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# LEARNING UNITS

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# SUSTAINABLE FASHION

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Wear(e)able  
BEST DRESSED SUSTAINABLY

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# 1 SUSTAINABLE FASHION

## 1.1 Introduction

### The Topic

Did you know that 80 billion garments are consumed each year and that we wear garments only 7 times before getting rid of them? Welcome to nowadays **fashion industry**!

As you will recognise in this unit the fashion industry with its low prices and fast changing trends bears many **challenges**. You have probably already heard about labour exploitation and child labour in the clothing industry, but have you ever thought of the **environmental effects**? Ethical issues are on everyone's lips and are very crucial to consider. However, another major issue to keep in mind is the environmental aspect that is still not that present, though representing a major threat as well.



The fashion industry is one of the main **polluting industries** worldwide, contributing to **air and water pollution**, **landfill** and to **water shortage**. One major, rather “invisible” threat lurking in our clothes is **microplastic** which is hidden in the fibres. By buying **new clothes** at **low prices** everybody of us is contributing to this negative impact. Thus, a sustainable shift is required.

This learning unit gives you a basic understanding of the fashion industry and sustainable fashion: You will get an insight in **nowadays fashion industry** including important facts and figures and get a clue what **fast and slow fashion** mean. Furthermore, you will learn about the **environmental challenges** of the clothing industry, especially concerning the problem of **microplastic pollution**. And finally, you will have a closer look at the **sustainable fashion development**, its **importance**, but also **problems** coming along.

## 1.2 Nowadays fashion industry

The **fashion industry**, as we know it now, is a phenomenon of **modern age**. The 20<sup>th</sup> century marked the beginning of a new era in fashion with arising **new technologies** such as sewing machines and the **start of mass production**.

Today, fashion is a **huge, growing industry** and an important part of everyone's life. Fashion is not only something to wear, it became a way to **define oneself**, and also, a **tool of influence**. Did you know that consuming fashion has doubled between 2000 and 2010 whereas the wearing time of clothes has halved? Overall, it is estimated that worldwide 80 billion pieces of clothes are consumed each year. Sounds quite a lot doesn't it? Even when you think that you probably have not worn more than 30% of your whole wardrobe for at least a year. This ongoing trend can be ascribed to **falling prices** and a **rise and faster delivery** of fashion to the consumer. Moreover, clothing is increasingly becoming a single-use commodity.





Regarding those facts you may already presume that the fashion industry is coming along with **various problems**. The **complex structures** of fashion supply and production encompass the **whole globe**, whereby production is outsourced to the cheapest countries. The growing consumption in the industrial countries has **precarious consequences** for the **manufacturing countries** like China, Bangladesh, India, Cambodia, Pakistan, Vietnam, or Turkey. You have probably all heard about the labour exploitation scandals in these Far Eastern countries. Although the textile industry **creates jobs** in those countries, the **working conditions are fatal**, characterised by dangerous working conditions (health and safety risks), child labour, slave-like conditions including forced and trafficked labour and minimum wage. Accusations of child labour by well-known fashion chains appear repeatedly.

#### PRACTICAL RELEVANCE

Think about how you are consuming clothes – how often do you go shopping?

How long are you wearing your clothes?

Are there clothes in your wardrobe that you do not or only randomly wear?

Moreover, **animal cruelty** must be mentioned in regard to the fashion industry. Animals are abused or even bred to use their fur, feathers and/or their skin within the industry. Furthermore, their habitats are destroyed and polluted by major environmental impacts. This leads us to the last, and also one of the biggest problems to mention.

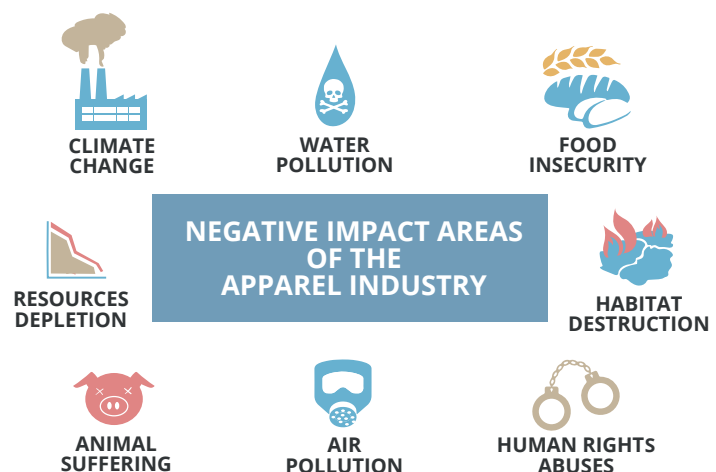
Have you ever thought about the **environmental impacts** of the industry? Besides the rise in CO2 emissions, it contributes to air and water pollution, to a tremendous increase in waste and to water scarcity. This does not only affect the animal habitats, but also the habitats of us humans. Thus, it is worth considering, what do you think?

#### EXAMPLE

The fatal working conditions in the textile industry are marked by the disaster that happened in Bangladesh in 2013, where more than 1.000 people died and even more got seriously injured in course of a collapse of an illegally constructed building including five textile factories. Unfortunately, not much has changed since.

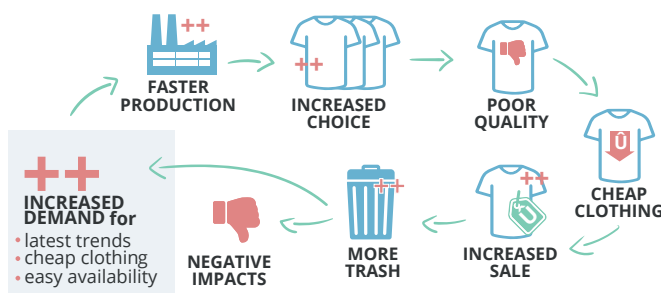
## 1.3 The Fast Fashion Boom

All the figures and facts mentioned can be ascribed to one phenomenon, which is called **fast fashion**. It can be traced back to the 1980s, marking the start of the **Industrial Revolution** with the introduction of technology and the initiation of the **Quick Response Strategy** that enabled a quick exchange of information regarding new trends.



How many clothing collections do fashion chains provide per year – what is your guess? While in former times clothing collections were season- based, including, two major collections for summer and winter clothes and two interseason collections for spring and autumn garments, nowadays collections are nearly changing on a daily basis with around **12-14 collections per year or even more** – what has been shown on the catwalks some days before is available in cheap version some days after in the retail stores. This is also driven by **increased demand** and **enhanced** and **changed** consumption by consumers. We want the latest fashion, easily available at an incredibly cheap price, isn't it true?

Shopping became an **entertainment** rather than a simple utility. **Cheaper, more and more often including boundless consumption** characterise nowadays fashion industry. But have you ever thought of all the consequences coming along? This trend is contributing to severe negative impacts. Summing up, fast fashion depicts a **vicious cycle**: consumers, especially young consumers, are constantly demanding and buying new fashion trends which requires production to be very quick further on leading to poor quality and an increased throw-away mentality as well as again leading to increased demand.



### DEFINITION

The term fast fashion describes readily available, inexpensively made fashion of today. (Source: Bick, R., Halsey, E. & Ekenga, C.C. (2018). The global environmental injustice of fast fashion. Environ Health 17, 92.

“Fast” refers to the fast changes of fashion within the stores keeping up-to-date with the latest trends and inexpensively can be traced back to the outsourced cheap production in low- and middle-income countries. Thus, the goal of the fashion industry is responding as quickly as possible to fast-changing consumer demands in the most cost-efficient way.

The definition of the Oxford dictionary refers to fast fashion even as “clothes that are made and sold cheaply, so that people can buy new clothes often”.

### EXAMPLE

You are invited to a summer party at a friend's house on the weekend. While walking home from work/school through the city, you see the perfect outfit for the party on the weekend in a shop window and it is even in sale. Does this sound familiar to you? Would you buy it though still having numerous suitable outfits already in your wardrobe?

### INDICATOR

To get a better insight into fast fashion have a look at the following video:

<https://www.youtube.com/watch?v=iq0--DfC2Xk&t=210s>.

And if you want to get an even better understanding of the fast fashion phenomenon and its widespread impacts, the movie “The True Cost” (2016) is highly suggested (<https://truecostmovie.com/>).

There is fortunately also a prevailing countertrend to fast fashion – **slow fashion**.

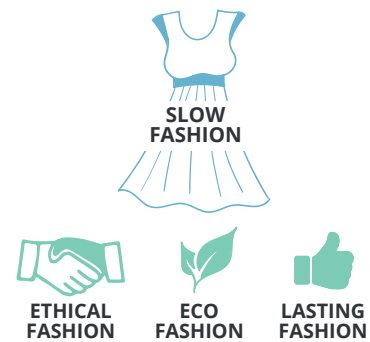
As counterpart to fast fashion, slow fashion supports **slowed-down and sustainable production and consumption patterns**. This includes the consumption of high-quality garments made from natural resources within fair working conditions in a sustainable production process as well as the extended use of clothes, by repairing, redesigning or buying second-hand clothes

### DEFINITION

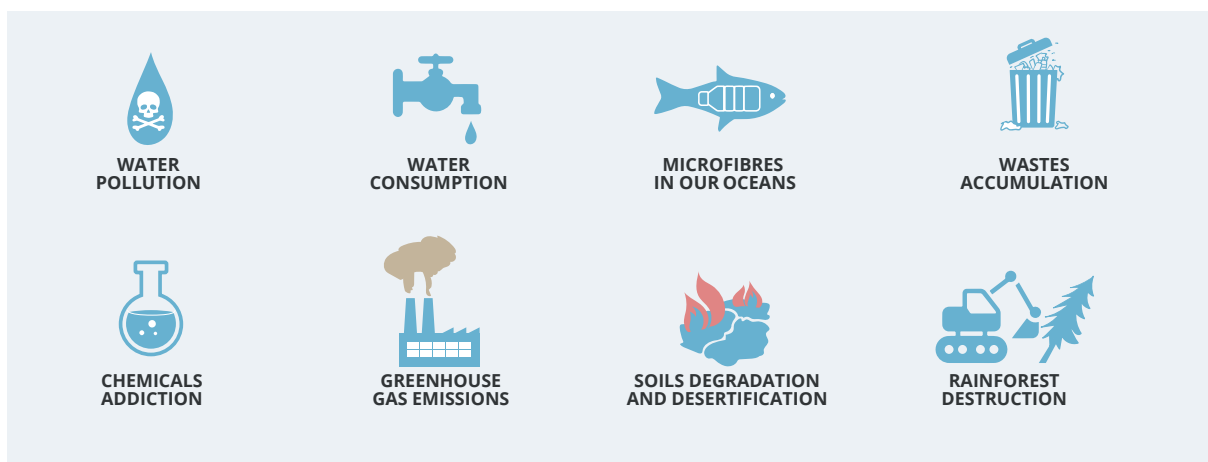
Slow fashion is a more sustainable and conscious approach fostering decelerated production, consumption and disposal to reduce the impacts of fast fashion and encourage better conditions for humans and the environment.

and clothes from small, regional manufacturers. Thus, slow fashion is placing a higher value on high-quality, durable garments and therefore counteracting throwaway society in clothing consumption. It is coming along with increased **respect, mindfulness and responsibility towards people and the environment**. Consumption patterns are slowly changing, but there is still a long way to go.

The following graphic depicts the concept of the slow fashion movement.



## 1.4 The environmental challenge



The industries drawbacks are versatile, also having a major **environmental impact** as you have already learned. The industry is **one of the major polluters** worldwide, sometimes even referred to as the second largest polluter worldwide. But how serious are the environmental impacts?

The fashion industry is responsible for the overall **rise in carbon emissions by 10%**, which is more than the emissions of all international flights and shipping together. Fashion industry as part of the textile industry is responsible for five percent of global emissions, attributable to the extraction of plastic fibres for which crude oil is used, further processing, and long transport routes of commodities and goods. Moreover, energy consumption especially for the spinning of fibres and the manufacturing process which mostly stems from coal power stations, within the production, is immense.

### INDICATOR

According to a study of the British Ellen-MacArthur-foundation, by 2050 the textile industry could be responsible for a quarter of the climate-damaging CO<sub>2</sub> emissions

Did you know that transport in the industry is a major aspect contributing to emissions? As an example: for the production of cotton clothes, cotton has to be harvested, washed, spun, weaved, coloured, cut and sewed into the final product → every single step is happening in a different country.

Next to **air pollution, water pollution and water scarcity** are major topics. Cotton, as one of the most popular raw materials in clothing consumes huge amounts of water and also the process of washing and dyeing fabrics is very water intense. Around 93 billion cubic metres of water are used within the fashion industry per year. Furthermore, water pollution is immense caused by the use of toxic chemicals in cultivation as well as in production (washing and dyeing of the fabrics). The used chemicals find their way into sewage and further into rivers and the sea. The released substances are poisoning the soil, lead to a decline in insects and are harmful for people's health. 20% of industrial water pollution can be ascribed to the global garment industry.



**INDICATOR**

In order to imagine what this really means, some indicators follow:

- High water consumption in the local textile industry is responsible for the drying up of the Aral Sea in Central Asia.

- For the cultivation of cotton pesticides are very often used, comprising around 6% of the world's pesticides (and 16% of insecticides).
- Only in China 320 million people do not have access to clean drinking water and over 60% of drinking water reserves are tremendously polluted.

**EXAMPLE**

Jeans and T-Shirts are made from the water-intensive plant cotton.

Approx. 2.649 litres water are used for the production of one cotton T-Shirt, which would be enough water for one person drinking at eight cups per day over 3,5 years. And approx. 7.570 litres of water are used for the production of one pair of jeans, which would be enough for one person drinking eight cups of water per day over 10 years.

Do you like to be up-to-date regarding the latest fashion trends? Then you belong to the majority of society who is contributing to the fast fashion trend causing an **enormous increase in waste**. Clothes are often just thrown away as soon as they are "outdated" though still without any lacks. 85% of textiles end up in landfill every year. In 2016, a Greenpeace study revealed the textile waste per year in 15 European countries, ranking Italy and Austria third. Did you think that you are producing that much waste only with your garments?

