (The Business of Fashion & McKinsey & Company , 2019). Consumers want to know ‘who made my clothes’ (Fashion Revolution Org , 2019).

2.2.3.2.2. Solutions

Fair Trade

The term Fair Trade means better working standards, wages, terms of trade, security, support and equality, contributing to a more sustainable world for all (World Fair Trade Organization , 2019; Minney & Watson, 2011). This concept appears in response to the current conventional trade, which discriminates the poorest (World Fair Trade Organization , 2019). The World Fair Trade Organisation presents 10 principles that form the basis for Fair Trade as seen in Figure 4:

Figure 4. Fair Trade principles

PRINCIPLE 1	Creating Opportunities for Economically Disadvantaged Producers
PRINCIPLE 2	Transparency and Accountability
PRINCIPLE 3	Fair Trading Practices

PRINCIPLE 4	Payment of a Fair Price
PRINCIPLE 5	Ensuring no Child Labor and Forced Labor
PRINCIPLE 6	Commitment to Non Discrimination, Gender Equity and Freedom of Association
PRINCIPLE 7	Ensuring Good Working Conditions
PRINCIPLE 8	Providing Capacity Building
PRINCIPLE 9	Promoting Fair Trade
PRINCIPLE 10	Respect for the Environment

Source: Adapted from World Fair Trade Organisation, 2019

Fashion companies need to increase the participation and skills of the garment workers. Creating unions and unified voices within garment workers fighting for their rights (Minney & Watson, 2011) (Global Fashion Agenda & The Boston Consulting Group , 2018). Garment workers need to feel protected, empowered and ready to speak up (Fashion Revolution Org , 2019). The garment industry has positive potential, since it can offer job to women, make them work independently and support themselves financially, companies just need to do this in the right way (Fashion Revolution Org , 2019). Companies need to listen to the workers voice outside the factory, and understand the real conditions they are working under (Minney & Watson, 2011).

Transparency

Fashion Revolution appeared a few years ago, a global movement that aims to connect people from the fashion industry to fight for a cleaner and safer sourcing, production and consumption of clothing (Fashion Revolution Org , 2019). The campaign #whomademyclothes is celebrated during the Fashion Revolution Week, and consumers ask brands who made their clothes, and brands answer back, being this a great example of transparency in the fashion industry (Fashion Revolution Org , 2019).

2.2.3.3. Stage 3: Packaging

Bubonia (2017) defines fashion packaging as the stage where the company prepares the product prior to its shipment and distribution. Packaging includes bags, boxes, cartons, hangers, tags, and much more.

2.2.3.3.1. Problems

Plastic pollution

The fashion industry is defined as a social and environmental emergency, and a major contributor to plastic pollution, not only for the plastic based fibers like polyester or nylon used at the raw material stage, but also all the plastic involved in its packaging stage (Europe, 2019). All the packaging involved in the process: tags, hangers, bags or boxes generate high levels of waste resulting in highly negative consequences (Sajn, 2019). One of the main drivers of this high rate of pollution is online retailing in fashion, where original shipments are broken down into individual packages generating high levels of waste (Bird, 2018). Fast fashion has transformed consumer behaviour, and e-commerce growth results in a high demand for fast deliveries and returns. 17% of apparel and footwear sales are now online (Passport, 2018), and this numbers are only expected to grow progressively over the next years (Intel, 2019). As Bird states in Forbes (2018:1) “we are drowning in a sea of packaging waste”. Plastic is now found in the ocean and even in the food chain, and packaging is one of the main drivers of plastic pollution (O’connor, 2018). Still, a 90% of plastic is only used once and only a 14% of global packaging is recycled (Engler, 2016).

2.2.3.3.2. Solutions

Elimination of single-use plastic: bio-degradable or recycled plastic

Rachel Lincoln Sarnoff (CEO of Lincoln Sarnoff Consulting) said in her talk at the Business of Fashion that eliminating single-use plastic is a big step that fashion companies can take (O’connor, 2018). Options like bio-degradable or recycled plastic do exist (O’connor, 2018). Bio-degradable plastic refers to plastic that decomposes in the environment naturally, different from traditional plastic that decomposes after hundreds of years (PEP, 2019). On the other hand, recycled plastic is plastic made from recovered plastic waste (PEP, 2019).

Transparency tags: direct information to consumer

Another important step in packaging for the fashion industry, due to the high demand for transparency in sustainable performance of fashion brands is to inform the consumer about the history of the product, and as Bubonia (2017) indicates, the tags can include

information as for example: country of origin, fiber information and care information. Transparency among brands keeps increasing, with many of the biggest fashion brands revealing their manufacturer list (Fashion Revolution Org , 2019).

2.2.3.4. Stage 4: Logistics: distribution

The logistics stage involves the transportation, the vehicles and the infrastructure networks needed to move the products from point of origin to point of consumption, and reverse logistics is the flow of the product from the point of consumption to the point of origin (Rogers & Tibben-Lembke, 1999). The goal is to reduce the environmental impact produced in these transportation processes (Rogers & Tibben-Lembke, 1999).

2.2.3.4.1. Problems

Outsourcing: long-delivery routes

The European Parliament (Sajn, 2019) mentions that one of the greatest environmental challenges in the fashion industry are the long-delivery routes involved in logistics. As Fernie and Grant (2015) mention, outsourcing has changed the fashion system completely. Fashion companies now belong to a global network of subcontractors and they import their clothes from the undeveloped countries (Fernie, 2015). As seen in Figure 5 (European Environmental Agency, 2014) the imports and exports of clothing between countries are enormous with millions of tonnes of clothing trade flows for both importations and exportations.

Figure 5. Clothing trade flows between Europe and the rest of the world, 2012



Source: European Environmental Agency, 2014

Today, 70% of clothing is manufactured overseas (Abnett, 2016). Mostly, these shipments are made by sea or air. The OECD (2019) claims that shipping and transportation involves an enormous level of emissions, and increasing pollution rates. With maritime transportation, the fuel pollutes the seas, contributing to the degradation of the maritime ecosystems (OECD, 2019). Degradation and pollution of air quality is produced by air transportation, destroying natural ecosystems (OECD, 2019). A study conducted by the European Union (2014:49), estimated the average distance of fashion companies from their manufacturers in km (European Commission, 2014) (see Figure 6):

Figure 6. Average distance from fashion companies to their manufacturers

Transportation mode	Average distance by zone (km)						
	Mediterranean	North America	South America	China	South Asia	South East Asia	Emerging Asian countries
Sea	4 894	10 398	11 598	19 601	12 354	15 999	17 885
Air	2 418	6 786	10 384	9 262	7 482	10 154	9 774

Source: European Union (2014)

2.2.3.4.2. Solutions

Local production and electric vehicles

In this way, the company performs the activities at home (Fernie, 2015). Not only does the environmental impact get reduced enormously, but the fashion company has a reactive and constant communication with the local manufacturer, the waste is reduced and it is easier to be transparent (Pant, 2018). Also, manufacturing near to the point of sale allows the fashion company to have a more agile supply chain (Pant, 2018). With local production, transportation and shipments can usually be made by road, and in order to avoid pollution, electric vehicles could be used, which are not only environmentally friendly, but cost effective (Carrington, 2019).

