# Performance requirements for textiles
# Input on EU sustainable design criteria for textiles

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# Responsibility

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# Executive summary

Textiles are an essential part of our day to day lives. Clothing keeps us warm, protects us from hazards and allows us to express ourselves. However, the production, maintenance and disposal of clothing comes with a high environmental burden. Therefore, the European Commission has presented its strategy for sustainable and circular textiles. One of the measures under the strategy is to regulate textiles through the Ecodesign for Sustainable Products Regulation (ESPR). Under the ESPR performance requirements and information requirements can be made mandatory for products to be put on the European market. In collaboration with member states, experts, and stakeholders, the commission will develop a proposal outlining performance and information requirements for the upcoming years. This study, which was commissioned by the Dutch Ministry for Infrastructure and Water management, provides input for the proposal on performance requirements. While this study is not directly aimed at information requirements, the knowledge gathered on information requirements is given in this report as well. However, the information requirements are not fully developed.

**ESPR**

The ESPR initiative has two main objectives: to reduce the negative environmental impacts of products throughout their lifecycle, and to improve the functioning of the internal market. The ESPR aims to improve several aspects of a products' life cycle to address relevant environmental impacts. These aspects are listed in table 0.1.

**Categories**

The focus of this report is on three types of textile products: consumer clothing, workwear, and household. These categories correspond to the circular textile policy program of the Netherlands, as well as to the Dutch textile Extended Producer Responsibility scheme. The aim is to extend the use phase of textiles, but this cannot be achieved through performance requirements alone. Overengineering textiles within the current situation of fast fashion will lead to an increased environmental impact by extending the technical durability of the textile product beyond its social and aesthetic lifespan. To address this, we propose the following differentiation as subcategories: textiles intended for a long cycle (longer than 2 years) and textiles for a short cycle (up to 2 years).

- For short cycle textiles the focus will be on recycled content and recyclability.
- For long cycle textiles the focus will be on durability and repairability.

For workwear we differentiate between protective and non-protective workwear. Protective workwear already has high standards, specific norms, and regulations to safeguard the end-user. As protective gear is usually leased in a business-to-business setting, longevity is part of the business case. Therefore, this report focusses only on non-protective workwear which is again divided in long and short cycle clothing. For household textiles we found that these textile items are long lived and are generally relatively easily recyclable as they are mostly made from mono materials and contain a minimum of components that hamper recycling.

Table 0.1 lists the ESPR aspects and describes the focus of the potential performance requirements for each category.

*Table 0.1*

| ESPR aspects | Focus | Note |
|---|---|---|
| A. Durability | X | Most relevant for categories with long cycle and household textiles |
| B. Reliability | - | Not relevant, except for safety wear which has its own regulations. |
| C. Reusability | X | Most relevant for categories in the long cycle and household textiles |
| D. Upgradability | - | Not relevant |
| E. Repairability | X | Most relevant for categories with long cycle and household textiles |
| F. Refurbishment | - | Not relevant |
| G. Presence harmful substances | X | Relevant for all categories |
| H. Energy use or efficiency | - | Not relevant, however energy usage in production or care is. This should be addressed by care instructions (M.) |
| I. Resource use or resource efficiency | - | Best through other regulations |
| J. Recycled content | X | Relevant for all categories |
| K. Remanufacturing or recycling | X | Most relevant for categories with short cycle and household textiles |
| L. Recovery of materials | - | Is lower step in the waste hierarchy than recycling. Therefore, we focus on recycling (K.) |
| M. Environmental impacts | X | Relevant for all categories |
| N. Expected generation of waste | - | Best through other regulations |

**Performance requirements**

The three general recommendations for performance requirements for all categories are repairability, substances of concern, and environmental impact. For long cycle clothing, spare components must be readily available on the market, and bespoke items must have orderable spare parts. According to the proposal for the ESPR, chemical hazards cannot be regulated through performance requirements, as this would interfere with chemicals regulation. However, performance requirements can be made on substances of concern as their presence or use in the supply chain impacts sustainability. Therefore, we suggest banning all additional substances listed in the MRSL issued by the Zero Discharge of Hazardous Chemicals Foundation, which are not regulated through REACH. This list aims at protecting protect workers, local communities, and the environment from the possible impacts of harmful chemicals This list should be reviewed regularly.

To minimize environmental impact, we advise to wash all plastic containing cloth before it is brought to the market, using laundry facilities equipped with filters that capture released microplastics.