Country	Yearly Total Textile waste (tonnes)	Yearly textile waste per person (kg)
Austria	62.446 tonnes	7 kg
Italy	465.925 tonnes	7,7 kg
Poland	103.683 tonnes	2,7 kg

Source: <https://labfresh.eu/pages/fashion-waste-index?locale=en>

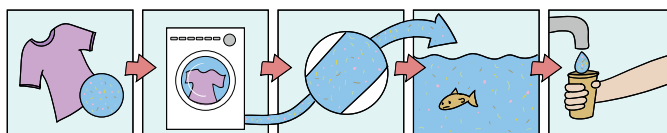
Have you ever thought about what your clothes are made of? Would you ever have guessed that plastic is a component of our clothes? Plastic is omnipresent in our lives and it is even a component of our clothes, contributing to water pollution.

**Synthetic fibres** are increasingly used in garment production. You have probably all heard about **polyester**. It is one of the most commonly used materials, constituting 60% of our clothing, and tending to rise. Additionally, other fibres produced on the basis of crude oil are increasing. While **natural fibres** are **decomposable**, **synthetic fibres** are **releasing tiny microplastic particles** during washing that cannot be filtered. Those microplastic particles are released into the sewage and further on into our waters (rivers, lakes, oceans) and fields and finally return into the food chain of animals and humans again. Microplastics in the water act like sponges, absorbing other toxins, which are then absorbed by wildlife entering and accumulating in the food chain. Generally, today most textiles are composed of a mix of different fibres, which makes recycling quite difficult.

It is estimated that each wash cycle releases 3.000 fibres that are poorly or not at all degradable. According to the International Union for Conservation of Nature (IUCN) around 35% of microplastic pollution in the oceans stems from washing clothes. 500.000 tons of microfibers are released into the ocean by washing clothes within a year. Thus, clothing is a major contributor to environmental plastic pollution.

**DEFINITION**

Microplastics are very tiny pieces of plastic that are smaller than 5mm and are composed of a mixture of polymers (the primary components of plastics) and functional additives.

**INDICATOR**

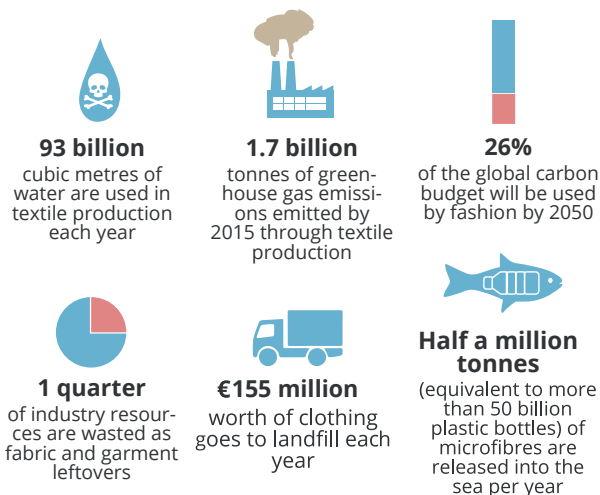
For a better understanding of microplastic pollution, watch the following video: <https://www.greenpeace.org/international/story/6956/what-are-microfibers-and-why-are-our-clothes-polluting-the-oceans/>



**EXAMPLE**

Researchers at the University of California found out that a synthetic fleece jacket unleashes 1.7 grams of microfibres per wash.

The **environmental impacts** of the fashion industry are **disastrous** and **widespread** and even **further increasing** with growing world population. Further participation in fast fashion consumption is supporting one of the most polluting industries worldwide, contributing to **climate change** and the **destruction of our planet**. The fashion industry and its often invisible serious impacts, like micro-plastic pollution, can therefore no longer be ignored; a **holistic** sustainable approach is required.



## 1.5 Sustainable Fashion

You already learned that there is a countertrend to fast-fashion – slow fashion – promoting a more sustainable approach in the garment industry. But have you ever heard about the term sustainable fashion? And do you have a clue what the term really means? Do you think something like 100% sustainable exists in the fashion industry? Let's check this out now.

**Sustainability** is on everyone's lips and became a **buzzword** (a fashionable word) today. The term **Sustainable fashion** is increasingly popping up and is highly **debated** in the media, in the news and at events. If you think of sustainable fashion many different terms are in circulation like slow fashion, eco fashion, green fashion, ethical fashion. Comparing different views, there seems to be no clear understanding of sustainable fashion and no clear detachment to the other terms mentioned. Thus, there is **no coherent definition** of sustainable fashion which comes along with the threat of misuse of the term. There are many different approaches to define sustainable fashion, one attempt is made with the following definition.

**DEFINITION**

„More sustainable fashion can be defined as clothing, shoes and accessories that are manufactured, marketed and used in the most sustainable manner possible, taking into account both environmental and socio-economic aspects.“ (Green Strategy <https://www.greenstrategy.se/sustainable-fashion/what-is-sustainable-fashion/>)

Therefore, sustainable fashion refers to clothing that is on the one hand produced under **environmental-friendly conditions** and on the other hand takes **social and economic factors** into account, fulfilling standards in all aspects. Throughout the whole garment lifecycle the undesirable effects on both levels should be minimised.



The lifecycle describes the way of clothes from the raw material to disposal and will be further elaborated in Unit 3 “The Life-cycle of Textiles”. Adverse effects are intended to be reduced through:

- an efficient use of resources
- using renewable energy
- avoiding toxic chemicals
- producing long-lasting, high-quality material
- reducing transportation
- supporting reuse and recycling
- improving working conditions
- ensuring occupational safety
- avoiding child and enforced labour
- ensuring fair wages
- organic farming
- improved livestock management and more.

Moreover, it is about **promoting a more sustainable consumption** and **usage** approach to foster a **changed attitude** towards fashion.

Although, more and more companies in the garment industry are starting to improve in every manufacturing stage and governments around the world are pushing this development, it seems obvious that **100% sustainable does not exist**, all clothes have at least some impact on the environment. Furthermore, it must be considered that **YOU**, as the consumer, are a **major driver** of how the industry is developing. Reducing negative impacts is coming along with investments and higher costs for companies that result in higher prices for the consumers which may result in consumers buying less and thus minimising the profits in the fashion industry. A general shift to sustainable fashion requires first and foremost the acceptance of consumers, who both accept higher prices and have a more positive attitude toward recycled clothing. Conversely, consumers also receive better quality garments.

Due to the fact that the term sustainable fashion is still quite vague, consumers are struggling to fully grasp the concept and also to recognise sustainable fashion, although they are increasingly becoming aware of the need for more sustainable consumption patterns in the fashion industry. Companies are recognising this and using the chance for themselves. What do you think which companies in the fashion industry are acting sustainable? Have you heard of sustainability approaches of fashion companies?

As you may have already recognised, a lot of fashion stores are advertising their sustainable product lines and practices. You are for sure able to mention and describe some of them. While some of them are really making efforts to be more sustainable, others are just taking advantage of the new hype, pretending to be sustainable. To promote this false and misleading information is called **greenwashing**.



#### DEFINITION

According to the Oxford Dictionary, Greenwashing is “disinformation disseminated by an organization so as to present an environmentally responsible public image.”

Therefore, you as consumer need to be **informed, attentive and critical** about what you buy and whether it is really sustainable. Additionally, advances in **legislation** and in the **companies** themselves are still required. The imparted knowledge in the present and the following units will guide you to become a well-informed consumer that is able to make sustainable decisions.

## 1.6 Summary

The **fashion industry** as we know it today has its beginning in the 20th century. It is a **huge growing industry** marked by **falling prices** and a rise and **faster delivery of garments**. However, it is associated with **multiple problems** like labour exploitation, child labour, animal cruelty and severe environmental impacts.



The industry is characterised by **fast fashion** depicting **fast changing, readily available inexpensive fashion** coming along with an increased and changed demand by consumers. Fashion chains are producing without a break providing around 14 collections and even more every year sticking to the latest trends on the catwalk and consumption is boundless.

The countermovement to fast fashion is **slow fashion** encouraging increasingly decelerated, sustainable and conscious production and consumption.

The fashion industry has a major **environmental impact**, often being considered the **second largest polluter worldwide**. It is responsible for a considerable rise in CO2 emissions, air and water pollution, water scarcity, a significant increase in waste and substantial microplastic pollution. Every wash cycle releases **microplastic particles** that pollute our waters, absorb other toxins, and return into our food chain. Those impacts are further increasing by fashion consumption contributing to climate change and the destruction of our planet.

**Sustainable fashion**, though not clearly defined, is approaching more **sustainable fashion** taking **environmental** and **socio-economic factors** on the supplier side into account, diminishing negative impacts and promoting sustainable consumption patterns. The consumer is a major driving force of this development. However, the term is still quite vague, and recognition is difficult for consumers. There are many different quality seals and production standards which makes assessment quite difficult for consumers. A further elaboration is found in Learning Unit 2. This fact enables companies to **greenwash their fashion, deluding consumers**. Therefore, well-informed, critical consumers are important for a positive development. However, progress in sustainable fashion development from both the legislative and company sides is also urgently needed.

## 1.7 Resources

<https://comovita.eu/blogs/sustainable-fashion-blog/ethical-issues-fashion-industry>  
<https://echa.europa.eu/de/hot-topics/microplastics>  
<https://edition.cnn.com/style/article/the-problem-with-sustainable-fashion/index.html>  
<https://ehjournal.biomedcentral.com/articles/10.1186/s12940-018-0433-7>  
<https://labfresh.eu/pages/fashion-waste-index?locale=en>  
<https://medium.com/@solenerauturier/sustainable-ethical-fashion-glossary-cef252976abb>  
<https://nachhaltige-kleidung.de/news/fast-fashion-definition-ursachen-statistiken-folgen-und-loesungsansatze/>  
<https://nachhaltige-kleidung.de/news/fast-fashion-definition-ursachen-statistiken-folgen-und-loesungsansatze/>  
<https://truecostmovie.com/learn-more/environmental-impact/#:~:text=The%20world%20now%20consumes%20about,of%20textile%20waste%20each%20year.>  
<https://utopia.de/ratgeber/slow-fashion-ein-konzept-fuer-bessere-mode/>  
<https://www.britannica.com/art/fashion-industry>  
[https://www.bund.net/fileadmin/user\\_upload\\_bund/publikationen/meere/meere\\_mikroplastik\\_aus\\_textilien\\_faltblatt.pdf](https://www.bund.net/fileadmin/user_upload_bund/publikationen/meere/meere_mikroplastik_aus_textilien_faltblatt.pdf)  
[https://www.cleanclothes.at/media/filer\\_public/cc/6d/cc6d10b5-e2c9-4115-b001-c06b59aa974c/factsheet\\_b\\_fast\\_fashion\\_2019-10.pdf](https://www.cleanclothes.at/media/filer_public/cc/6d/cc6d10b5-e2c9-4115-b001-c06b59aa974c/factsheet_b_fast_fashion_2019-10.pdf)  
<https://www.codecheck.info/news/Diese-Fasern-in-Deiner-Kleidung-sind-aus-Plastik-262205>  
<https://www.diepresse.com/5639396/osterreicher-haben-72-millionen-ungetragene-kleider-im-kasten>  
<https://www.ekoenergy.org/de/how-polluting-is-the-fashion-industry/>  
[https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/633143/EPRS\\_BRI\(2019\)633143\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/633143/EPRS_BRI(2019)633143_EN.pdf)  
[https://www.focus.de/perspektiven/nachhaltigkeit/nachhaltiger-leben/nachhaltigkeit-mode-wahnsinn-zerstoert-umwelt-wie-wir-das-aendern\\_id\\_10964545.html#:~:text=Die%20Schattenseiten%20der%20Modeindustrie,internationale%20Fl%C3%BCge%20und%20Kreuzfahrten%20zusammen.](https://www.focus.de/perspektiven/nachhaltigkeit/nachhaltiger-leben/nachhaltigkeit-mode-wahnsinn-zerstoert-umwelt-wie-wir-das-aendern_id_10964545.html#:~:text=Die%20Schattenseiten%20der%20Modeindustrie,internationale%20Fl%C3%BCge%20und%20Kreuzfahrten%20zusammen.)  
<https://www.goodhousekeeping.com/clothing/g27154605/sustainable-fashion-clothing/>  
<https://www.krugstore.com/pages/the-effect-of-fast-fashion>  
<https://www.pan-uk.org/cotton/>  
<https://www.publiceye.ch/de/themen/mode/gesundheit-sicherheit-arbeitsplatz/bangladesch/rana-plaza>  
<https://www.smarticular.net/kunstfasern-synthetik-kleidung-ohne-mikroplastik-materialkunde/>  
<https://www.thegoodtrade.com/features/what-is-slow-fashion>  
<https://www.theguardian.com/environment/2016/jun/20/microfibers-plastic-pollution-oceans-patagonia-synthetic-clothes-microbeads>  
<https://www.theguardian.com/environment/2016/jun/20/microfibers-plastic-pollution-oceans-patagonia-synthetic-clothes-microbeads>  
[https://www.verbraucherforschung.nrw/sites/default/files/2019-02/kvfw10\\_Fast%20Fashion.pdf](https://www.verbraucherforschung.nrw/sites/default/files/2019-02/kvfw10_Fast%20Fashion.pdf)  
<https://www.weforum.org/agenda/2020/01/fashion-industry-carbon-unsustainable-environment-pollution/>



# BASIC TEXTILE SCIENCE

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Wear(e)able  
BEST DRESSED SUSTAINABLY

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## 2 BASIC TEXTILE SCIENCE

### 2.1 Introduction

#### The Topic

How do you choose your clothes? What are your choice criteria? Probably you are first considering the appearance (colour and style), the brand and the price. But have you ever had a closer look at the materials used and have you thought about how they are produced?

There is even plastic in our garments – it is still unbelievable isn't it? But how exactly is plastic incorporated in our clothes? Let's take an excursion into **textile science**!



As you will recognise in this unit, the hazard of plastics lurks everywhere, confronting us daily by wearing our clothes. You will get an insight in the **different fibres and materials** used in **clothing** and details about **production** as well as **potential threats, advantages** and **disadvantages**. We are not aware of the consequences of producing the different materials. Moreover, you will receive information on which material is the **most environmentally friendly** - to be aware on your next shopping trip.

Not every material that seems environmentally friendly at the first sight fulfils this presumption. **Recognising sustainable, plastic-free, fashion** sounds easier than it really is. However, you will receive the essential knowledge to be able to do so.

The following learning unit gives you an insight into **basic textile science**: You will get an overview of **different fibres and materials** used in the garment industry. You will learn about **details in production** and **advantages and disadvantages** coming along with the different fibres. Finally, you will receive the knowledge how to **recognise sustainable, plastic-free fashion** and which **quality seals** exist in this regard.