2.2.3.5. Retail stores

2.2.3.5.1. Problems

Floor ready-merchandise: plastic pollution

The fashion industry is a major contributor to our oceans plastic pollution, and the floor-ready merchandise that refers to hangers, labels, stickers, and security tags is one of the principal causes (Bubonia, 2017). Millions of tonnes of floor ready merchandise are thrown away every year, contaminating our planet, and more specifically, our oceans (Bubonia, 2017).

Energy consumption

Additionally, large retail stores consume a high amount of energy. Schneider Electric (2014) released a report stating, for example, that only 600,000 retail buildings in the US consume 20 billion dollars worth of energy in one year, emphasizing on the potential to decrease this energy consumption and in consequence, save large amounts of operational costs (Jamieson, 2014).

2.2.3.5.2. Solutions

Development of green stores

Retail stores could transform into 'green stores'. Fashion retail stores could be transformed into 'nearly zero energy buildings', buildings that require a very low amount of energy which comes from renewable resources (European Commission, 2019). In terms of plastic use, they could eliminate single-use plastic and look into alternative materials such as bio-degradable plastic, recycled plastic or recycled paper (O'Connor, 2018).

2.2.3.6. Consumer use and end of life

A study by the European Parliament (Sajn, 2019) estimated that this stage accounts for the largest environmental footprint in the apparel industry.

2.2.3.6.1. Problems

The 'use and throw' attitude: landfills and limited resources

Fast-fashion brands continue to expand since consumers still focus on price as the top factor for purchasing decisions (Passport, 2019). Consumers have developed a 'use and throw' attitude, and while clothing sales keep growing, clothing utilisation keeps decreasing (Ellen Mc Arthur Foundation & Circular Fibers Initiative, 2017). Clothing sales have almost doubled since 2000, and the decrease in clothing utilisation has

almost been of the same percentage (Ellen Mc Arthur Foundation & Circular Fibers Initiative , 2017).

Accordingly, a study by the European Clothing Action Plan showed the high level of residual clothing waste in nine target countries (Gray, 2017) (see Figure 7):

Figure 7. Clothing Waste Disposal in 9 target countries

Tier 1 countries	Pop. (2014)	Quantity of clothing waste in residual		Tier 2 countries	Pop. (2014)	Quantity of clothing waste in residual	
		(tonnes)	(kg per capita)			(tonnes)	(kg per capita)
Denmark	5.7 m	15 735	2.8	Belgium	11.2 m	32 140	2.9
Germany	81.2m	280 972	3.5	Spain	46.5 m	306 744	6.6
Italy	60.8 m	440 179	7.2	France	66.4 m	214 920	3.2
Netherlands	16.9 m	71 374	4.2	Sweden	9.7 m	31 919	3.3
				UK	64.9 m	302,000	4.7

Source: Gray (2017)

What happens with 73% of the clothing at the end of life stage is that it gets landfilled or incinerated generating extremely high GHG (Green House Gases) emissions (Ellen Mc Arthur Foundation & Circular Fibers Initiative , 2017). The fashion industry produces a 10% of the global greenhouse gases emissions (Ellen Mc Arthur Foundation & Circular Fibers Initiative , 2017). Research conducted by the Ellen Mc Arthur Foundation (2017) created a vision for change, claiming that every second a garbage truck full of clothes ends up either burned or in a landfill. What happens is that incineration and landfilling of fibers result in high levels of CO2 emissions (Sajn, 2019). Not only is pollution a problem, but the extensive use of resources when our planet has limits, and still, less than 1% of the clothing used is recycled (Ellen Mc Arthur Foundation & Circular Fibers Initiative , 2017). Consumption and production growth of apparel is not possible if we consider that our planet has finite resources (Greenpeace, 2018).

Washing clothes: ocean pollution

Another critical environmental issue in the ‘use’ stage of the supply chain, is the environmental impact produced by washing clothes (Sajn, 2019). There is not only a high level of water and energy involved in washing clothes that increase the carbon footprint of clothes (Sajn, 2019). There is also a high level of micro-fibers released when a clothing

item is washed, and as Lincon Sarnoff mentions in O'Connor (2018) "Washing one synthetic fleece jacket releases as many as 250,000 micro-fibres.", that cannot be controlled by water treatments due to their small size, and end up in the ocean. On the other hand, a study financed by the European Union (2014) titled "Mitigation of microplastics impact caused by textile washing processes", does also explore the consequences of micro plastics that enter the wastewater produced by washing clothes (European Union, 2014). To sum up, by washing our clothes, we are polluting our oceans (Resnick, 2019). These micro fibers do not go over 5 mm in length, and that is why the filters are often too large to stop micro fibers to pass through to the oceans (Resnick, 2019).

