

CIRCULAR ECONOMY IN FAST FASHION INDUSTRY

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MOTIVATION

Fashion has become in recent years one of my greatest points of interest. It seems to me one of the most direct forms of expression and therefore art.

The idea for this special project arises after having studied several subjects of the Master in Technology Operations taught at the Illinois Institute of Technology. Those courses have made me see the incredible opportunities that the world of logistics and management offers. Specifically, the subject directed by Professor Theo Rigopoulos has allowed me to acquire knowledge in the field of supply chains. As a result, I decided to direct my final project towards this topic.

Also concerned about planet earth and the growing consumption of those who live there, I have proposed in this work to find a way to align the desires of consumers with the needs of the earth and make this sector more sustainable.

OBJECTIVES

The objective of this special project is clear: create a new business model in the fast-fashion industry which fits the customer needs and aligns with world-class sustainable practices.

For achieving this main objective, first, we have to determine sub-objectives that will lead us to the achievement of the main one. This project has 3 main areas: supply chain, customer expectations, and sustainability. We need to determine what customer value in the fast-fashion industry and how the supply chain can be optimized to fulfill these customer requirements taking into account the importance of sustainability to create a solid project for the future.

In the following chapters, we will set some metrics that will help us to measure the process and the objectives' degree of achievement.

ABSTRACT

During this work, I will analyze the supply chain of these companies that are dedicated to the fast-fashion business, analyze and seek solutions and analyze the possible impact that these solutions could have on customers and especially on the profitability and benefits of this Business. All this is framed in sustainability and in reducing pollution throughout this supply chain, both upstream and downstream the supply chain. The idea is to create a sustainable business model that meets the needs and desires of customers.

Throughout this work, I will also analyze a company in the fashion sector and study what measures they have taken and how they are adapting their supply chain to achieve a circular economy.

We will also study and compare the decisions that other companies have made to reduce their impact on the environment and what the results have been.

CHAPTER 1

BACKGROUND

Fast-Fashion industry

The term fast fashion has been with us for many years. It is becoming more and more common to listen to it and mostly with negative connotations. But... what is fast fashion and why is it problematic.

Fast fashion is the design, mass production, and sale of clothing at very low prices. It is characterized by rapid design and production to reflect current trends. In addition, the large quantities produced cheapen prices and reach a larger number of customers. This approach to fashion is changing the game and even worse, is changing the world. Every day people buy unnecessary garments just because they are cheap and trendy, and they rarely wear them. Most of these garments end up in landfills and just a tiny amount of them is recycled or reused. The consequences of this fashion approach are catastrophic and do not seem to come to an end. During this chapter, we will discuss the reasons and consequences of fast-fashion growth and how they are impacting the world.

For the last 200 years fashion and textile industries have been one of the main industries in the world. Since Charles Frederick, who is usually seen as the first modern designer, back in the early 19th century started a large business until today, fashion has evolved drastically. During the 19th and 20th centuries, the fashion industry started to turn into a more developed industry and mass production started to take place. Manufacturers began to produce garments that did not require fitting sessions with the tailors, and this led to an easier production process. Together with these developments, cultural and social changes appeared, and people started to see fashion beyond a functional need. By 1915 apparel was the third most important industry in America.

During the 20th century, ambition and the growing interest in people make a huge impact in the industry and more and more designers started to create their own businesses and created some of the labels we know nowadays to become arbiters of taste and capitalize on their designs.

Bound to the United States' economic growth in the 1970s and 1980s the fashion industry continued growing fast. New brands and retail stores joined the industry and competitiveness started to grow. This competitiveness led to an improvement in garment production efficiency and, many companies started to look for countries where they could reduce their production costs. The cheaper workforce in Asia made many companies settle their production in countries such as India, China, or Bangladesh. This was the beginning of a more globalized industry as we know it nowadays. With the outsourcing of production to developing countries, the importance of Supply Chain management started to grow and soon become one of the most important factors in this industry.

To fulfill people's preferences related to the fast-changing fashion trends, fast fashion emerged. One of the main reasons why fast fashion soon became so successful was the supply chain behind it. The development of strong supply chains enables companies to shorten the time between the designing of garments and the customer's purchase. This empowered apparel brands to adapt their collections to the desire of the customers in real-time. As an example, one of the most successful brands in fast fashion, Zara, can design a new product and deliver it to stores in four or five weeks.

Sustainability

Before analyzing how fast fashion impacts the world and how it is related to sustainability, we need to determine what is sustainability and what does it involved.

After the industrial revolution took place, the world started to change much faster than we were used to. During the 19th and 20th centuries, huge advances were made, and the world was completely transformed. One of the consequences of this transformation was overpopulation. This led to an increase in production and inevitably pollution levels grew.

The government and the institutions did not analyze and discuss the situation until several years later, even though there were several groups in society that were rejecting this series of rapid changes and vindicating life before the industrial revolution.

In 1969, sustainable development term was first used and described as “economic development that may have benefits for current and future generations without harming the planet’s resources or biological organisms” by the National Environmental Policy Act (NEPA). Three years later, Stockholm held the first United Nations conference on the human environment. As a result of this conference, a declaration containing 26 principles concerning the environment and development, an action plan, and a resolution were agreed upon.

Some years later, in 1983, a new organization focused on sustainable development was formed. It was created under the name of the World Commission on Environment and Development (WCED). Four years after the formation of this organization, the Brundtland Report was published. This report was also known as “Our Common Future” and throughout this document; sustainable development was defined as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". In addition, this report contemplated sustainable development as a combination of three pillars: environment protection, economic growth, and social equity. This interconnection between different dimensions was a remarkable event and laid the foundation of the future sustainable approach.

In March of 1989, a catastrophic accident occurred that boosted the change toward a more sustainable world. The Exxon Valdez, an oil carrier ship, spilled millions of gallons of crude oil into Alaska’s Prince William Sound. Exxon paid about \$ 2 billion in cleanup costs and \$1.8 billion for habitat restoration and personal damages. (History.com). This catastrophe made stakeholders more aware of the environmental impact of their businesses. In addition, as a result of this unfortunate event, The Coalition for Environmental Responsible Economies was established.

Some years later, John Elkington introduce the term “Triple Bottom Line”. This term refers to a new way of measuring company performance. In this case, instead of focusing exclusively on the economic profit, attention is also paid to the social and environmental impact. This new framework helped to develop the focus on sustainability.

At the start of the 20th century and during the next years, some institutions were established all over the world focused on sustainable development. One of the main events in these years was the establishment of the Global Sustainability Standards Board. This institution is responsible for setting globally accepted standards for sustainability reporting. In addition to the establishment of this institution, awareness among the global population was growing fast and soon sustainability became a topic of debate.

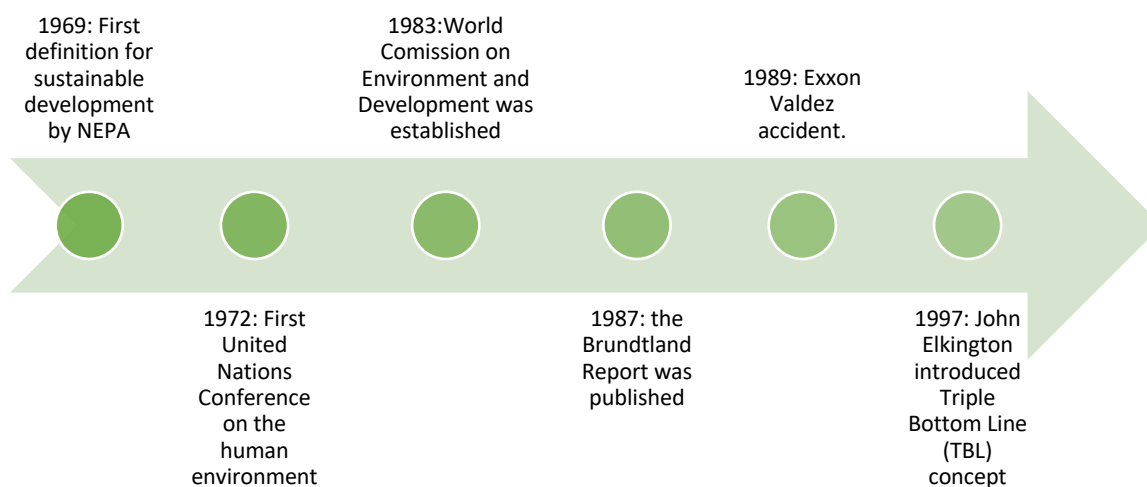


Figure 1: Main events on sustainability in the 20th century

Fashion Industry and sustainability

The first connection between sustainability and fast fashion was not made until late in the 1980s led by movements such as the anti-fur. Before this connection happened the great growth of the population and the increase in production and consumption by society caused a small part of this society to start movements against this trend, see the hippies and some years later the punk and goth movements.

It was in the last decade of the 20th century when fast fashion was born. Fashion became cheaper as a result of the growth in production levels and the importation of garments from Asia where the labor and material costs were much cheaper than in the western world. During these years,

new brands started to adopt a much more sustainable behavior and raise awareness about the impact of the fashion industry on the environment.

While fast fashion was growing, movements against it were being born. Thus, in 2007, a term opposed to fast fashion was born. The term “slow fashion” was introduced by Kate Fletcher, a fashion and sustainability pioneer. She and several contemporaries were inspired by slow food trends to extrapolate this concept to the fashion world. She linked the concept of slow fashion to diversity, information, identity and to the balance, durability and long-term quality of products.

During this first decade of the 21st century, numerous organizations were born to promote various actions aimed at achieving a more sustainable fashion industry. Of all these organizations I would like to highlight the following:

- Sustainable Apparel Coalition (SAC): It is a coalition of more than 250 brands, retailers, suppliers, trade associations, academic institutions, services providers and NGOs working to reduce environmental impact and promote social justice throughout the global value chain. This organization launched Higg Index in 2012, a suite of tools that enables retailers, brands and manufacturers to quantify their supply chain impact on the environment. One of the most important tools of this suite is the Materials Sustainability Index (MSI) which helps measure the environmental impact of materials used in the fashion industry.
- Ethical Fashion Forum: It was set up in 2006 and a few years later The Ethical Fashion Forum launched Source which is a database that promotes sustainable firms and services for the fashion industry. Through this platform, companies can make sure that the services they are contracting comply with the relevant sustainability standards.
- Ellen Macarthur Foundation: Was created in 2010 by Dame Ellen Macarthur with the main objective of promoting the change from a linear economy to a circular economy. (Later we will introduce the concept of circular economy).

But if we had to highlight an event that drove the shift toward a more sustainable and ethical fashion, it was the Rana Plaza accident in 2013. Rana Plaza was a garment factory located in the

Dhaka district of Bangladesh, one of the most densely populated textile factories in the world due to its low regulations and cheap labor force. This factory collapsed on April 24, 2013, leaving more than 1,000 dead and more than 2,000 injured. From this factory, clothing was supplied to 29 well-known western businesses. Most of these brands refused to compensate the families of the workers who died in this catastrophe and only 7 companies contributed.