The other performance requirements, based on the ESPR aspects, vary according to each category, and are presented in figure 0.1.

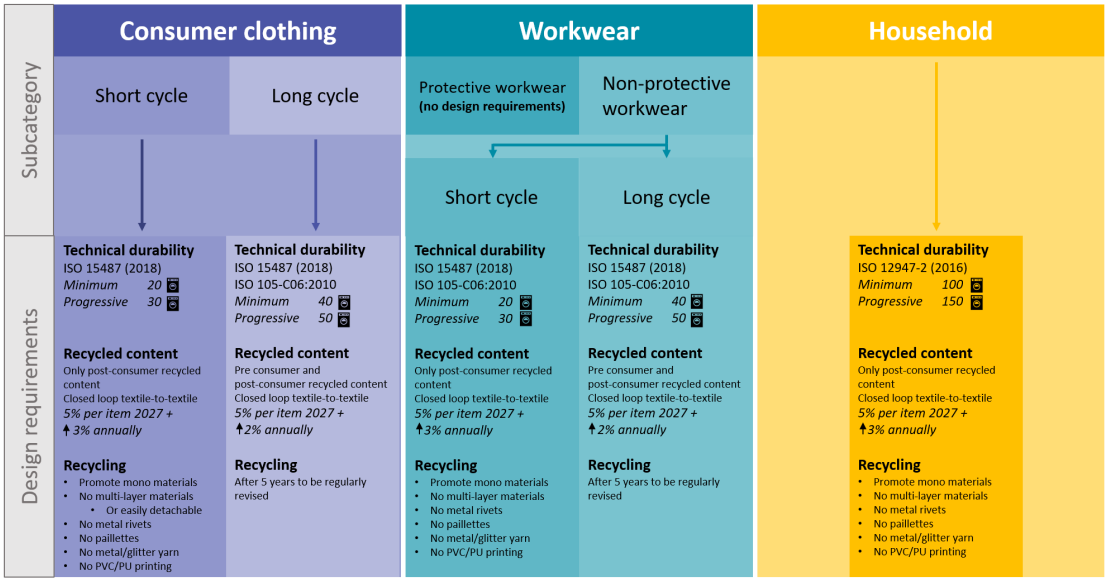


*Figure 0.1 An overview of performance requirements on each (sub) category*

### Provide additional information to increase transparency

There are alternative measures to mitigate the environmental impact of textiles, beyond extending of textile lifespan or design for recycling. A key approach is to increase transparency on the environmental impact of textile products and allow consumers to make conscious decisions. This can be achieved through an (digital) information label to each textile product. Although this study wasn't aimed at information requirements, we suggest considering the aspects in table 0.2 when designing information requirements.

*Table 0.2. An overview of essential information needed in the label.*

| Aspects of information label | Note |
|---|---|
| Resource efficiency | Make it mandatory to disclose the resource efficiency of the product passport. At a minimum report the following:<br>• The amount of energy used to produce the product, specifying the percentage of renewable and non-renewable sources<br>• The amount of resources required to produce the product, which can be determined through a mass balance |
| Environmental impact of an item | It should be mandatory to disclose the environmental impacts of the product's production. This should be done according to the PEF textile standard that is currently scheduled to be released in 2024 |
| Microplastics | Make it mandatory to disclose the potential for the product to release microplastics. Differentiate between products that release many microplastics and those that release less microplastics |

| Aspects of information label | Note |
|---|---|
| Repairability | Information about the correct replacement component must be and accessible for both the user/consumer and the tailor/repair professional |