Below, the estimated fibers released from a 6 kg wash are presented, showing that acrylic fibers are the most polluting ones (see Figure 8):

Figure 8. Estimated fibers released from wash

FIBER	RELEASED MICRO FIBER PER 6 KG WASH
ACRYLIC	728789
POLYESTER	496030
POLYESTER COTTON-BLEND	137951

Source: Adapted from Resnick (2019)

2.2.3.6.2. Solutions

Washing machine filtration

On one hand, improvement of washing machine filtration can prevent micro fibers to filter through to the oceans (O'Connor, 2018). The EU is already considering several mandatory initiatives for the instalment of improved filters in the production of new washing machines (Brodde, 2017). On the other hand, consumers can also take initiative and use their own filter bags when they wash their clothes in the washing machine, and the most known example are the 'Guppyfriend bags' that aim to stop micro waste (Guppyfriend, 2019). As seen on the "how it works" section, the microfibers get filtered and stay in the bag instead of being released to the waste water (Figure 9):

Figure 9. How it works



Source: Adapted from Guppyfriend (2019)

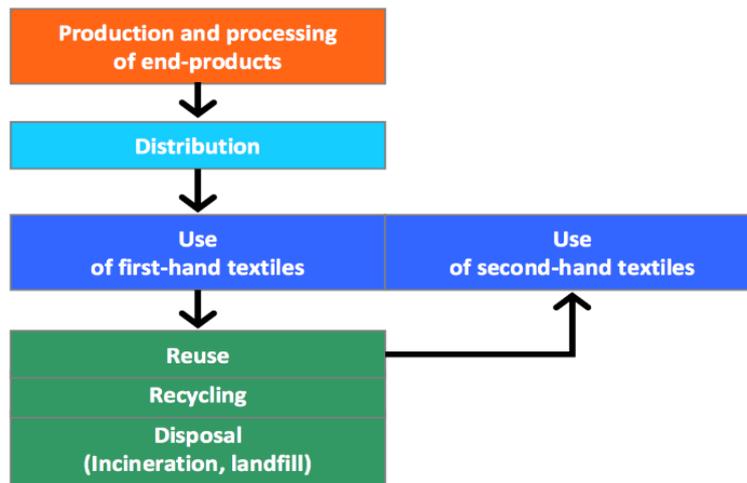
A new textiles economy: reduce, recycle, re-use

If we want to keep consuming fashion, a new textiles economy has to be created. Quantis (2018:40) establishes that it is possible to reduce the impact on climate change, freshwater consumption and human health by incorporating circular economy strategies in the fashion apparel system. If the fashion system achieves a 40% of recycled fabrics, climate change impact will get reduced 5.9%, freshwater consumption 4.4% and human health issues 2.8% (Quantis, 2018).

The new system has to be based on recycling, reusing and reducing (Passport, 2018). And even if end of use strategies have seen the highest improvement in the last years, companies do still have a long way to go (Global Fashion Agenda & The Boston Consulting Group, 2018). This system would lead to better: environmental, economic and social outcomes for the fashion industry (Ellen Mc Arthur Foundation & Circular Fibers Initiative, 2017). As seen in (Khalili N., 1955), the supply chain has to reach a closed-loop system, with the material flowing back from the customer through diverse waste management strategies: reusing, repairing, remanufacturing or recycling. Hawley J M (2006) also represents the routes that end of life can take proposing very similar strategies to Khalili (Hawley, 2006).

The European Commission does also explore the route of end-of-life presenting an alternative to the life cycle stage (see Figure 10) (European Commission, 2014):

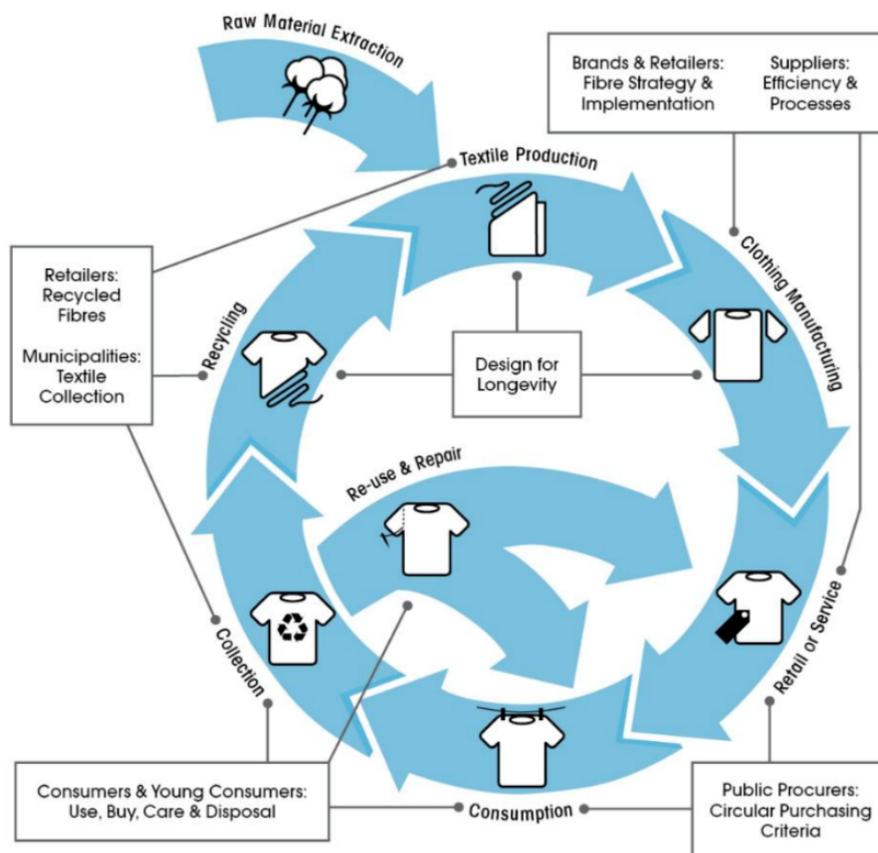
Figure 10. The route of end-of-life 2



Source: European Commission (2014, p.10)

And to finalize, the introduction of a circular clothing system is explored (European Clothing Action Plan , 2017) (see Figure 11):

Figure 11. The route of end-of-life 3



Source: European Clothing Action Plan (2017)

