THE FUTURE OF TEXTILES
Fashion affects us all. We wear clothing on our bodies, of course, but we and our planet are affected by fashion in other ways as well. Fashion is one of the most polluting industries in the world.

At the same time, the industry is in the midst of fundamental change. The awareness that we must stop producing and consuming clothing without consideration for its adverse environmental and social footprints is taking hold.

We talk about a systemic shift in which the fashion industry is moving from being a linear economy – focusing on producing as much and as quickly as possible at the lowest price – to a circular economy.

The aim is that all phases of a garment’s life cycle – from choice of materials and design to production, transport, distribution, consumption and re-use – will be integrated with as little adverse climate impact as possible. In the future, clothing may even have a positive impact on the climate.

On the Swedish fashion scene, new initiatives are continuously arising – from research projects to sustainable collections, from established businesses to start-ups, between different industries and otherwise competing operations – that pave the way for a fashion revolution.

Ideally, the fashion industry of the future will view sustainability as an opportunity rather than a limitation. As the well-informed fashion consumers of the future, we view sustainability as the new luxury and we choose clothing based on certifications that promise social and environmental responsibility.

Our wardrobe might consist of ‘fast’ garments, made from forest raw materials and used only a few times before being broken down, and ‘slow’ garments that have been adapted from the design and production phases to last many years. We might compost garments made of biodegradable fibres and recycle others.

Probably we also supplement our wardrobe with rented or borrowed clothes, as part of the growing sharing economy. The second-hand market will be even more sophisticated, and services that make it possible to extend garment life will compete – since extending a garment’s life is the single best thing we consumers can do.

Individual businesses, research networks, media and politicians need to learn how to collaboratively prepare the way for a fashion industry of the future.

Fashion Revolution is about the challenges – but also the opportunities that will change the fashion industry and help save our environment.

Over 90 per cent of Houdini Sportswear’s product line is made from recycled, recyclable, renewable, biodegradable or Bluesign-certified sustainable fabrics.
The fashion industry is currently dominated by a linear structure sometimes described with the words ‘take, make, dispose’. A linear business model entails a huge waste of limited resources and is unsustainable from an economic, human and environmental perspective.

It’s important to transition to a circular economy, in which every link in the value chain is connected in a closed-loop cycle, and the added value is preserved for as long as possible, while the amount of waste is reduced.

A garment’s life

The life of a garment starts with raw material and the production of textiles, and continues via the design phase to production, transport, distribution, consumption and re-use and recycling, finally becoming, in the material recovery phase, new textiles or other products.

To achieve a circular economy, changes must occur during all phases, and every step must be linked to the next, to ensure that the resulting environmental impact is as low as possible. At the same time, there is a need for new funding methods, corporate and market models, and consumer behaviours.

In the design and development stages, the brands have significant opportunities to influence a garment’s environmental and social costs, and decisions made during these stages have an effect throughout the value chain. To achieve a closed-loop cycle, it is essential to use fabrics made from biobased, renewable and recyclable fibres.

Sustainable design also requires that garments last and can be mended and re-used several times. In addition, actors who extend that life – through re-use or material recovery, for example – also have a responsibility to be efficient.

From clothes to food soil

Even though less than 50 per cent of the industry have begun to move toward a circular economy, many have come a long way. For those who want to start transitioning, there is help available.

The Swedish research group Sverea IVF helps companies create circular models and measures the resulting quality and financial advantages. Re:Textile also deals with research and innovation with the aim of creating a circular industry. In March 2017 Re:textile and Lindex launched the pilot project Re:design – a collection of upcycled products redesigned in Borås, Sweden.

One of the Swedish brands that is at the forefront of fashion sustainability is Houdini Sportsware. Roughly 53 per cent of their products have a circular life cycle.

Houdini has also conducted an experiment in which their clothing is composted into food soil. In addition – similar to brands such as Filippa K – the brand provides garment rental in its own stores, and collects worn-out polyester garments that are then recycled and turned into new garments.

What consumers can do

Choose garments made from renewable, biobased and recyclable materials – that have also been produced in ways that entail minimal climate impact.