# Glossary

| Term | Definition |
|---|---|
| Textile industry | All organizations who work on textiles, e.g., yarn, cloth, and clothing, from designing, production till the end-of-life manufactures, and all in between |
| Textile supply chain | A network of facilities that produce raw materials, transform them into intermediate goods and then final products and deliver the products to end users through a distribution system |
| Ecodesign directive | Ecodesign Directive 2009/125/EC,<br>Current legislation for Ecodesign, aimed at energy usage of electronic equipment |
| Ecodesign for Sustainable Products Regulation (ESPR) | Proposal for Ecodesign for Sustainable Products Regulation (europa.eu)<br>Upcoming legislation for Ecodesign with a wider scope of products and looking at the whole life cycle. The revision of the Ecodesign Directive which is currently being negotiated at the EU-level. With the revision, the Ecodesign legislation will cover a wider scope of physical products. Ecodesign requirements consist of sustainability and circularity aspects and cover the entire life cycle of a product |
| Extended Producer Responsibilities (EPR) | An instrument for encouraging more sustainable products on the market and for improving the treatment of waste streams of products |
| Environmental footprint | The overarching purpose of Product Environmental Footprint information is to enable to reduce the environmental impacts of goods considering supply chain activities (from extraction of raw materials, through production and use to final waste management). This purpose is achieved through the provision of detailed requirements for modelling the environmental impacts of the flows of material/energy and the emissions and waste streams associated with a product throughout the life cycle. (adapted from European Platform on LCA \| EPLCA (europa.eu)) |
| Closed loop recycling | Collecting and sorting recycled materials, extracting resources from the materials, and using those resources as inputs in the manufacturing of products identical to the original |
| Open loop recycling | Collecting and sorting recycled materials, extracting resources from the materials, and using those for new raw materials in products that are different from the original |
| Pre-consumer waste | Waste materials that were created during the process of manufacturing or delivering goods prior to their delivery to a consumer |
| Post-consumer waste | Waste materials that were created during the end of the use phase |

| Term | Definition |
|---|---|
| REACH | A European regulation on the Registration, valuation, Authorisation and Restriction of Chemicals Reach regulation consolidated text (europa.eu) |
| ECHA | European Chemicals Agency |
| ZDHC | Zero Discharge Hazardous Chemicals |
| MRSL | Manufacturing Restricted Substances List |
| Cradle to gate | Impact of a product from the moment it is produced to the moment it enters the store |
| Water usage | The aggregate sum of water extracted from its source to be utilized |

# 1 Introduction

Textiles are an essential aspect of our daily lives. Europeans consume on average 21 kg of textiles per person per year and discard about 11 kg of textiles per person per year[1] and the textile consumption in the EU is increasing[2]. The textile industry is on a global scale contributing to global greenhouse gas emissions, water pollution, poor working conditions, and overflowing landfills[3].

The European commission has set an ambitious goal to create a fully circular economy by 2050. Therefore, the textile industry should also be circular by 2050[4]. This implies a transformative change for the textile supply chain specifically. As part of the European Green deal and the circular economy action plan, the European commission has developed a new strategy for sustainable and circular textiles. As a part of this new strategy, textiles will be regulated with the Ecodesign for Sustainable Products Regulation (ESPR). Under this Regulation, design requirements will be set for textiles. The Commission is expected to start developing these measures in 2024. The design requirements can include binding targets for material use, and production (performance requirements) as well as information requirements. The design requirements should incentivise a more circular business model and increasing closed-loop recycling methods.

The Netherlands has set the goal to transform its economy to fully circularity by 2050. So, textiles must become circular, to be a part of this Dutch circular economy. Therefore, The Netherlands has developed a policy program for circular textiles[5]. The Dutch governments wants to contribute to the transition for textiles; therefore, the Dutch Ministry of Infrastructure and Water management has commissioned this study. The aim of this study is to provide relevant insights on potential performance requirements to be covered under the Ecodesign Directive for textiles and their feasibility, given the state of art in the sector. The results discussed in this report.

[1] Steeds meer textiel in Nederland (cbs.nl)
[2] EU strategy for Sustainable and Circular Textiles
[3] The impact of textile production and waste on the environment (infographic) | News | European Parliament (europa.eu)
[4] Textiles strategy (europa.eu)
[5] Bijlage beleidsprogramma circulair textiel 2020 - 2025 | Rapport | Rijksoverheid.nl

## 1.1 Scope of this project

Textiles have many functions, they are used in apparel, household textile, but also in products such as medical and protective equipment, buildings, and vehicles. In addition to this, textiles are made of many types of materials such as cotton, polyester, polyamide, wool, synthetic celluloses (viscose, lyocell), hemp or acryl.

**Textile products**

**Consumer clothes** such as:

- Trousers and shorts
- Skirts
- Jackets
- Coats/raincoats
- Pyjamas and nightwear
- Shirts, dresses and blouses
- Lingerie and underwear
- Swimwear

**Household textiles** such as:

- Bath towels
- Kitchen towels
- Bedding

**Workwear** such as:

- Casual workwear
- Promotional clothes

*Figure 1.1 Overview of textile products*

The focus of this report is on the following types of textile products, see figure 1.1. These categories correspond to the circular textile policy program of the Netherlands, as well as the Dutch textile Extended Producer Responsibilities (EPR)[4].