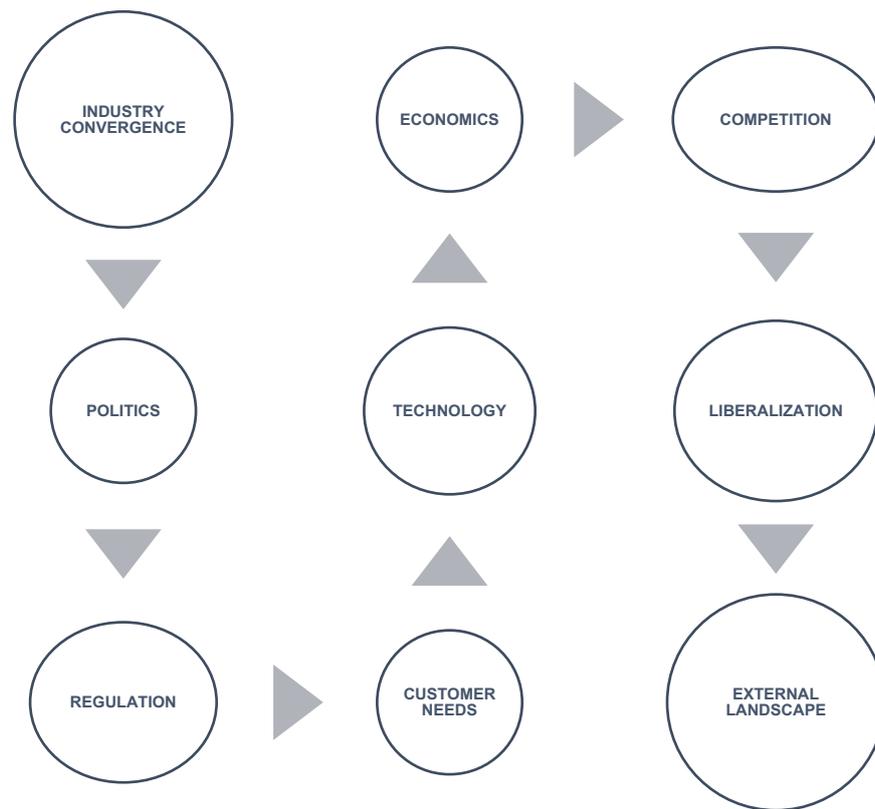
Ethical consumption: slow and sustainable fashion

There has been a raise in the 'ethical living' conscious mindset of consumers, who seek to make a positive impact through their purchases (Passport Euromonitor , 2018). In 2017, more than 60% consumers agreed to this fact and this percentage only continues to raise (Passport Euromonitor , 2018). There is a paradigm shift in the way people consume fashion (Passport, 2019). The "conscious consumer" was ranked as a top ten consumer trend for 2019 (Passport, 2019). They care about the environment, the society and animal welfare (The Business of Fashion & McKinsey & Company , 2019). Consumers have to move towards 'sustainable and slow fashion', an effort to buy fewer clothes but better quality, and make sure the materials are sustainable. It is key to spread this mentality and consumption habits in order to push the fashion system to change, because consumers are the centre of every fashion company, and if they demand, fashion companies will change.

2.3. External influences

As seen in "The External Landscape" presented by the World Economic Forum (2019) there are many external aspects that influence supply chain and transport management. It is therefore essential for every fashion company to rethink their sustainable supply-chain system in order to adapt to all these external circumstances (e.g. future of energy, global risks, consumer goods and lifestyle, international trade and geo-economics among others). Porter and Kramer (2006) agree that effective Corporate Social Responsibility also means looking 'outside-in' and understanding the competitive macro context so as to improve productivity and develop strategic decisions. They focus mainly on the social aspects of the macro context and the main areas to consider according to them are (Porter & Kramer, 2006): context for firm strategy and rivalry, local demand conditions, related and supporting industries and input conditions. In addition, Hawkins (2006) does also explore factors of the external landscape that influence industries (see Figure 12):

Figure 12. The external landscape



Source: Adapted from Hawkins (2006:11)

These include technology and politics, two aspects that are explored in depth in the next sections (Hawkins, 2006).

2.3.1. The role of Technology: Industry 4.0

This section will explore the role that technology has in sustainable supply chain management. Information technology improvements such as for example, PDM (Product Data Management) or PLM (Product Life-cycle Management) have improved the efficiency of supply chain management enormously, allowing companies to communicate in an efficient way with partners and identify potential improvements in social and environmental aspects (Bubonia, 2017). Improvements in technology have contributed to the development of many sustainability strategies (Hawkins, 2006). An undergoing macro trend is 'Industry 4.0' that focuses on technological transformation of future industrial production, and includes autonomous robots, Blockchain, Internet of Things, Big Data and Analytics among others (United Nations Environment , 2019). For example, blockchain powers transparency and allows brands to not only communicate their values, but also hold all of their supply chain partners and producers accountable for each step (Carson, 2018). Technology innovation is a key driver for sustainability,

and companies need to take advantage (United Nations Environment , 2019). The key aspect that fashion companies can take out from technology, is that it helps us to be more effective and get out more of the resources we have (United Nations Environment Programme, 2019). Reaching high levels of digital technology does also build consumer confidence and trust (World Economic Forum, 2019:22):

“Responding to digital disruption is now an existential question for companies”

2.3.2. The role of the public sector

As seen in the external landscape introduced by the World Economic Forum (2019) and in Hawkins (2006), political aspects do highly influence industries as well. In many cases, it is the responsibility of global, national and local public authorities to establish laws and regulations related to sustainability (Hestermaan, 2013). There has to be a synergy between the public policy and the private sector: regulatory risks, gaps in the legal and regulatory system, and uncompetitive market structures can be a barrier for the private sector (World Bank and International Monetary Fund , 2018). Enhancing public expenditure management, establishing laws, and investigating market failures can be driving forces to enhance the implementation of sustainability in supply-chain management systems (World Bank and International Monetary Fund , 2018).

2.4. Discussion of study outcomes

While economic activity is the principal driver for social and environmental degradation, it is also the main force to solve all these global challenges. Companies do therefore need to see this as a source of opportunity and competitiveness and be motivated to find different models and systems that deliver positive environmental, social and financial results without compromising the life of future generations. This is known as sustainability, and it can be incorporated in business management through many strategies of which this paper considered important: CSR (Corporate Social Responsibility), TBM (Triple Bottom Line) and circular economy. CSR was considered essential since a brand needs to operate with a leader, culture and values that aim to solve social matters and incorporate this in every strategic decision. The TBM model was considered relevant since businesses need to look no longer only at financial results, but measure similarly social and environmental results if they want to develop towards a sustainable model. Finally, circular economy was presented since the planet has limited resources, and long-term perspectives have to take into consideration this fact. Furthermore, the literature demonstrated that the fashion industry is one of the most polluting industries in the world, and that every stage of the supply-chain has severe