Ask the brands about their efforts to achieve minimal waste. Avoid turning garments you no longer use into rubbish. You might even be able to choose garments made out of scraps, PET bottles or ghost nets. Use your clothes for a long time – that is the single best thing you can do – and choose second-hand over new. Use services such as garment rental or garment repair, to make your clothes last longer.

The transition towards a circular business model has begun. More and more companies see the benefits of a system that does not deplete limited resources.
Houdini works to prolong the life of their products, offering repairs, rentals and second-hand sales.
Fast fashion is traditionally about quick sales and rapidly shifting trends. The idea is based on a linear business model according to which garments are produced without significant consideration for recycling.

Sustainability as an opportunity
For leading actors in fast fashion in Sweden, such as H&M, Lindex and Kappahl, sustainability is nowadays high on the agenda. A lot remains to be done, but a shift in attitude, with companies viewing sustainability as a profit opportunity instead of an obligation, can be discerned.

The antithesis of fast fashion is slow design, a concept used for fashion that prioritises quality over quantity, sustainable design, transparency, extended life, re-use and recycling. Two Swedish slow fashion brands are Maska and the winner of the Swedish Fashion Council’s 2017 Changers’ Awards, Ama Awe.

Collaboration and research in Sweden
To make fast fashion more sustainable, in Sweden emphasis is placed on the need for cooperation, new technology and innovation. Mistra Future Fashion is a cross-disciplinary research programme with a broad perspective that encompasses everything from design, production, material, consumer behaviour and recycling. Its vision is to introduce circular processes and new ways of thinking.

One of its projects, Circular Design Speeds, focuses particularly on the speed of fashion. Starting with the idea that fast fashion is not going to disappear, the project underscores the importance of materials that right from the start are adapted for different garment lifespans: fast materials for fast fashion and slow materials for slow fashion.

The user scenario should determine the value placed on the consumption of energy, water and chemicals, and the choice of material. While there is a need for new business models for long-lived fashion, the solution in the fast sector is radical new materials and systems.

‘Fast fashion could be made of paper and paper-like materials – garments you only wear a few times. You wouldn’t need to wash your garment (...) and it could be easily recycled with your own home paper recycling’, explains professor Rebecca Earley.

Circular Design Speeds is a two-year project. Working jointly with the Filippa K brand, the project is developing 100 per cent circular fashion garments, and the most important insights gained are shared with the industry.

What consumers can do
Research shows that even though awareness around sustainability issues is increasing, there is a gap between consumers’ attitudes and behaviour regarding clothing consumption.

As a consumer you can choose products made from sustainable material. Ask the brands how the garments are made to help you choose those with a small environmental footprint. You can also buy fewer garments and extend the life of every garment – and then eventually recycle the textiles.
A garment’s lifespan makes a great difference to its environmental impact. An average Swede buys 50 new garments per year, and almost one third of that is never used. If a garment were to be used three times longer, its climate impact would shrink by a full 65 per cent. Choosing second-hand knocks off a full 70 per cent of a garment’s climate impact.

A garment’s technical lifespan, however, is determined long before it reaches the store. Since up to 80 per cent of a garment’s total environmental impact is determined in the design phase, increasing numbers of designers and purchasers realise there is potential to make a great difference right at the drafting table and in the choice of suppliers.

From caring to sharing
The brands can help by educating consumers in how to make better choices and how to best care for their garments, and by providing services that extend the garments’ life, such as mending, rental and second-hand sales.

In Sweden, Nudie Jeans has been a pioneer by offering to mend its customers’ jeans for free. They also resell jeans that customers no longer use.

Garment rental is another business model that in Sweden is being tested by brands such as Filippa K and Houdini Sportswear. Renting instead of owning enables the consumer to experience variety in their wardrobe while it can extend the practical life of the garment. Ten per cent of Sweden’s population has used a service of the so-called sharing economy in the past two years, and the fashion industry is jumping on the bandwagon.