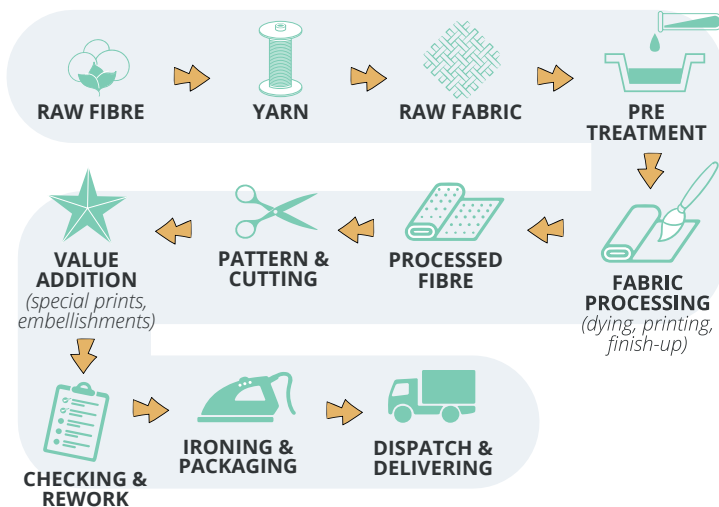
### 2.2 Materials in Clothing

Let's start right at the beginning – Have you ever had a look at the tags on your clothes that give information on the material your clothes consist of? The chance is small that anybody of us exactly knows what he/she is wearing. When you go shopping for clothes and have a look at these tags mentioning the different materials included you will probably find names like artificial leather, elastane, viscose, polyester, cotton, nylon and more. But what is really behind these different terms?

The way to the final garments we buy in the shops is a long one. Everything starts with planting and harvesting or producing the **raw material**. The raw material can either be of **plant** or **animal basis** or **synthetic**. The most common raw materials used are:

- synthetic polymers
- cotton
- wool
- cellulosic fibres
- leather
- silk
- bast fibres

The **raw fibres** are further on processed into **yarns** and **threads** by **spinning**. Through **weaving** the yarn is being further manufactured into the **final fabric**. Further on, a **pre-treatment** follows before the fabric is dyed, printed and finished up. Finally, the fabric can be **processed into the final garment** that we are buying, either a sweater, a shirt, jeans, shoes or something else. The clothes are then transported to the **retailers** where we are able to buy it.



There are three major types of fibres included in our garments:

- natural fibres
- synthetic fibres
- fibre blends/mixed fibres

**Natural fibres**, on the one hand, are **renewable** and consist of **natural materials** of **plant** or **animal** origin. Man-made, **synthetic** fibres, on the other hand, are a type of **plastic** derived from **chemical compounds** (hydrocarbons) found in natural gas, coal or oil, in **chemical processes**. Synthetic fibres evolved as a **cheaper alternative** in mass production tackling the increasing consumer demand in fast fashion. They are **not renewable** and therefore limited. Both natural as well as synthetic fibres are coming along with **advantages and disadvantages** and have their specific value within the fashion industry. Additionally, there are also **fibre blends and mixed fibres** that are commonly composed of a **combination of natural and synthetic fibres**. Fibre

#### INDICATOR

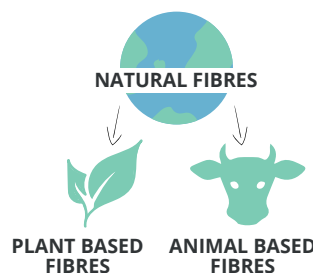
According to the “Preferred Fibres and Materials Market Report 2020” global fibre production has doubled within the last 20 years, reaching 111 million metric tons of produced fibres in 2019 and a prediction of 146 million metric tons by 2030.

blends and mixed fibres are used to **increase the quality** of garments in terms of function, care, look or simply to make it cheaper.

Let's take a closer look at the main fibre types.

## 2.3 Natural Fibres

Natural fibres are directly **provided by nature**, planted or raised for fibre use, readily usable. The fibres are ready for further treatment within the production process. A main distinction is being made between **animal- and plant-based fibres**. You can already assume the difference, right?



#### REMEMBER

As already mentioned, natural fibres are derived from natural sources like plants or animals and do not necessitate treatment for further usage.

**Plant-based fibres**, as the name already implies, are derived from **different parts of plants**. Those are also referred to as **cellulose-based fibres** and include:

- seed fibres, e.g. cotton fibre
- fruit fibres, e.g. coconut fibre
- stalk fibres, e.g. bamboo fibres
- bast fibres, e.g. jute, hemp, stinging nettles or flax fibres
- leaf fibres, e.g. banana leaf fibre





- animal hair (wool, mohair) – e.g. sheep wool, hair of Angora goat
- silk – produced by silkworms
- avian fibre – e.g. feathers, downs

### EXAMPLE

Have a look at the clothes in your wardrobe –  
Do you have purely natural fibre clothes in there?



**Animal-based fibres**, also called **protein-based fibres**, include proteins such as collagen, keratin or fibroin and are obtained from **different parts of animals**. Those comprise:

Let us have a look at the most used and known natural fibres:

**COTTON** (plant-based fibre) is probably the world's **most popular** and one of the **most used** fibres in garment production. It is very soft and breathable and often used for T-Shirts and underwear. Unfortunately, most cotton is **conventional** and **not organic** which means that it is treated with lots of **chemicals and pesticides** and is not as natural as you would believe it is.

**LINEN** (plant-based fibre) is produced out of flax and stronger than cotton, also coming along with longer durability. It is also very breathable and absorbent, but easily wrinkling. Today's linen, mostly produced in China, is **often chemicalised** a lot to make it cheaper, thereby still using less chemicals than in cotton production. Cheaply produced linen garments are also coming along with inferior quality than in former times.

Other well-known plant-based natural fibres include jute, coir, hemp, sisal, ramie or abaca.

**WOOL** (animal-based fibre) is one of the **earliest fibres used** and considered the most **important animal fibre** in garment production. Wool is obtained from the fur of sheep or lambs. The protein-fibres ensure high moisture regain, good absorbency also of unpleasant smells and temperature regulation. It is hardly flammable, very elastic, water and dirt repellent and quite resilient. Despite the ecological sustainability, wool production is partially coming along with **animal abuse**.

Next to wool, fine wool fibres like camel hair and cashmere are manufactured out of animal hair.

**DOWN** (animal-based fibre) – you have most probably down clothing in your wardrobe, but have you ever wondered how downs are produced or where those actually come from? Down is derived from the plumage of geese and ducks. The material is **very popular** in the clothing industry as it is very isolating, breathable, and light weight with low volume, being the ideal option for winter clothes. Unfortunately though, **animal suffering** is a major issue as well.

**SILK** (animal-based fibre) is one of the **oldest known fibres** in the world with its origin of production in China. It is characterised as **the strongest natural fibre**, being very soft, elastic and absorbent as well. Due to its shiny and elegant nature it is popular in high-end fashion. Silk is produced from the cocoon of particular insect larvae, the most well-known and most used is the cocoon of the silkworm of the species *Bombyx mori*.

Further major animal-based fibres are leather, alpaca, angora, mohair, camel, yak or cashmere.

Although you may assume now that natural fibres are always the best option to choose, there are advantages and disadvantages coming along and these also do not apply to all fibres in the same extent. Do you have a clue what may be the advantages and disadvantages?



On the one hand natural fibres are:

- more environmentally friendly. The environmental impact is smaller, due to the renewability of the resource and overall less chemicals and energy use in the production process.
- biodegradable and can be fully recycled (most of them).
- very durable, especially the plant-based fibres due to the cellulose structure.
- great absorbents.
- blocking UV-radiation.
- breathable; wool has the capability to trap air between the micro-holes of the fabrics generating coolness in summer and warmth in winter.



#### INDICATOR

Wool is considered the most fire-resistant natural fibre.

On the other hand:

- natural fibres are generally **more expensive**, and the **price fluctuates** depending on harvest results and politics.
- **price and quality** strongly **vary** due to (un)predictable circumstances (e.g. weather, seasons)
- not all natural fibres are sustainable in all aspects, negative impacts that occur are **high water consumption** and **use of pesticides** and **chemicals** in cultivation and processing, **increased land use**, **overgrazing** and **animal abuse**



## 2.4 Man-made Fibres

The differentiation in man-made fibres is not consistent and categorisation varies. A differentiation is made between **fibres from polymers** and **inorganic fibres**. We are only taking a look at **fibres from polymers** where a main distinction is made between:

- **fibres derived from natural polymers** and
- **fibres derived from synthetic polymers (pure synthetic fibres)**

#### INDICATOR

Polymers are materials made of long, repeating chains of molecules.

**INTERESTING:** Natural fibres also consist of polymers and some man-made fibres are obtained from naturally occurring polymers. Thus, man-made fibres can be very similar to natural fibres in their structures. For example two of the first ever produced man-made fibres (rayon and acetate) are composed of the same cellulose polymers that make up flax, hemp cotton and the structural fibre of woods.

(<https://www.britannica.com/technology/man-made-fiber>;  
<https://www.livescience.com/60682-polymers.html>)

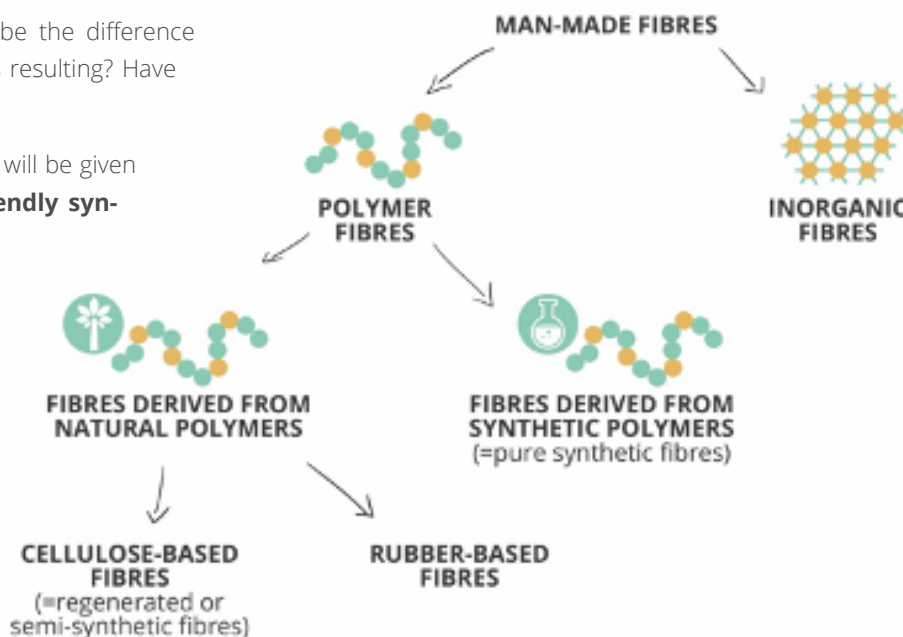
#### REMEMBER

Man-made fibres, as the name already implies are man-made, manufactured in course of chemical processes. When talking about man-made fibres, one mostly refers to pure synthetic fibres which are basically plastic.



What do you think could be the difference and what are the materials resulting? Have a guess.

Additionally, a short insight will be given into **environmentally friendly synthetic fibre options**.



Let's first have a look at **cellulose- and rubber-based fibres (=fibres from natural polymers)**.

Does the term cellulose-based fibre sound familiar to you? You just learned about cellulose-based fibres among natural fibres. **Regenerated (cellulose-based) fibres**, also referred to as **semi-synthetic fibres**, are of **natural origin** and were the **first man-made fibres** developed. Most semi-synthetic fibres are cellulose-based. The fibres are obtained from natural raw material, mainly **plants and wood**. Mostly, cellulose from wood is used to produce the fibres in the course of **complex and energy-intensive chemical processes**. The obtained thick cellulose mass is pressed through fine nozzles to receive the final fibre that sets either on the air or in sulfuric acid. Depending on the regenerated cellulose fibre established the production procedure varies to some extent.

#### DEFINITION

Cellulose is the main component of plant cell walls.

**VISCOSE** is the **most well-known synthetic fibre of natural origin** and is quite **similar to cotton**. It is also known as artificial silk (rayon) in the fashion industry. It has good absorption properties and is quite carefree.

Further regenerated fibres include Cellulose-Acetate/Cellulose-Triacetate, TENCEL®, Modal® or bamboo fibre.

Although semi-synthetic fibres manifest similar properties as synthetic fibres, they are **biodegradable**.

**Rubber-based fibres** are derived from the rubber tree and chemically produced. These are for example used for the production of shoes by eco-manufacturers.

Next, we are going to have a look at **pure synthetic fibres (synthetic polymers)**.

**Pure synthetic fibres** are established in course of various **energy-intensive chemical processes** using **non-renewable resources** such as coal, crude oil or natural gas. Through chemical processes the derived individual components (monomers) build molecular chains (polymers). Next, the resulting mass is dissolved or melted into a viscous fluidity that is further extracted via a spinneret into a fibre and solidifies.

#### DEFINITION

A monomer is a mixture of molecules that in combination with other molecules forms a polymer.

During the last years, synthetic fibres gained **increased popularity**. They accompany us throughout our daily lives, and it is probably no longer possible to imagine modern life without them. They are not only present in the garment industry, but also around furniture at home. Check it out at home – I'm sure you will find a lot of synthetic material all around, if it's furniture upholstery, covers, blankets, carpets and of course the clothes in your wardrobe.



Are you able to name some synthetic fibres? Let's check it out.

Although you will find many different terms on the garment labels, there are **seven main groups of pure synthetic fibres**. A quick overview follows:

Fibre group	Terms
polyester	Trevira, Dacron, Diolen, Terital, Polartec, Polarguard, Thermolite
polyamide	nylon, Perlon, Antron, Enkalon, Nylstar Nylgold, Tactel, Grilon, Dederon
polyacrylic (polyacryl nitrile)	Crylor, Dolan, Dralon, Leacril, Orlon
polyurethane	elastane, spandex, Lycra, Dorlastan
PVC (polyvinyl chlorid)	Rhovyl, Thermovyl
polypropylene	Berclon
microfibres	

Sources: <https://www.umweltberatung.at/download/?id=Textilienbroschuere-1106--umweltberatung.pdf>,  
<https://www.smarticular.net/kunstfasern-synthetik-kleidung-ohne-mikroplastik-materialkunde/>

**POLYESTER** is probably the **most popular and most commonly used synthetic fibre**, being a component in **60% of all clothes**. It is stain- and water-resistant, fast-drying, breathable, durable and tearproof, light- and weather-resistant as well as very carefree. Thus, it is multifaceted and produced and used in various different forms.

