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Circular fashion: an alternative to fast fashion

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DECLARATION

I declare that I have created the thesis by myself. All sources and literature used have been duly cited. The work was not used to obtain another or the same title. This declaration and consent will be signed by handwritten signature.

In Metz, 26/07/2021

signature:

A handwritten signature in black ink, appearing to read 'E. Peters', is written over a horizontal line. The signature is stylized and cursive.

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1. Introduction

Wearing clothes seems to be a nearly universal characteristic shared by humans. What drives humans to wear clothes? In my experience, everybody around me wears clothes so I have learned to wear clothes too. I wear different clothing items every day, and there are items in my closet that I have never worn.

According to the philosopher Williams Matthew Williams (1890), wearing clothes is a contingent human activity that enables the retention of a bodily temperature above the mean temperature of the earth's temperate zones. Indeed, clothing resists the passage outward of heat by low conductivity. Clothing can also absorb sweat and protect from weather events such as rain, sunshine, and wind. Shoes have the additional attribute of protecting feet from wet or bumpy ground.

However, people nowadays buy more clothes than they rationally need for protection purposes. In the last ten years, worldwide, we can observe growth in the global revenue of the apparel markets. According to Shahbandeh (2020), the income of the international clothing market has steadily increased from 2012 to 2020. This increase in revenue parallels a rise in consumption driven by the growth of a global middle class and an increase in per capita sales in industrialized countries (Shahbandeh, 2020). According to Statista (2020), the average number of clothes in a consumers' closet worldwide in 2019 was 136 items. What is the reason why people want to own so many clothes? What is the system that enables such amounts of clothes to be produced in the last decades?

The most important reason why people own so many clothes nowadays, which the philosopher Williams overlooks, is that clothing is the vehicle by which we promote ourselves to others. Clothing styles can convey personality, sociability, age, status, competence, and intelligence. They can be worn as an adornment with the desire to attract attention or secure preeminence (Dunlap, 1928). In societies with social mobility and a large middle-class such as the US and Europe, standing out through clothing is of great importance. Europe and the US entered an Era of democratized fashion during the 20th century that continues and expands today. In that context, people have the freedom to buy from a vast range of different styles. They can consciously make fashion choices to represent themselves the way they want to be perceived (Mair, 2018). While privileged classes are not

interested in competition since their position in society is secure, middle-class individuals who have a similar social status compete with each other by imitating those of a slightly higher social status than themselves. Georg Simmel argues that there are two forces that drive fashion: differentiation and conformity. One attempts to conform to those one wants to emulate, and one differentiates oneself from the others. Therefore, fashion is not a free form of self-expression. It entails implicit social pressure to fit in (António, 2014).

So, the reason why people want to own so many clothes is based on competition and imitation, but how does the fashion system enable and encourage such behaviour? Many companies are dedicated to taking advantage of human insecurities and feed on the urge of people to be validated to sell even more clothes in a small amount of time (DeLace, 2011). Indeed, staying trendy to impress others necessitates the consumption of ever more clothes at a quick rate. The system of production is designed that way, it entails "(i) a quick response policy employed to reduce the lead time so that volatile demand and supply can better match, (ii) frequent change of product assortments, (iii) a short product lifecycle and (iv) product design which fits the fashion trend and market needs" (Caro & Martinez-de-Albéniz, 2014:7). Of course, the psychological drive to buy more clothes cannot on its own explain the emergence of such a system. Indeed, the fast fashion culture is a product of historical-economic circumstances. According to Murray et al. (2017), the increase in consumption of clothes worldwide was mainly enabled by deregulated banking, globalization of markets of capital, information technology improvements, and outsourcing. These historical and economic circumstances may have positive aspects: more consumer spending, more jobs, more profits, and consumers are satisfied with participating in trends (Chouprina, 2014). However, it is not harmless. It has negative consequences both for the environment and for people's health.

The textiles industry has a significant impact on the environment. When it comes to water pollution, in 2011 it was estimated that 17 to 20 % of wastewater in the world comes from the fabric dyeing and treatment process (Kant, 2012). In one year, the clothing industry accounts for 10 % of international CO₂ emissions. This statistic represents more than all transnational air and sea transport. A half-million tons of plastic microfibers, mostly coming from accessories and clothes, but also insulation and tablecloth end up in the ocean each year. This quantity of microfibers amounts to about 50 billion bottles made out of plastic. It is impossible to extract microfibers from water. Therefore, the microfibers will enter the

food chain (World Bank, 2019). About 85 percent of the clothing Americans consume, 3.8 billion pounds annually, goes to landfills as solid waste. This amounts to nearly 80 pounds per person per year (Bick, 2018). According to Stall-Meadows & Peak (2010), the majority of textiles could be resold, donated to charities, or composted. Composting is possible with natural fibers such as linen, wool and silk, and cotton. So there are ways in which the current fashion system could be improved to reduce its environmental impact, but the costs need to be evaluated.

Furthermore, the fashion industry has a social cost. The reason why some clothes are so cheap is that the production of these clothes relies on labor that is paid under the minimum wage in the particular country where clothing is produced. Usually, the workplace in China or Africa usually entails difficult, dangerous, and climatically challenging work. It is scorching hot inside a dimly lit, and poorly ventilated factory (Gordon, 2009). Child labor laws may also be violated (Fair Labor Association, 2017). The working conditions are not the only negative consequences of the current fashion industry. With the excendent amount of clothes produced, since the 1980s, unwanted clothing from more affluent countries (the global north) is often shipped to poorer countries (the global South). While one usually intends to donate all the apparel for wearing, inevitably, some are resold by recipients who would rather have cash than clothing. Receiving countries such as Kenya, Malawi, Mozambique, Tanzania, Zambia had their own clothing manufacturing companies, but second-hand clothes have outcompeted and displaced local manufacturers in African countries. Various policy makers accused importers of used clothing to 'kill' African textile and garment manufacturers because the garments produced in their country are more expensive than second-hand clothing (Brooks, 2019).

The root of the problem, then, is the sheer amount of produced clothes, amongst which a significant part is redundant. Clothing production has increased twofold between 2000 and 2014. In 2014, the average user bought 60 % more clothes in comparison with the year 2000. As of 2019, the average value of clothes that were never worn that British citizens pile up over a lifetime is estimated to be 32,951 British pounds (Sabanoglu, 2019). Since large amounts of clothing remain unworn in our closets, and since living with fewer clothes than we do now has been done in the past, a reduction in clothing production and ownership is possible without negatively impacting the consumer's quality of life.

In this thesis, I delve deeper into two contrasting fashion industry models: fast fashion and circular fashion. My approach to the topic is to analyze the most relevant literature on the topic, in order to find out, for myself and for the reader, what the state of the fashion industry is, and where it might be headed.

Circular fashion's proponents claim that that fashion system could replace fast fashion and tackle challenges like climate change, pollution, and biodiversity loss. They argue that in the circular economy, products would be created to be used over a more extended period, made to be repaired or recycled, and manufactured from safe renewable inputs (Ellen MacArthur Foundation, 2017). This leads me to the main research questions of my thesis, which are:

- *How does circular fashion contrast with fast fashion?*
- *Can circular fashion become a viable alternative to fast fashion?*

The aim of my thesis is to provide a comparison of both fashion systems, so that the reader can gain an understanding of where the fashion industry stands and where it might be headed in the next decades. I found that circular fashion is the dominant industry model this past decade and responsible for the abundant production of clothing and impacts on the environment and people's health, and circular fashion is a budding movement that claims to be more respectful to the environment and people. Circular fashion has promising results in terms of the reduction of environmental impacts, however it has to overcome multiple challenges to be implemented. With the amount of research that stands at the moment, it is impossible to conclude that circular fashion can become a viable alternative to fast fashion.

2. Fast Fashion

2.1. Fast fashion: how does it work?

Caro & Martínez-de-Albéniz (2014) collected elements that are key to understanding fast fashion. They argue that fast fashion is a form of lean retailing, which means that clothes are produced in small batches. Fast fashion is a system in which lead times are short (Caro & Martínez-de-Albéniz, 2014). One can define lead time as “the total amount of time required for completing a product, beginning from the date of receiving the order and ending with the shipment of the goods to the customer” (Kader et al., 2014:268). Another characteristic of fast fashion is that its retailers are specialty retailers. They have an online presence and brick & mortar stores. They are not trendsetters; they follow trends instead. They target a mid-to-low price range for consumers (Caro & Martínez-de-Albéniz, 2014). Fast fashion is a model combining:

- (i) quick response
- (ii) frequent assortment changes
- (iii) fashionable design at affordable prices

(Caro & Martínez-de-Albéniz, 2014:7).

(i) Quick response is a set of standards for supply chain management and information exchange, which enables shorter lead times. It also increases supply chain efficiency. The definition of quick response has evolved to be more broadly interpreted: it means postponing all decisions involving production. The production of certain products is delayed because one waits to find out if the sales are high or not. The postponement happens until there is a sufficient amount of evidence that the demand of the market is present (Caro & Martínez-de-Albéniz, 2014). Future trends are forecasted with the use of real-time information to capture the desires of the clients (Bhardwaj, 2010). Quick response diminishes the opportunity that inventory will be sold at the clearance price. Indeed, it matches more closely demand and supply (Cachon, 2011). The practical implementation of quick response is supposed to produce less inventory and a better gross margin (Caro & Martínez-de-Albéniz, 2014). Rapid response is linked to shared situation awareness, which is defined as the identification of patterns and anticipation of what might happen next in the fashion industry.

It is built through the observation and the processing of raw data. The precise mechanisms at the origin of shared situation awareness are presented in the case study about Zara.

(ii) Frequent assortment changes are a crucial aspect of fast fashion. In that way, the shops can stay trendy and attractive. In the past, fashion followed the rhythm of collections. Companies changed assortments twice (Spring-Summer and Fall-Winter). This industry-wide standard was supported by design, communication, sales, and marketing. In contrast, the design, production, and distribution of fast fashion happen both at the beginning and the middle of the season (Caro & Martínez-de-Albéniz, 2014). Frequent assortment renewal of fashion products in sales outlets is about 2 to 4 times a month (Chouprina, 2014). Frequent assortment change is a very recent evolution that goes to pair with the rise of social media. Consumers believe that social media contributes to the acceleration of the buying process (Michaela, 2015). Indeed, a study has shown that consumerism on Instagram (a social media platform) contributes to creating an image of the self. Social approval in the form of “likes” and continued exposure to fashion items in the form of ads on Instagram exacerbate envy and superficiality and consequently encourage fast fashion consumption. Social media has its rhythm: it works non-stop. So does fast fashion (Dantas & Abreu, 2020).

(iii) Fashionable designs are made at affordable prices. Cheapness, easy access, and volume are prioritized (Fletcher, 2010). The costs that go for capital equipment are usually quite low. Therefore, opening a manufacturing plant is possible almost anywhere. Lower labor costs are also crucial to fast fashion. While activities such as cutting, sewing, and fitting necessitate intense labor, the skills required can be acquired easily. Laborers do not need any degrees to start working in the textile industry. Furthermore, customers expect to find fast fashion at a cheap price, and therefore medium or low quality. In contrast with designer fashion, buying fast fashion is not considered as investing in clothes. Customers go shopping often since they have to renew their clothes, which are often worn for short periods of time (Mihm, 2010). Companies have also put in place particular strategies to reduce the cost of making clothes. One of those strategies is the postponement strategy (Gattorna, 2015). Benetton is a brand that postpones the dyeing of sweatshirts to just before the moment they will be sold. The color is chosen according to the newest fashion. The process of dyeing postponing cuts costs. Indeed, it creates cheaper inventories and fewer unsold items (Aftab et al., 2017). To summarize, fast fashion is about increasing sales and growth while minimizing production costs and maximizing economies of scale. Is that business model

going to continue growing? I will look at the example of Zara to try to hint at answers to this question.