Physical clothing libraries and digital lending initiatives also contribute. #Sharewear, initiated by the Swedish Institute and Visit Sweden, engages consumers in clothing sharing via Instagram. Offering subscription to garments that can be exchanged – as children grow, for example – is another service that is gaining ground. Research shows that if we were to buy clothing made from recycled instead of newly produced materials and utilise clothing libraries, we could reduce our resource consumption by 50 per cent.

Filippa K aims high
Since 2014, Filippa K has operated by the motto that ‘sustainability leads the way to growth’, and lifespan is a primary focus of its sustainability work. The so-called Front Runners – garments developed in accordance with 12 criteria, such as sustainable materials, transparent supplier chain, recoverability and minimal emissions – lead the way for the rest of the brand’s collections, which the brand plans to align with the same criteria by 2030. The company also provides garment mending and garment rental, as well as resale of second-hand Filippa K garments.

What consumers can do
Choose materials and designs that will last and think about what would really work in your wardrobe over time. Activate your wardrobe and use what you have bought. Items you no longer use can be sold, donated, lent to others, exchanged for new clothes, or – as the last recourse – recycled.

Choose second-hand as often as you can, and rent or borrow garments you will only use occasionally. It is also important to take proper care of your clothes. Follow care and washing instructions – consider that airing or spot-cleaning stains is often sufficient. Remember to mend and maintain, and fold away and store your garments properly.

This dress from Filippa K, with a design and quality that lasts, can be worn for generations.
Clothes are traditionally made from natural fibres, synthetic fibres or a blend of the two. Natural fibres are often assumed to be more environmentally friendly since they are renewable and biodegradable, but the reality is more complicated. The fashion industry’s dependency on natural resources makes it difficult to ensure an adequate supply of textile fibres. Cultivating natural fibres can also consume large quantities of water, energy and chemicals.

Natural fibres come from the plant kingdom, such as cotton and linen, or from the animal kingdom, such as silk and wool. Synthetic fibres, on the other hand, are manufactured artificially and common varieties are polyester, polyamide (nylon) and acrylic.

According to the Higg Materials Sustainability Index (MSI), leather and natural fibres such as silk, cotton and wool have the greatest environmental impact in the short term – on the other hand, they are often durable, which evens out the total climate impact if we look at the garments’ total lifespan.

Synthetic fibres are a type of plastic that is usually extracted from fossil oils – a limited resource that gives rise to extensive carbon dioxide (CO2) emissions during incineration, and that is broken down extremely slowly in nature. To complement fossil fibres, active efforts are under way to develop new, better alternatives.

More sustainable fibres on the market

The challenge ahead is to scale up the production of sustainably produced fibres. The industry is exploring the development of both ‘old’ and ‘new’ materials, for example increased use of biodegradable fibres such as hemp and linen, and biobased raw materials such as the cellulose-based Lyocell. There are also prototypes of entirely new types of fibres – such as a Merino wool look-alike yarn made from gelatine, and a leather-like material made from pineapple leaves.

Brands are increasingly using organic cotton and recycled textiles from polyester, nylon, wool and Lyocell. Ecolabels such as Oeko-tex, Global Organic Textile Standard (GOTS), Better Cotton Initiative (BCI), Fairtrade, and the brands’ own environmental certifications are used to guide consumers towards more sustainable choices.

Research and new innovation

The innovation project ‘Establishing locally cultivated textile in Sweden’ (ENTIS) aims to re-establish and strengthen the Swedish textile industry by investigating how sustainable, biobased textile production can be facilitated by fibres from forests or recycled biobased textiles. Sixty actors from different industries participate in the project, which was initiated by BioInnovation – a programme dedicated to developing materials, products and services based on renewable raw materials.

What consumers can do

First and foremost, buy only garments you intend to wear, whether they are newly produced, recycled or second-hand – because it is by wearing the garments that you can reduce their environmental impact. Think long-term: if you wear a garment for several years you reduce its total environmental impact.

Arm yourself with knowledge about the materials that the clothes you wear are made from, and what the various environmental certifications mean. Also think about the eventual material recovery of the garments – using current technology, for example, it is difficult to recover material blends containing elastane.
The Swedish Tierra brand has developed a jacket entirely free of fossil sources. The Deterra® is made of 100 per cent biobased material from sources such as beans, corn and nuts.
Cotton is the most common raw material in the Swedish fashion industry. And while the material has many good qualities, such as durability, softness and washability, it represents a major environmental challenge.