This accident had a major global impact. In 2013, an organization called Accord on fire and building safety in Bangladesh was created to "help ensure that no worker has to fear fires, building collapses or other accidents that can be prevented by reasonable health and safety measures." This organization is a legally binding agreement between global brands and retailers and IndustriALL Global Union and UNI Global Union and eight of their Bangladeshi affiliated unions. Apart from Accord, other organizations were established as a consequence of this accident such as The UN International Labor Rights and the Human Rights Watch.

Apart from the establishment of a great number of organizations (some of which we have previously mentioned) that fight for the right of these workers, global awareness grew and multiple consumer-centered movements have appeared since then. With the idea of giving visibility to this cause, on April 24, 2015, the fashion revolution day (established a year earlier), the documentary "the true cost" was released. This documentary shows the hidden face of the fashion industry and puts the emphasis on those who really suffer the consequences of this accelerated fashion consumption.

Finally, over the last few years, numerous organizations and programs have been created that are fighting to change the fashion industry landscape. Among these, the following stand out:

- Common Objective (CO): It was created thanks to funds raised by the Ethical Fashion Forum and provides resources for companies to act in a sustainable way.
- Global Commitment Program: The collaboration between the Ellen Macarthur Organization and the United Nations Environment Program resulted in the creation of this program that seeks to eliminate the unnecessary use of plastics and innovate in the creation of reusable and less polluting plastics.

- Alliance for Sustainable Fashion: It was launched by United Nations at the UN Environmental Assembly held in Nairobi in 2019. The goal of this Alliance is to stop the environmental and socially destructive practices of the fashion and textile industry.

These organizations are just a few of the many that strive to safeguard human rights and the sustainability of the planet. Thanks to them and numerous local movements, actions are being taken to help save the planet and raise awareness of the responsible use of our resources.

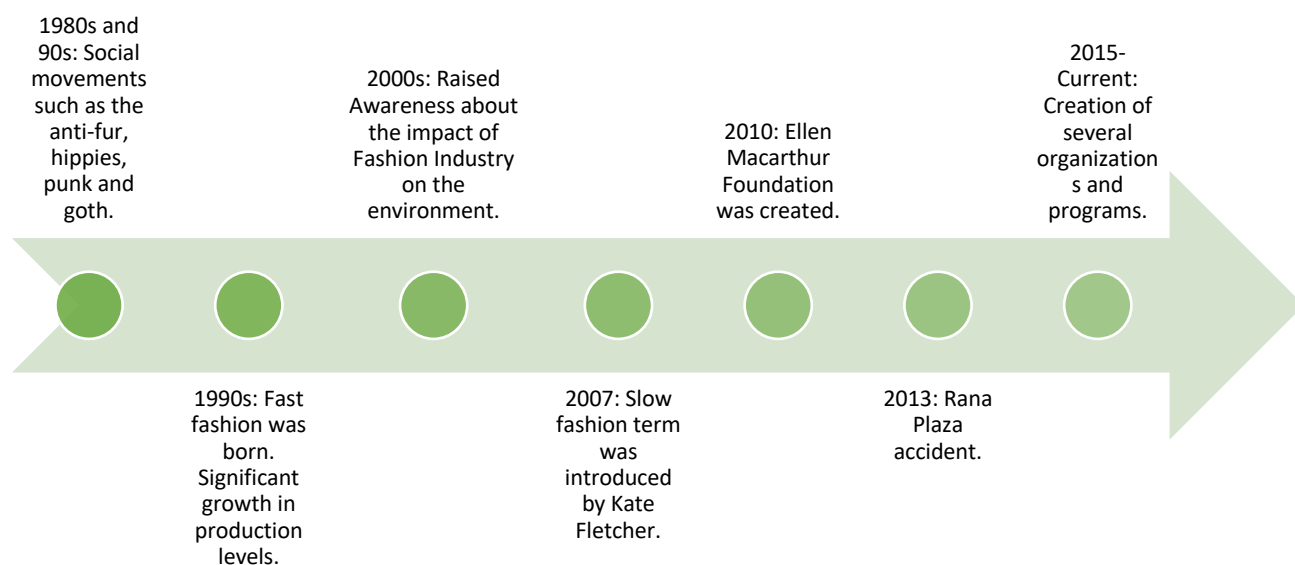


Figure 2: main events focused on sustainability in the fashion industry.

CHAPTER 2

PROBLEM CHARACTERIZATION

In the last chapter, we reviewed the major events of the past and how we have arrived at the situation we are in today. In this chapter, we will focus on the current situation and characterize the issues surrounding the fashion industry and specifically fast fashion.

We will divide this chapter into 3 sections; first, we will discuss the problems directly related to the fast fashion industry, then, the problems related to the supply chain model and finally, the problems derived from the social culture and the behavior of the consumer.

Fast Fashion Industry Challenges

Since fast fashion first came out, movements against this way of producing and consuming have appeared. The emergence of these movements is more than justified due to the great negative impact fast fashion has on the planet and the people. However, it has not been possible to stop the rise of fast fashion and year after year new brands are appearing that exploit the same

GROWTH OF CLOTHING SALES AND DECLINE IN CLOTHING UTILISATION SINCE 2000

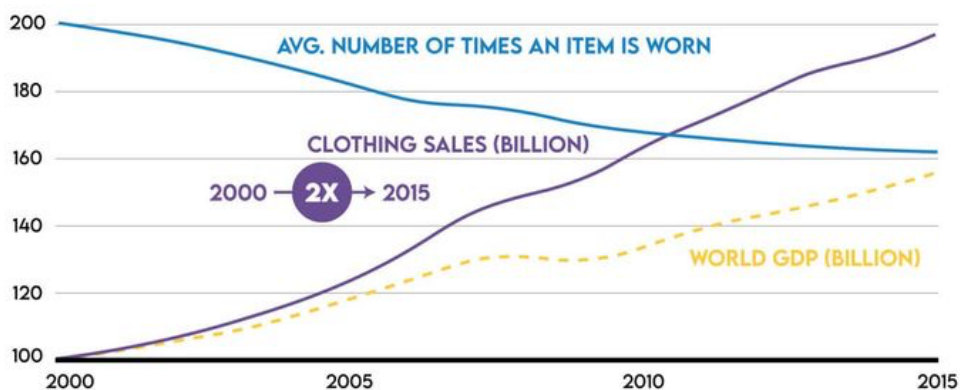


Figure 3 Dottle, R., & Gu, J. (n.d.). *The Real Environmental Impact of the Fashion Industry*.

production techniques. In this section, we will point out the consequences of the production model of the fast fashion industry.

In this graph, we can observe the two main trends in this 21st century. The first one is that every year more clothes are sold; this value has doubled between 2000 and 2015 while the world GDP has risen by 50%. The second trend is that garments are less and less used. This may be due to two reasons, the first is that year after year garments are manufactured with lower quality due to mass production and the other reason is that society prefers to buy new clothes regularly rather than give optimal use to the ones they have already bought. According to a study in the UK, 1 in 3 respondents considered their clothes to be old after 1 or 2 wears. In other studies, it has been determined that people discard their clothes after wearing them between 7 and 10 times on average.

While the greatest consumption of fast fashion is in the West (Europe and the United States are

FAST FASHION PURCHASING HABITS AROUND THE WORLD



Figure 4 Dottle, R., & Gu, J. (n.d.). *The Real Environmental Impact of the Fashion Industry*.

at the forefront), the worst affected countries are those where living conditions are already the worst. India, Cambodia, China, Vietnam, Indonesia, Bangladesh and Turkey are some of the most popular countries where fast fashion manufacturing is done. The reason is that there are almost

no safety requirements or regulations, and labor conditions are horrible. In this way, fashion brands can produce large quantities at a low cost thus allowing sale at reduced prices in the West.

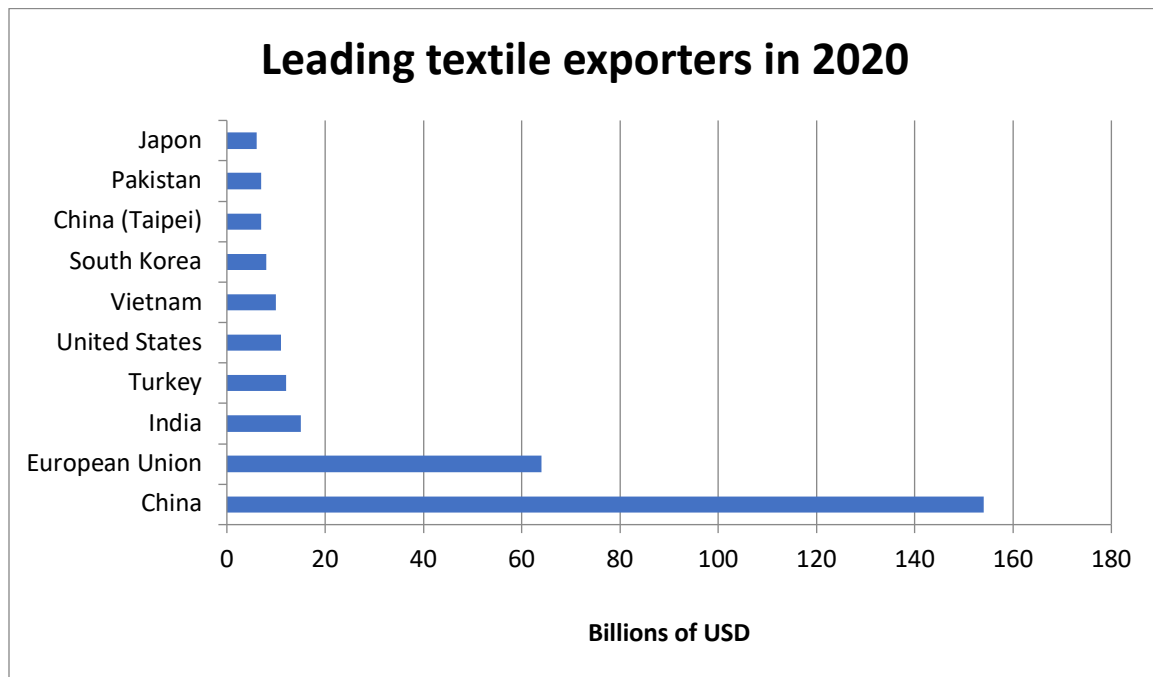


Figure 5: Statista. (n.d.).

This chart shows the main textile exporting countries in the world. In the first place, we find China, one of the most technologically advanced countries in the world and with labor conditions that invite many companies to produce their garments there. Secondly, we have the European Union. This is a different case; Europe is a very powerful and highly developed continent. Textile manufacturing in Europe is generally related to quality garments and designer brands. Finally, we can find in this list previously mentioned countries such as India and Vietnam.

Beyond the growing mass production in Asian countries and its subsequent export to the West, there are many other problems directly related to this production. The fashion industry generates 10% of total CO₂ emissions into the atmosphere. This makes it the second most polluting industry in the world behind only the energy industry.

According to a study by the aforementioned Ellen MacArthur Foundation, 97% of the raw materials used by the textile industry come from virgin sources. In addition, 12% of the fiber

produced is wasted in the manufacturing process. This study also points out that more than 500 million USD of value is lost due to a lack of recycling.