2.2. Leaders in fast fashion: Zara

Zara is a crucial leader in fast fashion since The New York Times utilized the idiom “fast fashion” for the first time to characterize Zara when it opened a shop in 1989, New York (Gazzola, Pavione, et al., 2020). Zara remains one of the largest and most well-known fashion industry leaders. This is the reason why understanding the functioning of Zara can shed light on the fast fashion industry as a whole.

Zara was founded in 1975 as a family business in Galicia, the northern part of Spain. The founders are Rosalía Mera and Amancio Ortega. Zara’s vision was to target the mass market rather than exclusive luxury, with fashionable designs at a low price. In the next eight years after it was founded, Zara’s vision and its business model grew increasingly popular. Nine new stores opened in the largest Spanish cities. In 1985, Inditex became Zara’s holding brand. According to Crofton & Dopico (2007), Inditex’s business model was founded on the principles of creative and qualitative design with a quick response policy to demand, as well as democratized fashion (Crofton & Dopico, 2007). Zara started its expansion within worldwide markets, including “Portugal, USA, France, Mexico, Greece, Belgium, Sweden, Malta, Cyprus, Norway and Israel” (Inditex, 2020). In 2019 Zara had more than 3000 stores located across 98 countries (ibid). Zara has shown tremendous growth and success in the past decade. The question one is inclined to ask is: what differentiates Zara Inditex from the traditional clothing industry?

Traditional clothing is produced along seasonal lines. It features star designers and is made by subcontractors multiple weeks in advance. It is heavily advertised. Zara does not follow these rules. Zara delivers new clothing every three weeks (Crofton & Dopico, 2007). Three-quarters of the merchandise changes every 3 to 4 weeks (Aftab, 2018). Zara uses teams of designers, sourcing specialists, and product development personnel rather than star designers. That team is responsible for creating clothes both for the current season and the following season. Their goal is to produce constant variation, expand on successful products/items, and continue in-season development. Furthermore, Zara makes use of vertical integration. This production method adapts to customer demand. Much of the

merchandise is produced internally by Zara’s manufacturing facilities for capital-intensive processes such as “fetching raw materials, dyeing, quality control, ironing, packaging, labeling, distribution” (Crofton & Dopico, 2007:43). Here is a diagram that describes Inditex-Zara’s operations and flows along the value chain.

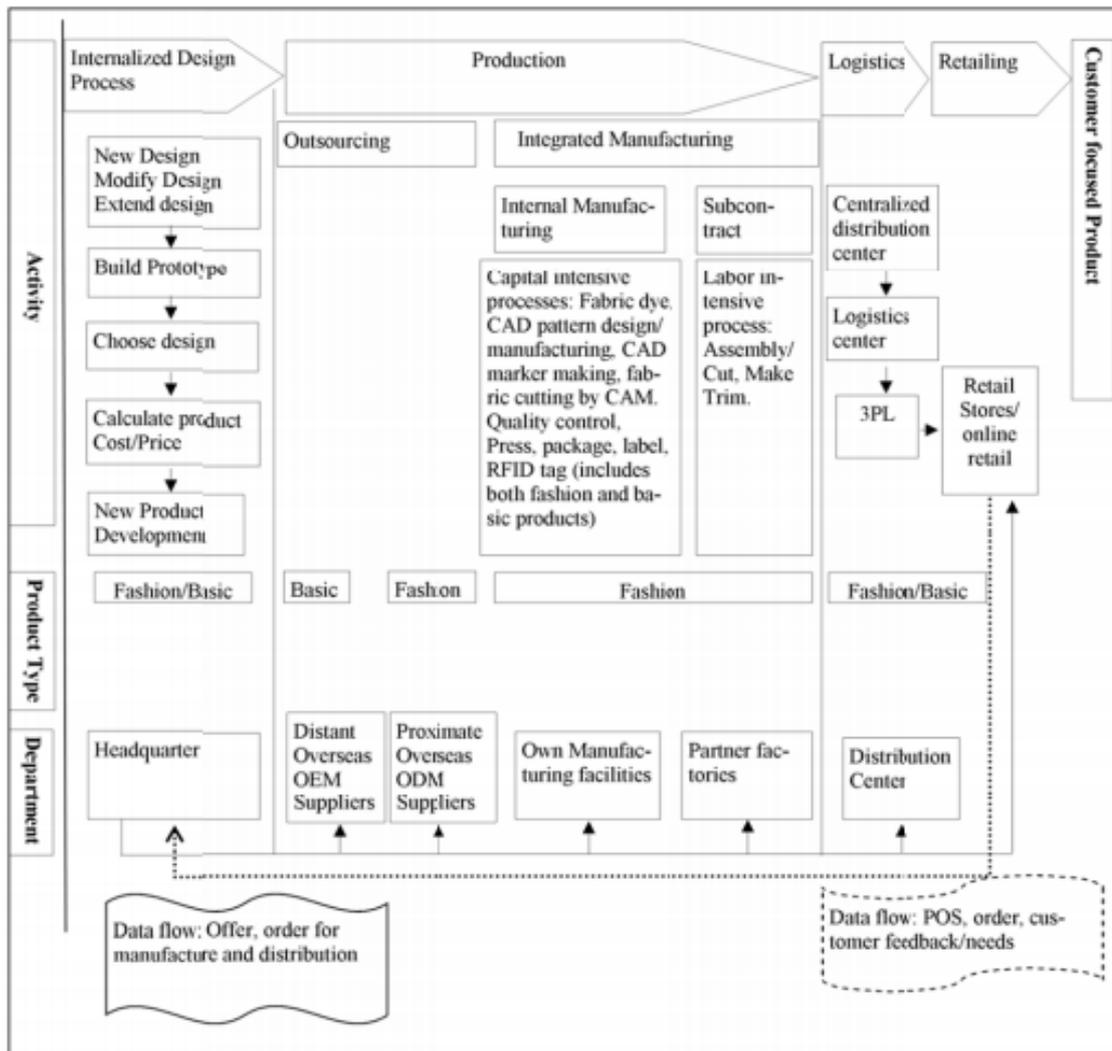


Figure 1. An illustration of Zara's/Inditex’s functioning (Ghemawat & Nueno, 2006).

As one can see in Figure 1, Zara functions both with outsourcing and integrated manufacturing. Outsourcing is “the business practice of hiring a party outside a company to perform services and create goods that traditionally were performed in-house by the company's employees and staff” (Twin, 2021). When it comes to essential items, Zara uses distant overseas suppliers. Zara uses proximate overseas suppliers, own manufacturing facilities, or partner factories when it comes to fashion items. Twenty factories are wholly

owned by Inditex, 18 of them around Arteixo in Spain (Ghemawat & Nueno, 2006). Other clothing is produced by partner factories subcontracted, which produce labor-intensive work such as sewing (Crofton & Dopico, 2007; Aftab, 2018). Internal production represents 60% of Zara's clothing production; the 40% left are partner factories in Europe, North Africa, and Asia. Just 20 suppliers represent 70% of external purchases (Ghemawat & Nueno, 2006).

So, among other fast fashion companies, Zara does not stand out because of outsourcing. H&M, Benetton, Nike, Adidas are global fashion brands that outsource just like Zara does. Zara does not stand out because of marketing with heavy advertising since Zara spends only 3% of the money it makes on an advertisement (Ghemawat & Nueno, 2006). What makes Zara stand out is the ability to spot opportunities and create and maintain shared situation awareness. It means identifying patterns and anticipating what might happen next in fashion trends (Cachon, 2011). How does Zara build shared situation awareness? Firstly, Zara collects raw data through store managers. Store managers decide which products they will sell. They are compensated according to how accurately they can foretell the sales. They provide feedback on what the customer likes or dislikes to regional managers, who offer observations of a million regional trends, and country managers, who provide an aggregate view of national trends. Second, Zara makes sense of that raw data within the circle of commercial and designer teams, both located in the company's headquarters. To create new designs, designers create a prototype. Finally, the latest products are commercialized (Ghemawat & Nueno, 2006). The design development process of total product collections is presented below (Aftab, 2018).

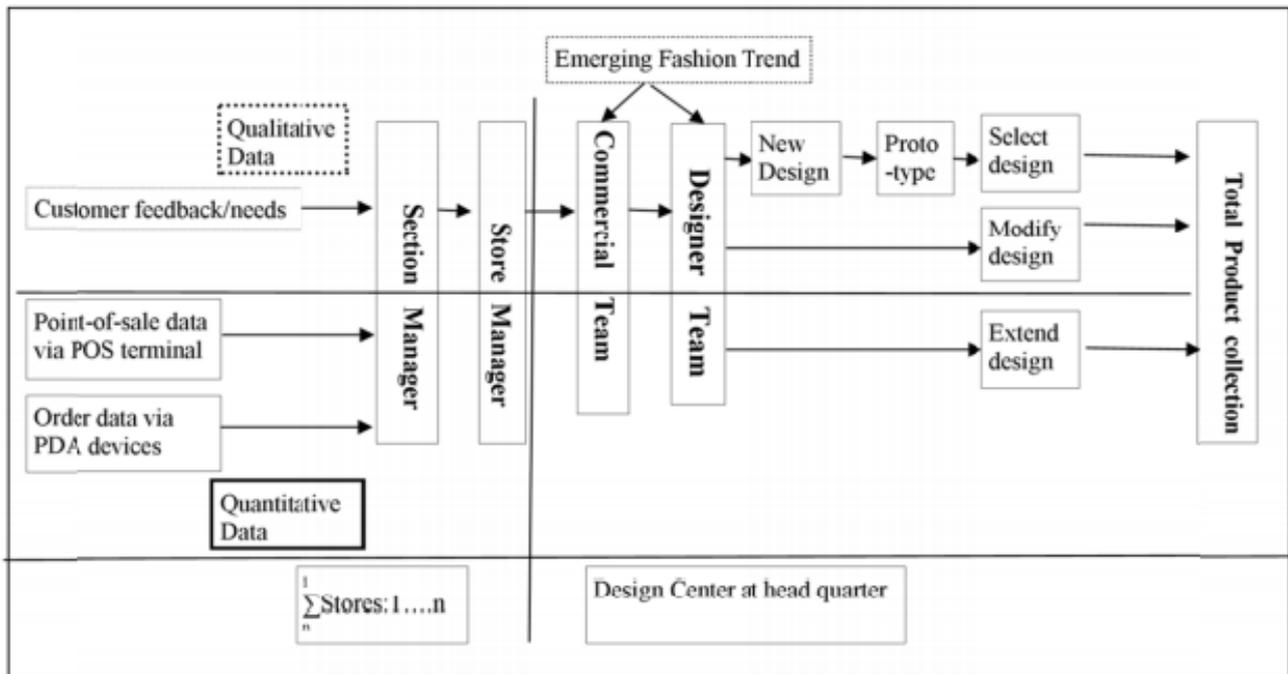


Figure 2. Process of development of designs of Zara (Aftab, 2018).

As we can see in Figure 2, Point-of-sale and order data and customer feedback are communicated to the section manager. The Section Manager then transmits the information to the Store Manager. The Commercial Team and Designer Team collect that information to design clothes that fit customer demand. Some designs are selected, others modified or extended. These designs finally enter the Total Product collection. This is the way the creation of the Total Product collection is developed in a fast-fashion system.

Once new products arrive, the section manager's responsibility is to order replenishments (Aftab, 2018). The weekly rhythm of replenishment reduces the costs of low success with a design. If an item of clothing is very successful, the company can extend it. When it is not successful, the small initial inventory minimizes the markdown (Ferdows et al., 2005). It is commonly said that the clothing production principle is to create “clothes to be worn ten times” since it is made with less expensive, and thereby low quality, fabric (Aftab, 2018). All in all, Zara is oriented to respond to customer demand to satisfy impulsive buying of cheap but trendy clothes, not long-term practical and valuable clothing. Nevertheless, Zara's business model has proven to be successful.