**POLYURETHANE** which you probably know as **elastane** or spandex is, as the name already implies, particularly elastic and shape-retaining and therefore specifically used as stretch material.

**POLYACRYLIC** is similar to wool and is used in diverse garments like pullovers, faux furs or also in socks.

### INDICATOR

The most well-known polyester type used for clothing is **polyethylene terephthalate (PET)**. Does PET sound familiar to you?

We know it from so-called PET or plastic bottles. Thus, as we all know that plastic bottles are omnipresent in our everyday life, we can assume that more polyester is used for the plastic bottles than for garments, right? You probably already apprehend that this is not the case. In fact, more polyester is used in clothing (60%) than for plastic bottles (around 30%)





**POLYAMIDE** that you know as **nylon** is very elastic and resilient and is mostly used for stockings and tights in clothing.

#### INDICATOR

In 1931 nylon was invented as the first synthetic fibre.

**PVC (polyvinyl chlorid)** what you mostly hear in connection to flooring is also used in the clothing industry. It hardly absorbs any water and is thus used for rainwear or artificial leather for shoes and boots.

**Polypropylene** is the lightest available synthetic fibre. It is, as all synthetic fibres, relatively durable, skin-friendly and therefore mostly used for outdoor and sportswear.

**MICRORFIBRE** is often used for cleaning products, but also for diverse types of clothing. It is very soft and also stain-resistant and wicking moisture away keeping the body dry and cool. Hence, microfibre is used for sportswear, swimwear, undergarments, bathrobes, jackets and can be further manufactured into **Ultrasuede**, synthetic imitation suede leather.

Although, synthetic fibres are generally the “bad guys” among fibres, there are again advantages and disadvantages that cannot be generalised for all synthetic fibres:

On the one hand synthetic fibres are:

but on the other hand, synthetic fibres:

• cheaper.



• are responsible for **microplastic pollution**.

• are except of functional clothing **not breathable**. Thus, unpleasant smell can occur easily as sweat is not absorbed and heat accumulates.

• are **heat-sensitive** and melt easily and are also more easily flammable.

• are coming along with **high** electrostatic charge.

• are **not skin-friendly**.

• are coming along with a **waste of natural resources**, such as crude oil.

• are **not sustainable** and **damaging the environment** as they are very energy-intensive in production and contribute to environmental pollution especially in course of plastic contamination. Furthermore, they do not decay and are hardly recyclable.

• are **water- and chemical-intensive in production**.



In regard to bioplastics, a main differentiation is made on the

basis of the renewability and the biological degradability of the raw material:

Due to the major concern of plastic pollution in the oceans, **biologically based and degradable commodities** are of major interest. These renewable resources are mostly derived from **agriculture** such as starch and sugar from wheat, potatoes or corn. This are two examples:

- bioplastics out of renewable raw material that is either biological degradable or not
- bioplastic out of non-renewable raw material that is biological degradable

#### INDICATOR

There are already attempts for more environmentally friendly synthetic fibre options with so-called bioplastics.

However, this development is still in its infancy in the clothing industry.



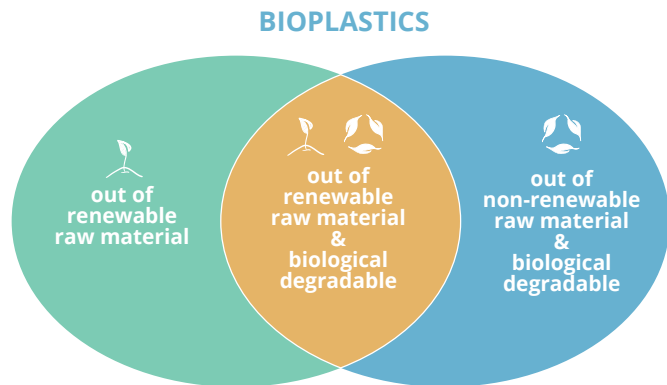


## 2.5 Fibre Blends/Mixed Fibres

Did you already have a look at the labels on the clothes in your wardrobe? Did you recognise something?

To get back to what you have just learned: Natural

- **Thermoplastic starch (TPS)** that is generated out of starch, e.g. from wheat, potatoes and corn
- **Polylactic** resulting from the fermentation of sugar or starch to lactic acid, e.g. from corn



as well as synthetic fibres are coming along with various advantages and disadvantages concerning their attributes, but also regarding the different stages within their lifecycle. Additionally, there seems to be no solution for absolute sustainability in garment production. However, to **balance advantages and disadvantages** in terms of quality, appearance, handling, sustainability and also profitability to some extent, **fibres are mixed or blended** together. You probably already ascertained this after having a look at the labels on your clothes.

A difference is being made between **fibre blends and mixed fibres**.

There are many different options for fibre blends, allowing **different blends** between natural, semi-synthetic and synthetic fibres. The most popular blends are polyester, cotton, viscose blends with the most popular being **cotton/polyester**: Other blends include:

- |                  |   |
|------------------|---|
| • nylon/wool     | • wool/cotton                                   |
| • nylon/acetate  | • linen/cotton                                  |
| • silk/polyester | • cotton/polyester/rayon/spandex and many more. |

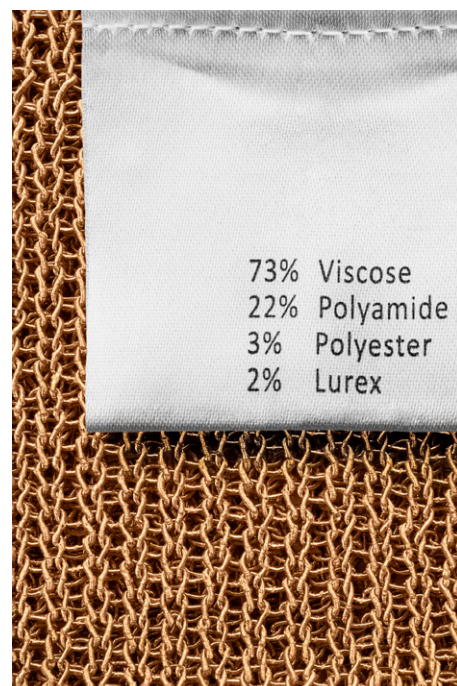
There is continuous trial for always new and better blends. Be aware of it on your next shopping trip.

But what do you think is the main problem with fibre blends and mixed fibres? Although it may seem the best option as the overall advantages outweigh, there are also **drawbacks**. First of all, the **quality is extremely reduced** and there is also a major problem with **recycling**.

This leads us now to the next question: what is really sustainable in the fashion industry and how can we recognise it?

## 2.6 Recognition of Sustainable Fashion

As you already recognised and learned **100% sustainable and environmentally friendly** fashion **does not exist**. There are many components to consider within the lifecycle of textiles (see Unit 3) to consider garments sustainable. This starts with the raw material and involves growing and harvesting, manufacturing, delivery, use and recycling – including all stages along the lifecycle of textiles.



### DEFINITION

Fibre blends on the one hand, are more common and merge two or more fibre essences in one single fibre or yarn. Mixed fibres, on the other hand, combine two or more different yarns in clothing production.



Moreover, it is not fully clear what sustainable fashion means and many companies use the sustainability hype for greenwashing. Therefore, one cannot always trust what is promoted or promised by companies or brands. Brands, no matter if cheap or expensive, often have **untransparent production details and supply chains**. This already implies the **difficulty in recognising sustainable fashion** without extensive prior research.

Same as with the final clothing, there is also not THE ONE **base material** that is the most sustainable option. For example, it is not even clear that natural fibres are always the better option.

Thus, it can be concluded that a **sum of various factors** has to be contemplated to consider clothing as **sustainable**. However, there are factors that should be taken into account for your next shopping trip to act as sustainable as possible:

#### EXAMPLE

Buying a T-Shirt made of bio-cotton and throwing it away after wearing it twice may be worse than wearing a polyester T-Shirt for 10 years.

It can be recommended to take the base material into account:

- **Synthetic fibres** should be **avoided** as those are releasing plastics into our water and contribute largely to plastic pollution. Moreover, it is more difficult to recycle synthetic fibres due to their plastic nature.
- In regard to **natural fibres**, it is recommended to choose **organically produced fibres** which can be recognised on the basis of quality seals.

Additionally, **proven quality seals** provide orientation for choosing sustainable garments. In this regard it is recommended to rely on quality seals of **independent organisations**.

Nevertheless, as you can already assume, it is also not that easy to gain an overview of the various quality seals available. There are distinct quality seals for different purposes, acknowledging either **ecological, social or other available standards** (e.g. for home textiles or leather). Do you know any sustainability seals in the garment industry?

Some quality seals and initiatives, specifically referring to **ecological standards**, are going to be described in the following table:



Quality label	Quality label description
	<p><b>IVN</b></p> <p>IVN, an assembly of over 100 companies in textile manufacturing, <b>ensures ecological and social standards</b> within the entire production chain. The standards are currently the <b>strictest worldwide</b>, offering high transparency and security. Only natural fibres are approved.</p> <p>There are three quality seals that are assigned by IVN:</p> <ul style="list-style-type: none"> <li>• NATURTEXTIL – IVN certified BEST</li> <li>• NATURLEDER (NATURAL LEATHER) – IVN certified</li> <li>• Global Organic Textile Standard</li> </ul> <p>The seal „Naturtextil – IVN certified BEST“ is assuring the highest possible ecological standards, exceeding the GOTS requirements. Further information: <a href="https://naturtextil.de">https://naturtextil.de</a></p>

	<p><b>GOTS</b></p> <p>The GOTS (Global Organic Textile Standard) is a globally recognised standard for <b>organically produced natural fibre garments</b> defining <b>environmental</b> as well as <b>social requirements</b> in textile production.</p> <p>Certified textile products must consist of at least <b>70% organically produced natural fibres</b> and used chemical additives must comply with <b>pre-set environmental and toxicologic criteria</b>. Quality is assured by independent certification along the supply chain. Further information: <a href="https://www.global-standard.org/de/">https://www.global-standard.org/de/</a></p>
	<p><b>EU ECOLABEL</b></p> <p>The EU Ecolabel („EU flower“) is an international quality seal, valid within the European Union, Norway, Liechtenstein and Island certifying <b>environmentally friendly consumer products and services</b>. There is a focus on <b>low energy and water consumption, minimal use of chemicals</b> as well as <b>keeping emissions to a minimum</b>. Further information: <a href="http://www.eu-ecolabel.de/">http://www.eu-ecolabel.de/</a></p>
	<p><b>BLUESIGN</b></p> <p>bluesign certifies garment value chains in regard to a reduced ecological footprint taking resource efficiency, water protection, emission control, consumer protection, occupational safety and specifically harmless chemical usage safety into account. Further information: <a href="http://www.bluesign.com">www.bluesign.com</a></p>
	<p><b>STEP BY OEKO-TEX®</b></p> <p>The certification STeP (Sustainable textile Production) by OEKO-TEX® supports <b>sustainability along the whole production chain</b> with a special focus on <b>environmental performance and management, chemical management, quality management, social responsibility and health and safety at work</b>. More information: <a href="https://step.oeko-tex.com">https://step.oeko-tex.com</a></p>
	<p><b>OEKO-TEX®-STANDARD 100</b></p> <p>The label OEKO-TEX®-Standard 100 certifies clothing harmless to health, setting <b>standards for contaminant usage</b>. More information: <a href="http://www.oeko-tex.com">www.oeko-tex.com</a></p>
	<p><b>OEKO-TEX® MADE IN GREEN</b></p> <p>OEKO-TEX® MADE IN GREEN certifies garments according to STeP by OEKO-TEX® as well as OEKO-TEX®-Standard 100, verifying <b>environmental performance and management, chemical management, quality management, social responsibility and health and safety at work</b> as well as <b>pollution load</b>. More information: <a href="https://www.oeko-tex.com">https://www.oeko-tex.com</a></p>





	<p><b>CRADLE TO CRADLE (C2C)</b></p> <p>Cradle to Cradle is based on <b>recycling management</b>. The evaluation is based on the following five main categories: material health, reuse, renewable energy, social fairness and water. Certified products are <b>environmentally friendly and safe, recyclable and harmless to health</b>.</p> <p>There are five different certification levels: basic, bronze, silver, gold and platinum. More information: <a href="https://www.c2ccertified.org/">https://www.c2ccertified.org/</a></p>
	<p><b>GLOBAL RECYCLED STANDARD (GRS)</b></p> <p>The GRS ascertains the <b>recycling material in the end product</b>, which has to be at least <b>20%</b> and sets <b>standards for chemical additives, environmental management and social responsibility</b>. Additionally, the „Content Claim Standard“ demands a <b>transparent supply chain and traceability of goods</b>. More information: <a href="https://textileexchange.org/wp-content/uploads/2017/06/Global-Recycled-Standard-v4.0.pdf">https://textileexchange.org/wp-content/uploads/2017/06/Global-Recycled-Standard-v4.0.pdf</a></p>
	<p><b>MULTISTAKEHOLDER- INITIATIVES</b></p> <p>There are initiatives for sustainable produced cotton, like the “<b>Better Cotton Initiative</b>” (BCI) or „<b>Cotton made in Africa</b>“ by Aid Trade foundation. The labels are checked, but the criteria are <b>less strict</b> than for bio-cotton.</p>
	<p><b>ECO- PROGRAMS FASHION RETAILERS</b></p> <p>Many textile and fashion companies have their own eco- programs for <b>specific collections</b>. This is usually only concerning a specific part of the overall fashion collection and <b>standards are usually not very strict</b>.</p>
	<p><b>FLUSTIX</b></p> <p>Flustix is a <b>new and Europe-wide quality seal</b> in regard to <b>plastic sustainability</b>, certifying plastic-free clothing as well. It has four different categories for certification:</p> <ul style="list-style-type: none"> <li>• completely plastic-free products (content and packaging)</li> <li>• plastic-free products</li> <li>• plastic-free packaging</li> <li>• products without microplastics</li> </ul> <p>Flustix follows a multi-stage test procedure ascertaining the plastic concentration in products. More information: <a href="https://flustix.com/">https://flustix.com/</a></p> <p>Quality seals for plastic-free products (garments) are still in it's infancy, whereby gaining increasing popularity due to the environmental issues coming along.</p>



Moreover, there are also **labels** ensuring **social standards** and **animal welfare** that are not going to be presented and elaborated in greater detail within this scope.