Cotton farming is one of the world’s most chemical-intensive forms of agriculture, one that also requires enormous amounts of water and land area. As the earth’s population grows, so do the demands on agricultural production to feed everyone. Considering the shortage of clean water, the dilemma arises whether to produce cotton or food.

The problem becomes even clearer when we consider that nine per cent of the earth’s population have no access to clean drinking water. At the same time, it takes 10,000–30,000 litres to produce one kilogram of treated cotton. The intensive use of chemicals increases the risk that the existing water will become polluted and may also substantially disturb the balance of the ecosystem.

The way forward

Finding alternative fibres to conventional cotton is one of the fashion industry’s most urgent challenges, and it requires efforts on many levels. The aim should be no less than to transition to cotton that is organic and certified in accordance with both environmental and social requirements, such as GOTS (Global Organic Textile Standard).

Organic farming constitutes less than one per cent of total cotton farming. It is becoming increasingly common, however, and its environmental footprint is one-quarter that of conventionally produced cotton.

Cotton is challenging to chemically recycle, and so far, it is only done on a small scale in laboratories. The result is different from the original raw material, so the preference is often to continue using virgin cotton or some other fibre, such as polyester.

According to results from the Mistra Future Fashion research programme, the most efficient intervention would be to replace cotton with either forest-based or recycled cellulose fibres. Another alternative is eco-labelled polyester from recycled materials, such as PET bottles.

Swedish initiatives gathering steam

Organic cotton is increasingly common in Swedish brands. In 2017 Velour launched the world’s first jeans certified by the Nordic Svanen ecolabel. Nudie Jeans has worked with sustainability since its founding in 2001. Apart from a transparent production chain and the so-called Repair Shops that mend garments to extend their life, the company focuses intensively on sustainable materials. Since 2012, all their denim products have been made from 100 per cent organic cotton.

Many Swedish brands, such as Lindex, Uniforms for the Dedicated, Mini Rodini and Boob, sell GOTS-certified garments. The New Wave Group sells garments, such as promotional apparel, that are both Svanen-labelled and GOTS-certified. H&M has set a target such that by 2020 all cotton it uses must come from sustainable sources: organically produced, recycled, or from Better Cotton Initiative.

What consumers can do

Choose ecologically produced cotton and look for ecolabels such as GOTS or the EU Ecolabel. Invest in garments you will really use, regardless of their origin, but particularly if they are new. When possible, choose garments made from materials that do not require as much water as cotton, such as Lyocell, hemp and recycled polyester. Buy second-hand to extend the garment’s life.
Since 2012, all Nudie Jeans denim products are made from 100 per cent organic cotton and are produced under socially responsible conditions on a transparent production chain. The company also provide mending, resale of second-hand items and recycling of worn-out products.

More than half of the garments from Swedish mid-sized brand Lindex are made from sustainable materials, and 91 per cent of their cotton is either organic, recycled or lives up to the Better Cotton Standard.
Both fibre cultivation and dyeing require large quantities of water and chemicals. It takes 2–4 kilograms of chemicals and 10,000–30,000 litres of water to produce one kilogram of textile.

According to Mistra Future Fashion, up to 75 per cent of a garment’s climate impact can be traced to the production stage, which is often lengthy and complicated and includes spinning, weaving/knitting, dyeing and sewing.

Traditional cotton farming involves insecticides, and the dyeing process is equally problematic. Even when the cotton is organic, the garment may still be dyed with carcinogenic colouring agents. A black shirt made of conventional cotton must be used three times longer than a black shirt made of polyester, to compensate for the toxins spread during the farming and dyeing of the cotton.

Waste treatment plants are often unable to fully treat the waste water emanating from the textile industry. The polluted water has devastating consequences for both people and the environment. Numerous reports suggest that the drinking water in the areas near to textile plants is unusable. Production often takes place in countries in which access to clean drinking water is already limited, and the fashion industry’s water consumption is expected to grow by 50 per cent by 2030.