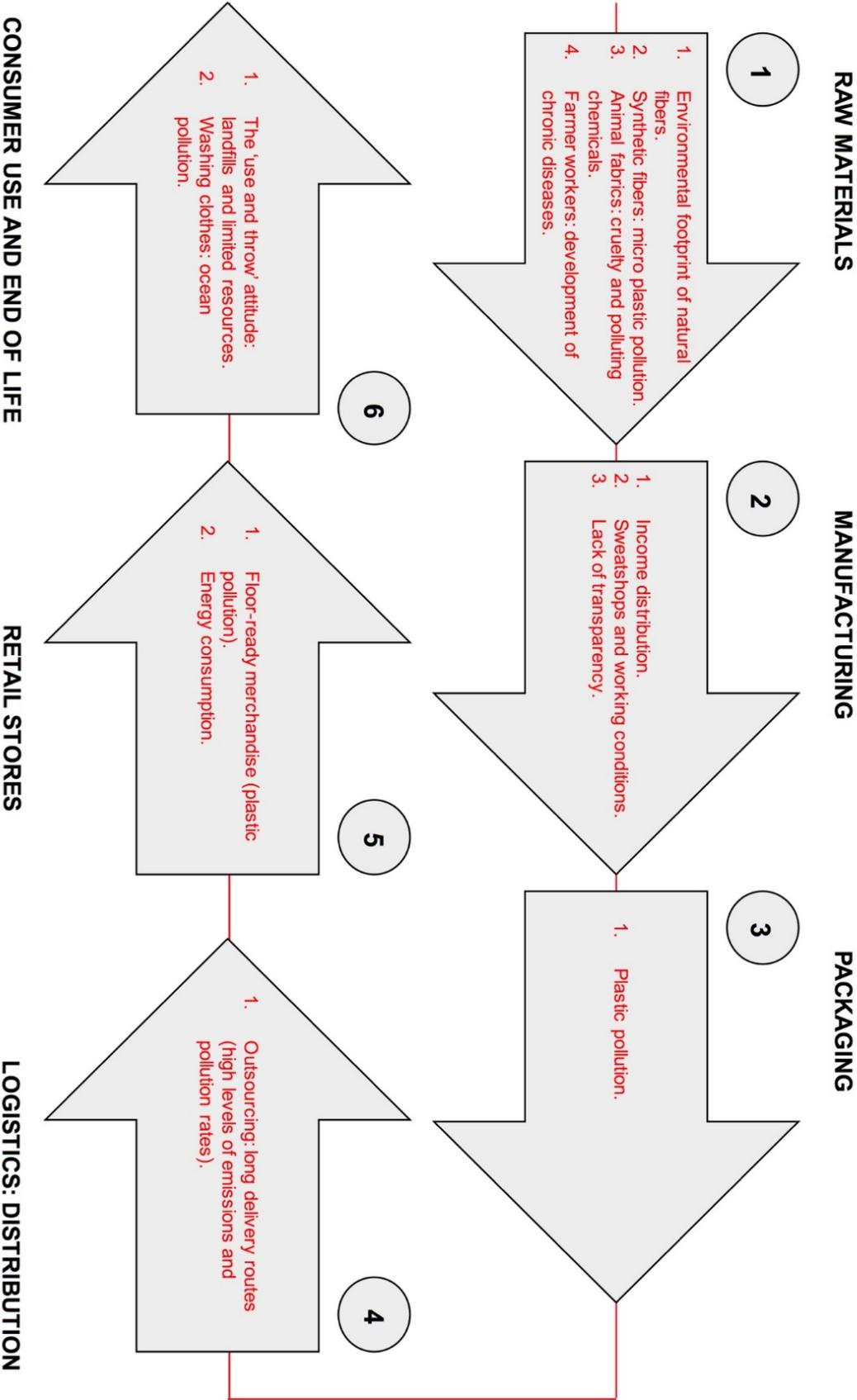
social and environmental challenges, and that both the public sector and technology can act as facilitators towards a sustainable supply-chain system.

The literature led the researcher to develop:

- The current fashion supply-chain model: social and environmental costs (Figure 13).
- An integral socially and environmentally responsible circular fashion model: social and environmental solutions (Figure 14). The sustainable supply-chain model presented represents the solutions found through literature research. In the following section, the researcher explored this model further.

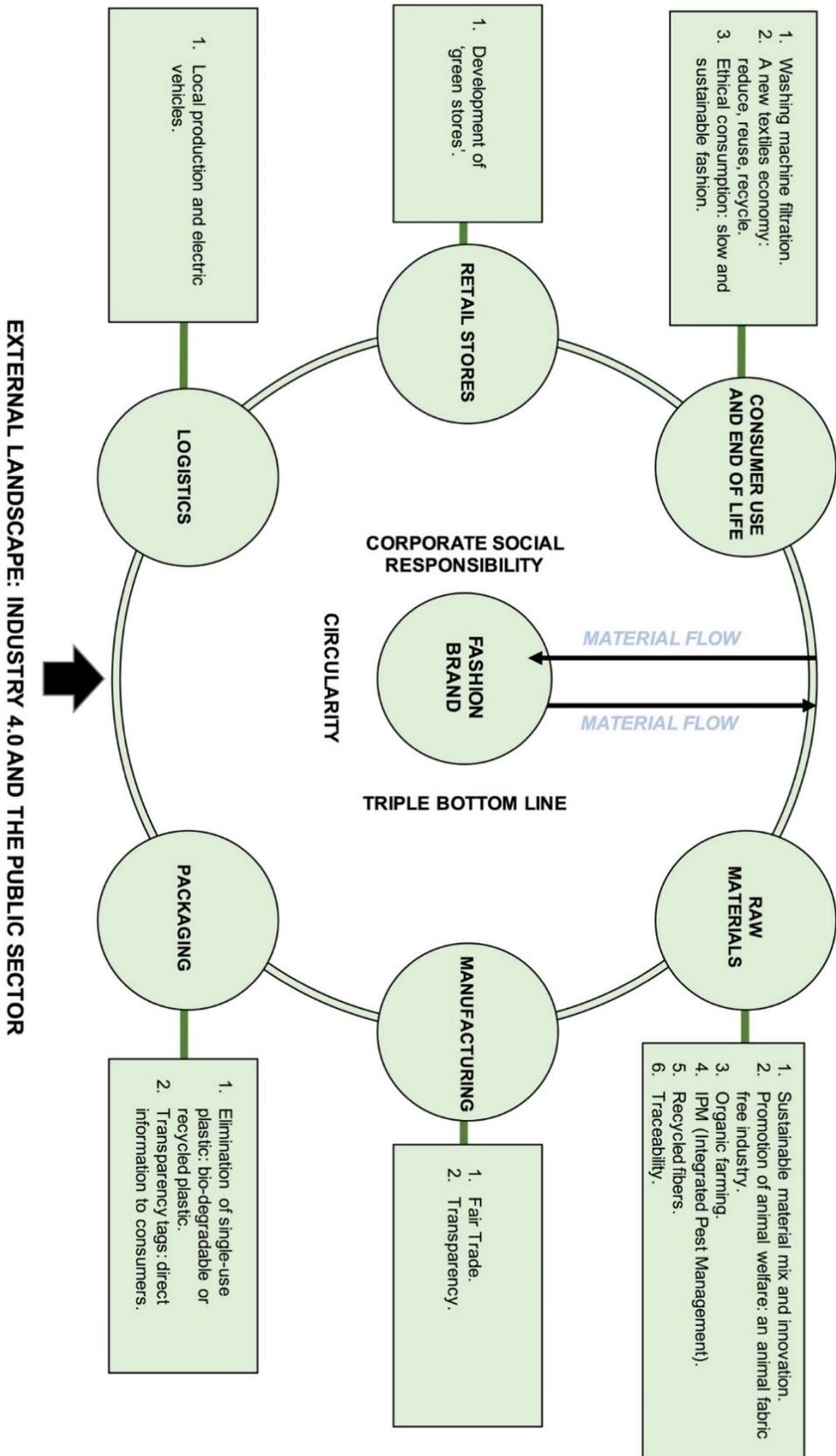
These figures are a graphic representation in two models of the environmental and social challenges involved in every step of the supply chain, and proposed environmentally and socially friendly solutions that fashion brands can utilize as guidance to incorporate in their supply chain management system. They summarize in two models the main social and environmental challenges and solutions found in the fashion supply chain.