In 2019, Zara's brand value was \$18.4B (Fig 3) (Statista, 2021). As of July 27th, 2020, Zara's brand value was \$14.7B (Ochab et al., 2020).

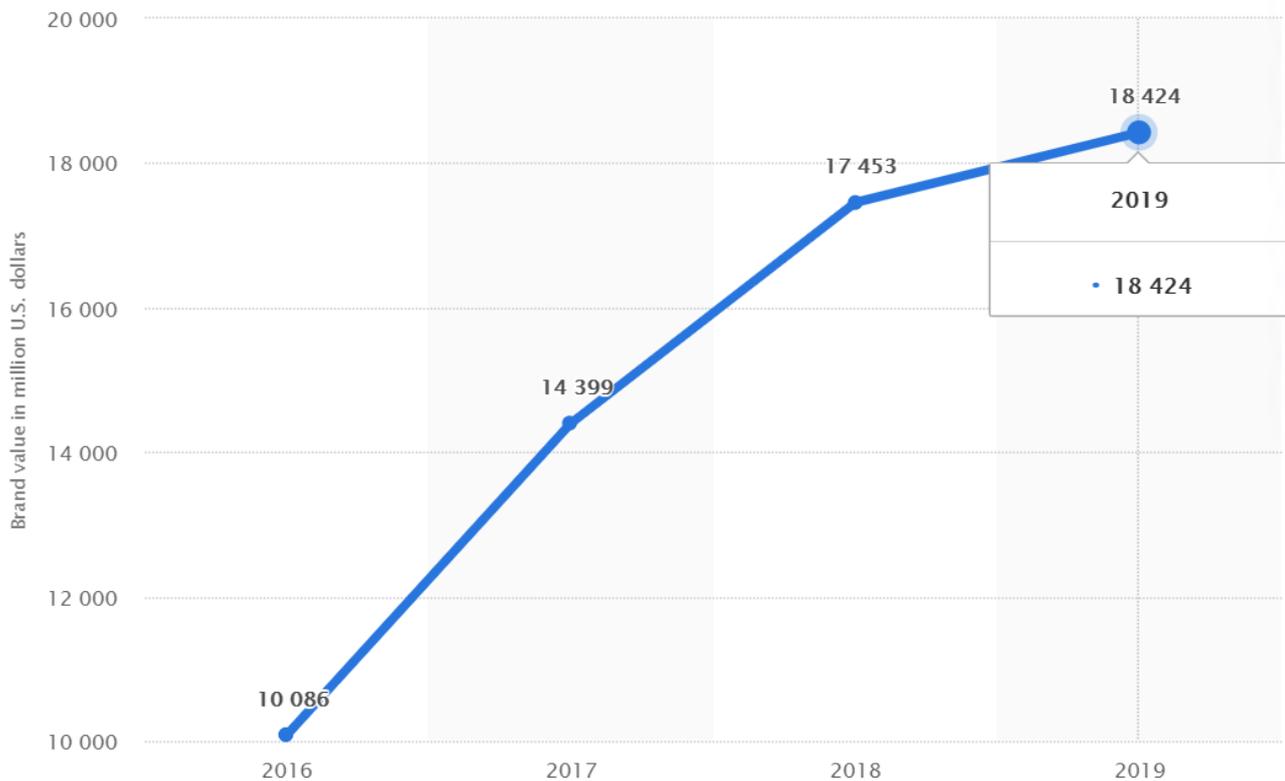


Fig 3. Zara's worldwide value (in million U.S. dollars) from 2016 to 2019 (Statista, 2021).

This graph shows that the brand value has grown from around 10 million to 18 million U.S. dollars from 2016 to 2019. Will they be able to maintain their current size? According to a SWOT analysis of Zara conducted by Duoyan (2021), there are several reasons why Zara will remain popular and thriving: low prices, unique and abundant designs, quick production, and low production costs. However, Zara also has weaknesses: the quality of products is low, there is an overextension of scale, and Zara is deeply involved in the plagiarism of other designers. Zara still has opportunities to evolve with artificial intelligence and the development of e-commerce. Yet, it is also threatened by strong brands that might outcompete Zara in the future (Duoyan, 2021). Public opinion may shift towards a type of consumption that is more respectful of people and the environment.

Zara is already conscious that consumers will increasingly regard sustainability as crucial for their clothing choice, which is why they included four keywords that define Zara: "beauty, clarity, functionality and sustainability" (Inditex, 2021). While sustainability has

various definitions I will use the following in my thesis: “to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs” (Butlin, 1989:1). The sustainable practices they have put in place are “installation of clothing recycling containers in-store and a scheme providing for free at-home collection of used garments to complement the delivery of online orders,” “eco-stores” and the “join life” collection (Inditex, 2021). However, a study by Sitaro (2020) has argued that most of these statements made by Zara about sustainability are empty promises because of a gap between sustainability reporting and actual sustainability practice. In fact, the business model of Zara, and fast fashion in general, is argued to be incompatible with sustainability (Sitaro, 2020). In the next chapter I will look into the environmental impact of fast fashion to build on that point.

2.3. The environmental impact of fast fashion

Fast fashion produces 8-10% of global CO₂ emissions. Fast fashion makes use of 79 trillion water liters yearly, representing 20% of the pollution of industrial water and 35% of oceanic pollution due to microplastics. This statistic is linked to cotton production and textile manufacturing. From 1975 to 2018, globally, the production of textiles per capita increased from 5.9 kg to 13 kg yearly (Niinimäki et al., 2020).

The textile sector is linked to 7% of depletion of groundwater and the loss of drinking water. The wastewater produced by it can be detrimental to the ecosystem. The cotton industry uses a great deal of water and pesticides. The use of fertilizers, pest control tools and highly drained water and soil degrade ecosystems. Effluent might entail several toxic substances (Shafiq & Rehman, 2000). Furthermore, leaching – when the solute detaches from its carrier with a solvent - results in CO₂ emission and the pollution of water (IPCC, 2006). According to a study by Azizullah et al. (2011), in Pakistan, leaching from cotton production lands contaminates freshwater. Mechanization of cotton treatment has increased non-renewable energy use – making the production of cotton even more resource-intensive (Choudhury & Kennedy, 2005). Even at the landfill stage, cotton is an issue. While the natural fibers decompose, landfills bury textiles, thereby preventing fibers from disintegrating due to a lack of sunlight and oxygen (Gwilt, 2012). When these textiles are finally incinerated, the particles ending up in the air contribute to air pollution (Stall

Meadows & Peak, 2010). So, fast fashion makes intensive use of resources, especially cotton. Intensive cotton production destroys or endangers ecosystems.

It is estimated that the textile industry causes 10% of greenhouse gases worldwide. In 2018, global emissions reached 29Gt of CO₂, mainly driven by synthetic materials (polyester, acrylic, nylon, etc.) during fiber production (Niinimäki et al., 2020). Synthetic fibers are created from fossil fuels. The production of synthetic fibers is, therefore, more energy-intensive than cotton or linen, which are natural fibers. Furthermore, most clothes are produced in countries essentially running with coal (China, India, Bangladesh). Coal is one of the most polluting industries in terms of CO₂ emissions (Warner & Glenn, 2019). The transportation of garments with container boats or air cargo also contributes to CO₂ emissions. Air cargo is 25% more polluting than container boats (Niinimäki et al., 2020).

The fashion industry makes use of over 15 000 different chemicals for production. Using agrochemicals may result in nausea, diarrhea, cancer, and respiratory disease. Acute poisoning caused by pesticides kills 1000 people daily. The chemicals also can infiltrate soils. This results in lower “biodiversity and fertility, interrupt biological processes and destroy microorganisms, plants, and insects” (Niinimäki et al., 2020:193). One single European textile-finishing company makes use of “over 466 g of chemicals per kg of textile, including sizing agents, pretreatment auxiliaries, dyestuff, pigments, dyeing auxiliaries, final finishing auxiliaries, and basic chemicals” (ibid:193).

The textile fibers release microplastics into the ocean. Cotton and polyester make up 90% of garments sold in the U.S. Polyester fleece shed abundant microplastics amounts (Almroth et al., 2018). Šajin (2019) argues that one load of laundry of polyester clothes can discharge 700 000 microplastic fibers. After microplastics are released into the oceans, microplastics gather toxic organic contaminants, which are then ingested by Phytoplankton and zooplankton. Since these organisms are at the base of the food chain, they, in turn, become food for other organisms and can thereby enter the human food chain and affect human health (Wu et al., 2017; Scopetani et al., 2020).

The business model of fast fashion itself is a significant contributor to fashion’s nefarious environmental impact. The business strategy of fast fashion incites clients to switch their clothes often. The short life of clothes and the face past of changing trends make

items of clothing disposable. Since fast fashion brands place more value on low prices instead of high prices and durable fabrics, the clients purchase more clothes than they rationally need (Pääkkönen, 2020). This tremendous amount of clothes produced results in the creation of waste before and after the consumer buys the clothes. When it comes to pre-consumer textile waste, 15% of clothing textiles is wasted. The reason why is that some pieces of fabrics are cut off during production. The amount of waste depends on the way clothes are designed. Clothing waste is also produced in deadstock: new, unworn clothing that is unsold and designated as waste. H&M revealed that in 2018, it had \$4.3 billion worth of clothes that were never sold. It was also revealed that in the year 2018, Burberry incinerated £90 million of unworn clothing. While incineration produces little CO₂ relative to the production of clothes, burning unworn clothing represents a waste of energy, materials, water, and chemicals. When it comes to post-consumer textile waste, little is recycled. In 2015, it was estimated that 15% was recycled globally, of which 1% is recycled in a closed-loop. In the UK, per capita, this represents 11kg of clothes that is wasted (Niinimäki et al., 2020). People nowadays do not care about their clothes like they did a century ago. Clothes have become so cheap that people would rather buy new ones than repair them. The rate of buying and disposing has significantly risen from 1994 to 2014 (Laitala, 2014). All in all, the production of clothes in a fast fashion system has a significant environmental impact that could be reduced through more intelligent resource management and production methods and a change of business model. Does fast fashion have positive implications for those who produce the clothes? What are the social issues linked with fast fashion production?

2.4. The social impact of clothing production

One of the main social issues regarding clothing production is the possibility of occupational hazards in the workplace. Firstly, poor ventilation with cotton dust and synthetic air particulates created respiratory hazards. Second, repetitive motions might lead to musculoskeletal hazards. Most clothes are made in Bangladesh, India, China, Vietnam, Ethiopia, Indonesia, Sri Lanka, and the Philippines. Those making clothes usually work in sweatshops. A sweatshop is a place where a worker gets paid “an income for a 48h workweek less than the overall poverty rate for that country, systematic forced overtime; systematic health and safety risks that stem from negligence or willful disregard of employee welfare; coercion; systematic deception that places workers at risk; and underpayment of earnings” (Kuyumcuoglu, 2020:2). It is argued that “debilitating and life-threatening conditions such

as lung disease and cancer, damage to endocrine function, adverse reproductive and fetal outcomes, accidental injuries, and death” are consequences of working in sweatshops (Bick, 2018:2). A critical event that illustrates the dire conditions in which clothing is produced is the 2013 collapse of the Rana Plaza building in Bangladesh. The Rana Plaza building began to crack on 23 April 2013. In spite of safety concerns, several thousand garment workers entered the building the following day despite shops and offices on the lower floors closing. Over 1100 Bangladeshi workers were killed in the collapse, highlighting the lack of voice for workers to refuse unsafe work (Donaghey, 2017).