Another major problem of the fashion industry is the raw materials it uses. The current trend is clear. More and more synthetic materials are being used. In fact, in the last year, polyester has become the most used material in the textile industry, ahead of cotton, which had been the most used material until now. Cotton, although commonly believed to be a clean and healthy material, consumes large amounts of natural resources (it consumes a lot of water), 10% of all agricultural chemicals used and 25% of insecticides. In addition to cotton, the textile industry uses petroleum-derived materials, such as polyester and nylon, which are not biodegradable and therefore have a strong impact on the environment. It is estimated that more than 70 million barrels of oil are used annually to produce these fibers. The main reason why polyester has become so popular in the last years is that it is hardy and versatile. Sometimes polyester is seen as a more sustainable material than cotton because it does not need as much water to generate it, the problem is that with use, polyester and other synthetic fibers release microplastics that often end up in the oceans and are very harmful to the environment.

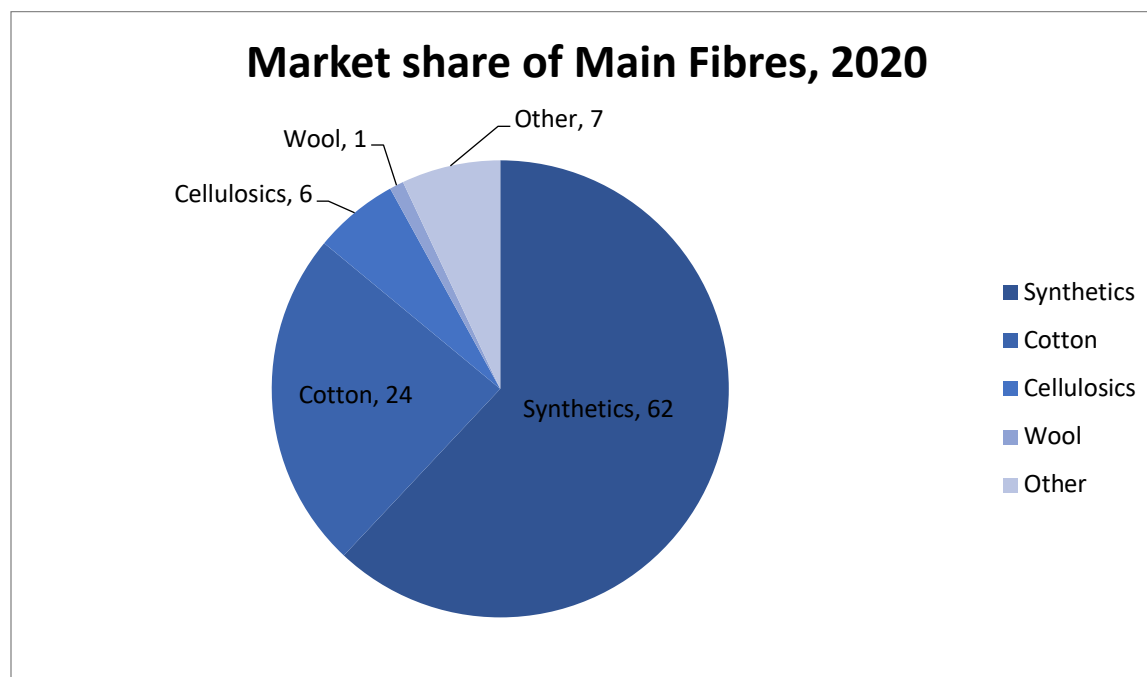


Figure 6: Clothing Materials & What Our Clothes Are Made From. (n.d.).

Finally, another challenge we face when trying to make the textile industry more sustainable is the problem of garment dyeing. Large quantities of water are used which are mixed with chemicals that generate waste liquids that are rarely treated and end up in rivers or streams. This is potentially dangerous for the ecosystem, animals and people who generally use the water from these rivers for washing and even drinking. Some of the chemicals used to dye clothes in India are banned in Europe.

Supply Chain Challenges

The supply chains of the fashion industry are unique. We could say that they have always worked quite well despite being long chains with players in very diverse locations. Thanks to these supply chains, fast fashion companies can design, produce and sell their garments in less than 5 weeks. This is incredible considering the distance that usually separates the physical stores from the main suppliers. However, we have detected inefficiencies and problems related to the sustainability and environmental friendliness of these chains. These are described below. The following chart shows the actions in the supply chain that produce the most greenhouse gases.

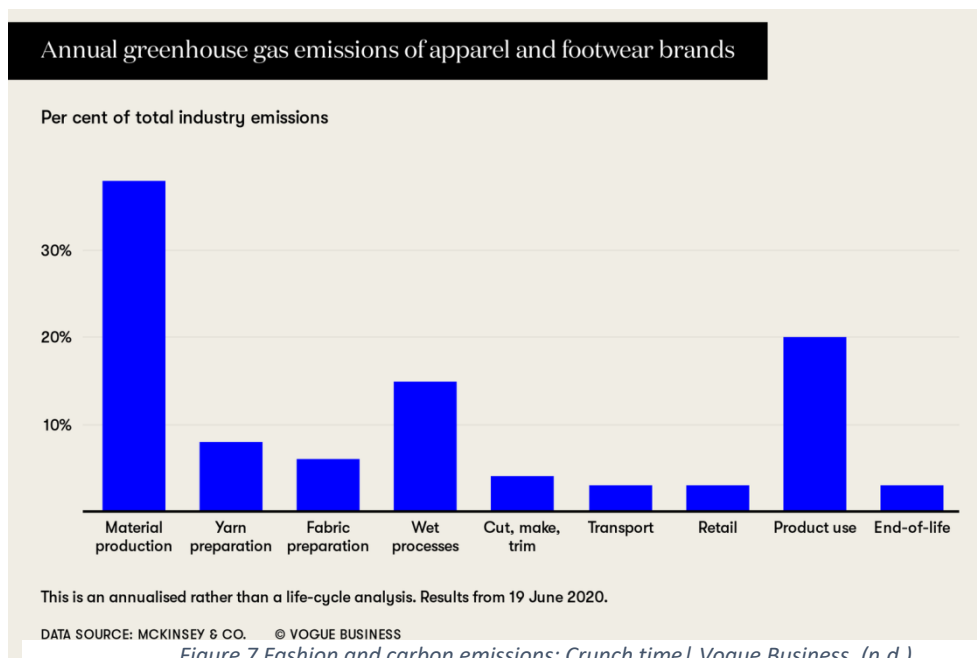


Figure 7 Fashion and carbon emissions: Crunch time | Vogue Business. (n.d.).

Suppliers

This is one of the main sources of problems in supply chains. We have previously analyzed the problems that exist in Asia to control human rights and the environmental impact that factories have there. In addition, it is a challenge for major apparel brands to manage their suppliers and even more so the suppliers of these suppliers, about whom information is rarely available. For this reason, it is sometimes impossible to align the values of a brand in relation to its sustainability policy with the policies of its suppliers.

To all this must be added the passivity of these companies to control their suppliers. Although this control is a complicated task for these companies, the lack of commitment shown is sometimes incomprehensible considering the values that the company then exhibits.

Transportation

To analyze the impact of fashion-related transportation on the environment, it is necessary to consider the entire supply chain. This chain generally includes the following steps:

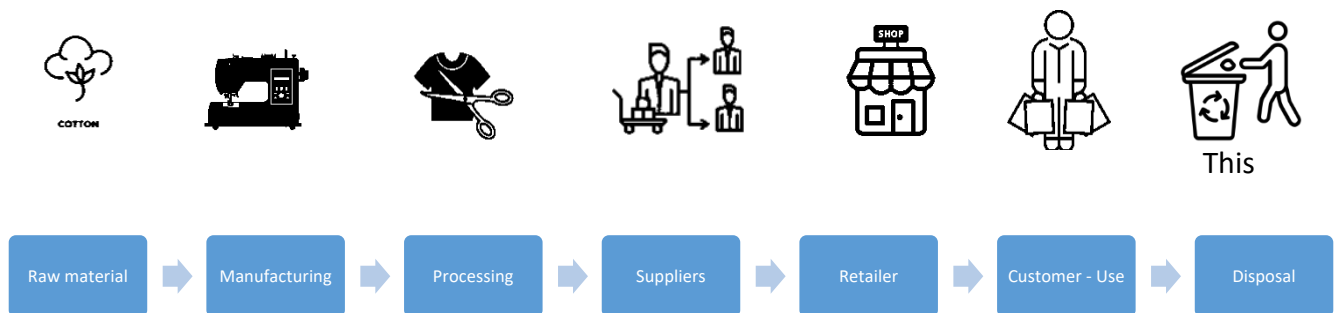


Figure 8: Fashion industry supply chain

could be a typical supply chain in the fashion industry. In between each of these steps, transportation may come into play. Moreover, it is almost certain that this sequence of steps takes place over more than one country, and may include, as in the case of fast fashion, some form of transoceanic transport.

Currently, almost 90% of freight transport is carried out by ship. It is the transport preferred by most companies in the world because it is the most economical. In addition, it is considered to be the least harmful to the environment in terms of carbon dioxide emissions. Nevertheless, it is still a high source of emissions and in the following chapter: we will look at possible solutions to mitigate its impact and that of other types of transport.

Another issue is that due to the nature and business policies of the fast fashion companies, there is a large amount of clothing that is transported all over the world to the different stores and is never sold. This generates waste that is easily avoidable and wasteful transportation, with its corresponding emissions.

Customer behavior

This analysis could be included in the supply chain section, as customers are a very important step in this chain. However, I want to consider their behavior outside the supply chain and analyze the patterns that guide consumption.

For this reason, I created a survey that I distributed among my acquaintances. Eighty people answered this survey that asked about their clothing consumption habits. Below I will highlight the conclusions I was able to draw from these responses and share the graphs created from their answers.

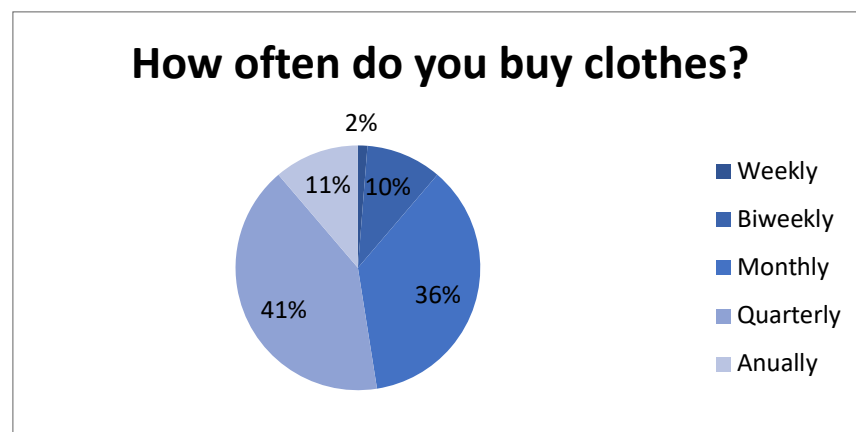


Figure 9 Own elaborated survey

These are the responses after asking respondents how often they buy clothes. We can observe how almost half of the respondents buy clothes at least once a month. This added to the fact that 75% of the respondents buy most of their clothes in physical stores, means that in addition to the pollution due to the production and distribution of clothes, we must add the emissions emitted by transport every time we go to the shopping streets or shopping centers.