To help you recognise fair, sustainable fashion, you can try the **app “Good on You”**. You just type in the brand's name and you receive an assessment including a short description. Furthermore, you get information on where specific brands are sold in your surroundings. However, the **reliability** of the app has to be questioned.

Regarding the availability of so many different seals and the varying standards behind it is not always easy to make the right decision in regard to sustainable clothing consumption. Additionally, as you have already learned, it is crucial to have a closer look at the materials used to avoid plastics in clothing. Yet, you received an overview and got a better insight in where to put your focus on your next shopping trip.

More tips on how to consume your clothes as sustainable as possible will follow in Unit 3 and Unit 4.

## 2.7 Summary

The way of garments, from the raw material to the final clothes is a long one, starting with the **raw material**. There is different material used in clothing, whereby three major fibre types are distinguished: **natural fibres, synthetic fibres and fibre blends/mixed fibres**.

**Natural fibres** are **provided by nature** and can be divided into **plant-based and animal-based fibres**. The most used natural fibres include **cotton, linen, wool, down or silk**. Natural fibres are coming along with **various advantages and disadvantages** in regard to their impact on the environment and also in regard to their attributes.

**Man-made fibres** are **artificially produced** through chemical processes using non-renewable commodities. A main differentiation is made between **fibres from polymers** and **inorganic fibres**. Fibres from polymers are further subdivided into fibres derived from **natural polymers** like cellulose-based fibres and fibres derived from **synthetic polymers** (also referred to as pure synthetic fibres) Examples of man-made fibres include **viscose, polyester, polyurethane, polyacrylic, polyamide, PVC, polypropylene and microfibre**. Although synthetic fibres are generally less desirable in terms of environmental impacts, they are also associated with advantages based on their features and profitability. Moreover, there are already developments for a **more environmentally friendly synthetic fibre option**. One of these is called **bioplastics**.

And finally, **fibre blends** or **mixed fibres** try to **balance the advantages and disadvantages** of both, natural and synthetic fibres. Whereas **fibre blends** are **more common** and merge **two or more fibre essences in one single fibre, mixed fibres**, blend **two or more different yarns**. The most common fibre blend is **cotton/polyester**.

It can be concluded that **100% sustainable and environmentally friendly** does not exist whether regarding the material nor regarding the final garment. There are various different factors to be taken into consideration to declare clothes as sustainable, this includes not only the fibre or the final material but all stages along the **lifecycle of clothes**. Moreover, greenwashing and untransparent production details and supply chains make sustainable fashion **difficult to identify**. **Quality labels, defining ecological standards**, help to gain an overview and

make a more sustainable decision, whereby it is important to rather rely on **independent organisations**. High standard quality labels provide a good **orientation for your next shopping trip**. Furthermore, the **material** has to be born in mind – **natural fibres**, especially organically produced natural fibres should be the **primary choice**, while **synthetic fibres** should be **avoided** as far as possible due to their immense environmental impact involving disastrous microplastic pollution.

## 2.8 Resources

<http://www.fao.org/3/i0709e/i0709e03.pdf>  
<https://barnhardtcotton.net/blog/what-is-a-natural-fiber/>  
<https://buygoodstuff.de/neue-oekologische-chemiefasern/>  
<https://byjus.com/chemistry/natural-fibres/>  
<https://compareethics.com/natural-fibres-vs-synthetic-fibres/>  
<https://ecoworldonline.com/what-are-natural-fibers/>  
<https://fashionunited.ch/nachrichten/mode/wie-nachhaltig-ist-mein-naechster-modekauf-die-app-good-on-you-verraet-es/2018081615488>  
<https://greenwire.greenpeace.de/system/files/2019-04/e01211-greenpeace-chemie-einkaufsratgeber-textil-siegel-2018.pdf>  
<https://levan-tex.com/natural-fabrics-vs-synthetic-fabrics/>  
<https://pdfs.semanticscholar.org/bd5b/1803423f5b29cce6540bce1c517b6ecbec64.pdf>  
<https://sewport.com/fabrics-directory/silk-fabric>  
<https://textilebeat.com/what-are-your-clothes-made-from/>  
<https://textileexchange.org/2020-preferred-fiber-and-materials-market-report-pfmr-released/>  
[https://textilelearner.blogspot.com/2011/08/wool-fiber-properties-of-wool-fiber\\_5920.html](https://textilelearner.blogspot.com/2011/08/wool-fiber-properties-of-wool-fiber_5920.html)  
<https://textile-one.de/pages/mischgewebe#:~:text=Bei%20Mischfasern%20werden%20verschiedene%20Bestandteile,und%20dann%20zu%20Stoffen%20verarbeitet.&text=Elasthan%20erh%C3%B6ht%20E2%80%9320wie%20man%20wei%C3%9F,vertr%C3%A4glich%2C%20Polyester%20trocknet%20unheimlich%20schnell.>  
<https://tirol.orf.at/stories/3025648/>  
<https://utopia.de/ratgeber/daunen/>  
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# THE LIFECYCLE OF TEXTILES

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Wear(e)able  
BEST DRESSED SUSTAINABLY

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## 3 THE LIFECYCLE OF TEXTILES

### 3.1 Introduction

#### The Topic

What do you think – to how many places have your garments been before you bought them? And what do you do with your clothes after you don't wear them anymore? Do you throw them into garbage or give them to charity or a second-hand shop? And what happens further with it? Let's check out **garment's lifecycle**.



**Clothing lifecycles** are increasingly **accelerating** due to the prevalent **fast fashion trend**. And we, as **consumers**, are major **contributors** to that trend. Shopping is an experience and one of our favourite hobbies, the availability of online shops makes it even more convenient and fast. How long do you wear your garments? Are you trying to repair them when they are broken or are you just buying new ones?

How long does it take you to buy the jacket you saw in the window of a shop – 10 minutes? But how long is the way of clothes before they end up in the stores and after we throw/give them away? Within the lifecycle our **clothes travel halfway around the world** for manufacturing before finally ending up in our wardrobe. Then they are usually worn for a relatively short time and are ending up in garbage or in the clothing drive, going on travel again. After the last two units you can already presume that every stage within the lifecycle is coming along with **immense environmental burdens**. But what can be done to minimise these burdens and how can the clothing lifecycle be extended?

In the following unit you will receive concrete information on all those questions: You will learn about the **lifecycle of clothes** in more detail and the **environmental impacts** coming along within every single lifecycle stage. Furthermore, you will get more insights in how we as **consumers** are **affecting** and **influencing** garment's lifecycle. And to conclude you will receive **important tips** on how the **clothing lifecycle** can be **extended** to preserve the environment.

### 3.2 The Lifecycle of Clothes

The **lifecycle of clothes** reflects the stages of clothing from the **production** of the raw material **to disposal**. However, if you have a closer look at the lifecycle you realise that the term lifecycle is rather misleading as it reflects not a cycle, but rather a **line** with a distinct start and end.

How many different stages and places did you define? As it is well known, T-shirts, jeans or other garments do not grow on trees (though some fibres do), they undergo several manufacturing processes, depending on the present material. In the last learning unit you already got a little insight in some production steps, now we will get into more detail. The lifecycle of textiles, also called apparel chain, comprises different stages. It starts with the extraction of fibres or production of the raw material and ends with disposal.

#### EXAMPLE

How does the lifecycle of our clothes look like – what do you think? – Try to sketch it.

The first stage is **fibre production**, as you already learned in the last unit. At this stage there is a difference in the fibre production for natural and man-made-fibres.

### Natural fibres

Primarily, the raw material is produced, this includes: cultivation, crop protection and fertilisation, harvesting, ginning in case of cotton and cleansing.

### Synthetic fibres

As you already learned, synthetic fibres are manufactured in course of chemical processes using non-renewable resources (coal, crude oil, natural gas).

### Semi-synthetic fibres

The chemical composition, structure, and properties of semi-synthetic fibres are significantly modified during the manufacturing process using renewable resources (plants, wood)

The next step is **textile manufacturing**. At this stage yarns are produced by spinning. Next, the **textile processing** is accomplished where the textile is pre-treated, dyed, printed and finished. Then further processed by knitting, weaving, knotting, felting, tatting or crocheting into the final fabric. Additionally, the fabric is often impregnated and processed for non-iron. Finally, in factories the fabric is brought into final form for ready-to-wear clothing or other usage (e.g. blankets, coatings, curtains etc.).

Look at the T-Shirt you wear today – where does it come from? Probably from outside Europe, is that right? Most raw materials and garments are imported to the EU, coming along with long delivery routes. Through **trading**, the garments are distributed around the world via trucks, ships or planes and end up in the **retail stores** where you bought your T-Shirt. Clothes are usually **used by consumers** for a very short time-period, if even worn at all, remembering the key facts in Learning Unit 1. Furthermore, they have to be maintained, which includes the process of washing, drying and ironing. Care instructions on the clothes help you to keep your garments in good condition as long as possible.

After you wore your clothes, everything is about **disposal and recycling**.

This could involve various scenarios:

- Clothes are repaired and worn again
- Clothes are recycled by giving them to clothing drives
- Clothes are given to second-hand shops or charities
- Clothes are resold on flea markets
- Clothes are thrown away

Thus, garments are then either **reused, recycled or end up in landfill or incinerators**.

Mostly clothes are disposed either in clothing drives or worst case in residual waste. In charity collection bins, the old clothes are collected for resale, usually to other countries, or further processed and down-cycled into cleaning rags or insulants, or for reuse in weaving and spinning.



#### EXAMPLE

What are you doing with your clothes if you don't wear them anymore? Do you throw them away or take them to a clothing drive?

And do you think a clothing drive is more sustainable than throwing your clothes away?



**INDICATOR**

In the EU, it is estimated that around **80% of garments**, the majority, is **thrown away, burned in incinerators or end up in landfill**.

Worldwide **less than one percent** of clothing material is recycled back into clothing.

As you may have recognised our garments are **travelling a long way within a very short time** within their whole lifecycle.

**INDICATOR**

Imagine that a jeans travels approximately **50.000 km** around the world until we can buy it in the store. For a T-Shirt it is around **20.000-30.000 km**. And before garments end up in our wardrobe they travelled to up to **10 countries and more**.

And this is not even the whole way as travel continues after we give our clothes away.

Have a look at the lifecycle of a T-Shirt:

[https://www.youtube.com/watch?v=BiSYoeqb\\_VY](https://www.youtube.com/watch?v=BiSYoeqb_VY).



Jeans are trendy and everybody has them in their wardrobe in various styles, shapes and colours – so let's check out the way within the lifecycle of a jeans. Before starting: have a guess to which countries your jeans have been.

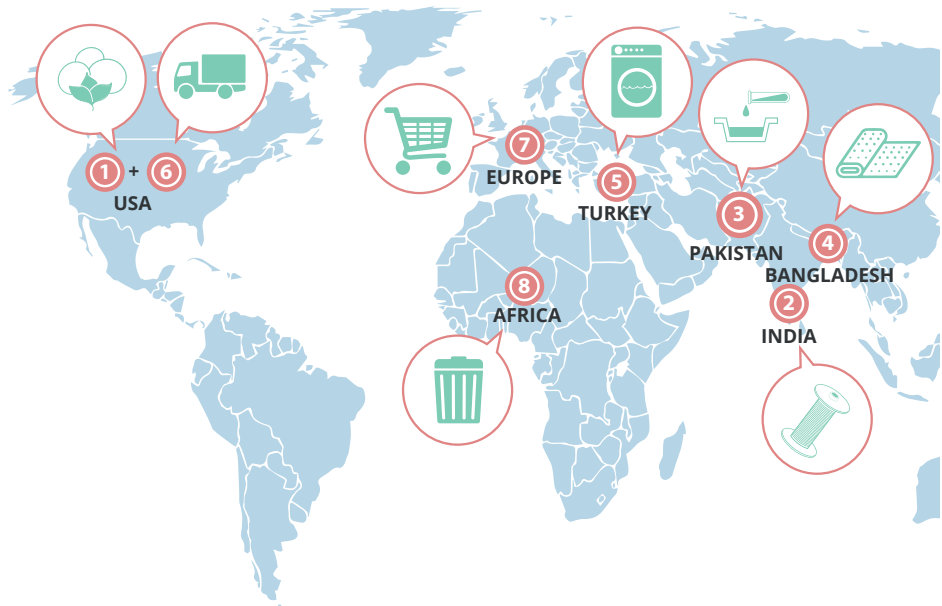
More than 100 people in around 10 countries around the globe are working on the production of a jeans.

Although the way varies to some extent, it may look like the following:

1. cotton is planted on huge plantations and harvested by hand in USA, India or also in China which are the biggest cotton producers
2. the cotton is spun into yarn in India
3. in Pakistan, the fabric is woven and dyed
4. the fabric is further manufactured into the final jeans product in Bangladesh - the sewing thread comes from Indonesia and the buttons and zips from China.
5. the final jeans is further transported to Turkey to be washed, further processed and packaged.
6. it is then further transported to the central warehouse in the USA
7. and finally, garments are coming back to Europe to be sold within the different countries.

Who believes that the way of the jeans is over at this point is wrong.

8. As soon as we, as consumers want to get rid of our clothes and take them to the clothing drives, most of them are transported to mainly Africa for reselling or disposal





## 3.3 Influencing Factors

You got an insight in how the lifecycle of clothes looks like and how far your clothes travel until ending up in your wardrobe. Although the lifecycle is always kind of the same, there are various factors influencing it – e.g. accelerating it or allowing new possibilities. What do you think – which factors are influencing the lifecycle?

Two major influencing factors are **consumer behaviour** and the **fast fashion trend**.



The consumer is the most important stakeholder within the fashion industry. Thus, **consumer behaviour** is a **major driving** and **influencing factor** of garment's lifecycle. Every decision and every action including purchase, wearing, care and disposal, has an effect. Behaviour is changing quickly and often quite unpredictably due to quick changing trends. Rather than satisfying basic needs, clothes became a tool of influence and self-definition. A strong emotional connection to clothes evolved.

Consumers are constantly flooded with information through various media about new trends born, not only on the catwalk, but also on the street. Does this sound familiar to you? Many companies use multi-channel approaches to reach customers on various different levels and the role of fashion influencers is growing.