Figure 13. The current fashion supply-chain: social and environmental costs



Source: Own Design

Figure 14. An integral socially and environmentally circular fashion model



Source: Own Design

SECTION 3: DELPHI STUDY

3.1. Methodology

The study aimed to:

- Investigate the level of importance experts give to sustainable supply-chain management.
- Explore which of the stages they believe have the highest environmental and social impact and why.
- Examine the limitations of a fashion brand to incorporate these strategies into their supply-chain system.

The research methodology for the paper has been *inductive theory*, since data collection has been used to investigate a phenomenon and later on has helped to build up a conceptual framework, in this case, a model (Bryman & Bell, 2011). The *primary research* has been based on quantitative and qualitative social research, (Dawson, 2009). The method used has been the Delphi Study. For the study, the participants have been chosen based on convenience sampling of the topic researched (Dawson, 2009). The Delphi study structures group communication and it is a forecasting process in which the researcher revises the opinions of knowledgeable experts about a specific problem, in order to create a group consensus and reach common conclusions and explore these further through different rounds (Lindstone & Turoff, 1975). The technique has been divided into two rounds (two questionnaires done with Survey Monkey). The following table represents the background of the panel of experts (8 in total):

Table 1. Panel of experts Delphi Study

SECTOR	PARTICIPANTS
Management positions at fashion brands (globally)	6
Corporate Social Responsibility sector professionals	2

Ethical considerations were taken at every step of the study. The anonymity of the experts was maintained. The questions and answers can be seen on Appendix 1, and the second round questionnaire can be seen on Appendix 2.

3.2. Findings and analysis

3.2.1. Questionnaire 1

Firstly, all the participants agreed to participate on the Delphi Study and they were informed that their identity would be kept in anonymity. In order to analyse the data, comparative analysis was used, comparing and contrasting the diverse answers (Dawson, 2009). The main findings and analysis include:

- A 90% of the participants 'strongly agree' that fashion supply-chain models will have to change towards a sustainable supply-chain management model, and a 10% 'agree'. This demonstrates the necessity of developing sustainable supply-chain models, since according to current expert opinions the fashion industry is moving towards sustainability.
- The panel of experts gave an average score of '95' from a scale of 1 to 100 when analysing the importance of incorporating sustainable strategies at every stage of the supply-chain, manifesting the necessity of taking into consideration every stage of the supply-chain system when developing new sustainable supply-chain models.
- When asked about which stages of the supply chain they believe involves the highest environmental impact: a 67% answered 'consumer use and end of life', a 22% answered 'raw materials' and a 11% answered 'manufacturing'. This question was developed further and participants responded why. 4 out of the 7 participants that gave a response, considered 'consumer use and end of life' because of landfills, and CO₂ emissions. 2 out of 7 considered 'raw materials' because of the energy and water involved in its production and the impact of unsustainable fibers. In consequence, 'consumer use and end of life' and 'raw materials' are the stages that involve the highest environmental impact.
- When asked about which stages of the supply chain they believe involves the highest social impact: 50% answered 'manufacturing' and 50% answered 'consumer use and end of life'. This question was developed further and participants responded why. The 5 participants that gave a response though, referred to 'manufacturing' by indicating that the social impact is because of the negative working conditions of the factories. In consequence, 'consumer use and end of life' and 'manufacturing' are the stages that involve the highest social impact.

- When asked about the difficulty of keeping track of the social and environmental impact of the whole supply-chain process. 7 out of 8 participants agreed that it is difficult because of the following facts: lack of traceability, lack of departments in fashion brands that work specifically with these issues, lack of technological advances that work with transparency, and lack of communication with suppliers. One participant disagreed by answering 'I don't believe it is difficult'. To sum up, lack of knowledge and resources are the main difficulties experts find.
- When asked about which stage they believe it is the most difficult to keep track of (in terms of social and environmental challenges) as a brand: 50% answered 'consumer use and end of life', 37.50% answered 'raw materials', and 12.50% answered 'manufacturing'.
- When asked about the limitations as a brand to incorporate sustainable strategies in their sustainable supply-chain management models: 2 out of 8 considered that lack of control over the different stages makes it difficult, 6 out of 8 considered that economic reasons and investment are a limitation, and 5 out of 8 considered lack of knowledge and commitment.

To sum up, incorporating sustainable strategies in fashion supply-chain systems is a necessity. Results have shown that 'consumer use and end of life' is not only the stage that experts believe it is most difficult to keep track of, but also, the stage with the highest environmental and social impact. This demonstrates that there is a gap for fashion brands to invest in 'consumer use and end of life' strategies and explore this stage further. On the other hand, the 'raw materials' stage was also considered to have a high environmental impact, and 'manufacturing' a high social impact, also demonstrating the need to explore and invest in these areas. Finally, the main limitations and difficulties that experts find to incorporate these strategies involve: lack of economic resources, lack of education and lack of commitment. So, there is a gap to investigate how companies can do this and what they should do. It is for this reason, that after this round, the researcher wanted to explore more in depth: the 'consumer use and end of life' stage, and challenge the limitations considered by the experts. The researcher wanted to find out which factors make the stage of end of use difficult to keep track of and understand what companies can change in their strategic decisions in order to challenge this perception.