**Textile types**

Aside from product types this report focuses on the following textile materials.

- Cotton
  - A cellulose based textile. Other cellulose based textiles are e.g., hemp, linen ‘Viscose,’ ‘Lyocell’ and ‘Modal’
- Polyester
  - A synthetic textile made of oil. Other synthetic fibres are polyamide, polyacrylic, polypropene, aramid and elastane

These two types of fibres are the most common types of fibres. In addition, these two fibres can be seen as representatives of the largest textile groups, the synthetic fibres, and the cellulose fibres. Within this report animal-based fibres (approximate less than 1 % of the market) have been left out of the scope, see figure 1.2.

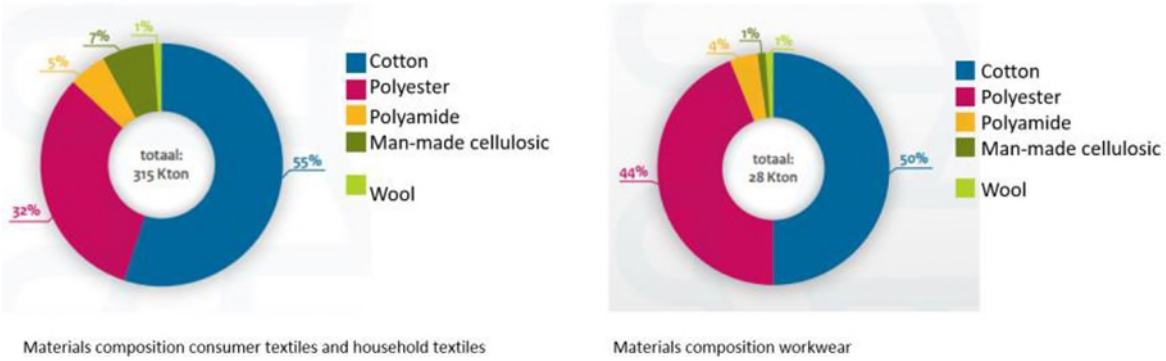


*Figure 1.2 The composition of materials in consumer, household textiles (left) and workwear (right)*[6]

Because of workers safety, using disposable textiles is common in the industry. These disposables are commonly made of synthetic nonwoven materials. A type of fabric made of plastics that mimics the properties of paper. Because of these different properties these disposables are excluded from the development of performance requirements.

## 1.2 Purpose of this report

This research aims to come to realistic and ambitious performance requirements for textiles, in line with the Dutch government's position on circular and sustainable textiles, to obtain a more circular textile supply chain. This report intends to answer the following questions:

- How could textile performance requirements be defined?
- Which minimum ambition level is required to achieve a footprint reduction of the textiles sector?
- What are realistic performance requirements given the current state of technology and anticipated technology developments and innovations?

## 1.3 Target audience

The final report targets the readers who work in the textile supply chain and are interested in the upcoming process of drafting EU design requirements for textiles. This report will be made publicly available by the Dutch ministry of Infrastructure and Water management and will be presented to the relevant stakeholders including the European Commission.

## 1.4 Reading guide

The structure of this report is as follows. Chapter 2 gives the approach of this project. Chapter 3 gives an overview of the European Commission’s aim for the textile sector as well as the circular economy policy regarding textiles in the Netherlands. Chapter 4 entails the current textile supply chain and the environmental impact of the textile supply chain. Followed by key issues and the complexity of the textile market in chapter 5. The performance requirements are described in chapter 6. Lastly, the recommended performance requirements are shown in chapter 7.

[6] Monitoring beleidsprogramma circulair textiel (overheid.nl)

# 2 Approach

The goal of this report is to present performance requirements as an input for the EU wide comitology procedure on design requirements for textile products. The performance requirements are aimed at the same textile categories that fall under in the Dutch EPR-scheme and the circular textile policy program of the Netherlands. These textile categories are (1) consumer textiles, (2) workwear and (3) household textiles. Figure 2.1 shows the approach used in this project to develop design requirements.