Many Swedish companies require that suppliers purify their water emissions in sewage systems before the water is released into watercourses.

New methods gaining ground
New technology that will transform dyeing processes is on the way. Swedish company We aRe SpinDye dyes materials such as synthetic textiles before they are woven into fabric. Usually the dyeing is done to the finished woven fabric, which requires significantly more water, chemicals and colouring agents.

By means of ‘spin-dyeing’, water use can be reduced by 75 per cent and chemical use by 90 per cent. Moreover, the energy consumption and the environmental footprint in the form of CO2 emissions are rendered significantly lower. The method is currently used by brands such as Fjällräven and Odd Molly.

Work is also under way internationally to replace hazardous chemicals. The Swedish Chemicals Group advises its more than one hundred member companies, mainly in the textile industry, on legislation and development involving chemicals in textiles. This knowledge sharing entails an export of environmental knowledge from Sweden to the production countries.

The Lindex clothing chain has collaborated with the Spanish denim consulting company Jeanologica in the launching of a jeans collection that derives its worn look from the use of air and laser, a technology that only requires two litres of water per pair of pants, instead of the usual 50–70 litres required for, say, abrasive blasting.

What consumers can do
Approximately 2,400 chemical substances are used in textile production, and of these, 368 are hazardous to our health. As a consumer, you can choose eco-labelled textiles that meet the chemical requirements. You can also avoid garments that are impregnated, flame-retarded or treated with antibacterial agents. Be extra careful with children’s clothing, as children are more sensitive than adults to chemicals. It is a good idea to wash new garments and sheets before using them for the first time, but try to avoid using water unnecessarily; use the short wash settings and only wash with full loads, to avoid causing unnecessary wear to the clothes, and use eco-labelled laundry soap.
Physical water scarcity
Water resources development is approaching or has exceeded sustainable limits. More than 75 per cent of the river flows are withdrawn for agriculture, industry, and domestic purposes (accounting for recycling of return flows). This definition – relating water availability to water demand – implies that dry areas are not necessarily water scarce.

Approaching physical water scarcity
More than 60 per cent of river flows are withdrawn. These basins will experience physical water scarcity in the near future.

Economic water scarcity
Human, institutional, and financial capital limit access to water, even though water is available locally to meet human demands. Water resources are abundant relative to water use, with less than 25 per cent of water from rivers withdrawn for human purposes, but malnutrition exists.

Little or no water scarcity
Abundant water resources relative to use, with less than 25 per cent of water from rivers withdrawn for human purposes.

Not estimated

Source: A Comprehensive Assessment of Water Management in Agriculture/International Water Management Institute

RAW MATERIALS STAGE
Water, energy, chemicals, and ethical practices in raw material production

<table>
<thead>
<tr>
<th>Impact area</th>
<th>Magnitude of Impact</th>
<th>Biggest drivers</th>
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<tbody>
<tr>
<td>Water</td>
<td>MEDIUM</td>
<td>Irrigation methods, e.g., choice between conventional cotton versus more sustainably sourced cotton.</td>
</tr>
<tr>
<td>Energy</td>
<td>MEDIUM</td>
<td>Using recycled plastics/fibres, e.g., replacing virgin polyester.</td>
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<tr>
<td>Chemicals</td>
<td>MEDIUM</td>
<td>Amount and frequency of fertiliser and pesticides use.</td>
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<tr>
<td>Waste</td>
<td>LOW</td>
<td></td>
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<tr>
<td>Labour practices</td>
<td>MEDIUM</td>
<td>Low level of wages. Prevalence of child labour.</td>
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<tr>
<td>Health &amp; safety</td>
<td>MEDIUM</td>
<td>Safeguarding safety standards.</td>
</tr>
<tr>
<td>Community</td>
<td>LOW</td>
<td></td>
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<tr>
<td>Ethical practices</td>
<td>MEDIUM</td>
<td>Guaranteeing animal welfare; extensive land use, consideration of use for food production.</td>
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PROCESSING STAGE
Both the environmental and the social footprints have a large impact in the processing phase