3.2.2. Questionnaire 2

The main findings and analysis of the second questionnaire include:

- When asked about why they consider 'consumer use and end of life' is the most difficult stage to keep track of, general concepts of the answers included: lack of control over consumer habits, lack of contact with consumer in post-purchase experience.
- When asked about how to keep better track of the 'consumer use and end of life stage' all the experts gave interesting answers, and they all have in common that it is important to build a fidelity relationship with the consumer, and to keep in touch with them so as to understand their consumer habits.
- When asked about the role that fashion brands can play in bringing back the clothes from consumers when they reach their end of life stage, all the respondents considered that they play a vital role.
- When asked about any alternative solutions to circularity apart from the ones presented in the model, the common trends include: biodegradable materials (design for circularity) and consumer education.
- On the other hand, a comparison was established between the limitations found in the first questionnaire (lack of economic resources, knowledge and commitment) and the actual opinion of the expert. All the respondents believe that it is important to invest in sustainability and that sustainability should be incorporated to the culture of the company, but still complain that they do not have enough economic resources and that they have lack of knowledge. This fact emphasizes on the fact that companies need to start taking action.
- To finalize, 100% of the respondents agreed that fashion companies will need guidance on how to incorporate sustainability and circularity in their supply-chain systems, demonstrating the need of developing guidance models like the one proposed in this specific research.

This second questionnaire allowed the researcher to understand alternative strategic solutions to be incorporated at the 'consumer use and end of life' stage, and challenge the perspective that fashion companies have about circularity by proposing potential strategies to be incorporated in their SSCM (Sustainable Supply Chain Management) systems.

SECTION 4: CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

To conclude, this research gives a broad concept of the current social and environmental challenges we are facing on a macro level, and reflects on the social and environmental challenges involved in the micro level of the fashion industry. The outcome of the literature research resulted on the elaboration of a SSCM (Sustainable Supply Chain Management) model titled 'an integral socially and environmentally responsible circular fashion model'. Further on, the proposed model was challenged by a panel of experts through a Delphi Study, which allowed the researcher to develop the following conclusions:

- Experts believe the 'consumer use and end of life' stage is the most difficult stage to keep track of in terms of social and environmental impact, and in addition, it is the stage with the highest environmental impact. 'Manufacturing' is the stage that represents the highest social impact.
- Main limitations of incorporating sustainable strategies in SSCM systems are: lack of economic resources and lack of commitment.
- Alternative solutions such as biodegradable materials, design for circularity and consumer education could be incorporated at the 'consumer use and end of life stage'.

In general, the research and outcomes showed that there is an existing gap for guidance on how to incorporate sustainability and circularity into supply-chain systems, demonstrating the relevance of the proposed model.

Further research recommendations incorporate the exploration of consumer habits towards the 'consumer use and end of life' stage in order to understand what happens with the garments at the end of use stage and how fashion companies can contribute to circularity and bring the garments back to the supply-chain system.

Limitations of the study include that the Delphi Study was not developed completely. The number of experts was reduced and the study was limited to two questionnaire rounds. More questionnaire rounds and a wider panel of experts would have allowed the researcher to find more conclusions and common trends related to the topic, as well as exploring in depth the common findings. Additionally, the main social and environmental challenges were identified, but the fashion industry involves many other social and environmental challenges in each stage of the supply chain.

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LIST OF APPENDICES

Appendix 1. Survey Monkey Questionnaire 1

QUESTION	RESULTS
<p>1: I agree to participate in this Delphi Study, and I have been informed that the panel of experts will be anonymous.</p> <ul style="list-style-type: none"> - Yes - No 	<ul style="list-style-type: none"> - Yes: 100% - No: 0%
<p>2: Considering the social and environmental state of our planet, and the increasing consumer demand towards sustainable fashion, fashion supply-chain management models will have to change towards a more 'sustainable supply-chain management model'.</p> <ul style="list-style-type: none"> - Strongly agree - Agree - Neither agree nor disagree - Disagree - Strongly disagree 	<ul style="list-style-type: none"> - Strongly agree: 87% - Agree: 13% - Neither agree nor disagree: 0% - Disagree: 0% - Strongly disagree: 0%
<p>3: From 0 to 100, how important do you believe it is to incorporate sustainable strategies at every stage of the supply-chain process?</p>	<ul style="list-style-type: none"> - 95%
<p>4: Considering that the fashion supply chain stages are as follows: raw materials, manufacturing, distribution, retail, consumer use and end of life. Which of these stages do you believe involve the highest environmental impact? Explain why.</p> <ul style="list-style-type: none"> - Raw materials 	<ul style="list-style-type: none"> - Raw materials: 22% - Manufacturing: 11% - Distribution: 0% - Retail: 0% - Consumer use and end of life: 67% - Comments: 'consumer use and end of life': "because of the CO2 emissions, landfills, toxins". 'raw

<ul style="list-style-type: none"> - Manufacturing - Distribution - Retail - Consumer use and end of life <p>Why?</p>	<p>materials': "it requires a lot of energy/ water and sometimes even chemical pesticides to grow the most widely used material".</p>
<p>5: Considering that the fashion supply chain stages are as follows: raw materials, manufacturing, distribution, retail, consumer use and end of life. Which of these stages do you believe involve the highest social impact? Explain why.</p> <ul style="list-style-type: none"> - Raw materials - Manufacturing - Distribution - Retail - Consumer use and end of life <p>Why?</p>	<ul style="list-style-type: none"> - Raw materials: 0% - Manufacturing: 50% - Distribution: 0% - Retail: 0% - Consumer use and end of life: 50% - Comments: 5 participants that gave a response referred to 'manufacturing' by indicating that the social impact is because of the negative working conditions of the factories: "violation of workers rights, violation of human rights, child labour, low wages, social and environmental of low prices on working conditions".
<p>6: Do you believe it is difficult to keep track of the social and environmental impact of the whole supply-chain process as a brand? Explain why.</p>	<ul style="list-style-type: none"> - 7 out of 8 participants agree that it is difficult because: lack of traceability, lack of departments in fashion brands that work specifically with these issues, lack of technological advances that work with transparency, and lack of communication with suppliers. - One participant disagrees by answering 'I don't believe it is difficult'. - Comments: "I believe it is, since usually they are not even in the same country. You can't be constantly checking up on them, so it is all about relying on them", "Yes because you