And as everybody wants to stay up to date there is a **constant demand for the latest trends** and **fast and easy supply**.

Clothes are not bought seasonally anymore, but rather monthly or even weekly. This is on the one hand accelerated by the fast and easy availability through online businesses and on the other hand by easier affordability. The e-commerce segment is experiencing increasing growth with online shopping platforms in all different fashion segments that allow consumers to shop anywhere, anytime. This leads to consumers **buying more than they need** and shopping more often as it is very convenient. Furthermore, a large part of the ordered clothes is often returned. Does that sound familiar to you? Unfortunately, those **returned garments** are not tried to resell due to the fact that it is cheaper for retailers to **discard or burn** those. The easy affordability is further declining the willingness to repair.

The abundant availability of cheap clothing leads to **increased consumption and value-decrease**, contributing to **throwaway mentality**. Moreover, this is also supported by **low awareness** of many consumers. All those factors lead to an **accelerated garment lifecycle**.

Fortunately, there is also a countertrend in consumer behaviour with an increased attention for sustainability as a driver in fashion purchasing decisions.

### EXAMPLE

You probably all know Kim Kardashian or David and Victoria Beckham? The fashion and beauty icon Kim Kardashian for example is one of the most powerful influencers in the world.

Which fashion influencers do you know? Do you follow any fashion influencers?

### INDICATOR

According to studies, 57% of global internet users have bought fashion-related products online in 2018.

### REMEMBER

It is the consumer, YOU, who decides what happens on the market

**YOU** as consumers are also the **main driver of the fast fashion industry**, as you already learned. It implicates an immediate reaction between an emerging trend and its supply as demanded. It is not only seasonal changes in clothes, but rather daily changes in trends that fashion stores are trying to handle to please the customer. To satisfy the need and facilitate immediate supply, the creativity of designers and quality is often suffering. Additionally, the workforce suffers as production is decentralised to countries with cheap labour costs.

What are further factors influencing the garment's lifecycle – have a guess.

### Legislation

Legislation has, of course, an impact on garment's lifecycle as it progressively enables internationalisation and globalisation by reducing trade barriers globally **enforcing unlimited market access conditions**. However, the existing trade provisions do **not regulate environmental, health or ethical standards**.

### Internationalisation and globalisation

Internationalisation and globalisation, facilitated by legislation, are increasingly important influencing factors. When travelling you probably realised that you are able to buy a lot of brands not only in your home country, but also in other countries in- and outside Europe. This has on the one hand an impact on stock planning and the supply chains as seasons vary in-between countries. On the other hand, internationalisation is increasingly impacting product cycles and location decisions, **allowing more flexible location decisions and faster product cycles**. Therefore, international trade is changing constantly to be as cost-efficient as possible. Furthermore, due to internationalisation, brands are operating in a **highly competitive environment with vast changes and uncertainty** which leads to increasingly faster supply by all brands to be the first to keep up with the latest trends and unethical behaviour, such as greenwashing, to gain competitive advantage.

### Technological advances

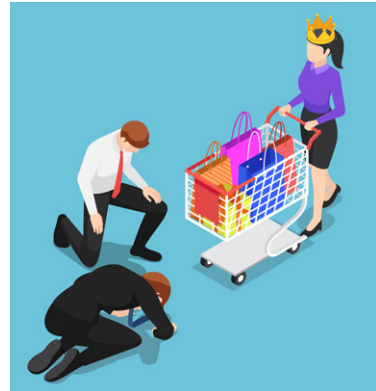
As you probably realised technology increasingly developed within the last centuries. It is changing our lives and makes it mostly easier and better. And, of course, it also has an impact on the whole garment lifecycle – technology is coming along with **advantages for production and supply**. This contributes to faster production and supply chains, but also to advances in production and disposal in regard to the environment.

Additionally, the fashion industry is more and more interconnected with the digital world. Digital platforms and digital marketing strategies are becoming prevalent in the fashion market and many new brands have emerged with the development of **e-commerce**, which allows companies to engage with consumers through virtual reality.

## 3.4 Environmental Impact of the Clothing Lifecycle

Reflecting on what you have learned in the first Learning Unit, you already know that the industry's environmental effects are disastrous. What do you think are the impacts of the individual stages in the clothing lifecycle? Try to think of it before going to have a look at the single stages.


Obviously, each clothing lifecycle stage has an impact on the environment, by **consuming environmental inputs and releasing environmental outputs**. The following table provides an overview of those.




LIFECYCLE STAGE ↓	ENVIRONMENTAL IMPACT	
	INPUT	OUTPUT
raw material	<ul style="list-style-type: none"> <li>• use of a large amount of land, water, pesticides and fertilisers</li> <li>• use of fossil fuels</li> </ul>	<ul style="list-style-type: none"> <li>• emissions</li> <li>• air and water pollution</li> <li>• contamination of soil</li> <li>• hazardous waste</li> <li>• health risks for workers</li> </ul>
fibre production	<ul style="list-style-type: none"> <li>• use of fossil fuels</li> <li>• energy use</li> </ul>	<ul style="list-style-type: none"> <li>• emissions</li> <li>• air and water pollution</li> <li>• contamination of soil</li> <li>• hazardous waste</li> <li>• health risks for workers</li> </ul>
processing and garment production	<ul style="list-style-type: none"> <li>• use of chemicals</li> <li>• water and energy use</li> </ul>	<ul style="list-style-type: none"> <li>• emissions</li> <li>• air and water pollution</li> <li>• contamination of soil</li> <li>• (hazardous) waste</li> <li>• health risks for workers</li> </ul>
transport, distribution and retail	<ul style="list-style-type: none"> <li>• use of fossil fuels</li> <li>• energy use</li> </ul>	<ul style="list-style-type: none"> <li>• use of chemicals</li> <li>• emissions</li> <li>• waste</li> </ul>
consumer use	<ul style="list-style-type: none"> <li>• use of energy, water</li> <li>• use of chemical detergents</li> </ul>	<ul style="list-style-type: none"> <li>• emissions</li> <li>• release of microplastics</li> <li>• water pollution</li> <li>• health risks/allergic response</li> </ul>
disposal	<ul style="list-style-type: none"> <li>• use of energy</li> </ul>	<ul style="list-style-type: none"> <li>• waste generation</li> <li>• emissions</li> <li>• water pollution</li> </ul>


Did you think that the effects are that present along the whole lifecycle?

What stage do you think has the most and which the least environmental impact?

 Considering what you already learned, it is obvious that the **consumer has a major impact**, right? Consumers tend to wash their clothes often at high temperatures and tumble-dry their clothes which causes an immense water, energy and chemical consumption and the release of microplastics into the water through washing.

 Another impact-intense stage is **processing and garment production**.

 Although the **transport, distribution and retail stage** causes emissions due to the long travel routes, the main environmental burden at this stage is **waste**. You might now question which waste is generated. It is waste emerging through packaging, bags, hangers or tags and more significantly waste originating from unsold and returned garments. Remind yourself again of what happens with the clothes ordered and returned in course of online shopping.

 In regard to **disposal**, a large part of garments is unfortunately not recycled, but thrown away as already mentioned. Therefore, resulting in emissions through incineration and released methane from landfill as well as huge amounts of landfill.

#### INDICATOR

**Over 1.900 different chemicals are used in clothing production, 165 of those are graded hazardous by the EU. Furthermore, the cut-off leftovers in production account for 20% of the industry's waste.**

Nevertheless, also the resource and pollution-intensive stages raw material and fibre production cannot be disregarded. Thus, it is **difficult to identify the stage with least impact on the environment**.

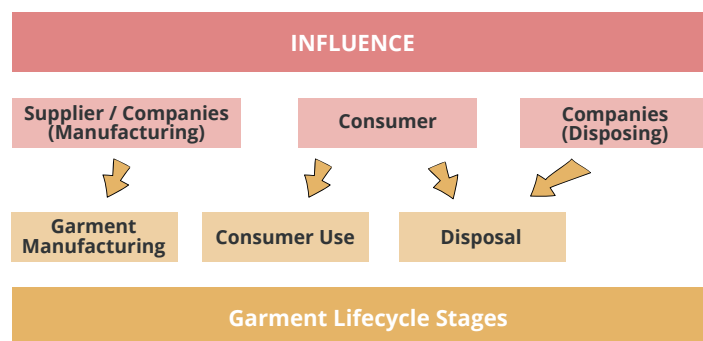
Garments travel around the globe with every lifecycle stage in a different country and the lifecycles are increasingly accelerating. This also causes the impacts to add up, though difficult to measure due to the diversity and the broad spread around the globe. With the increasing scale of the industry, the environmental impacts are reaching detrimental wide-spread impacts.



It is obvious that **change is immediately required**. Although the product lifecycle will never be impact-free, small steps in the right direction by all different stakeholders involved are already a good start.

## 3.5 Extending the Lifecycle

There are diverse aspects to be taken into account for a more sustainable fashion industry. The garment lifecycle is a crucial aspect. To mitigate the environmental impacts along garment's lifecycle a main aspect is to **slow down and most importantly extend the lifecycle**. At this point two major stakeholders are in responsibility, the **consumer** on the one hand and the **suppliers/companies** in **manufacturing and disposal** on the other hand. The **overall target** would be to **reach a circular economy** in the fashion industry, going from a linear lifecycle to a closed system.



As you already learned, YOU as the **consumer** are **the main decision maker**, having also a major impact on the supplier side. Consumers are increasingly getting aware of the need for more sustainable practices in everyday life. Especially, the younger generation is caring about the future of our planet, willing to change their lifestyles in order to give the environment a chance to relax and stay intact for a long time.

Generally, there is an existing willingness to engage in practices extending the lifecycle of clothes, but the actual commitment is still rather low, which applies also to the fashion industry. There are different options to **slow down and extend the garment lifecycle**. This include:

- **conscious shopping**
- **increasing the clothing use stage**
- **appropriate recycling or enabling reuse**

### EXAMPLE

Try to think of possibilities of how the lifecycle can be extended from the consumer and the supplier/company side.

Primarily it is crucial that we as consumers change our mindsets towards garments, to not perceive it as disposables, but rather as valuables and evince conscious shopping behaviour. As already mentioned in an example in Learning Unit 1, we are constantly enticed to buy new garments offered by the fast fashion industry. However, it is more important to think of what we really need and pay attention to the material, the processing, the quality and the care instructions of the garments we intend to buy. Therefore, it is worth spending a bit more on high-quality garments out of natural materials.

Extending the use phase of clothes can have a considerable positive impact on the environment.



There are various factors to be taken into consideration for a longer use:

- storing clothes properly
- following the care instructions including guidance on how to appropriately wash and dry your clothes
- learn about basic repairing and repair your clothes

#### INDICATOR

It is estimated that the **extension of garments use for nine months of active use would reduce the waste, water and carbon footprint by 20–30% (WRAP report).**

This will help you to maintain your clothes as long as you can. More concrete tips are following in the last Learning Unit. Furthermore, there are also additional options to increase the using stage of your clothes. We all need something new in our wardrobe sometimes and get tired of the clothes that we have – so what would be environmentally friendly options?

#### INDICATOR

Imagine that **95% of textiles going to landfill each year could be reused.**

You have probably heard of the collaborative or also **sharing economy**, or at least about Airbnb and Uber, don't you? This also exists within the fashion industry, did you know that? Collaborative consumption enables consumers access to already existing fashion through **alternative options** and at the same time also helps you to save money. So, what are those alternative options?

#### Clothes swapping

Did you ever think of organising a clothing swap with your friends? In this way you are able to fill your wardrobe with new garments without spending money on the one hand. And on the other hand, you can give away your valued garments that you don't wear anymore and bring happiness to some of your friends.



#### Second-hand clothing

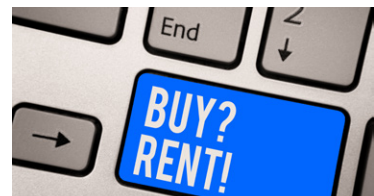
Although buying second-hand clothes is still often associated with dirty or damaged clothes, rather the opposite is the case as new garments are usually contaminated with lots of different chemicals. Second-hand got a huge business. There are already even lots of online stores offering second-hand fashion.

#### Donating clothes

There is always the option to donate your clothes either to second-hand shops or to charity.

#### Lending/renting/leasing

Yes, this is possible, and the popularity of fashion rental services is rising. While it was formerly used for renting special-occasion garments, its increasingly gaining popularity for everyday-clothes. It's like Airbnb for fashion – check it out!



Taking all those mentioned things into account the ultimate goal would be to **reach circular economy (cradle-to-cradle approach)** in the fashion industry, keeping waste to a minimum and keeping materials in the loop as long as possible. Furthermore, this would facilitate far reaching access to affordable, high-quality and individualised clothing. Considering this, also suppliers and the industry are responsible to make efforts in extending garment's lifecycle through for example technological innovations in reducing environmental impacts, **Extended producer responsibility (EPR)** or in-store collections.



### DEFINITION

Extended producer responsibility (EPR) is a policy approach (and also practice) that could regulate the legal responsibility for disposal management (reusing, recycling) once consumers want to give away their used garments. In this regard, companies can either organise their own programmes or financially contribute to an official collectively responsible organisation.

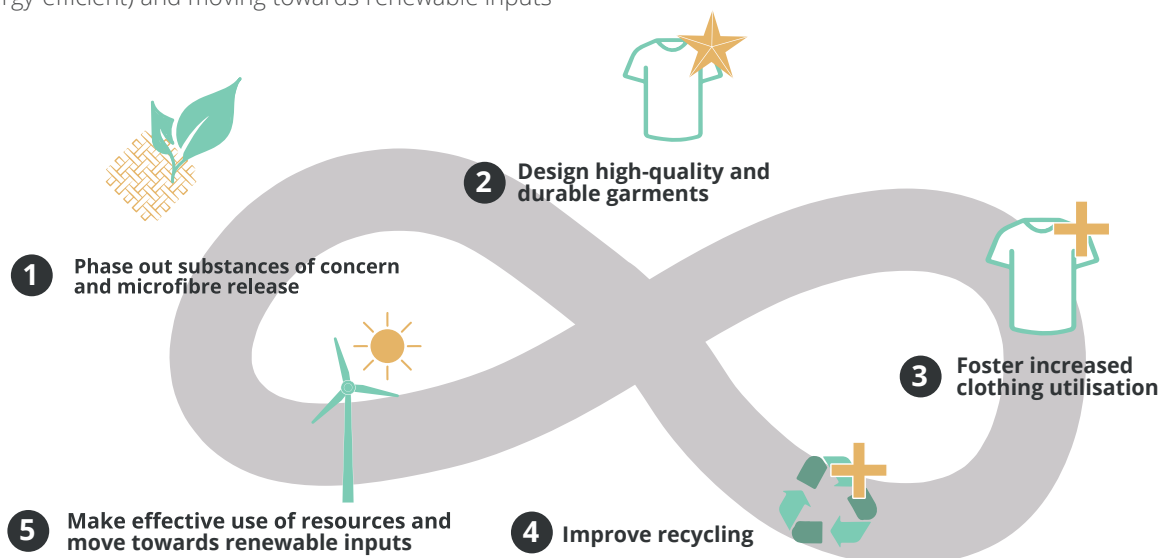
France is the only European country having an active EPR law.