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<thead>
<tr>
<th>Impact area</th>
<th>Magnitude of Impact</th>
<th>Biggest drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals</td>
<td>VERY HIGH</td>
<td>Lack of waste water treatment in dyeing. Chemicals for fibre treatments.</td>
</tr>
<tr>
<td>Waste</td>
<td>MEDIUM</td>
<td>Waste of fibres/fabrics (e.g., roll ends, off-cuts, samples)</td>
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<tr>
<td>Labour practices</td>
<td>VERY HIGH</td>
<td>Low level of wages, non-compliance to labour laws, gender inequality; worker wellbeing, bonded and child labour.</td>
</tr>
<tr>
<td>Health &amp; safety</td>
<td>VERY HIGH</td>
<td>Building safety. Chemical exposure of workers.</td>
</tr>
<tr>
<td>Community</td>
<td>LOW</td>
<td></td>
</tr>
<tr>
<td>Ethical practices</td>
<td>LOW</td>
<td>Prevalence of corruption.</td>
</tr>
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Source: Pulse of the Fashion Industry 2017
MICROPLASTICS

Polyester is currently the most common raw material for textiles. Synthetic textiles, like all plastic materials, are extracted from fossil oil, which is a limited natural resource, so recycling these materials has many advantages. Even so, all types of synthetic garments involve major environmental challenges, microplastics being one of the greatest.

In 2017, H&M released a collection of garments made from recycled plastic from beaches and watercourses, and Tretorn and Swedish outdoor retailer Naturkompaniet launched raincoats made from ghost nets from oceans.

The problem with microplastics

Microplastics are extremely small plastic particles in the environment. These are generated in all contexts in which plastic is present, and it is estimated that household textile washing is one of the greatest sources.

All fabrics shed, and synthetic fibres will release microplastics when they are washed. The plastic particles released are then transported out with the rinse water and only a fraction are stopped by filters in waste treatment plants before being released into nature.

It is estimated that 15–30 per cent of the plastic pollutants in the oceans consist of microplastics, and that 35 per cent of these come from the laundering of synthetic textiles. In our marine environments, the particles attract pollutants that are normally not water-soluble, which are then transferred to aquatic animals and plants – and eventually into our bodies via the food we eat.

Since plastic is not biodegradable, microplastics represent an ongoing threat to our environment and health.

Focus on research

To prevent emissions of microplastics from synthetic textiles, we must first look at the production stage and how we might create synthetic materials that shed less microplastics. Currently, the textile industry lacks the knowledge required to make the necessary changes. Therefore, we need actors such as Mistra Future Fashion – which in collaboration with Swedish brands H&M, Filippa K and Boob Design, and researchers from Swerea IVF – has conducted a study to analyse the relationship between the properties of polyester fabrics and microplastic shedding. The project has concluded that fabric cutting should be done using ultrasound and that microparticles in fabrics should be removed in the production phase.

Another question is whether washing machines can be designed differently or supplemented with filters that reduce the emissions of microplastics, and whether laundry detergent can be manufactured so that it counteracts the release of these particles. We are already seeing new temporary solutions, such as GuppyFriend, a recyclable washing bag that traps the microplastics released when synthetic garments are washed. Working in collaboration with the Swedish School of Textiles, Chalmers University of Technology and a number of companies, Swerea IVF will continue its work to obtain more knowledge.

What consumers can do

Avoid taking your car when you go shopping for clothes (tire wear is one of the absolute greatest sources of the release of microplastics) and think about the types of fibres you consume. Also, remember there are both advantages and disadvantages of synthetic materials. Consider using a washing bag to trap microplastics and care for your garments in a way that contributes to lower emissions of microplastics.

Sources of marine microplastics and the various physical, chemical and biological processes affecting microplastics in the marine environment.
The GuppyFriend washing bag is a German innovation sold by Swedish brands like Filippa K and Houdini Sportswear. It prevents microplastics from ending up in our lakes and oceans, and due to its soft texture, there is less loss of fibres – which extends the life of your garments.
The high energy consumption of the textile industry is present in every stage of a garment’s life cycle. Just where most of the energy is consumed varies. About 70 per cent of a garment’s total climate impact occurs in its production phase, and apart from the heavy use of water and chemicals, energy costs are high whenever cloth fibres are spun, woven, knit and dyed.