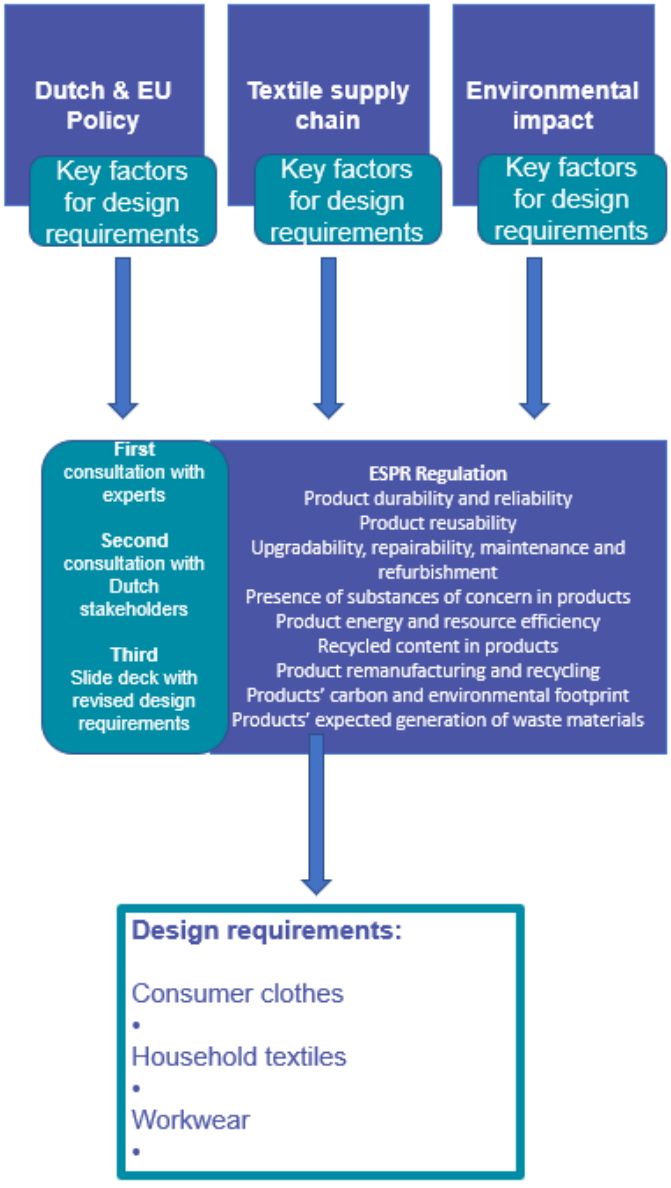


*Figure 2.1 The approach to develop design requirements*

Through literature review different key facts were gathered from (1) the Dutch and EU policies, (2) the textile value chain and (3) the environmental impact of the textile value chain. The information gathered through the literature review was assessed through an ESPR lens.
The result of this research showed current difficulties in manufacturing (e.g., deficit of materials in recycling), the policy instruments used to reach a circular economy for textiles and the complexity of the textile supply chain. Chapter 3 and 4 give the information gathered in this step.
Based on the gathered information independent specialists were consulted on practical and feasible performance requirements. This consultation round helped the project team to formulate a pencil sketch of the performance requirements. In the next phase these preliminary performance requirements were tested in interviews with market parties. This helped improving the performance requirements to a level where they could be evaluated through a wider written review round with stakeholders. The review round was mostly with progressive stakeholders, so the requirements are deemed to be ambitious.

# 3 Dutch and EU circularity and textile policy

This chapter describes (paragraph 3.1 and 3.2) and compares (paragraph 3.3) relevant Dutch and EU policies.

## 3.1 Circularity and textile policies in the Netherlands

In September 2016, the Dutch government launched the *Government wide program for a Dutch Circular Economy*. The aim of the program is to be completely circular by 2050. By 2030 the consumption of primary raw materials must be reduced by half. To reach these goals for the textile supply chain the *Circular textile policy* has been established in 2020. In this policy document, the Dutch government describes the transition towards a fully circular textile industry in 2050. Several intermediate goals are set for 2025, 2030 and 2035. These goals are presented in table 3.1.