To fully reach this, **fundamental change** is required within the garment industry, moving towards a **regenerative model** that benefits the environment and also society and economy. Within this model, garments never end up as waste. This presupposes:

- Phasing out substances of concern to the environment or health and pollutants such as microfibres
- Designing high-quality and durable garments
- Fostering increasing clothing utilisation through new business models, policy and/or brand commitment
- Improving recycling through innovative technical solutions and aligning clothing design and recycling processes
- Effectively using resources through more efficient and effective production processes (less pollution and waste, energy-efficient) and moving towards renewable inputs

### DEFINITION

Cradle-to-cradle characterises a continuous and consistent closed-loop economy, taking into account the regeneration of natural resources, environmentally friendly production, avoiding pollution and the usage of renewable resources and energy.





## 3.6 Summary

The **lifecycle of clothes** reflects the **different stages in clothing from the production of the raw material to disposal**. The lifecycle consists of following **different stages**: production of raw material, textile manufacturing and processing, trade, retail, usage and disposal. To go through these different stages, your garments are on a **long journey half around the world** in a **very short time**.

There are various factors **influencing the clothing lifecycle**, primarily **consumer behaviour** and the accompanied **fast fashion trend**. The **consumer**, as the **most important stakeholder** in the fashion industry, is the **driving force for changes** in the lifecycle. The fast fashion trend is responsible for an increasingly accelerated lifecycle. Additionally, **legislation, internationalisation and globalisation and technological advance** are influencing the garment's lifecycle.

Environmental impacts of the fashion industry are disastrous. Every single lifecycle stage has an impact on the environment, **consuming environmental inputs and releasing environmental outputs**. Environmental inputs on the one hand include land, water, fossil fuels, energy or chemicals. Environmental outputs on the other hand include emissions, waste, pollution or undesirable co-products or even health impacts. **Consumer- use and garment production and processing** have the **most environmental impact**.

**Extending and slowing down the garment lifecycle** to reduce environmental impacts is an important measure for a more sustainable fashion industry. The **consumer** as well as the **supplier side** can make a good contribution. **Consumers** are able to **extend clothing lifecycles** by conscious shopping behaviour, increasing the clothing use stage through following the care instructions, mending/upcycling and appropriate recycling or enabling reuse in course of sharing economy approaches like second-hand, donations, lending/renting/leasing or clothing swaps. **Companies** and **suppliers** can contribute by utilising renewable and safe inputs, designing high-quality and durable garments in course of an efficient and effective production process, establishing new business models for an extended use of garments and fostering an improvement in recycling. The **major goal** is to **reach a circular economy** in the fashion industry.

## 3.7 Ressources

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# RECOMMENDATIONS FOR SUSTAINABLE CLOTHING

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Wear(e)able  
BEST DRESSED SUSTAINABLY

**Projectnumber:**

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## 4 RECOMMENDATIONS FOR SUSTAINABLE CLOTHING

### 4.1 Introduction

#### The Topic

So, what is needed for a more sustainable fashion industry and how can YOU contribute? What can you specifically do to reduce microplastic pollution? What do you have to pay attention to? And most importantly: Are you ready to become sustainable fashionable?



You already received lots of input in this respect within the last three units which we are going to consolidate in this final section. You will receive the knowledge that is required to contribute to a **more sustainable** and most importantly **plastic-free fashion industry** having a look at **best-practice initiatives** and **examples** and **concrete recommendations for action** in your daily life.

**Small actions** in your personal life can already have a **huge impact** for a more sustainable fashion industry. Be ready to **become a game changer** and a **peer guide** for the Wear(e)able project.

The present learning unit provides you with an overview and summary of **how sustainability can be increased** in the fashion industry, summarising **what is needed** for a more sustainable approach in the clothing industry, **revealing alternatives in fashion consumption** and **highlighting what YOU personally can do** and how YOU can contribute. Additionally, **examples of initiatives** are presented and **ideas for personal action** to become an ambassador and peer guide for this important topic are revealed. You will learn how YOUR initiative can create a snowball effect for a positive impact and change towards a more sustainable clothing industry.

### 4.2 Increasing sustainability in the fashion industry

So, how can sustainability in the fashion industry now be increased? To trigger actual change in one of the most polluting industries is challenging due to its complex, widespread structure and many different stakeholders involved. Thus, there is **not the ONE solution** and it is still a long way to go.

However, there are already lots of developments pointing in the right direction. What is primarily needed to increase sustainability is **innovative technology and solutions, education** and the **accountability of brands and manufacturers for their supply chains**.

Many changes are required by the **huge players controlling the fashion industry and manufacturers**. Furthermore, improvements on the **brand and supplier side** are required coming along with **new business ideas** (e.g. renting, option to return clothes that are not used anymore, selling second-hand, on-demand clothing etc.), **innovative supply chain** and **sourcing management tools** and **providing transparency** to consumers within supply chains.

Not to forget the need to catch up by **legislation and politics** in this matter. As an example, microplastics in our oceans is a major worldwide problem that must be tackled through political initiatives as well, like a stipulation of obligatory filters for washing machines or a mandatory upgrade of wastewater treatment plants.

Nevertheless, let's not forget the most important thing at this point, the **great power of consumers**. **YOU** are in a powerful position. The clothing industry produces what is demanded and sells well. Thus, **your action** contributes significantly to changing and improving the situation. In this respect, **education** on how to contribute

to a more sustainable and especially plastic-free fashion industry should be a major priority.

There is already **existing commitment and initiatives** for an increasing sustainable transformation within the fashion industry from the supplier and manufacturing side. Those draw up on different stages within garment's lifecycle.

Commitment starts in the **raw material and fibre production stage**. This includes first and foremost increasingly **using natural material in production**. Remind yourself again what natural materials you know. Many companies are shifting to only using (certified) organic cotton. Additionally, there is also a shift towards the use of recycled polyester, which, however is not preferable in terms of microplastic pollution.

Furthermore, there are also innovations in the **material used for garment production**, some of which you have already learned about by going through the learning material. Did you ever hear the word "**Biocouture**"? Sounds quite fancy, doesn't it? Biocouture is becoming an increasingly big business and characterises fashion produced out of **environmentally friendly, sustainable materials**, most importantly **without any plastics involved**.

But there are also interesting **innovations** emerging and in development, some examples are:

- Production of bioplastics out of renewable, degradable raw material
- Production out of regenerated cellulosic fibres
- Production following the "wealth from waste" approach, producing sustainable textiles out of farm waste plant fibres like banana, aloe vera, corn, rose petal, plus wood pulp and Peace Silk
- Production of fermented garments, resulting for example in a beer or wine dress – really, clothes made out of party drinks? If you believe it or not – YES.
- Recycled CO<sub>2</sub>- based fibres

Further new, alternative approaches are used in the **production and processing stage**:

- Dying with pigments from plants, sugar molasses or micro-organisms
- 3D-print of garments – this approach is still in its infancy and development. Doesn't that sound very cool to print your own individual outfit?
- Developments towards more efficient production and processing, e.g. using renewable energy in production, increasing energy efficiency
- Campaigns of individual companies in regard to reduced water consumption and chemical usage and more sustainable practices in production and processing

Throughout the whole **supply chain** companies are trying to **reduce packaging** and **provide increasing transparency and traceability** of the garments by using for example live cams, smart tags, metric tools, Life Cycle Assessment software or Radio Frequency Identification.

#### EXAMPLE

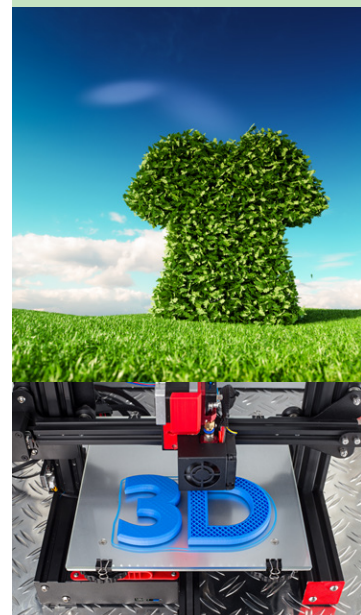
What are you focusing on when shopping for groceries, specifically fruits, vegetables, or meat? You are probably interested in where your food comes from and how it was produced (e.g. produced in conventional or organic farming, eggs from battery chickens or free-range hens), right? This is also an essential point in fashion shopping.

So, try to focus on those details on your next fashion shopping trip.

#### INDICATOR

Cotton-like cellulose, appearing leather-like, is created using bacteria and beer, wine, tea or coconut water. In this process living microbes are fermenting a garment without the need for sewing. Colour is derived by the raw material used.

**Hint:** Listen to the following TED- talk to receive a better idea about how those garments are produced <https://www.youtube.com/watch?v=ab6RV3E6Xkl>



And finally, there are also many developments and innovations at the **end of the clothing use phase**. You already learned about **EPR** and **in-store collections**, companies and brands are making efforts in this regard with the provision of **collection schemes, repair services and recycling systems** (recycling and reusing).

Furthermore, **improvements are made in new technologies for sorting out and recycling**. For example:

- The Circular Systems' Textloop, a mechanical and hydrothermal process, facilitates recycling fibre blends back into raw material that can be used again in production.
- HKRITA (Hong Kong Research Institute of Textiles & Apparel ) in cooperation with H&M and Novete developed the Garment-to-Garment (G2G) Recycle System allowing garment's recycling and reusing of post-consumer products within a waterless and solvent-free process. Further companies with innovations in this regard include Ambercycle, BlockTexx, the Infinite Fibre Company and some more.

The **EU** adopted the **circular economy package** that requires all Member States to separately collect textiles. And finally, lots of effort is made in the developments towards circular economy models within various initiatives:

- The Global Fashion Agenda, a leadership forum guiding the industry towards increased sustainability, launched the "2020 Circular Fashion System Commitment". This emphasises the implementation of new design strategies and ensures an increased collection, resell and recycling of used clothes.
- WRAP (Waste and Resources Action Programme) initiated the "Sustainable Clothing Action Plan (SCAP) 2020 Commitment" aiming for a 15% reduction in carbon, water and waste by re-inventing the design and production of garments, rethinking on how to extend garment's lifecycle and redefining possibilities for reuse and recycling.
- Accelerating Circularity, a collaborative industry project, focusing on the accelerated development of the whole textile industry towards a circular economy.

Another big issue where research is still ongoing is **microfibre pollution in the fashion industry**. Though it is proven that a huge amount of microfibres is shed during washing synthetic fibres, the problem also occurs in other stages within the lifecycle. More research is still required in what factors influence microfibre release. Regulatory issues in this regard are highly debated and are primarily focusing on managing it as responsibly as possible. One example for initiatives tackling this issue is:

- **The Microfibre Consortium (TMC)** and the **Cross Industry Agreement (CIA)**, a collaboration of five European Industry associations, are working on practical solutions to prevent or at least minimise microplastic release.

#### INDICATOR

**BE AWARE** – appropriate recycling is crucial in preventing pollution and landfill and there is still a necessity for innovations in this regard.

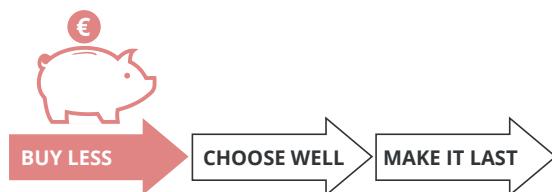
**BUT** the general preference of choosing natural fibres and prolonging the clothing use phase is ecologically better than recycling synthetic fibre. So, watch out for brands promoting clothes made out of recycled plastic as those are strongly contributing to microplastic pollution.




## 4.3 Practical tips for ConsYOUmers


Significant change towards a more sustainable and, above all, plastic-free fashion industry can only be achieved through consumer's involvement and engagement. The cited quote contains the essence of information needed for a more sustainable behaviour in the fashion industry.


So, **how can YOU personally best contribute** in course of the different stages of buying, using and disposing garments? Remind yourself of what you have already learned.





### BUY LESS – LESS IS MORE

 First of all, it is essential that you perceive **clothes as valuables** and **develop consciousness** about your clothes and your shopping behaviour. Think about how much work and resources were involved in the production of your garments.


 **Declutter your wardrobe** and try to simplify and **organise it**. In course of this it could be useful to set yourself a shopping ban for some time– this can help you to find out what is unused in your wardrobe and what you really need.


 Try to keep your clothes to an essential minimum and follow the **Capsule Wardrobe movement**.

 Try to **use better what you already own** – how can you combine your clothes differently. Tips and inspirations can be found for example on Pinterest.

 Try out **alternatives for clothing consumption** – share, borrow, rent, lend, swap your clothes or buy second-hand clothes.

### CHOOSE WELL – QUALITY OVER QUANTITY

 Think about **what you really need** and keep your focus on that while shopping.

 Try to **resist the temptation to always follow and buy the latest trends**, create your own, more timeless, style.

 Prefer **high-quality garments** instead of owning a huge quantity of low-quality garments

#### INDICATOR

**"Buy Less, Choose Well and Make It Last – because we don't need so much."** You should internalise those wise words by the British fashion designer Vivienne Westwood and keep it in mind.



#### INDICATOR

Did you ever hear about **Capsule Wardrobe movement**? An encapsulated wardrobe is a small number of clothes that can be differently combined to create a variety of outfits. Check it out!

**BE AWARE** that trying to follow this movement does not mean fully clearing out your wardrobe and then buying new clothes again which would not be very sustainable. It rather develops in course de-cluttering and (re-)organising your wardrobe as well as less and more targeted garment shopping.