Polyester, which is the most common textile fibre in the world, is petroleum-based and requires enormous energy input during its raw material production. For cotton the greatest consumption occurs in the wet process.

**Where and how we shop**

Energy is also consumed for the finished garment. This is partly because we wash, dry and iron our clothes, but particularly because we travel to and from the store. Fully 22 per cent of a garment’s total climate impact is caused by consumers’ travel, and most of this travel is done by car.

Transport in the supplier context is less critical from a climate perspective. Shipping from Asia to Europe accounts for less than one per cent of a garment’s total climate impact. That said, just what logistical solutions the brands choose plays a role. Air transport is the greatest environmental culprit and is only used in certain situations – such as when a collection needs to be added to during mid-season.

**New habits urgently needed**

Energy consumption generates emissions of CO₂ and greenhouse gases, which in turn cause climate change. Political commitments that translate into actual emission reductions and cleaner energy options are urgently needed.

Emissions of CO₂ from the fashion industry are expected to increase by over 60 per cent by 2030 – a staggeringly high figure that clarifies how the switch to renewable energy in the production phase is expected to be the single most effective change for reducing a garment’s climate impact, and that improved energy management in the fashion industry is potentially valuable for the world economy.

Just how much energy is consumed makes a huge difference, but equally important is the type of energy used. Coal power plants emit large amounts of CO₂ and the techniques for reducing emissions from coal power plants are expensive, whereas solar and wind power hardly emit any CO₂ at all.

**What consumers can do**

As a consumer it can be helpful to consider energy as a material: producing a garment requires more material in the form of fuel than in the form of fibres. A full car tank containing 60 litres of petrol – that is material that literally goes up in smoke.

Choosing to buy second-hand is another critical factor: fully 97 per cent of the energy can be saved compared to buying a new garment.

Choosing your form of transport and the place where you shop makes a major difference. Avoid driving your car. Regarding the growing e-commerce, there is a risk that transport and freight will account for the primary environmental impact unless we figure out sustainable methods.
Globally, we consume about 62 million tonnes of clothing per year, and only 20 per cent is re-used or recycled. The fact that the textile industry has no functioning waste management entails an ongoing risk of major resource shortages and environmental problems.

There is a need to incorporate, already in the design phase, a model in which garments may be recycled into other products or new fibres. In the short term we must first develop systems for collecting and processing textile waste.

The long-term aim is to enable automatic sorting of the building blocks of the materials, create new separation technologies and enable cleaning of blended materials on the molecular level.

Mechanical and chemical recycling methods
Recycling of textiles is usually divided into mechanical and chemical processes. In all textile recycling, fibre quality is a critical factor. When a garment is used and washed, its fibres become shorter and the quality is reduced. Recycling also changes the properties of most materials, and the number of times they can be recycled is limited.

With mechanical recycling, it is possible to achieve a new material without a lot of process stages. So far blended materials have presented a greater challenge. Certain types of mechanically recycled fibres can be re-spun into new yarn, but it is also possible to use recycled raw material to develop plastic materials, composites and non-woven material. This is the subject of research involving a test bed in Sweden.

Chemical recycling can be everything from melting a synthetic material and spinning it into new yarn, to dissolving and breaking it down into molecules that can then be recombined into polymers and further into textile material. The methods may be more or less suitable depending on the requirements of the final product.

Regarding chemical recycling of cotton, most of the activity takes place on the laboratory level, where cotton fibres are transformed into regenerated fibres, such as viscose or Lyocell. On the other hand, polyester recycling is taking place full-scale in Asia and is expected to be scaled up globally in the coming years. Wool is also recycled industrially.

Swedish innovation
In Sweden a great deal of research is being done on textile recycling. In 2017, Mistra Future Fashion presented the results of a six-year research project called Blend Re:wind that has developed a process for chemical recycling of cotton and polyester fibre blends.