While this tragedy highlights the horrors of working in a sweatshop, some believe that sweatshops are defensible. They argue that sweatshop work comprises by far the best local job opportunity in the country in which they operate. Additionally, they contend that a work practice or wage is ethically acceptable, as long as its choice is made by informed employees (Miller, 2003). However, the job is not really free: workers are prone to physical and psychological coercion. Individuals may be forced into sweatshops or prevented from leaving them once they start working through physical coercion. For example, at a Guangdong shoe factory in China, it was reported that 2,700 workers were forbidden to leave the factory by 1,000 live-in security guards who patrolled the walls. Psychological coercion is the threat of being fired unless one agrees to work overtime. Coercion goes against the idea that workers have the choice (Kuyucuoglu, 2020). Yet, a study about Ethiopian Sweatshop workers argued that sweatshops have an advantage: they provide stability. This is crucial because Ethiopia has not got a social safety net like social insurances (Blattman & Dercon, 2017). According to economist Arthur Lewis, Sweatshops have another benefit. They move surplus low-skill workers out of the traditional agricultural sector into the cities. This enables the growth of the country as a whole. This model is argued to apply well to China’s economic growth from the 1970s to the 2000s (Islam & Yokota, 2009). While sweatshops have advantages, public opinion in Europe and the US are still in favor of reform to improve the living conditions of the workers. Worker exploitation is argued to be mainly a consequence of corporate greed, lax international policies where countries often do not have enough effective labor laws, a proliferation of supply chain specialists between suppliers and merchants, and high pressure to lower costs throughout the supply chain (Adams, 2002). Therefore, a change of business model that slows down the fashion production, which is more transparent and regulated, could solve many of fast fashion’s

social issues. In the next chapter, I will explore how circular fashion contrasts with fast fashion, to see if it can solve some of the issues presented above.

3. Circular fashion

3.1. Circular fashion: how does it work?

While there is no fixed definition of what circular fashion is, one can say that circular fashion is based upon the concept of the circular economy, and it prioritizes clothing that is designed to last. According to Anna Brismar of Green Strategy (2021), circular fashion can be defined as “clothes, shoes or accessories that are designed, sourced, produced and provided with the intention to be used and circulate responsibly and effectively in society for as long as possible in their most valuable form, and hereafter return safely to the biosphere when no longer of human use.” To have a more in-depth understanding of circular fashion, I will first explain the circular economy since circular fashion is a part of it.

The concept of circular economy is little known in the Western world. However, this is not the case everywhere. The circular economy was present in the last two ‘Five Year Plans’ created by the Chinese government (Zhijun & Nailing, 2007). The circular economy has now gathered the attention of the West. It is brought forward by several NGOs, with positional papers and think tanks such as the Ellen MacArthur Foundation (Preston, 2012). The notion of circularity and the idea of cycles in real-world systems is ancient and has echoes in various schools of philosophy. After World War II, it revived in industrialized countries with the advent of computer-based studies of non-linear systems (Ellen MacArthur Foundation, n.d.). The concept of Circular Economy has deep-seated origins and cannot be traced back to one single author. Murray et al. (2017) refer to the circular economy as a “general term covering all activities that reduce, reuse, and recycle materials in production, distribution, and consumption processes” (Murray et al. 2017: 5); However, there seems to be a trade-off between ecosystem functioning and human wellbeing. We will see how far the circular economy can alleviate the ecological footprint of the clothing industry in the following chapters.

The Circular Economy is an umbrella concept. According to Blomsma and Brenna (2017:605), umbrella concepts “create a relation between pre-existing concepts that were previously unrelated, or not related in the manner the umbrella concept proposes, by focusing the attention on a particular shared quality or characteristic of the concepts it encompasses.” In the case of Circular Economy, the concept encompasses various schools

of thought such as industrial ecology, biomimicry, cradle-to-cradle, and performance economy. I will not focus on the differences between these schools of thought but rather on their unifying feature, which is that waste is considered as a recyclable material or nutrient for further processes.

The concept of Circular Economy is linguistically an antonym for the linear economy. A linear economy is one defined as “converting natural resources into waste, via production [...] with the removal of natural capital from the environment (through mining/unsustainable harvesting) and by the reduction of the value of natural capital caused by pollution from waste” (Murray et al., 2017). It follows the “take-make-dispose-pollute” step-by-step plan. This plan formulates that we “take” raw materials, “make” clothes and after usage, “dispose” them as waste, which “pollutes” the environment (Dieguez, 2020). In opposition to a linear economy, a circular economy functions cyclically. It follows the “make-use-reuse-remake-recycle” step-by-step plan. The Ellen MacArthur Foundation (2017) offers a detailed diagram of a circular economy:

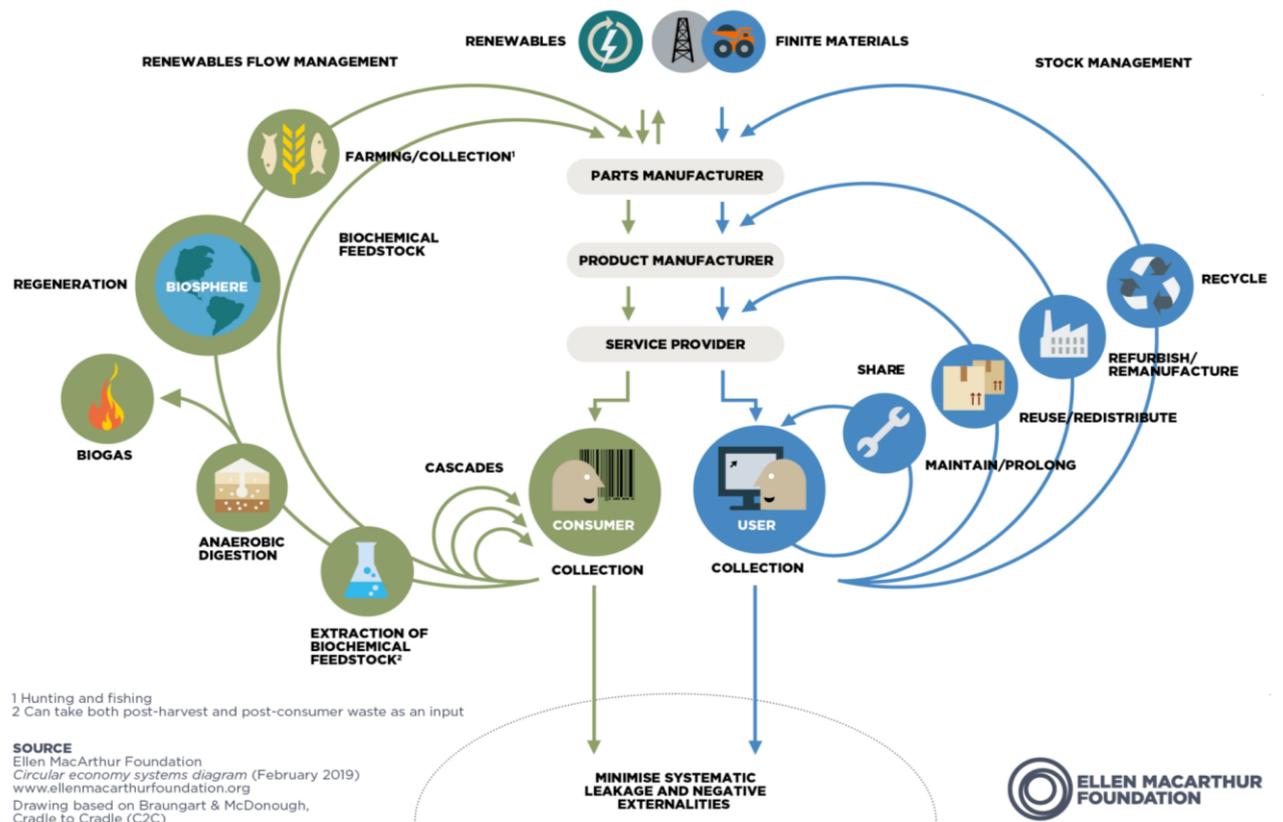


Figure. 4. Diagram of the circular economy (Ellen McArthur Foundation, 2017:49).

Interestingly, a person utilizing products is not called a consumer but rather a user. It is argued that in a circular economy, one does not “consume” technical goods since they will be re-used, remanufactured, or recycled. Only biological materials can be regarded as consumables in a circular economy, while technical materials are used. However, that does not mean that there is not a cost to these activities. Even with technical goods, energy is being consumed. Some of the barriers to recycling include a lack of markets for recycled products, high costs, competition with countries that don't practice environmental practices, and a lack of equipment and technology. The sorting of waste is very labor-intensive (Larney, 2010). So, while the new term “user” instead of “consumer” makes it seem like there is less of a social and environmental cost to the circular economy, there is still a cost, which we will discuss later.

Remanufacturing is the process of disassembling a product, rebuilding it to a new condition, and giving it the same warranty as a new product. In essence, refurbishment is an aesthetic process whereby a product is repaired as much as it is capable of being repaired, without the need to disassemble or replace any parts. Recycling means returning a product to its materials. New products are then made from the materials. The loss of embedded labor and energy, the cost to transform products in their entirety, and the inevitable material losses make recycling a lower value process than others closer to the center of the system diagram, such as reuse and remanufacturing. Biological cascades repurpose materials and components used within the cycle in different ways. The process of extracting material order and stored energy is taking place gradually. Material order decreases in a cascade which results in the material becoming a nutrient. As an example of a cascade, cotton jeans can be transformed into furniture stuffing. After that, they are transformed into insulation material. Finally, they are anaerobically digested, thereby returning to the soil as nutrients (Ellen McArthur Foundation, 2019). According to the Ellen MacArthur Foundation (2021), there are three critical aspects of a Circular Economy:

- designing out waste and pollution (greenhouse gases and hazardous substances, as well as structural waste such as traffic congestion);
- keeping products and materials in use (designs for durability, reuse, remanufacturing, and recycling to keep products circulating in the economy);

- regenerating natural systems (avoiding non-renewable resources and enhancing renewable ones, for instance, by returning valuable nutrients to the soil) .

All in all, the circular economy promises a business model that makes use of remanufacturing, refurbishing, recycling, and cascades - all these processes aiming to keep the products in a closed-loop. Nothing is supposed to be wasted since goods are either repaired, transformed, or composted. However, what does a circular business model look like in real life? Can it keep its promises? Is it viable? I will use the case study of MUD Jeans, a circular textile brand, to attempt to respond to these questions.

3.2. An example of Circular fashion: MUD Jeans

According to Solbrand (2020), MUD Jeans is a Dutch denim brand founded in 2013 by Bert van Son to create good quality ethical jeans and inspire others to make the fashion industry more sustainable. Their motto is the following: “If you love jeans as much as this planet, you are at a good place here. We aim to change the fashion industry, starting with the most popular piece of clothing: a pair of jeans” (MUD Jeans, 2021a). The MUD Jeans brand has a leasing concept. The aim is to make sure that every garment is brought back to be recycled. The brand also offers free repairs, possible during the entire lease period. The ecological footprint is reduced with the reuse of cotton, which reduces waste and water (Solbrand, 2020). Finally, there is the “Send Old Jeans” program, where the company takes used jeans of any make that are made of 96 percent of cotton minimum (Thatta & Polisetty, 2020).

According to Thatta & Polisetty (2020), the production process of MUD jeans produces 61% less CO2 emissions when compared to other denim brands, thanks to materials recycling and revolutionary techniques. What is the MUD jeans method? According to Wijnen et al. (2018), MUD jeans rely on co-product recovery, circular sourcing, resource recovery, re-condition, re-make, access, and performance (see Figure 6 below).