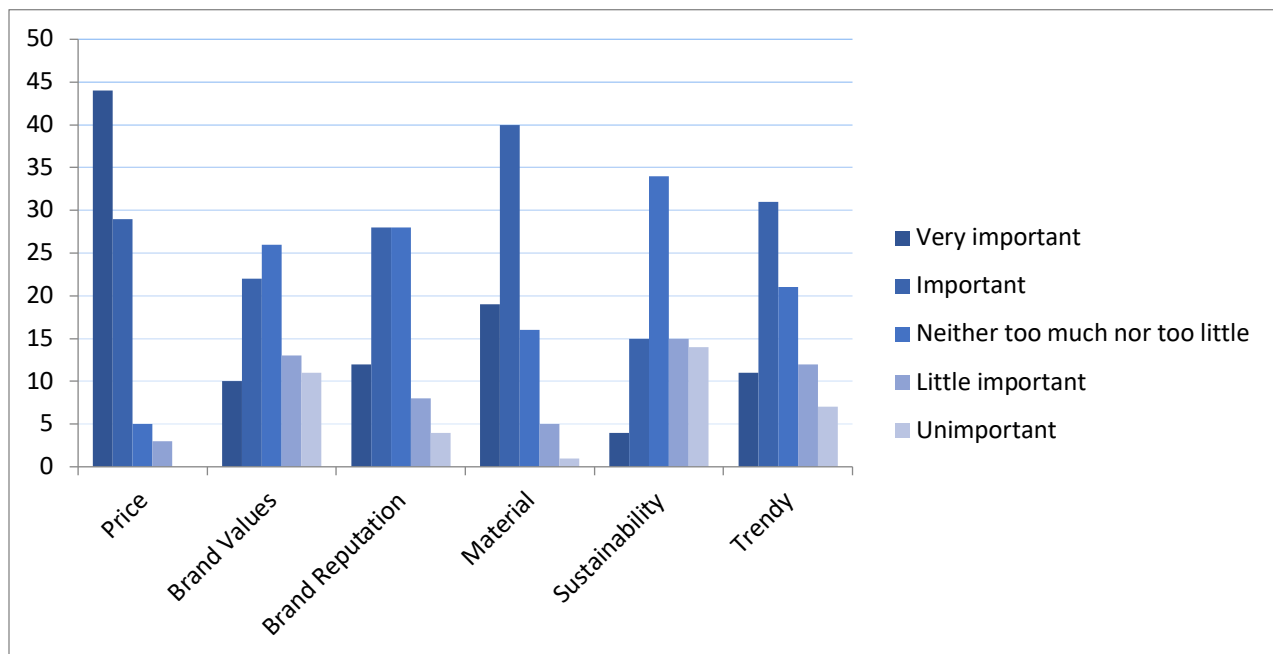


Figure 10 Own elaborated survey.

Respondents were also asked how important certain factors were when deciding on one garment over another. As we can see in the graph: the most important factor is the price, followed by the material. It is surprising to see how the respondents value the reputation of the company more than the values of the company. In addition, of the 6 factors we asked about, sustainability comes in last place. This is the main problem of society, and we could associate it with the lack of sensitivity to responsible consumption and sustainability.

The consequences of mass production of clothing are devastating for the environment, but even more so when it comes to fast fashion. That's why we also asked about fast fashion consumption habits. These are the results we obtained when we asked: what percentage of your clothes is classified as fast fashion?

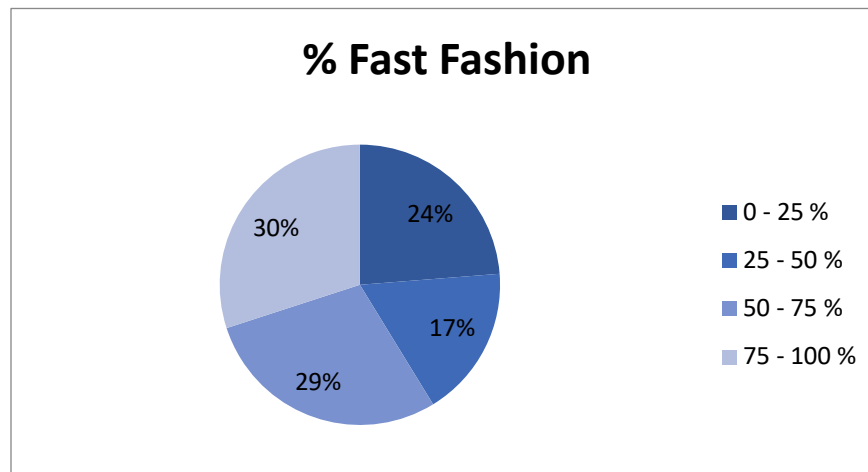


Figure 11 Own elaborated survey

This graph shows the purchasing patterns of the respondents with respect to fast fashion. In it, we observe how more than half of the respondents base their consumption on fast fashion. Previously, we analyzed the disastrous consequences of this business model. The main reasons that lead these people to buy in stores of this type are low prices and designs updated weekly.

We also wanted to know the response of the respondents to the following situation: you are in a store, and you find two very similar products, one of them is made following sustainable patterns and the other is not. In this situation, which product would you choose? Approximately 60% of respondents said that they had never had this dilemma. And of those who had been in this situation, only 47% decided to buy the sustainable item. This clearly denotes a lack of involvement on the part of society. Later, we will propose different strategies to raise awareness in society, since part of this problem comes from the behavior of this society. Continuing with the behavior of society and its habits, 90% of respondents stated that they keep clothes in their closets that they no longer wear.

One of the main objectives of this work is also to calculate the economic impact that the adaptation of the fashion supply chain to a circular economy can have. In this regard, we asked respondents how much more they would be willing to pay to obtain a sustainable product. The answers can be seen in the following chart:

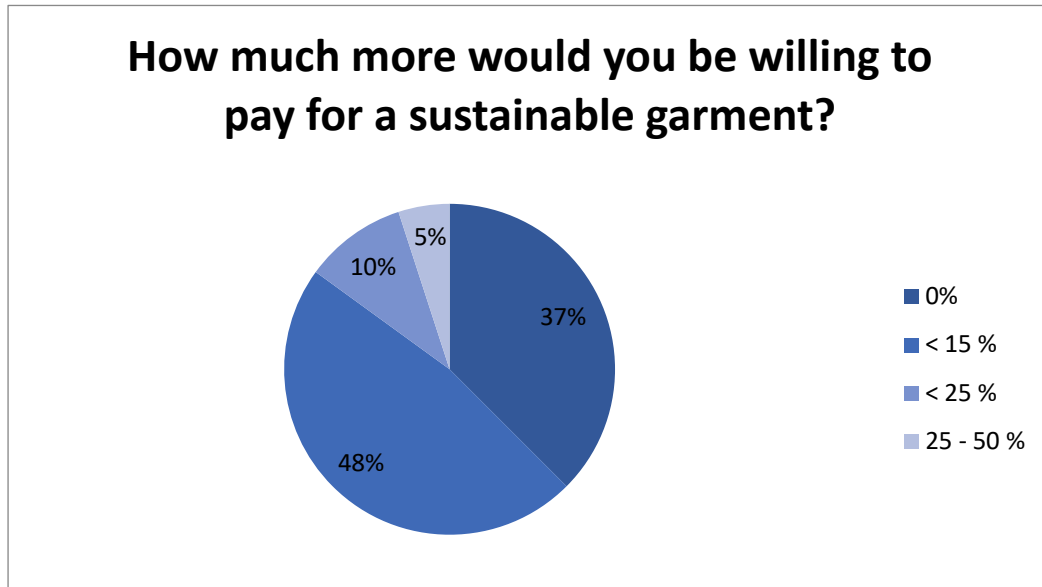


Figure 12 Own elaborated survey

If we analyze the graph, we can see how 37% of respondents would not pay extra for products to be more sustainable and 47.5% would be willing to pay up to 15% more if the product met sustainability criteria. This leaves us with a narrow margin for action: if we want to maintain current consumption, products should not become more expensive by more than 15%.

After having analyzed what are the habits of consumers when buying clothes, we are going to analyze how the population disposes of clothes, which are no longer used or have been damaged. To do this, we asked respondents three questions: why they stop wearing certain clothes, how they dispose of them, and what actions they would be willing to take to achieve a more sustainable textile industry. The results of these questions are summarized below:

- Only 27% of respondents stop using a garment because it has deteriorated too much.
- 67.5% say they stop wearing a garment because they no longer like it.
- The other reasons why people stop wearing a garment are that it no longer fits them or that it has gone out of fashion.
- 59.5% of the people who took the survey say that the way they dispose of it is by donating it.

- A quarter of those questioned said that they deposited their clothes in the specific containers dedicated to garment recycling.
- Among the other options chosen by people, the option to sell it and the option to give it as a gift stand out.
- Finally, 95% of respondents would be willing to incorporate new gestures in their daily lives to make this industry more sustainable. Among these actions, the following stand out: recycle and donate more (78.8%), buy second-hand clothing (40%) and buy less clothing (36.3%).

After having made this analysis and knowing the causes and habits that make the fast fashion industry keep growing, we are able to propose new actions that can make this industry a much more sustainable and environmentally friendly one.

CHAPTER 3

DEVELOP SOLUTIONS

We already know the problems that the fast fashion industry causes on the planet and the causes that make this industry the second largest polluter on the planet. The objective of this chapter is to find a way to address this situation.

Introduction to Circular Economy

At this point, it is a good time to introduce the concept of circular economy. The circular economy has been defined by numerous organizations in recent years. Personally, the definition I like the most is the one given by the European Parliament which reads as follows "The circular economy is a model of production and consumption, which involves sharing, renting, reusing, repairing, renewing and recycling existing materials and products for as long as possible". (*Circular Economy, 2015*). As we can see from this definition, the circular economy encompasses production and consumption, that is, from the first supplier to the last consumer.

The circular economy is based on three principles that together seek to transform the existing production and consumption model into a much more sustainable one. These principles are design products to reduce waste and pollution, keep materials and products in use, and regenerate natural systems.

Although the circular economy is becoming more and more present in the daily life of society, there are still few who consume and produce in a linear way (traditional way). The linear concept is defined as the extraction of raw materials from the earth, their processing, their use and their disposal as waste. The linear economy has been the predominant form of consumption and production. This model has generated not only irreparable damage to the environment but has also caused problems in society and business. Fortunately, this model is almost obsolete, and more and more companies and individuals are deciding to behave in a circular economy.