The Trash-2-Cash project is also working intensively with this process, though using a different technology. The Re:Mix project, initiated in 2016, aims to develop the technical methods required to separate nylon and elastane out of fibre blends in used textiles.

The Re:Newcell project, another result of Swedish research, has developed a method for transforming used cotton and viscose into new, biodegradable pulp that can be made into new fibres, yarn, fabrics and, ultimately, new garments. Re:Newcell contends that the new material is of an equivalent or higher quality than the original fibre pulp. The process is already in use in Re:Newcell’s first plant.

What consumers can do
Instead of throwing unwanted garments and textiles into the garbage, the first and most environmentally friendly alternative is to re-use – that is, sell or donate – items you no longer want. Apart from donating intact garments to aid organisations, you can give or sell them to second-hand shops and, as is increasingly common, back to clothing retail chains. Find out if a clothing store near you will accept used garments and textiles for a trade.
Transparency is a key concept and an important driving force for change. The ability to track the creation of a garment through various stages and subcontractors shows that a brand has control over and can take responsibility for its undertakings.

The Sustainable Apparel Coalition (SAC) measures transparency through indexed criteria seen from both a social and environmental perspective throughout the value chain, including evaluations and improvement measures. RFID (radio-frequency identification) technology enables transparency and traceability in the value chain. Initiatives coordinated by Swerea IVF and funded by Vinnova introduce RFID on garments for purposes of efficient recycling and production traceability.

From individual to collective:
Insight into the industry’s general sustainability levels is important if we are to gain a shared understanding of what the most critical areas of the value chain are. This knowledge in turn will create the conditions for change and will channel investments to the areas that committed companies can focus on and benefit from.

Demand for more coordinated, comparable and reliable sustainability information is currently growing. While many individual brands and actors have made major progress in the area to date, applying ‘best practice’ on a cross-industry level internationally requires an even greater collective effort.

In Sweden it’s common to take advantage of a ‘triple helix’ – an innovation model in which universities, businesses and public authorities collaborate. With the industry united on a common sustainability agenda, the parties can work together and efficiently with resources to promote innovation and growth.

The Chemicals Group at Swerea IVF is one such network that works actively with mutual requirements and transparency in the supply chain. The initiative, which has been in existence for over 10 years, has approximately 120 members from the textile industry. The tools called ChemicAll, developed by the network, have been recognised by the OECD.

A Swedish key player:
Swedish H&M is an industry-leading brand in sustainability issues. When the global movement Fashion Revolution, in collaboration with Ethical Consumer, published its latest Fashion Transparency Index in 2017 – an evaluation of transparency in supplier chains and working conditions in textile factories - H&M was ranked third of the 100 companies on the list.

H&M is a partner of the Global Fashion Agenda group, rooted in the sustainability event Copenhagen Fashion Summit, who work to create a unified agenda for key environmental, social and ethical problems in the fashion industry. As one of the original members of the Sustainable Apparel Coalition, H&M also works to promote the issue of transparency. With the help of Swedish experts, this organisation developed the Higg Index – a holistic self-evaluation tool used to measure social and environmental impact at all stages of the value chain. Both Mistra Future Fashion and H&M also participate in the Circular Fibres Initiative of the Ellen MacArthur Foundation, which brings together key actors in the fashion and textile industry to build a circular economy.

What consumers can do:
The better informed you are as a consumer, the greater the pressure you can exert on companies to act sustainably. There are also many organisations and actors that provide information on the labour exploitation and environmental depletion that continue to occur within the fashion and textile industry. With the help of simple, reliable tools, it could be possible for us as consumers to make better-informed choices.
Fashion is, perhaps surprisingly, one of the top polluting industries in the world. Clearly, we must start producing and consuming clothing with an increased consideration for its environmental and social footprint. It’s a global matter and international cooperation is essential. In Sweden, the challenge to find new solutions is met by conglomerates, start-ups, consumers and research centres working together. The goal is to stay fashionably sustainable. Awareness is on the rise with lots of exciting new solutions, so make sure to become a part of the fashion revolution.