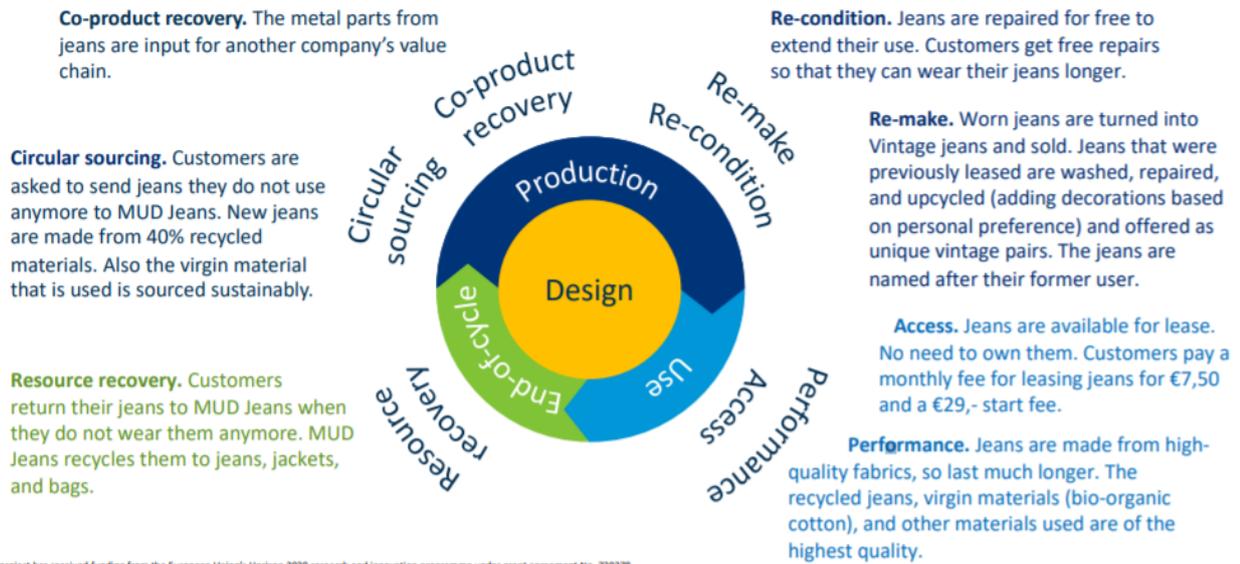


Figure 5. Circular economy business model of MUD-Jeans (Wijnen et al., 2018:21).

As we can see in Figure 5, the business model of MUD Jeans emphasizes durability, recyclability, and performance. The production of jeans is enabled with the collection of materials from customers and another company's value chain. Jeans are repaired, re-made for them to be used as much as possible. At the end of the cycle, the jeans are recycled into other products such as jackets and bags, and waste is thereby avoided. With regards to access and performance, the jeans are high quality and are available for leasing at an accessible price.

MUD jeans rely on 23–40 % of post-consumer recycled denim. While the recycling process is more expensive than producing virgin cotton, the company chose to recycle to save natural resources. MUD uses recycled organic cotton only. The labels printed are not made out of leather. The company MUD uses eco-friendly techniques such as C2C certified indigo dyeing. 95% of the water used by the company MUDJeans is purified to be reutilized with the “reverse osmosis method” (Thetta & Polisetty, 2020:7). The reverse osmosis method is a filtration method that uses “high pressure (100–800 psi) to force water through a semipermeable membrane that filters out dissolved ions, molecules, and solids (nanofiltration). This process can both remove microbiological contamination and desalinate water” (M.H. Abd El-Salam, 2003: 3833). With that process, all-fiber and

indigo residues are filtered out of the water (MUD, 2021). In terms of water consumption, MUD Jeans utilize 1,500 liters to make one pair of jeans. In contrast with industry standards, the company uses 22% of water.

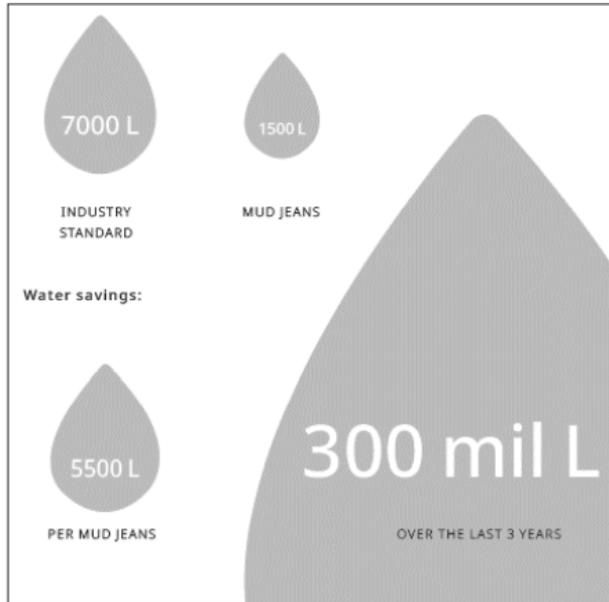


Figure 6. Water consumption per Year (Thatta & Polisetty, 2020:7).

Williams (2016) estimates that 78% of water and 61% of CO₂-equivalent are saved per pair of jeans compared to industry standard. Overall, about 300 million liters of water have been saved and nearly 700,000 tonnes of CO₂ avoided (Williams, 2016). Packaging for MUD Jeans is handled by RePack. Compared to thrown-away packaging, RePack is claimed to produce 80 percent less carbon footprint.

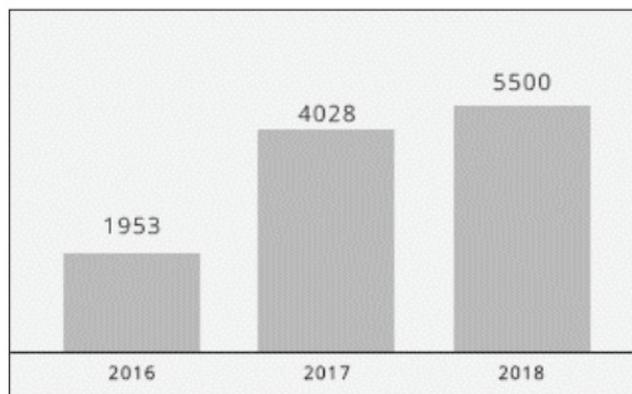


Figure 7. Jeans Saved from Landfill and Incineration (Thatta & Polisetty, 2020:7).

Thanks to the circular economy framework MUD Jeans uses, the CO2 emissions of the company are 61% lower than other denim brands. Over the past few years, MUD jeans have been made from 23% recycled cotton, saving them from landfills and incinerators (Figure 5).

With regards to the social impact of MUD Jeans, it is argued that “fair wages” are paid in a “safe and healthy environment” even though the amount is not specified (Thatta & Polisetty, 2020:7).

Looking at MUD jeans’ growth, we can see that sales numbers of jeans have gone up by 147 percent, starting from 2016 (refer to Figure 8).

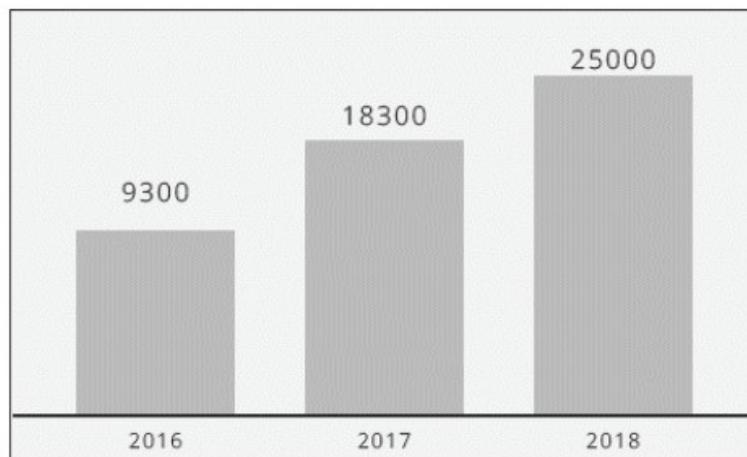


Figure 8. MUD Jeans sales from 2016 to 2018 (Thatta & Polisetty, 2020:7).

While MUD Jeans is growing, the circular economy method they use comes with several challenges. Investors and customers both have behavioral inhibitions. In general, funding sustainability models is not easy due to the long gestation period of such projects before they can generate returns. Many consumers do not like paying premium prices for recycled products since they feel they are just like secondhand products. Indeed, the price to rent one pair of jeans is around 10 euros per month. Bought, it costs around 120 euros (MUD Jeans, 2021c). In comparison, the average price spent by women on jeans is \$34 (Tuttle, 2012). Also, traditional rivals as well some non-conventional ones are posing stiff competition to the

company. MUD Jeans' slimmer profit margins due to high production costs is another major challenge (Thetta & Polisetty, 2020). Figure 7 is a summary of Wijnen et al.'s (2018) findings about MUD Jeans regarding strengths, weaknesses, opportunities, and threats.

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> • Solving a real and pressing problem within the fashion industry • Strong storytelling skills • Large social media base • High predictability of revenues because of leasing subscription model • Valuable partnerships with fair factories 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • VAT regulations: pay twice when leasing • Upfront financing for lease products • Dependency on factories, run by companies that are also vision-driven
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Regulations in fashion industry about fair production • Fashion industry is a very polluting industry • Consumers developing a greater desire to learn where products are manufactured and under what conditions • Enormous under-utilization of products in the fashion market • AI predictive analytical ordering • Upcoming of modular fashion where parts of an item can be replaced when necessary 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • Cheaper alternatives from fast fashion companies • Low raw material supply

Figure 9. SWOT assessment matrix (Wijnen et al; 2018:26).

According to Figure 9, the strengths of MUD jeans are their innovative quality and high predictability of revenues thanks to the leasing subscription model. The weaknesses are the extra costs of leasing: VAT regulations and upfront financing for lease products. Furthermore, the range of factories they can work with is narrow. They have to share the same vision. MUD jeans' opportunities are the emergence of regulations in the industry regarding fair production, artificial intelligence, and modular fashion. Since the fashion industry is polluting, MUD represents an alternative to usual fashion products and can become influential among conscious consumers. The threats MUD jeans face are the concurrence with fast fashion, which provides clothes at a lower price, and low supply of raw materials.

3.3. How circular fashion tackles the problems of fast fashion

The Ellen MacArthur Foundation (2017) argues that by making fashion circular, the industry can create products that are used more, made to be repaired or recycled, and made from safe and recycled or renewable inputs.

According to the Ellen McArthur Foundation (2017), circular fashion has four core aims:

1. Phase out substances of concern and microfibre release
2. Transform the way clothes are designed, sold, and used to break free from their increasingly disposable nature
3. Radically improve recycling
4. make effective use of resources and move to renewable inputs

Ellen McArthur Foundation (2017:17).

These four core points are the framework for my presentation of circular fashion.

3.3.1. Substances of concern and microfibre release

The production and consumption of clothes releases microfibres and toxic substances into the environment. This disrupts ecosystems. In response to this negative environmental impact, some companies and NGOs have made efforts and collaborative innovations to create safe material cycles. Michael Braungart, German chemist and head of the Agency for the Encouragement of Environmental Protection, and William McDonough, an American industrialist, came up with the Cradle to Cradle (C2C) certification in 2002. They came up with a label for circular products via the McDonough Braungart Design Chemistry and Environmental Protection Encouragement Agency, called “C2C”.

The certification criteria cover five areas:

1. Toxicity of the materials used.
2. Reuse of materials
3. Energy
4. Water
5. Social responsibility

There are 4 levels of certification within C2C (basic, silver, gold, and platinum). I summarized the criteria in the table below, basing my information on the Cradle-to-cradle products innovation institute (2019).

 BRONZE		CRADLE TO CRADLE CERTIFIED^{CM} PRODUCT SCORECARD				
QUALITY CATEGORY	BASIC	BRONZE	SILVER	GOLD	PLATINUM	
 MATERIAL HEALTH				✓		
 MATERIAL REUTILIZATION			✓			
 RENEWABLE ENERGY & CARBON MANAGEMENT		✓				
 WATER STEWARDSHIP			✓			
 SOCIAL FAIRNESS				✓		
OVERALL CERTIFICATION LEVEL		✓				

Figure 10. Table of C2C label criteria (Cradle to Cradle Products Innovation Institute, 2021).