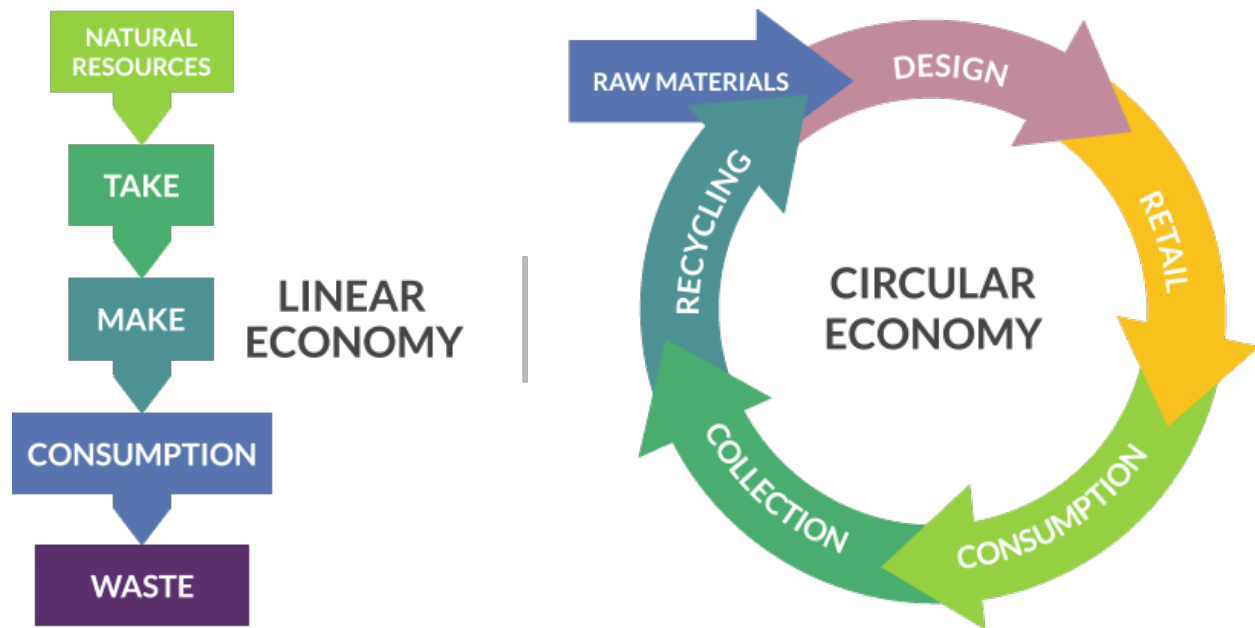


Figure 13 End of Waste Foundation

In this image we can clearly see the main differences between these two models. As mentioned before, the linear model exploits natural resources to finally convert them into waste. In this way, the environment is not regenerated, and natural resources are depleted. On the contrary, the circular economy reduces the amount of raw material entering the system. This is because throughout the cycle, materials and products are reduce, reuse, refurbish, repair and recycle.

The benefits of the circular economy are many and diverse. First of all, waste reduction, eco-design, reuse and recycling lead to a significant reduction in CO₂ emissions, greenhouse gases and waste generated. They also allow for less dependence on natural resources. Secondly, this responsible behavior on the part of companies creates awareness in society and promotes a change in consumer habits. Finally, the economic benefits of the circular economy are many: increase in GDP, savings in raw materials, creation of new employment opportunities, value creation, and many more.

Unfortunately, the implementation of the circular economy still has many barriers. Below we will analyze what they are and why they are slowing down the development of the circular economy.

- Currently there is no single criterion or standard to certify when a company behaves according to the circular economy. In addition, the guidelines that guide companies in the shift towards the circular economy are often unclear and change depending on the country you are in.
- Society is not fully aware of the importance and positive impact that the circular economy has on the earth, both environmentally and economically. Moreover, changing society's habits is a slow and tedious process.
- At the technological level, there are also barriers because the investments by the institutions are not as important as they should be.

Despite these difficulties, many companies are trying to implement the circular economy in their businesses.

Circular Economy in fast fashion supply chain

The circular economy is a system that involves all the steps in a supply chain. The implementation of the principles described above and the actions to be taken depend strongly on the level within the supply chain. These measures will be different if we are at the beginning of the chain or if we are at the end. For this analysis we have considered the following assumptions:

- The chain has two suppliers prior to the arrival of material at the apparel brand.
- The brand will process and produce its products from the material purchased from its suppliers.
- Once produced, the clothes will be delivered to the stores they have around the world.
- We will consider two consumers. The first one, the one who goes to the store and pays for the clothes, the second and last step of the supply chain will be the person who gets the clothes thanks to donations and gifts.

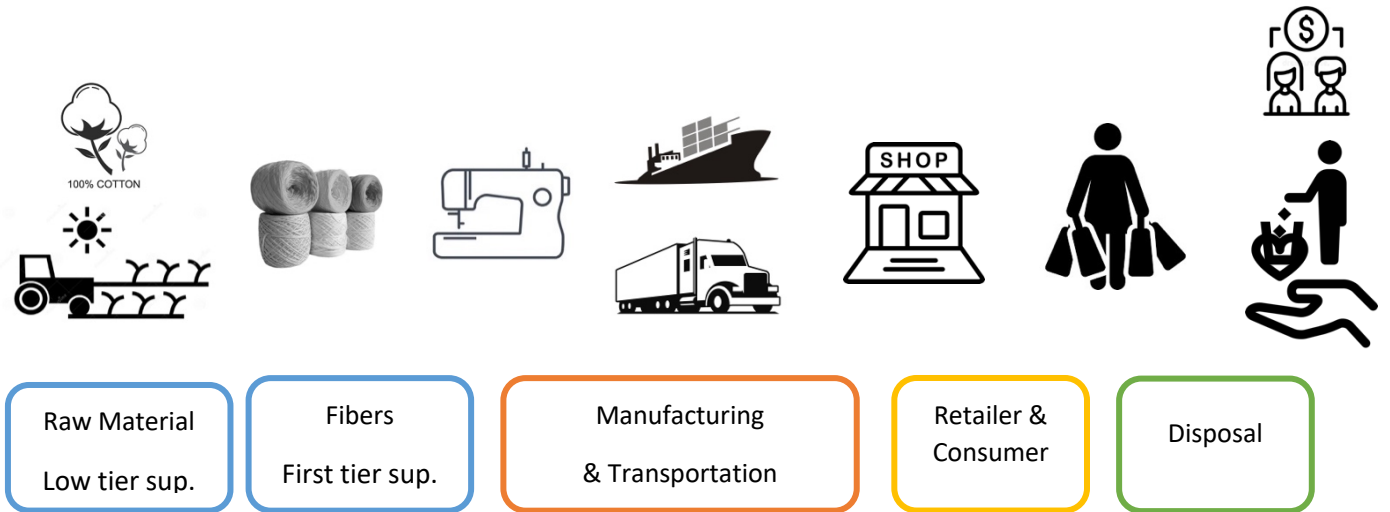


Figure 14 Own elaborated. Fast fashion supply chain representation.

This is the representation on which we will base our analysis and implementation of the circular economy in the supply chain of the fast fashion industry. This representation has been elaborated considering the assumptions mentioned above and we have also considered the answers provided by the respondents to the question "How do you dispose of the clothes you no longer wear?". We can observe how in the last step of the supply chain we have 3 options, get rid of the garment, give it away or sell it (these were the 3 most popular answers).

Throughout this chapter, we will analyze 1 by 1 each step of this supply chain, trying to implement measures that bring this model closer to a sustainable model based on the circular economy.

Low-tier and First-tier suppliers

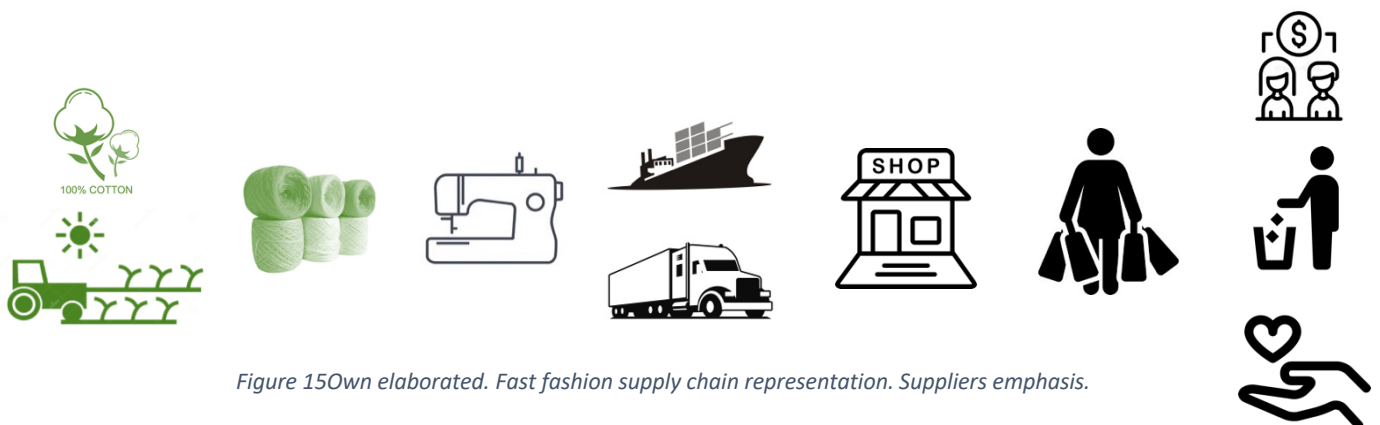


Figure 15 Own elaborated. Fast fashion supply chain representation. Suppliers emphasis.

This process begins with the proper selection of our suppliers. Due to the lack of standards related to circular economy, it is sometimes very difficult to know perfectly what the degree of sustainability of our supplier is. Moreover, in this case, this supplier would not be directly our supplier but the supplier of our supplier. Thus, our control over it decreases and our margin of action is reduced. So, what can we do to ensure that the first step in our company's supply chain is sustainable and acts according to the principles of the circular economy?

The strategy for managing low tier suppliers is very complex. They are generally very small companies that do not follow any sustainability standards. In addition, their capacity to invest in new technologies is generally low. Therefore, if we want to have suppliers that behave according to our company's standards, we will have to support them.

One of the first steps in implementing the circular economy in the company is to define a strategy. This strategy will help us make decisions throughout the supply chain as all decisions will be made to align with the strategy. Once we have a clear reference, we can start with the functions that the purchasing department will have and its influence on the company. This department is in charge of finding the best suppliers following economic, sustainable and quality criteria. Generally, these agreements with suppliers are signed with the first-tier suppliers. By having a direct relationship with this supplier, we can demand quality and sustainability standards that must be met. We will also have to periodically check that these criteria are met and ask for documents to prove it. Therefore, for the selection of our first-tier supplier we will need to thoroughly analyze its sustainability policy. In addition, we must try to ensure that they are able to implement the circular economy within their business.

First-tier suppliers will in turn have other suppliers that we call low tier suppliers (second tier and third tier suppliers). These are more difficult for us to control, as we are not in direct contact with them. However, our first-tier supplier will have to commit that all their low tier suppliers follow sustainable standards and if possible incorporate circular economy in their business.