**NOTE**


- Carefully consider the **material of your garments** and be aware to preferably choose **natural fibre material** to avoid microplastic pollution. Natural fibres are also more skin-friendly and biodegradable.
- Be aware of **quality seals**. These offer a good orientation for environmentally friendly shopping. You already got a good overview of existing, trustable quality seals in Learning Unit 2.
- **Avoid chemicals** when buying clothes – hints on clothing tags like “crease-resistant”, “non-iron” or “wash before wearing” indicate questionable chemical contamination.
- Following this, you do something good for the environment, conducing to avoid exploitation of workers and child labour and also saving money in the long-term.

**MAKE IT LAST – CARE AND REPAIR**

 Follow the **wash and care instruction** of your garments.

 **wash environmentally friendly**

- wash only when necessary (air your recently used clothes)
- wash with similar colours
- wash your clothes inside-out
- avoid unnecessary products when washing (e.g. fabric conditioner, spray starch, stain remover)
- choose a gently, biodegradable detergent
- avoid chlorine bleach or detergents containing chlorine bleach
- get a Guppyfriend
- wash with full load, but don't overload your washing machine
- do not wash too hot – normal everyday clothes get clean washing them at 30 degrees

 **store** your clothing **properly**

 learn about **basic repairing**

**Repairing** was for a long time not usual at all due to:

- the reputation that repairing is/was not fashionable, only done by grandparents
- the fact that repairing is/was associated with poverty and a lack of financial resources
- the fast fashion trend implicating repairing more expensive than buying new garments
- and finally, a of lack of skills/knowledge for mending.

**DEFINITION**

**Guppyfriend** sounds funny, doesn't it? Probably it reminds you of the Guppy fish that is the name giver. But a Guppyfriend is what we all need to **avoid microplastic pollution in course of washing synthetic fibre material** until we get rid of synthetic (plastic) material in clothing.

The Guppyfriend is a scientifically proven bag that collects the microfibres released within a washing cycle and prevents them from entering the waterways. It works like a laundry net bag in which you put your synthetic fibre clothes for washing.

However, nowadays **repairing** as well as **upcycling** and **creating clothes** on your own (e.g. by knitting, crocheting, sewing etc.) is experiencing a comeback, getting increasingly trendy again with different workshops and books offered in this field. **“Do it yourself”** makes you a trendsetter – it is worth a try!

And finally, after the use phase, don't just throw your clothes away. Try to prolong the use phase, even if you don't want to wear them anymore. You already learned about the different options.



 **Swap your clothes** with friends or relatives or in course of clothing exchange events/parties or flea markets

 Give your garments to a **second-hand store**

 **Donate** your clothes to charity organisations

 Bring your garments to **cloth collecting points** – many stores already offer this

 Take your old clothes to **legitimate charity collection bins**

## 4.4 Get moving and become a peer guide

There is a great **upswing in the environmental movement**, initiated mainly by the younger generation, so YOU, as they are worried about their future. This can be recognised in course of worldwide movements like **“Fridays-for-Future”**. Young people care about the future of our planet and are also willing to change their lifestyles. Is this true for you as well? Do you care about the environment and are you willing to take action? What are you waiting for – get moving and take action and spread the word about everything you have learned to contribute to change towards a more sustainable fashion industry!



There are different initiatives to participate in and that also offer ideas for action, for example:

### **Fashion Revolution**

The Fashion Revolution is a global movement involving people from industry and public from all around the world aiming for **change for a more sustainable fashion industry** that conserves the environment and values people over profit. Every year, at the time of the anniversary of the Rana Plaza disaster, the Fashion Revolution Day/Week takes place including hundreds of events around the world. Besides that, they offer additional input on how to take action. Check it out on <https://www.fashionrevolution.org/>!

### **Youth Fashion Summit**

The Youth Fashion Summit, as part of the Global Fashion Agenda, is a **platform for students supporting the sustainable development of the fashion industry**. Every two year, students can apply to be part and commonly develop and co-create solutions in this respect.

### **Sustainable Fashion Forum (SFF)**

Sustainable Fashion Forum (SFF) is a global community that strives for a change towards a more sustainable fashion industry.

#### **EXAMPLE**

Do you know other initiative in regard to a more sustainable fashion industry maybe in your home country or your hometown? Think about it.

What can you personally do now to spread the word and initiate change as well?

We have already talked a lot about this in the last units and want to provide a final overview with ideas of how to get moving together and trigger a snowball effect for a more sustainable fashion industry with YOUR own initiatives. **So, let's get moving together!**

- **Change your own dealing with fashion** according to the recommendations you got throughout the contents. Remember: **"BUY LESS – CHOOSE WELL – MAKE IT LAST"**.

- **Check out possibilities to shop second-hand or lend/rent your clothes (even online).** As learned **second-hand clothing** is not about old and dirty clothes anymore, you will find unique pieces there. And nowadays it is even possible to shop your second-hand clothes online. Furthermore, you can also take your unused clothes there. Another opportunity would be to **lend or rent clothes** – what about lending clothes from friends, have you done that before? Or even better: you can rent clothes, not only for special occasions, but there is also the possibility to rent a defined amount of clothes on a regular basis. You will find renting opportunities on place, but also online – have a look. Both options are associated with some new style on a regular basis.

- **Spread the word to your friends and convince them about changing their habits in fashion consumption.** You certainly know the saying: **"Do good and talk about it?"** This is especially true when it comes to sustainable clothing. People still do not give enough thought to the effects of decisions made in regard to their own wardrobe. Talk about what you have learned with your friends and family, inform them, inspire them and achieve great effects. All the content of the Wear(e)able project is divisible and every person you can convince will contribute to make a big difference. Here is a hint: enthuse people to talk to about it and also consider other opinions. **Undeniable facts and your own enthusiasm will fascinate others**, even if it sometimes takes time.

- **Organise regular clothing swaps** with your friends.

You are wondering how such clothing swaps are organised? Well there are many different models and its mainly up to you. As an example, points can be awarded for clothes that have been brought in, each person can then exchange these points for other items. Or you just meet and swap with gossip and drinks. As a tip: The bigger the event, the more regulations you need. Start small and get support from family and friends. What about visiting a clothing swap event first and gather ideas before organising your own event?

**Positive side effects** of a clothing swap: you have an opportunity to meet and spend a good time together, you are not spending money though going home with new clothes, you are doing something good for the environment and you will have a lot of fun. Doesn't that sound convincing?

- **Take part in flea markets** to get rid of your unused clothes or **take them right away to charity.** **Partner-up with a friend or family member and take part in a flea market** to give away your unused clothes. It is a simple way to make some extra money by clearing out your own wardrobe, you will meet new people and for sure have some fun looking around other offers.

And of course, there is always the option to **give your garments to charity** and bring joy to other people.

- **Support regional, sustainable brands** by buying your clothes at their stores.

Everybody wants to be unique and have his/her own **unique style** – so what would be a better idea than shopping at regional, sustainable fashion shops? You will get very unique pieces there that nobody else is wearing.

- **Learn to DIY** and visit courses, workshops or repair coffees.

There are many **different courses and workshops offered** in this field, no matter if you are interested in basic repairing, knitting, crocheting or upcycling.

- **Organise your own repair coffee or upcycling and design event** if you are already a Pro, you can share your skills with others.

Do you love knitting, crocheting, are you creative in redesigning clothes or do you have any other creative talent that maybe useful in designing, redesigning, or repairing garments?

Don't hide it but **share it with others**. Together it's much more fun and maybe you can even do some work in exchange? Someone who is particularly good at spicing up jeans could do this in exchange for a self-knitted scarf. The possibilities are endless, and hopefully the fun is endless when you do something useful together.

- **Become active and connect with local initiatives.**

Have a look around, there are many initiatives by people or organisations that are working for more sustainability and environmental protection. For example, ask Fridays for Future in your region - maybe you will find people interested in the topic? Or have a look around for theme events in your region, maybe you have the opportunity to present the Wear(e)able content and pass on your knowledge?

But even on a smaller scale a lot can be achieved. Maybe your biology teacher can take up the topic or you can give a presentation or further elaborate the content within a school project? In this way you can inform several people at once and achieve a great impact.

#### EXAMPLE

**What are your personal ideas? Implement those and contribute to a more sustainable fashion industry.**

## 4.5 Summary

There is **not the one and only solution for a more sustainable and plastic-free fashion industry** due the **broad structure** of the whole industry. However, major issues to be tackled in this respect are **proper education, innovative technology and solutions** as well as **accountability of brands, suppliers and manufacturer** for their **supply chains**. There is still **lots of changes required** by the different stakeholders involved where **YOU, as consumer**, are a **main player** as well.

Changes in the fashion industry are already happening in course of **existing commitment and initiatives** in the different lifecycle stages of garments. In the **raw material stage** there is an increasing focus on **using natural, biodegradable material, innovation in production and processing** involve a reduction in chemical and energy usage, and packaging is tried to be reduced within the whole supply chain. Moreover, progress is made in **providing transparency** over the whole supply chain and **major efforts** are made in the **post-consumer phase**. The industry is working hard to achieve the **overall goal of a circular economy** in the fashion industry.

YOU, as the consumer, are a major stakeholder to make change happen. Focus on the approach of **buying less, choosing well and making your garments last**. There are lots of **easy to implement tips** for your everyday life and everyday handling with garments included.

**Get ready to take action and become a peer guide for a more sustainable fashion industry!**

## 4.6 Resources

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# TERMINOLOGY

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<b>carbon emissions</b>	Talking about carbon emissions it is mostly referred to carbon dioxide also known as CO <sub>2</sub> . CO <sub>2</sub> is one of the main greenhouse gases, stemming e.g. from the burning of fossil fuels. CO <sub>2</sub> is also absorbing radiation in the atmosphere and thus contributes to global warming (same as methane). <a href="https://www.youtube.com/watch?v=fStmxJfwXel">https://www.youtube.com/watch?v=fStmxJfwXel</a>
<b>circular economy</b>	Circular economy is an regenerative economic system that aims at the establishment of a closed-loop system enabling the continuous use of resources and the reduction of raw material use and waste. In contrast to the traditional linear economy model (produce, use, dispose), resources are used as long as possible. <a href="https://www.youtube.com/watch?v=zCRKvDyyHml&amp;t=141s">https://www.youtube.com/watch?v=zCRKvDyyHml&amp;t=141s</a> <a href="https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits">https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits</a>
<b>collaborative economy/ sharing economy</b>	The collaborative or sharing economy, probably known from huge players like Airbnb or Uber, describes an economics system, typically organised via the internet, in which commodities or services are shared among individuals for free or a fee.
<b>DIY</b>	DIY, also Do-it-yourself, is an English phrase referring to activities done by oneself without the help of professionals, specifically in handicraft e.g. producing, repairing, upcycling, improving, reusing, decorating.
<b>e-commerce</b>	E-commerce, also known electronic or internet commerce, defines buying and selling goods or services via the internet.
<b>hydro-carbons</b>	Hydrocarbons are organic chemical compounds consisting of hydrogen and carbon. They are the basis of coal, natural gas, crude oil and other important energy sources.
<b>Industrial Revolution</b>	Technical advances have a great impact on how things are produced and also on the working conditions and the lifestyle of humans. Changing to new production technology which completely differs to the past one used is referred to as Industrial Revolution. We already went through four Industrial Revolutions.  <b>1st Industrial Revolution:</b> can be dated back to the 18th century and started with the use of steam power and the mechanisation of work.  <b>2nd Industrial Revolution</b> started in the 19th century with the discovery of electricity and the start of assembly line production.  <b>3rd Industrial Revolution:</b> has its beginnings in the 70's of the 20th century and was defined by the start of automated production using electronics, programmable logic controllers, IT systems and robotics.  <b>4th Industrial Revolution:</b> started in the 21st century and is marked by the intelligent and networked digitalisation of the work environment through the application of modern information and communication technologies. Cyberphysical systems, smart factories, artificial intelligence, connected devices, virtual reality and the internet of things are characteristic for this time.  <b>5th Industrial Revolution:</b> has started in the second decade of the 21st century with personalisation, reinforcing the cooperation between humans and technology for innovation and inclusiveness.
<b>inorganic fibres</b>	Inorganic fibres are made out of inorganic materials, for example glass or metal.
<b>in-store collections</b>	Some fashion stores are offering in-store collection schemes to contribute to reducing the fashion industries waste problem. Costumers can bring their old clothes to those stores that have recycling systems in place. The old clothes are either resold as second-hand if still in good condition or downcycled into products like cleaning cloths or insulants.
<b>Life Cycle Assessment</b>	Life Cycle Assessment facilitates the assessment of environmental impacts of products (e.g. garments) along the entire lifecycle.

<b>mass production</b>	Mass production, originally introduced by Henry Ford, has its beginnings in the 19th century in the automotive industry. It refers to manufacturing large quantities of standardised products, mostly using assembly lines or automation technology.
<b>methane</b>	Methane is a colourless, odourless, flammable gas, and the second most important man-made greenhouse gas. It absorbs radiation in the atmosphere and contributes to global warming of the air. Man-made methane stems for example from landfill or natural gas.
<b>metric tools</b>	There are different sources for data and metrics that are used to ensure sustainability in the clothing industry. One of those metric tools would be the HIGG-Index that facilitates the assessment of sustainability throughout product's lifecycle in the garment industry from the raw material to the end-of-life.
<b>Quick Response Strategy</b>	The Quick Response Strategy had its beginnings in the late 1980s, specifically starting in the textile and clothing industry. The strategy, now widely used in various supply chains, enables a quick adaption to changing market demands as well as inventory reduction throughout the supply chain. This is facilitated by an ongoing exchange of decision-relevant information in production, purchasing and sales.
<b>repair coffee</b>	Repair coffees are locally organised private meetings for the purpose of repairing broken goods, e.g. household electronics, computers, bicycles, clothes (upcycling) etc..
<b>smart tags</b>	A smart tag is an electronic tag, attached for the purpose of tracking.
<b>sourcing management tools</b>	Sourcing management describes the materials management and determines the procurement of goods and services.
<b>supply chain</b>	The supply chain describes the system producing, distributing and delivering a product or a service from the beginning (raw material) to the final delivery to the end user. It includes all organisations, people, resources, activities and information involved in supplying a product/service.
<b>upcycling</b>	Upcycling is a kind of recycling, reusing potential garbage or useless things again to create something new.
<b>vicious cycle</b>	A vicious cycle is a system in which several factors add on and reinforce each other, making the situation constantly worse.

## Sources

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