The basic certification ensures that all chemicals must be present in amounts less than 0.1% of the product; there are no harmful substances such as PVC, chloroprene, or associated chemicals. The materials and chemicals must not present any risk to humans, and the environment, and all materials must be recyclable or biodegradable. The silver criteria certify that the product presents less than 100ppm halogenated hydrocarbon present and heavy metals (hexavalent chromium, cadmium, lead, mercury) in addition to meeting the basic criteria. The reuse of materials is greater than 50%. There is the adoption of company-wide water management principles. The gold criteria certifies that the product meets the basic and silver criteria, with no preoccupying chemicals, reuse of materials more significant than 65%, 50% of the energy used for production must be of renewable origin, a strategy for product reuse, and the conduct of an audit on water use and the company's practices in terms of corporate social responsibility. The last and highest certification is platinum, which entails

that the product meets the basic, silver, and gold criteria. It has reuse of materials potential greater than 80%, 100% of the energy used for production must be of renewable origin, and there is the implementation of innovative measures to improve the quality and conservation of water.

The C2C standard is already used in the clothing industry. In June 2017, C&A introduced C2C certified garments. C&A T-shirts achieved C2C gold certification. These shirts are made of pure organic cotton, including labels and thread. The dyeing meets C2C standards, and the clothes can be composted in home composting units (taking 12 weeks to decompose) (C&A, 2019).

3.3.2. Breaking free from disposable clothing

When it comes to the access model to clothing, there are four ways in which clothes can be consumed in a close-loop.

Firstly, there is the rental subscription model, a model according to which clients pay a fee each month to purchase a fixed number of garments on loan (Ellen McArthur Foundation, 2017). This is the case of Kleiderei, founded in Köln in 2016 and expanded to Freiburg in 2019, Germany. That clothing store claims to offer “endless styles from vintage highlights, high-quality basics and fair fashion” (J.K.A., 2020). In that shop, one can borrow up to four pieces and swap clothing items as often as the wardrobe requires, without extra costs or limits. Membership is about 29.00 euros per month. There is a discount of 3.00 euros for students, schoolchildren, and trainees (J.K.A., 2020).

Second, there is the short-term rental model, in which clients rent garments on an as-needed basis. Fashion designers typically use this model for luxury clothing, baby clothes, maternity clothes, and formal wear (Ellen McArthur Foundation, 2017). Rental the Runway, created in 2009 primarily as an online marketplace to rent clothes and accessories, is an example of this short-term rental model. For less than 10% of retail price, clients may rent a designer garment for a period of four or eight days. Subscription options are also available that ship either “unlimited” items or four items per month at a lower price. Aside from children's clothing and accessories, including jewelry and handbags, and essentials like lingerie, tights, shapewear, and cosmetics, the company rents out children's clothing, too

(The Economist, 2018). Approximately \$100-\$500 million in revenue is generated by Rent Runway each year, and they employ 1,000 people (Inc Fact, 2021).

The third model involves the sale of highly durable goods, where customers select high-quality garments with a warranty. It usually pertains to staple clothing, non-seasonal styles, workwear, and intimate clothing (Ellen Macarthur Foundation, 2017). A case in point is Patagonia's Common Threads Program. Under the Common Threads Garment Recycling Program, Patagonia collects, refurbishes, and recycles worn-out old Capilene base layer garments from customers. New polyester is made from the garments. A new filament yarn will be made from the polyester (Rathinamoorthy, 2019).

Fourth, is resale, where clients purchase clothing that has already been worn. Second-hand stores fall into this category. Several informal methods exist for selling second-hand items: online auction sites, flea markets, rummage sales, expositions, vintage/antique fairs, swap meets, and car-boot sales, for example. The inventory in second-hand stores is sourced through auctions, consignments, and donations. A century ago, there were a great deal of stigmas attached to second-hand stores when they were emerging. Buying clothing that was already worn before reflected the image that one did not have enough money to afford new items. Therefore, this type of store segmentation was seen to target low- or medium-income households (Lemire, 1988). Second-hand stores were revived only at the beginning of the 2000s (Ferraro, Sands, et al., 2016). The trend has largely been attributed to the shift in consumers' perceptions of fashion and increased awareness of the industry's severe environmental impacts. It has become more popular to shop at second-hand stores. As an alternative to regular clothing stores, these stores are seen as socially acceptable (Brace-Govan & Binay, 2010). Still, the number in terms of consumers purchasing second-hand clothes remains very low. In 2020, only 8% on average accounts for consumers' closets (Guenin, 2020). It is yet to be seen how much the market for second-hand fashion will grow. The London-based peer-to-peer social shopping app Depop is an example of a second-hand store. It works the following way: one creates a profile, photographs the clothes one wants to sell, and posts it on the app. Once a buyer is interested, one messages the buyer and ships the clothes in safe packaging. Depop charges a 10% flat-rate fee on every clothing item sold, which pays for marketing, rent, and servers (Depop, 2021).

Furthermore, to reduce the amount of clothing produced while at the same time producing enough clothing that people actually want, personalization services can be put in place, such as manufacturing customized personalization clothing on demand, designing clothes that adapt needs that change over time, or fitting services provided at the point of purchase (Ellen MacArthur Foundation, 2017). An example of matching production with consumer demand more closely is the brand Betabrand, which has a voting system where consumers can decide which colors, designs, features, and styles should be produced next (Betabrand, 2021). Furthermore, designers could create garments that are more modular. In other words, these clothes are adaptable, multi-purpose, and upgradable. This could increase the number of times a customer uses an item. It would also decrease the number of clothing items customers keep in their closets (Ellen MacArthur Foundation, 2017). An example of modular clothing is Petit Pli's clothes for children. These items are pleated to adapt to the toddler's size as they grow (Petit Pli, 2021).

3.3.3. Radically improving recycling

Textile recycling refers to the reprocessing of pre-or post-consumer textile waste, which involves "reuse, reprocessing or reproducing a product with multiple aims of conserving raw materials, energy, water and other chemicals diminishing waste, and preserving environmental impacts." (Muthu in Shirvanimoghaddam et al., 2020:7). It is argued that people should recycle clothing because waste is valuable. Depending on the particular method of recycling, raw materials may be conserved and water and energy saved for the fabrication of new clothes and textiles. The carbon footprint of making clothes and solid waste in landfills may also be reduced. Another reason why recycling is beneficial is that it provides employment. A research review about the environmental impact of recycling found that within 41 papers that were written about the subject, all but one described textile recycling as beneficial for reducing environmental impacts of production (Sandin & Peters, 2018). Recycling can take place at various stages of clothing production (Figure 11).

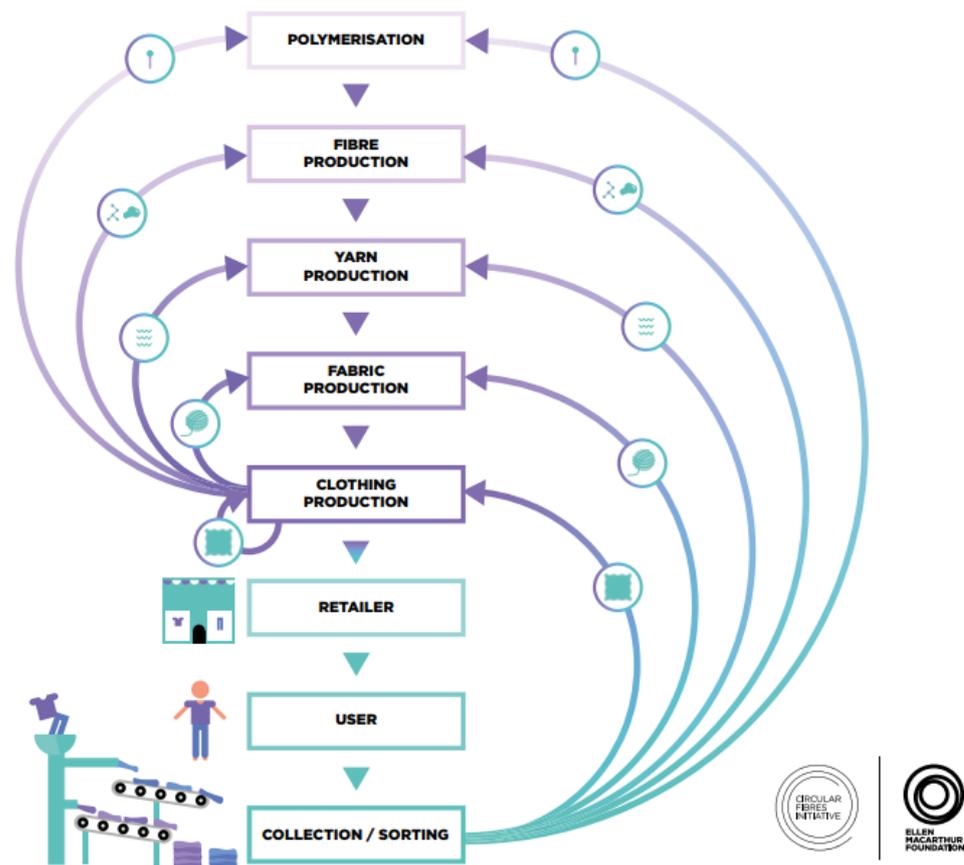


Figure 11. Textiles recycling can capture value at various levels (Ellen MacArthur Foundation, 2017:95).

Taking pieces of complete fabric and resewing them to create a new garment is known as fabric recycling. Sometimes, this level of recycling is also referred to as the term 'remanufacturing' refers to the process of reutilizing leftover materials and factory offcuts, or components of used garments that are disassembled and repurposed into new clothes. It is possible to dye or bleach the fabric. A yarn recycling process involves unraveling yarns used in knit clothing. There are some garments that are unsuitable for yarn recycling because they may not be knitted in a way that allows the yarn to be unraveled in a reasonable amount of pieces. Fabric recycling involves sorting garments by material and color, shredding them, and processing them back into fibers. Known as mechanical recycling, fiber recycling involves shredding fibers in order to lengthen them. Consequently, their quality deteriorates. The loss of quality makes it necessary to use higher-quality fibers to create new yarns. Fibers are recycled into polymers using polymer recycling. The material is destroyed, but its chemical structure is preserved (Ellen MacArthur Foundation, 2017).

The two variants are as follows:

- 1) Recycling of mechanical polymers: Textiles made from mono-material plastic-based fibers are melted and extruded for mechanical polymer recycling.
- 2) Recycling of chemical polymers: After the garments have been de-buttoned, de-zipped, shredded, and sometimes decolored, chemical polymer recycling dissolves them with chemicals.

Shirvanimoghaddam et al. (2020) outline the following strategies for reducing textile waste generation and recycling opportunities in manufacturing, consumption, and post-consumption of textiles.

Step 1	Manufacturing	Rethink Reduce	Use renewable resources Made reusable and recyclable products Fully biodegradable Increase product quality Reducing the energy consumption in manufacturing process Decrease the use of natural resources and materials
Step 2	Consumption	Rethink Reuse Repurpose	Buy high quality products Buy for long-term Good maintenance of the product Multipurpose buying Support sustainable products and local suppliers Swap Borrow Renting, Trading Donate to charities use discarded products or its parts for a new purpose
Step 3	Post-consumption	Recycle Repurpose Repair Recover	Monomer, oligomer, polymer recycling Fibre recycling Fabric recycling Use materials Repair defective products and resell it with a low price Energy recovery via incineration

Figure 12. Different strategies are proposed in manufacturing, consumption, and post-consumption of textiles to reduce textile waste generation and recycling opportunities (Shirvanimoghaddam, 2020:6).

As we can see in Figure 12, Shirvanimoghaddam divides the cycle into three stages - manufacturing, consumption and post-consumption - with four possible strategies that are recycling, repurposing, repairing and recovering. Without going into details, there are three patterns that are prevalent in the strategies offered: durability, circularity and energy efficiency.