In addition, in this initial phase, we must also consider the option of designing the garments in a sustainable manner. We call this practice eco-design, and it consists of designing also considering

sustainable criteria. In the case of the fashion industry, we should look at the materials with which these garments are designed and always try to choose the most environmentally friendly materials.

Within the fashion industry, there are many suppliers that could satisfy our quality and price requirements, however, when we introduce the sustainability factor the number of suppliers is reduced. Some options within the low tier suppliers may be those that grow and harvest 100% cotton, i.e., grown without the use of pesticides and chemicals and with regulated water use. When looking for first tier suppliers it would be interesting to look for those in which a large part of their input is recycled material, fibers from old clothes or even fibers from sustainable materials such as bamboo. In this way, we will introduce very little raw material into the system since a large part of the input for the creation of fibers will be recycled material.

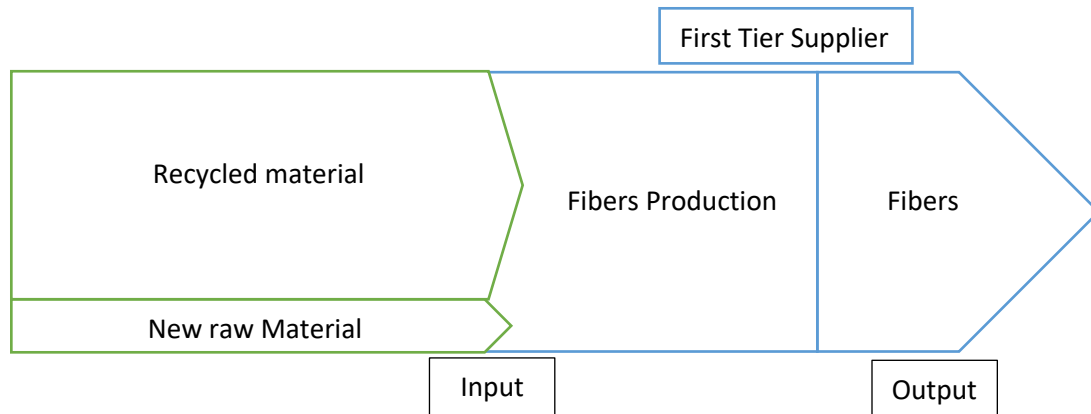


Figure 16 Input for suppliers

Manufacturing

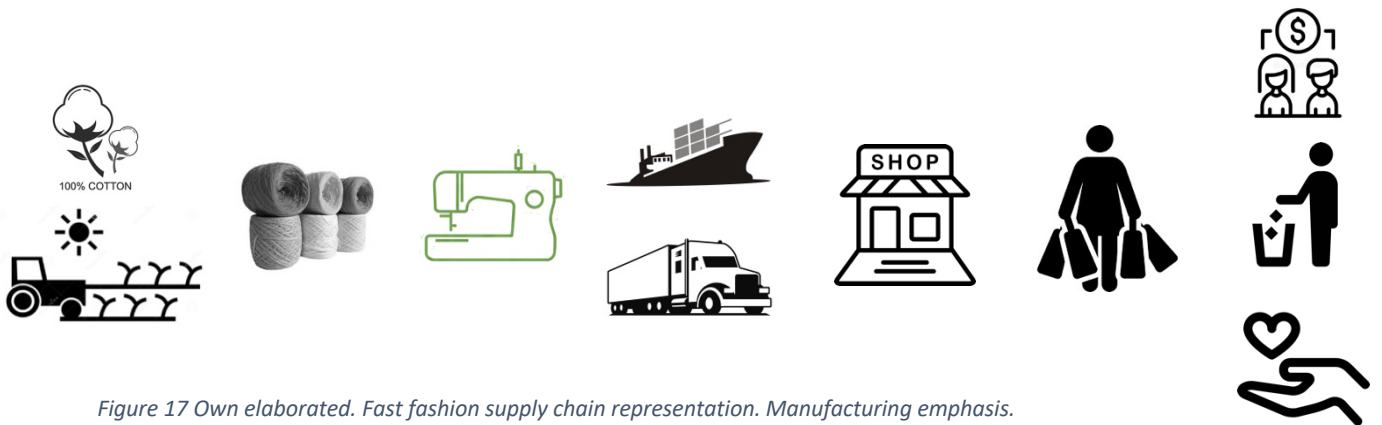


Figure 17 Own elaborated. Fast fashion supply chain representation. Manufacturing emphasis.

Manufacturing is one of the most complicated operations in the fashion industry supply chain. In recent years, it has been marked by the events mentioned at the beginning of the project. Human rights violations, long working hours and high levels of pollution have been the main problems of this operation.

If we want to include policies that respect the environment and work according to the circular economy, we will have to make an effort.

The vast majority of clothing production is done in Asian countries or countries where regulations are lighter. Large companies try to take advantage of this situation with the aim of manufacturing clothes for the lowest possible price. The consequences of this production policy are catastrophic. Here are some guidelines to help companies produce more sustainably.

The first is to offer decent wages and working conditions. It is in this part of the supply chain where most abuses are committed and that is why implementing measures is a critical issue. To counteract this, many measures can be proposed, but one of the most decisive is to bring production closer to the places where it will be consumed. With this, we not only manage to control working conditions but also reduce the carbon footprint that these garments generate. Often, when we outsource production to Asian countries, we are abstracted and we leave aside what happens there, since it is often difficult to control. That is why bringing manufacturing closer would help to obtain greater control and monitoring of sustainable policies.

When we consider production, we must do so from two different perspectives. The first is related to the design of the product and is that much of the waste from the manufacture of clothing could be avoided with better design. This practice is known as eco-design. Eco-design focuses on reducing pollution throughout the life of the garment, from manufacture to disposal, through use, maintenance and so on. The impact of transportation is also considered when designing a product. In short, we could consider the ultimate goal of eco-design as the reduction of the impact of clothing on the environment. This practice also tries to keep the clothing in use as long as possible and thus make the most of the resources that were used for its manufacture.

On the other hand, within the manufacture of garments, it is necessary to take into account the process itself. One of the keys is to be able to have an efficient production chain, thus reducing

the waste generated. In addition, we also have to control the waste generated during manufacturing, whether it is water pollution, chemical use or energy waste.

In order to control waste, there are many ways to do this, we could use KPIs, and we can also try to allocate the amount of waste and goods/raw materials consumed to each garment manufactured. In this way, we can know the impact that the manufacture of a garment has on the environment. Once this is analyzed, we can take action and prioritize those garments that generate a lower impact and try to redesign those that generated a higher impact.

In this new step towards the circular economy, fashion designers are more important than ever. A good attitude and more environmentally conscious designs will be necessary and key to achieve the goal. The difference between a sustainable product design and a non-sustainable one is abysmal not only during manufacturing but for the rest of the product's useful life and its subsequent disposal.

Transportation



Figure 18 Own elaborated. Fast fashion supply chain representation. Transportation emphasis.

After the Coronavirus crisis, nothing has been the same and transportation has been one of the main challenges worldwide. We can say that after this first crisis, many others have been unleashed, and one of the most important has been the transport and logistics crisis. The consequences have been devastating and can be summarized in the increase in the cost of fuel,

the lack of drivers due to the consequent loss of covid and the stoppages imposed by the countries that converged in a massive increase in transport costs.

This has generated a before and after worldwide and has made many companies think about their supplier policy. There are many companies that, in order to obtain cheap labor, turn to countries that are far away from the rest of their operations. Now that transportation costs have risen, many companies have seen their profits fall considerably. Moreover, if we focus on the fast fashion industry, which is characterized by rapid production and transportation to bring the latest trends to the street, we see how the situation is more critical.

At this point, there are many issues that we must solve and all within the framework of the circular economy. The good news is that all this leads us to the same point. A change in the strategy of companies that will lead them to bring their suppliers as close as possible. Relying on more local companies, closer to their operational centers and thus allowing greater control over the actions and policies of suppliers. In this way, we can obtain a reduction in costs and emissions related to transportation, promote the local economy and reduce the risk of shortages and lead times.

When we talk about transportation, we must consider not only the transportation of the finished product, but all the transports related to the garment manufacturing from start to finish. In order to adopt a sustainable approach within our transportation network, it is necessary to define and know the routes that our products will take. Thus, if we know that our product is only sold in Europe, we should try to produce it in Europe to save on maritime transport. Other aspects to consider in transportation can be the use of more energy-efficient vehicles that generate less waste to the environment such as hydrogen or electric vehicles.

Another type of strategy is to plan both the route and the delivery times. Thus, we can combine several shipments in a single trip. Maximizing the space of the trucks and making packaging that allows a better fit inside the vehicles is essential to ensure sustainable transport.

Finally, one of the best strategies for incorporating the circular economy into the transport sector is known as the transportation backhaul program and the main goal is to reduce the "empty kilometer". This strategy would try to prevent trucks from making unladen journeys, i.e., in vain.

In this way, once we unload a truck we can fill it with another type of goods, whether waste, raw materials or shared with another company, we are collaborating to a significant reduction of emissions of these goods.

	US	CHINA
Manufacturing Labor Cost	\$ 27	\$ 6.5
Airfare Transportation Cost (100kgs)	-	\$ 14.31
Shipping Transportation Cost (40' container)	-	\$ 5,000

Figure 19 Manufacturing cost comparison

This is a small comparison of the costs for a company to produce in the United States or in China. Due to the limited data I have been able to find on the internet I have only taken into account manufacturing costs and transportation costs.

Clearly, it is economically beneficial to produce in China but the current uncertainty due to delivery times and rising ocean container prices suggests that producing in the U.S. may be safer and more beneficial to the company.

Retailers and Customers



Figure 20 Own elaborated. Fast fashion supply chain representation. Retailers and Customers emphasis.

In this section, we are going to study simultaneously the different sales channels and the habits of buyers as they are closely related. There are several channels through which clothing brands can sell their products. Historically, physical stores have been the most widely used. However, with the new technologies and the last big acceleration due to covid, nowadays internet sales have increased considerably. Therefore, in this chapter we will consider both channels and propose several strategies to implement sustainable actions in each of the options.

In terms of shopper habits, we will take as a starting point a study by MIT ((Weideli, n.d.) in which they classified shoppers into 7 categories based on their clothing shopping habits and calculated the carbon footprint that each of them generated with their behaviors. These 7 categories and the difference between each one of them are presented below.

Behaviour	Search	Purchase	Return
Traditional Shopper	In stores (multiple trips)	In store	In store
Traditional Shopper Impulse	In store (Single trip)	In store	In store
Traditional Shopper e-informed	Online	In store	In store
Modern Shopper (Impatient)	Online or in store	Online (express delivery)	Online
Cybernaut (Impatient)	Online	Online (express delivery)	Online
Cybernaut Quick Return (Impatient)	Online	Online (express delivery)	In store
Cybernaut Pick Up	Online	Online and store pick up	In store

Figure 21 Types of customers. (Weideli, n.d.)

These categories are based on how shoppers make their purchases and returns. Once we know the categories in which to frame the consumers, we analyze the carbon footprint that they generate when performing these operations. Fixed values have been given to the pollution that the actions derived from buying clothes generate, such as transport to the store or the air conditioning of the establishments.