	<p>don't have control over the different companies", "Yes, there is no traceability" "Because there are no technological advancements that will analyse precise environmental impact per item of clothing, it is more of an estimated guess".</p>
<p>Q7: Which of the stages of the supply chain do you believe is the most difficult to keep track of (in terms of social and environmental challenges)?</p> <ul style="list-style-type: none"> - Raw materials - Manufacturing - Distribution - Retail - Consumer use and end of life 	<ul style="list-style-type: none"> - Raw materials: 38% - Manufacturing: 12% - Distribution: 0% - Retail: 0% - Consumer use and end of life: 50%
<p>Q8: In your opinion, which are the limitations for a brand to incorporate sustainable strategies in their supply chain management models?</p>	<ul style="list-style-type: none"> - 2 out of 8 consider that lack of control over the different stages makes it difficult, 6 out of 8 consider that economic reasons and investment are a limitation, and 5 out of 8 consider lack of knowledge and commitment. - Comments: "investment involved in sustainable strategies", "economic, and lack of education in sustainability", "size, resources, high level of commitment to sustainability, necessity", "I can get very expensive and hard to recruit a team for this". "awareness, costs and margins", "certain parts of the process that the brand doesn't have control over" ...

Appendix 2. Survey Monkey Questionnaire 2

QUESTION	RESULTS
<p>1: Outcomes of the previous questionnaire demonstrated that the 'consumer use and end of life stage' is the most difficult stage to keep track of as a fashion brand in terms of social and environmental impact. Explain why.</p>	<p>- Comments: "There is no technology to keep track of consumer habits", "Once the consumer buys a garment, they disappear from the value chain", "because there is no advanced system in place which could track how consumers are using their clothes and whether they recycle it", "the brand has no control over that happens to garments post sale", "because once the consumer has purchased a product, the brand can no longer keep track of how the consumer uses and disposes the product", "no contact with consumer", "no control over consumer".</p>
<p>2: How do you believe companies could keep better track of 'consumer use and end of life'?</p>	<p>- Comments: "relationship with consumer", "better relation with consumer, incorporation of new technologies", "asking for feedback through emails about their purchases", "building consciousness around sustainable acts", "creating collaborations or marketing tactics", "surveys, questionnaires", "technologies such as blockchain", "fidelity programs", "consumer loyalty programmes".</p>
<p>3: Do you believe fashion companies can play an important role in bringing back the clothes from consumers when they</p>	<p>- Comments: "Yes, I believe they are responsible for it", "definitely, by educating them about the impact of throwing away clothes", "yes, I believe this is a strong idea", "yes, if</p>

<p>reach their end of life stage? Yes or no? in case of yes, how?</p>	<p>incentives are offered then consumers could be convinced to deal with the end of life stage differently”, “yes of course, if fashion brands do not take care of it, who will?”, “definitely, because they can bring back clothes into the system”, “yes, because they can integrate those clothes again in the supply chain”.</p>
<p>4: The main body of the research proposes the following solutions to the 'consumer and end of life' stage: a new textiles economy (reducing, reusing, recycling), washing machine filtration (to prevent micro plastic pollution), and change of mindset towards ethical consumption. Can you come up with any other solution?</p>	<p>- Comments: “educating consumers, encouraging them to take part in circularity through discounts, fidelity programs”, “consumer education”, “implementation of advanced materials such as biodegradable leather and algae”, “marketing tactics from brands, making consumer conscious and 100% aware of the result, picking up used clothes and recycling building brand ethos from that point of view”, “consumer education”, “companies could offer discounts to consumers if they help with circularity”, “education to consumers”.</p>
<p>5: Outcomes of the previous questionnaire demonstrated that lack of economic resources is one of the limitations that keeps fashion brands from investing in sustainable supply-chain strategies. Do you not believe that investing in sustainability is going to bring profitability in the short term? Explain why.</p>	<p>- Comments: “I do believe it, but it is difficult to apply once you are in a company, “Yes I believe so, I just think companies do not understand still the negative impact of not introducing sustainable strategies”, “investment in sustainability implies radical changes in a business structure, resulting in additional expenses, however companies</p>

	<p>should analyse the bigger picture and focus on sustainable practices which will definitely bring profitability in the long term”, “it depends, I believe that if a person is conscious enough and around sustainable issues then of course investing in sustainable prices will bring profitability in their own experience. However, if the brand doesn’t have a very powerful tactic on why they are spending more to save the environment it can use confusion and the belief of unworthy spent”, “brands might not profit hugely from sustainability short term but I imagine long term if the right methods are used then profit and sustainability could go hand in hand”, “yes, but it is true that companies are afraid to invest in something uncertain, not ready to invest in sustainability yet”, “yes, if companies do not do it they will not success”, “yes I believe it, corporate social responsibility brings value to companies”</p>
<p>6: On the other hand, outcomes of the previous questionnaire demonstrated that lack of knowledge and commitment are two other limitations that keep fashion brands from investing in sustainable supply-chain strategies. Do you not think it is necessary to incorporate sustainability in the mission of the company? Explain why.</p>	<p>- Comments: “Yes, I think everybody needs to be conscious and become a conscious consumer”, “Yes of course, if the company has a ‘sustainable culture’, the social and environmental impact of the company will definitely decrease”, Sustainable practices will resonate with consumers desire to drive a positive societal and environmental change and will help to establish consumers</p>

	<p>loyalty which will in turn result in more sales”, “it is important and necessary now more than ever, as physical aspects of the world are starting to show together with climate change and pollution – we need to act now if we don’t want to end up destroying our own world, however there needs to be a clever and clear strategy per company to communicate this to their customers”, “absolutely! As consciousness and awareness of the masses arise, consumers will start learning more about their impact on the planet and perhaps this may drive them to rethink consumers behaviour and in return this might change the approach brands would have to use to attract customers”, “of course I believe it is necessary, if everyone is conscious, the company will be managed differently”, “ yes I think it is, but companies are still not conscious enough”, “yes, sustainability has to be integrated in the mission of the company”.</p>
<p>7: Do you believe fashion companies will need guidance and references on how to incorporate sustainability and circularity in their supply-chain systems?</p> <ul style="list-style-type: none"> - Yes - No 	<ul style="list-style-type: none"> - Yes: 100% - No: 0%