3.3.4. How circular fashion makes use of resources

Material selection is based on specific functionality and cost optimization in the production of clothing. Their resource use is, however, a significant disadvantage. A kilogram of cotton garments, for example, uses about three kilograms of chemicals to manufacture (Posner & Jönsson, 2014). In 2014, textile production (including cotton farming) accounted for 4% of freshwater withdrawals worldwide (World Bank, AQUASTAT, and FAO, 2014). According to Hogg and Ballinger (2015), textile manufacturing emits GHG at a high rate since one kilogram of textiles produces 20 kilograms of CO₂ equivalent, while a kilogram of plastic or paper emits 4 kilograms and less than a kilogram of CO₂ equivalent, respectively.

Despite the efforts made by countless entrepreneurs and innovators to find new solutions to save resources, they are often very small in number, according to the Ellen McArthur Foundation (2017). Scaling up these solutions presents challenges to entrepreneurs and innovators. The lack of incentives makes it difficult for suppliers to compete and develop effective ways of using resources and renewable inputs, such as installing energy-efficient lighting or treating water for reuse at production facilities. The use of recycled materials could reduce the consumption of non-renewable resources. In spite of this, they also struggle to gain large-scale adoption because of a lack of cost-competitiveness. Retailers are generally not spending any money on research and development for production technologies (although they do spend money on designing and searching for trends). All in all, for the moment there is not enough information to say if the implementation of renewable energy for clothing production is realistic and scalable. From my research I can conclude that fast fashion has a significant environmental impact partly induced by the use of non-renewable resources, and circular fashion aims to reduce that impact through the implementation of circular fashion but it has not shown many results yet.

4. Challenges

4.1. How to implement circular fashion?

While changes in policy, regulations, economic incentives, and technological innovations are crucial to transition to a circular textiles economy. The current culture of consumerism, which celebrates fast access to ever more clothes at a lower price, would be required to change. Otherwise, the circular economy rebound effect, which I will describe later, might undermine efforts to reduce the environmental impact of the clothing industry.

The European Commission formulated the EU Circular Economy Action Plan in 2020. There are three sustainable product policy frameworks within the action plan:

- A. Designing sustainable products
- B. Empowering consumers and public buyers
- C. Circularity in production processes

I will use these three points as my outline for the next three chapters. In the two chapters that follow, I will discuss the possible circular economy rebound effect and the need for cultural change.

4.1.1. Designing sustainable products

According to the European Commission's report on ecodesign (2014), up to 80 % of the impact on the environment is determined at the phase of design. The European Commission (2020) argues that products are breaking down quickly in a linear economy, are difficult to be reused or recycled, and are made for single use only, by design. The EU can influence product design and supply chain management. In an initiative to ensure the sustainability and circular nature of all products placed on the EU market, the EU offers a comprehensive set of requirements. A core aspect of this legislation is the expansion of the Ecodesign Directive beyond products related to energy in order to build an Ecodesign framework that applies to a broader range of products (European Commission, 2020). Under the Ecodesign Directive (Directive 2009/125/EC), products sold across 28 countries are required to meet certain ecological requirements. A framework directive, the Ecodesign Directive (ECEEE) is a policy guideline. The ECEEE does not directly establish minimum

ecological requirements (ECEEE, 2021). Within this legislative initiative, the Commission establishes sustainability principles that will govern the design of products through complementary legislative proposals.

Factors relevant to the textile industry include:

- Enhancing product durability, reusability, upgradeability, and reparability, addressing hazardous chemicals found in products, and improving their energy and resource efficiency
- Improving the performance and safety of products by increasing their recycled content;
- To enhance remanufacturing and recycling;
- Environmental footprints and carbon reduction;
- Preventing premature obsolescence by restricting single-use items;
- imposing a ban on the destruction of unsold durable goods;
- Providing incentives where producers can retain ownership or responsibility of the product throughout its lifecycle through product-as-a-service or other models;
- Utilize digital technology for product information, including digital passports, tagging, and watermarking;
- Providing incentives for high-performance products based on their sustainability performance.

European Commission (2020:6-7).

However, legal action to enable the design of sustainable products is not enough to transition the textile industry to a circular economy. Barriers such as a lack of cost-saving opportunities for consumers and lack of information regarding the textile (lifespan, availability of repair services, production location) make it difficult for consumers to purchase sustainable clothes made in a circular economic system. Therefore, it is critical to empower consumers.

4.1.2 Empowering consumers

According to the Fashion Transparency Index, a large portion of the supply chain is often hidden in companies' publications. The industry needs to become more transparent so that the population can learn how to consume responsibly. Thereby, the consumer will know exactly where the clothes come from and at which price they are produced (Guenin, 2020).

Consumers will be able to know exactly where and at what price the clothes are manufactured as transparency and environmental labeling increase. Shopping trends may be positively impacted by this. Consumers should have the ability to choose sustainable clothing consciously. The issue is indeed catching the attention of many consumers. Companies that employ marketing strategies such as 'greenwashing' can, however, confuse the consumer. According to Will Kenton (2021), "Greenwashing is the process of conveying a false impression or providing misleading information about how a company's products are more environmentally sound."

According to the European Commission (2020), consumer protection against greenwashing and premature obsolescence needs to be strengthened, sustainability labels and logos require minimum requirements, and information tools need minimum requirements. As part of this effort, the Commission is establishing a 'right to repair' and will ask companies to substantiate their environmental claims to provide consumers with accurate information. The EU Ecolabel criteria will also be regularly revised to incorporate more criteria related to durability, recyclability, and recycled content.

The issue of consumer empowerment is that there exists an attitude-behaviour gap in sustainable fashion consumption. A study has found that consumer attitudes are an insignificant or weak predictor of buying sustainable clothes. The factors that come into play when purchasing second-hand fashion products are perceived consumer effectiveness and income. Regarding upcycled fashion goods, subjective norms and education play an essential role (Park et al., 2020).

The attitude-behaviour gap with respect to sustainability varies across countries (Koszevska et al., 2020). Comparing consumer behaviour in Canada and Poland, researchers found that factors such as recyclability, environmental performance certification

with an ecolabel, reusability and disposition, energy savings, and water conservation were considered moderately important by consumers from both countries. Compared to sustainability issues, price, comfort, fit, style, and workmanship quality were deemed to be more important. In Poland, durability was the only sustainable factor considered important. Clothing that is less harmful to the environment and people is more appealing to Canadian consumers. It is more likely that Canadians avoid clothes produced in an environmentally damaging way. Their willingness to reduce consumption was greater than that of Polish participants. Clearly, consumers will have a different experience transitioning to a circular textiles economy (Koszewska et al., 2020).

While it is not clearly present in the European Commission framework, from a consumer perspective, the everyday enactment of clothing practices regarding purchase, use, and disposal plays an important role in the transition to a circular textiles economy. A study about consumer clothing practices in Sweden revealed that there are a number of practices that directly contribute to a circular fashion market: second-hand shopping, mending, doing alternative methods of laundry, selling and donating clothes (Sjöberg & Andersson., 2019). These practices are summarized in the table below (Figure 13).

Consumption-phase	Practice	Versions of Practices	Contribution to a Circular Fashion Market
Purchase	Second Hand Purchasing	-	Contributes when performed
Use	Doing Laundry	Wash & Dry	Does not contribute
		Alternative methods	Contributes
	Mending	-	Contributes when performed
Disposal	Clearing out	-	Problematic, depends on disposal method
	Disposing	Selling	Contributes
		Donating	Contributes
		Discarding	Does not contribute

Figure 13. Identified consumer practices and their Circular Contributions (Sjöberg & Andersson., 2019:597).

I will discuss the ways in which education can play a part in changing consumer behaviours in section 4.3. called “change of fashion system implies a cultural change”.

4.1.3 Implementing a circular fashion system

A meta-analysis by Pal et al. (2019) recounts barriers and solutions to circular fashion presented in the table below.

Impediment classification	Impediment type	Prescribed solutions	Empirically evidenced in
Reverse supply chain ineffectiveness	High uncertainty, e.g. in stock, availability, quality and sizes of used clothes	Generate higher sense of responsibility and ownership among consumers	Henninger <i>et al.</i> (2019), Pedersen <i>et al.</i> (2019), Paras and Curteza (2019)
	Traditional infrastructure	Enter into partnership	Kant Hvass and Pedersen (2019)
Customer and market unacceptance	Lack of understanding of customer motivation to purchasing used clothes	Institutionalize consumers' active roles as customers, sellers, partners and suppliers Encourage consumer involvement with slow fashion	Machado <i>et al.</i> (2019), Kant Hvass and Pedersen (2019)
	Lack of sufficient market	Product lifecycle-centred sales and marketing instruments	Kant Hvass and Pedersen (2019), Sandvik and Stubbs (2019)
Organizational inertia	Combining circular economy thinking with conventional business model logic	Integrate role of designers to design multi-function products for plural CBMs Define circular value proposition	Kant Hvass and Pedersen (2019), Pedersen <i>et al.</i> (2019)
	Myopic firm-centric view	Collaborate across professions, departments and organizations in the loops Cross-organizational commitment	Kant Hvass and Pedersen (2019), Pedersen <i>et al.</i> (2019)
Technological un-readiness	Lack of technology, e.g. for separation of blends or recycling	Circular product design strategies, e.g. design for disassembly, mono-materiality Innovative recycling technologies	Sandvik and Stubbs (2019)
Strategic misalignment	Difference in practices, goals and strategies, e.g. related to material quality, design perspectives, pace of product introduction	Consumers' rejection of the fast fashion attitude Lifecycle focused customer engagement strategy	Kant Hvass and Pedersen (2019), Machado <i>et al.</i> (2019), Sandvik and Stubbs (2019)
	Fast fashion quality	Build to last	Paras and Curteza (2019), Pedersen <i>et al.</i> (2019)

Fig 14. circular fashion: barriers and solutions (Pal et al., 2019:302).

Several barriers to circular fashion are discussed in Figure 14. First, there is the uncertainty that comes with the supply of used fabrics. The solution offered would be to create loyalty between the client and the brand through a higher sense of responsibility on their part. Second, circular fashion may not be accepted in the market because wearing used clothes is unpopular. A good way to solve this problem is to sensitize customers to the principles of circular fashion. Third, the firm-centric view prevents scaling up circularity. The firm-centric view issue may be resolved by broadening the scope of the circular economy to cross-organizational goals. Fourth, there are technological barriers to implement sustainability and circularity, which has to be solved with technological innovation. Finally, there are strategic misalignments in regards to fast fashion. However, in the future consumers may reject fast fashion, which will provide an advantage to circular fashion.

At the EU level, we can see that the European Commission aims to enable circularity in the fashion industry with innovation policies, economic incentives, and regulations:

- By establishing eco-design policies to ensure that textile products are circular in nature, ensuring the incorporation of secondary raw materials, and reducing the presence of toxic chemicals, consumers will be able to buy sustainable textiles and access reuse and repair services;
- By improving the business setting and regulatory environment for sustainable and circular textiles in the EU, by providing incentives and investments in product-as-service models, circular materials and processes, by increasing transparency through international cooperation;
- By establishing guidance to ensure Member States achieve high levels of separate collection of textile waste by 2025;
- By incubating innovation and industry applications, as well as by extending producer responsibility through regulatory measures for boosting textile sorting, re-use, and recycling (European Commission, 2020:13).

4.2. The rebound effect in circular economy

A study by Zink & Geyer (2017) argues that in spite of the potential benefits the circular economy may have, thinkers of the circular economy have overlooked the *economic* part of the circular economy. The circular economy is a system whose impacts on primary production are overlooked. The authors argue that there is the possibility that a “circular economy rebound effect” will occur. This expression comes from the term "energy rebound", which is a mechanism generating consumption growth through increased efficiencies which result in a relatively cheaper price for the consumption of certain goods, for example energy. There may be a close parallel with the circular economy. To understand that effect, let us imagine that there is a 1:1 displacement between what is produced and what is recycled. In other words, 1 kg of recycled products prevents 1 kg of new products from being fabricated.