After this division and the calculation of the carbon footprint of each of these types of buyers, MIT concludes that the type of buyer who has the least impact on the environment is the one who buys and returns clothes online, the cybernaut. After this, the traditional shopper who only goes to the store once is the one who generates the least emissions. On the other hand, the type of shopper who generates the most emissions is the impatient modern shopper, i.e. the one who buys online but chooses express delivery services.

If we think about how fashion has developed over the years, we find that physical stores have always been very important. That's where consumers fell in love with the clothes they would later buy. Today, despite all the changes, stores are still very important in the fashion world. If we want to consider them as key to promote a change towards the circular economy, we will have to carry out several strategies that will lead us to that ultimate goal.

The first solution is to create open spaces that have a lot of natural light in order to be less dependent on artificial lighting. Secondly, we must have green points in all establishments that allow users to dispose of garments they are no longer going to use. At this point, it could be a great idea to encourage users to get rid of the clothes they no longer use or have very deteriorated in exchange for discount coupons in the establishments. In this way, the brand would benefit because it would increase the number of garments collected and would have a large amount of material for new designs. In addition to these two options, there should be the possibility in the physical stores of being able to fix the clothes. Finally, advice should be given on how to keep clothes in perfect condition for a longer period of time.

The second most used sales channel is online shopping and, according to the MIT study, the most sustainable channel, since not having a physical store considerably reduces emissions. At this point, we must bear in mind that although this is the least polluting sales channel, it is still not

the main one and we cannot get rid of physical stores, as they are a very important engine in the economy of many countries and provide employment for many people around the world.

However, within this shopping model there is still a lot of room for improvement. First of all, packaging is one of the main problems. Brands must look for the best materials and the cleanest packaging. Reducing the plastic in packaging and using sustainable materials for packaging can make a difference. Below, several sustainable options for product packaging are mentioned. First, the option of using a single material, either paper, plastic or metal, would facilitate recycling and reuse. Another option is to use lighter packaging, with a smaller amount of material. Finally, we can use sustainable materials and refocus the packaging, for example, we can send cardboard bags instead of big boxes. In addition, we can include in the shipment a guide on how to dispose of the packaging of our product to cause the least damage to the environment.

There are other strategies to make more sustainable use of online shopping. Group several items in a single order and order from a single store, rather than placing small orders from several different stores. Also, we have to take into account the impact that generates the return of our products, that is why, we must buy whenever we are clear that the product interests us and not do it with the idea of returning it. Finally, whenever possible, choose normal shipping instead of express shipping.

In addition to all the above, I think this is the right time to discuss one last strategy. It is about renting clothes. Many times, users simply buy clothes for a special occasion and never wear them again. That is why more and more people decide to rent clothes. This is a very useful way to dress differently and wear different looks without the need to buy so much. Fortunately, there are more and more stores that allow renting clothes, and more and more people are turning to this type of stores.

Disposal

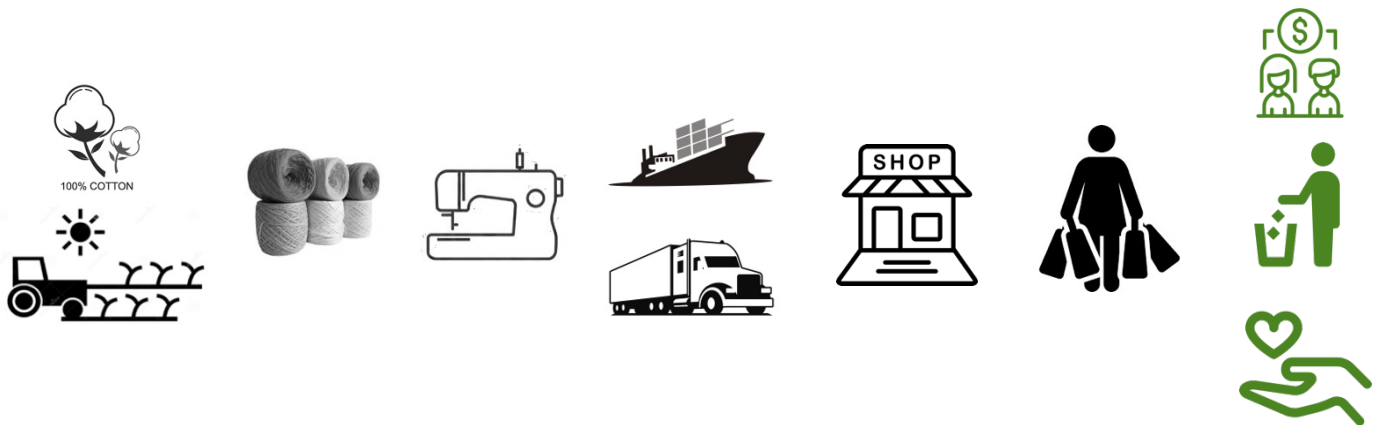


Figure 22 Own elaborated. Fast fashion supply chain representation. Disposal emphasis

Disposal is the last part of the supply chain of the fast fashion industry. Our idea is to be able to turn this last step into the first step of the supply chain and in this way, to be able to close the circle and achieve the circular economy.

Based on the survey we conducted throughout this study and information gathered through other sources, we can consider that buyers typically dispose of unused, unwanted or deteriorated clothing in three main ways. Below, we will discuss each of them and propose strategies for each option.

Secondhand Sale

There are many people who resort to this option to get rid of clothes they no longer want for whatever reason. There are platforms through which users can buy and sell clothes, thus getting a second life for these garments. Vinted is one of the world's leading platforms for selling second-hand clothes. Its growth in recent years has been impressive and its PR manager in Germany and Southern and Eastern Europe says that the two main reasons that lead people to consume through this application are two, ethical awareness about the environment and a more sustainable behavior and the possibility of earning extra money with the clothes you no longer wear.

Within this trend, it is young people who have the greatest presence. This is very interesting as it implies that the younger generation is growing more and more aware of a more sustainable world. In addition, nowadays it is very fashionable to buy second-hand clothes, categorized under the name of vintage, many people resort to buying this type of garments.

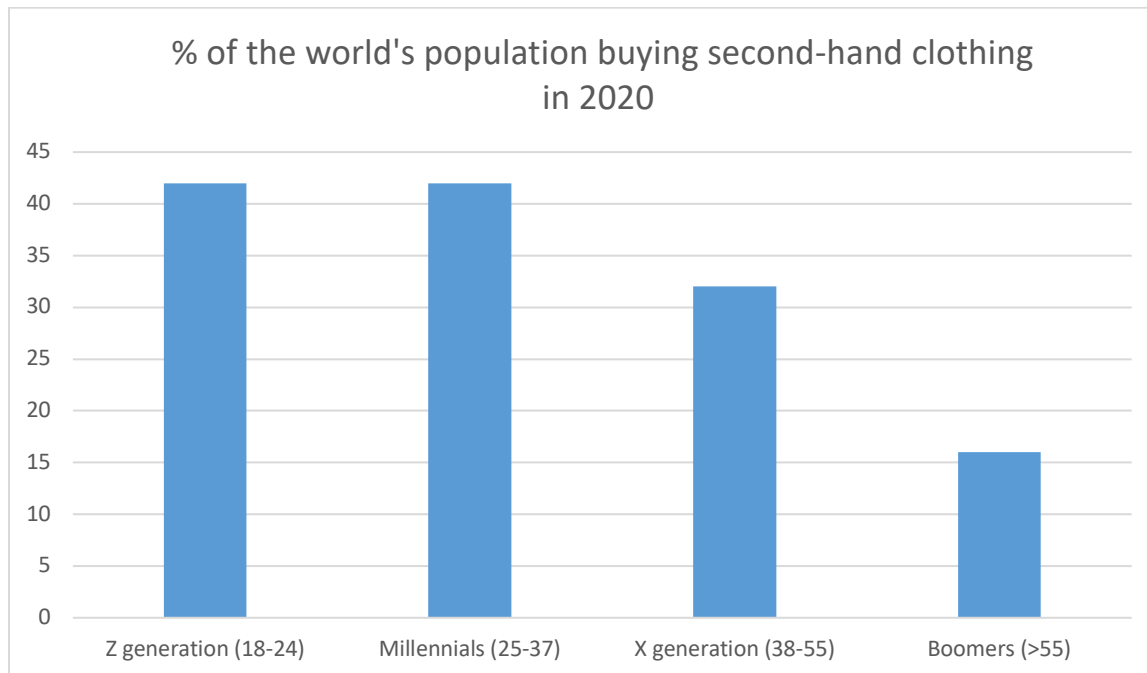


Figure 23 % of world's population buying second-hand clothing in 2020(Moda de segunda mano, n.d.)

As we have commented above, this graph shows how young people up to 37 years old are the ones who consume more second-hand clothes. 42% of young people between 18 and 37 years old bought second-hand clothing in 2020.

Donations

There are numerous organizations that try to collect clothes that users no longer want in order to donate them to underprivileged people. This is another strategy that buyers follow when it comes to getting rid of clothes that they no longer wear and that are still in good condition.

Donating clothes allows the clothes to continue to be used by other people, thus extending their use.

These clothes end up with people who really need these clothes and that by getting them thanks to donations do not have to end up buying them in the cheapest stores that happen to be fast fashion stores. In this way, we not only help to keep the clothes in use, but we also reduce the consumption of fast fashion.

It is true that these donations often occur because buyers want to buy more clothes and renew their closet. That is why, although it is a good method to get rid of the clothes that one no longer uses, we should not complement it with the purchase of more clothes, since, in such a case, we would not be helping to achieve a circular economy.

Finally, in relation to clothing donations, it is necessary to investigate which organizations you donate to and check that they are used properly, as there are many false organizations that try to profit from the good faith of users. Worst of all, in these cases, most of the clothes that are donated end up either in the garbage or in fabric recyclers.

Recycling

Currently, only 1% of the garments that are recycled end up as new garments. There are several reasons why this happens, many times, the garments are composed of different materials, and it is very difficult to separate them in order to be recycled. That is why, as mentioned in the chapter on production, fewer materials should be used when making clothes in order to facilitate their recycling.

There are many clothing brands that promote the recycling of their branded garments in their physical stores, such as Patagonia and the fast fashion brand H&M, which allow you to dispose of clothes you no longer wear in their stores. Other brands, such as Napapijri, have developed a customer loyalty system that allows you to get rid of your clothes after two years of buying them and get a 20% discount on your new garment. This is only valid for the jackets category and along with this, they have also developed single material jackets that can be recycled. In addition to

these brands, more and more brands are trying to encourage recycling in exchange for incentives to users.

In addition to the option to recycle, there is also the option to reuse. When a garment is no longer valid to wear due to wear and tear, it can be put to other uses. Turning a T-shirt into a grocery bag, a sweater into a pillow or other options that come to mind is a strategy that reinforces the circular economy. Remember, the key to the circular economy is to extend the life of the products either by performing the function for which they were created, or others that come to mind.

Finally, it should be noted that users are often not fully informed about the options they have for recycling their garments, which is why greater involvement by organizations, brands and governments can help to raise awareness of the importance of recycling.

CHAPTER 4

FEASABILITY MATRIX

In this chapter, I will list all the strategies that have been mentioned in chapter 3 and analyze the impact they can have on brand sustainability and the effort needed to implement them. From this analysis, we will see which are the strategies that any fast fashion brand should start with if it wants to implement the circular economy.

Strategy	Step in the Supply Chain
Define sustainability and circular economy strategy for the brand	Corporate
Potential Suppliers who are aligned with company's strategy Analysis	Low and First Tier Suppliers
Designing garments from a sustainable perspective - Eco-design	Corporate & Designers
Improve wages and working conditions for manufacturers	Manufacturing and Production
Bring production closer to the place where clothes are bought.	Manufacturing and Production
Waste reduction in production using KPIs and Metrics.	Manufacturing and Production
Suppliers as close as possible	Low and First Tier Suppliers and Transportation
Rely in local suppliers	Low and First Tier Suppliers and Transportation
Shipments and orders planification	Transportation
Reduce/Avoid "Empty Kilometers"	Transportation
Reorganize physical stores	Retail
Boost the e-commerce strategy	Retail

Sustainable packaging	Retail and Transportation
Grouping different orders into one shipment	Retail and Transportation
Prioritize normal shipping versus Express shipping	Retail and Transportation
Secondhand Sale	Customer Disposal
Donations	Customer Disposal
Recycling and Reuse	Customer Disposal

Figure 24 Own elaborated table. Staregyies summary.

These are the strategies that have been mentioned throughout this paper, we will now evaluate their impact and effort required and stipulate a priority order.

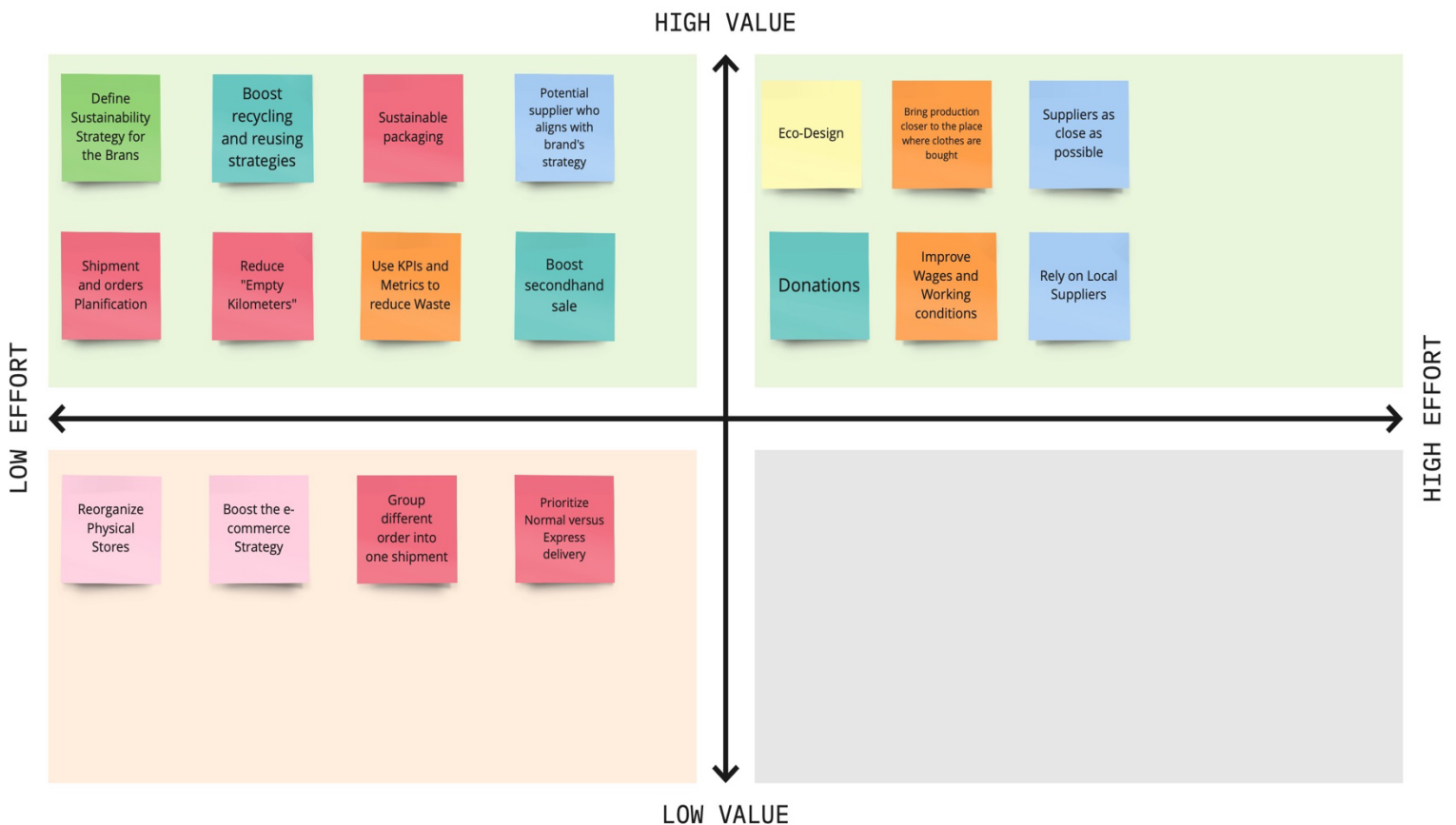


Figure 25 Feasibility Matrix

Each label corresponds to a previously mentioned strategy. As for the color of the label, green is for those related to corporate. Blue for those related to suppliers. The transport ones are red.

The orange ones are related to production. The two pink labels are strategies for commerce and the green/blue ones are for disposal.

After having developed the top traffic, we have to prioritize the strategies that are in the upper left quadrant. These are the ones that require the least effort and give us the most positive impact. After these strategies, there are those in the upper right quadrant. Finally, the strategies framed in the lower left quadrant.

CHAPTER 5

SUMMARY AND CONCLUSIONS

This is the final chapter of the paper, in which we will review and outline the main strategies that have been mentioned throughout the paper. We will also recapitulate the work and draw some conclusions.

Below is a figure representing the circular economy, with each of the steps of the supply chain indicated. Around it, the main strategies at each step, as discussed above, are mentioned.

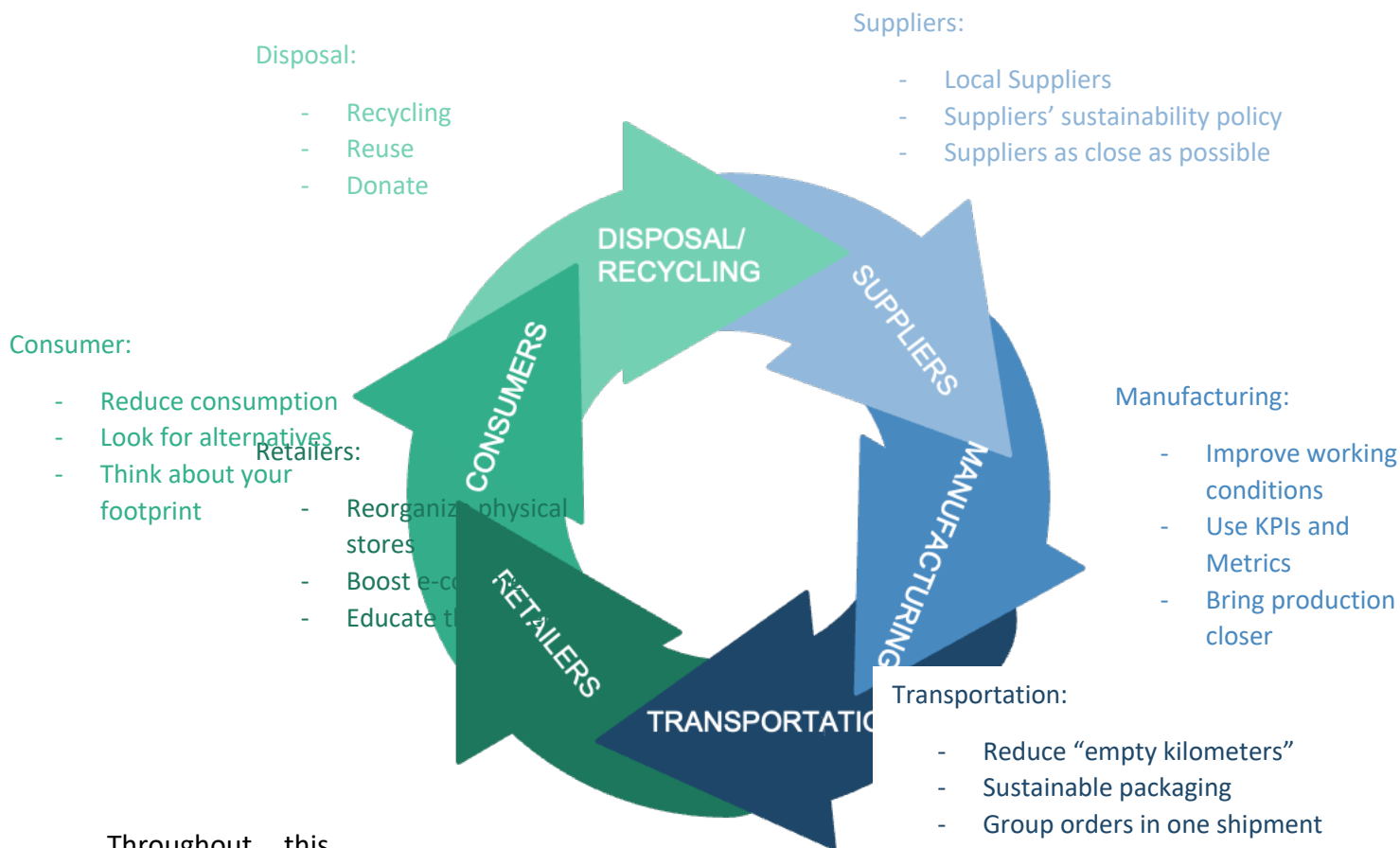


Figure 26 Circular Economy Figure

Throughout this paper we have tried

to understand the complex supply chain that reigns in the fast fashion industry.

We often believe that our individualities and personal acts cannot make enough of an impact on the world to be worth doing. However, we are wrong. Every gesture we make towards the environment has a direct impact on it and a very important indirect impact: we influence other people.

There is a long way to go until we reach a clean and totally sustainable fast fashion industry. Currently there are many objectives opposed to the circular economy that complicate the change. However, more and more people, institutions, brands and governments are fighting for a transition to a much greener industry.

Brands have the most leeway because of the impact they have on the world, but it is the buyers who are driving the industry to change. The industry generates what the buyer wants to buy, which is why, if users are inclined towards sustainable fashions and slow fashion, brands will also evolve in this direction.

I hope that this work can serve as a guide for all those who are interested in responsible consumption in the fashion industry and those who are interested in the functioning of the supply chains of this industry.

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