The environmental benefit of recycling can be translated into the following formula:

$$E_{\text{net}} = (e_p - e_r) Q_r$$

E_{net} : environmental benefit

e_r : environmental impact of recycled product

e_p : environmental impact of primary production product

Q_r : quantity of produced secondary materials

As soon as $e_r < e_p$, $E_{\text{net}} > 0$. There is an environmental benefit.

ΔProd represents the increase of production:

$$\Delta\text{Prod} = Q_{r2} - Q_{r1}$$

$$E_0 = e_p Q_p$$

$$E_1 = e_r Q_{r1} ; E_2 = e_r Q_{r2}$$

(see Figure 15)

Activities performed by the circular economy may have a rebound effect by either failing to compete effectively because of a shorter life span of secondary production or by lower prices of the secondary production, both increasing consumption.

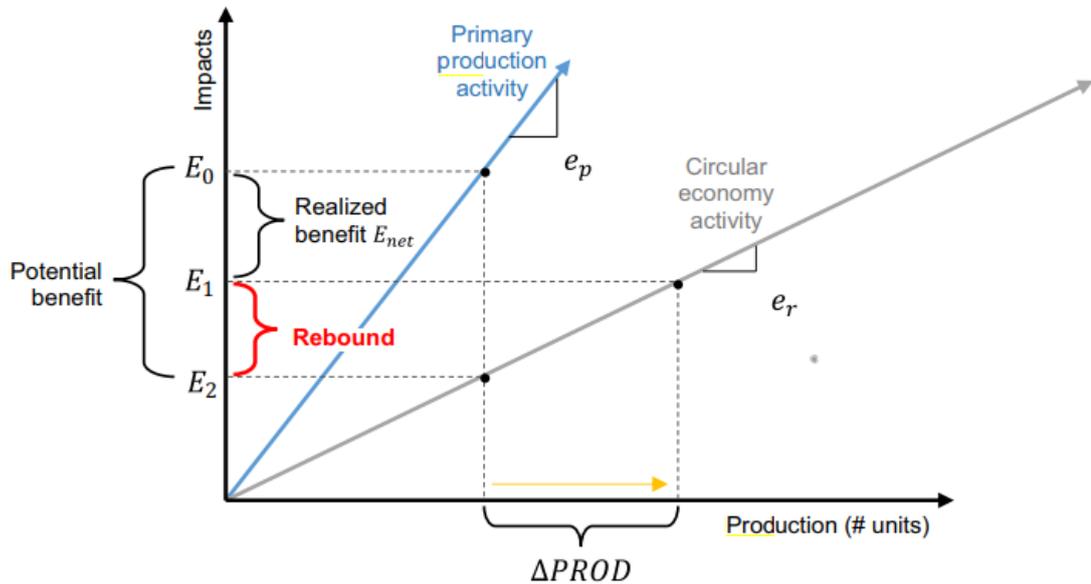


Figure 15. increased production can cause a rebound effect in a circular economy (Zink & Geyer, 2017: 598).

As shown in Figure 15, potential benefit is realized with no rebound effect taking place, when the amount of production of primary and secondary products is the same. Yet, when $\Delta Prod > 0$, the net benefit decreases, which means that a larger quantity of the recycled products is produced than of primary products, $Q_{r2} > Q_p$.

To solve the rebound effect, life cycle assessment (LCA) in the circular economy has to be done to increase the lifespan of secondary production. Furthermore, it is important to ensure that products reflect benchmark alternatives and promote products in markets where buyer price sensitivity is low. Also, it is argued that managers must focus on displacement of primary production rather than simply closing material and product loops, as grounded in the circular economy ideology. All in all, creating a close-loop does not necessarily lead to the improvement of fashion's environmental impact because of the rebound effect that may ensue (Zink & Geyer, 2017).

4.3. Change of fashion system implies a cultural change

Karen-Leung Moon published interviews with anonymous firm leaders in 2015, in which they describe barriers to sustainable fashion. The first is a design manager who runs 53 shops across Asia working for a local fashion retailer (Firm A). The second is a textile designer and fiber artist who works for an online shop and a design studio (Firm B). The third is the founder of a well-known apparel company in Asia. Besides fashion design, he has participated in several projects related to sustainability (Firm C). The fourth is an executive at a research and development company, creating and producing innovative sustainable fibers (Firm D).

The main barriers, as they saw it, were:

- 1) *Limited knowledge*: Firm B says with regards to the consumer: “I think most of our customers do not fully understand what sustainable fashion is, even though they claim that they are very supportive of environmental protection”. He says with regards to the fashion industry professionals: “it is hard for the industry to achieve a real, sustainable standard because it often involves a lot of processes when producing a sustainable garment” (Moon, K., Ka-Leung, et al., 2015: 947).
- 2) *Supply*: According to Firm C, “we did try to source organic cotton yarns for our collections; however, there are limited sustainable yarn suppliers.” Firm D states that “the availability of recycled material is limited due to the lack of knowledge and the high cost of producing recycled materials” (Moon, K., Ka-Leung, et al., 2015: 947).
- 3) *Economic issues*: Firm B claims, “I think our market is driven mainly by the desire of the consumers. If the consumers do not want to pay more for sustainable products, they might prefer fast fashion, which could be much cheaper.” Firm D declares, “the cost of sustainable fashion is very high because of the verification and traceability of the production process” (Moon, K., Ka-Leung, et al., 2015: 947).
- 4) *Product design*: Firm C states that “the limited availability of sustainable materials could restrict our designers in the selection of right fabrics or accessories.” Firm B says that “most of the sustainable fashion designs at this stage still focus on the use of environmentally friendly materials [...] not much attention is put on the styles or aesthetic side of the product” (Moon, K., Ka-Leung, et al., 2015: 947).

The solution for the implementation of sustainable fashion that Firm A, B, and D agree on is education of consumers and businesses (Moon, K., Ka-Leung et al., 2015).

There needs to be education to stir cultural change in order to transition to a circular textiles economy. The question is, in what world is circular fashion going to function? Circular fashion is one piece of the puzzle. What will be the whole picture? In which cultural and political frameworks can circular fashion develop? I propose two worldviews to approach the problem, the first being degrowth, and the second being ecomodernism.

The degrowth approach, as described by Luc Ferry in the book *The Seven Ecologies* (2021), is a school of thought whose leaders in France are Jean Marc Jancovici, Aurélien Barrau and Serge Latouche. Their vision is to reduce human's environmental impact through a reduction of the human population, the overthrow of capitalism and the end of economic growth. The root of their ideology is based on the rejection of the heritage of enlightenment thinkers and abstract humanism. The ideals that enlightenment thinkers sparked, such as progress, science, growth, freedom, rationalism, democracy, republicanism, are rejected as a false utopia by degrowth thinkers. They think that the enlightenment worldview allowed humans to believe that they could dominate Nature and always progress, which led, according to them, to the current challenges such as climate change. The utopia of degrowth thinkers is localism. In the degrowth worldview, fashion should be abolished and clothing should be reduced to their purely functional aspect. Namely, protecting from the environment (Ferry, 2021). Following their line of thought, I would add that the rhythm of renewing fashion collections should slow down to a two-season cycle. Indeed, autumn-winter and spring-summer require different types of clothing. However, within a season, buying more clothes is superfluous. The clothes should be as durable as possible and come from local sources. The degrowth worldview sees the solution to environmental issues in a radical attrition of human consumption, energy, food, and mobility. Their ideology is pessimistic, punitive. Luc Ferry argues that this worldview is impossible to accept both by the wealthy populations of the West, and by the billions of humans who expect to raise their standards of living. The only way to implement degrowth measures would be in a tyranny. While philosophers such as Hans Jonas argued for a 'well-meaning tyranny', meaning that the government have to take decisions against people's will for people's own good, others find that expression to be an oxymoron, there can not be a 'well-meaning tyranny' since they believe that only democracies can allow Societies to flourish.

The ecomodernist approach, according to Luc Ferry (2021), is a school of thought led, amongst others, by Michael Shellenberger and William McDonough. They do not

believe that the human population has to be reduced or that the world should deglobalize. Their solution to environmental issues lies in decoupling. First, decoupling demographic growth to concentrate most of the world population in cities so that more than half of the planetary surface can become wild Nature. Second, decoupling of technology, for instance with intensive agriculture, cellular meat and nuclear fusion, in order to enable a decent quality of life for a population concentrated in cities. The ecomodernists share with degrowth thinkers the idea that the first industrial revolution had negative impacts, such as pollution and destruction of the environment. The model of the first industrial revolution is based on a linear economy: from cradle to grave. The worldview ecomodernists propose is to create production while envisioning their disassembly. Planned obsolescence is not considered as bad, as long as one can recycle. Therefore, one shifts from “cradle to grave” to “cradle to cradle”. As shown above, ecomodernist vision follows the principles of the circular economy. The circular economy attempts to reduce waste as much as possible: everything should have a use. Therefore, ecomodernists believe that on a finite planet, infinite growth is possible as long as one recycles (Ferry, 2021). Those who criticize ecomodernism say that the limits to growth are being reached, or will be reached in the near future. Richard Heinberg allegedly showed that conventional oil, natural gas, and heavy oil production topped out around 2010. Furthermore, the critics of ecomodernism argue that decoupling, having more “good stuff” without any “bad stuff” is impossible. There cannot be more economic and demographic growth and increase in consumption, without pollution and decline in energy stocks. Furthermore, ecomodernist’s trust in technology is claimed to be naive: nuclear power presents issues for long-term storage and may create environmental hazards (Caradonna et al., 2015).

According to the degrowth worldview, going back to the question of coexistence of fashion and sustainability, the mass-production of fashion has to be abolished. Clothing is reduced to bare essentials. People have little freedom to develop their own styles unless they fabricate clothes themselves. According to the ecomodernist view, fashion can thrive through recycling. Notably, the circular economy, which encompasses second-hand, leasing, recycling, and upcycling businesses, can keep the fashion collections going. Both degrowth and ecomodernism ask for a revolution of the clothing industry. The political programs established by governments and the actions of businesses and consumers will determine which path countries will take. The quality of these actors' education on sustainability will determine how the clothing industry transforms.

5. Conclusion

The aim of my thesis is to contrast fast fashion to circular fashion, and to find out if circular fashion can be considered as a viable alternative to fast fashion. On that account I researched how both fast fashion and circular fashion operate. The negative environmental and social impacts of fast fashion, a linear mode of consumption, are too significant to be dismissed. There is a new process of producing, distributing and handling clothes in the world of fashion to be put in place.

Fast fashion is a system that has been growing at a time of economic growth and wealth, responding to a psychological human need for self-promotion. While it has positive aspects related to jobs, profits, and consumer satisfaction for a limited number of people, fast fashion has destructive environmental and social impacts in the long run. Circular fashion is a recent evolution of the fashion industry from the beginning of the 21st century. It still remains a marginal system. Research and small-scale applications of circular fashion have shown positive impacts in terms of the reduction of environmental footprint. Yet, one has to be careful with how the circular economy is implemented, since there is the possibility that a “circular economy rebound effect” happens. There is little research done to assess what the social impact of the circular fashion industry could be. Circular fashion is still in its development stages, and it has a lot of challenges to overcome. There is not enough information to conclude that circular fashion is definitely an alternative to fast fashion. By design circular fashion aims at sustainability. A move towards sustainability will be crucial for future generations.

My proposal is the implementation of a change of culture, in the clothing industry based on the education of the consumer as much as the supplier, to spur the transition to sustainable fashion, transforming the current fashion industry. This cultural change will be part of a larger picture of the economy.

Future research has to be done to evaluate how education can instigate cultural change towards sustainability. It could be interesting to compare the transition to circular fashion to the transition to organic food. Indeed, the demand for organic food probably increased in the last years with the education of consumers about health and environment benefits of organic food. A similar case could be argued about circular fashion. Education of consumers about the positive aspects of circular fashion is key to create and expand consumer demand.

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