*Table 3.1 Government circular textile policy 2020*

| Policy transitions towards a fully circular economy[7] | |
|---|---|
| 2025 | • Share of recycled (post-consumer) / sustainable material in textile products is 25 %<br>• 30 % of all resources, materials and products put on the Dutch market, will be - if direct reuse is not possible anymore- recycled<br>• A minimum of 10 % of the disposed textile products will be reused on the Dutch market |
| 2030 | By 2030, the transition towards a fully circular economy will be halfway complete, which means that:<br>• All textile products put on the Dutch market will contain 50 % sustainable material. From that 50 %, 30 % will be recycled material and 20 % sustainable materials<br>• After collection and when re-use is no longer possible, 50 % of resources, materials, and products put on the Dutch market should be recycled<br>• A minimum of 15 % of the disposed textile products will be reused on the Dutch market |
| 2035 | The ambition is to cut the ecological footprint of subjects such as emissions, water use, chemicals, and microplastics by half |
| 2050 | Fully circular economy |

The Dutch circular textile policy contains several policy measures related to the eco-design of textile products:

- In October 2020, several parties from the denim supply chain signed the **Green Deal Circular Denim (Denim Deal)**. The aim of this agreement is to further encourage the use of post- consumer recycled (PCR) cotton in the production of new denim garments. Local producers, next to societal- and environmental parties are involved to achieve sustainable impact in production countries. Progress on the targets is annually monitored. In 2021 a baseline study was executed with 2020 as a base year. This provides insight into the starting point from which the member parties worked towards the agreed objectives. The baseline measurement shows that in 2020, 8 percent of denim garments put on the Dutch market by the affiliated parties contained the targeted 5 percent PCR cotton.

[7] Beleidsprogramma circulair textiel 2020-2025

For the global market, this applies for 12 percent of the denim garments they produce. The 2022 report on the year 2021 shows that the target of 5 percent PCR is met for 26 % of all the denim garments put on the Dutch market by signatories of the Denim Deal. Of the 1.1 million jeans put on the market by the signatories of the Denim deal 36 % contained more than 20 % PCR

- In 2016, a broad coalition of businesses and other organizations signed the **Dutch Agreement on Sustainable Garments and Textile**. During a period of 5,5 years, they worked together to improve working conditions, prevent pollution, and promote animal welfare in production countries. This covenant has been reviewed, next to the other 'International Responsible Business Conduct (IRBC)' covenants. The review of this policy was presented in the paper 'Van Voorlichten tot Verplichten'[8]. As mentioned in the coalition agreement 2021-2025[9] the Netherlands is promoting IRBC legislation in the EU and will introduce national IRBC legislation that considers a level playing field between neighbouring countries and the implementation of possible EU regulations
- **Microplastics** can be released into the environment during production, use or recycling of clothing. When washing synthetic or coated cotton clothing, thousands of microplastics end up in the sewage system. While sewage treatment plants remove much of this from wastewater, a substantive volume is discharged into surface waters. As a result, synthetic fibres contribute to the amount of plastic in the sea[10]. To minimize the spread of microplastic fibres the government takes a collective approach with all stakeholders in the supply chain: textile and clothing manufacturers, retailers, consumers, washing machine manufacturers, detergent manufacturers, sewage treatment companies and local governments. A concrete example is the research of TNO commissioned by the ministry to define a measurement method for microplastics from textiles[11]. The Dutch government would like to work together with other countries on microplastics abatement as this is most effective. The European Union already initiated the 'measures aiming to reduce the presence in the environment of unintentionally released microplastics from textiles' to reduce the impact of microplastics. The Dutch government will urge the European Commission to tackle the removal of microplastics from textiles at the source
- **An Extended Producer Responsibility (EPR),** in the Netherlands will enter into force on July 1st, 2023. The EPR entails that textile producers and importers are responsible for the collection, recycling, and reuse of their products. The EPR aims to promote more reuse and recycling, leading to less waste and pollution. Currently, only 12 percent of the collected textiles are recycled (not all fibre-to-fibre) and only 2 percent is reused in the Netherlands. The decision is intended as a financial incentive that will effectively manage textile waste and minimize the need for new raw materials. In the EPR, several targets are included for the producers[12]. These are presented in table 3.2. In addition, producers are also responsible for informing consumers, providing annual reporting, and publishing an appropriate take-back

[8] IMVO maatregelen in perspectief (overheid.nl)
[9] Coalitieakkoord 2021 – 2025: Omzien naar elkaar, vooruitkijken naar de toekomst (overheid.nl)
[10] Maatregelen tegen milieubelastende microplastics uit kleding | RIVM
[11] Adviesrapport inventarisatie uniforme meetmethode voor microplastic vezels uit textiel
[12] Besluit uitgebreide producentenverantwoordelijkheid textiel

system including financing. Producers can jointly start a producer organization to implement the obligations under the EPR

*Table 3.2 Obligations included in the EPR textile*

| Goals 2025 | Goals 2030 |
|---|---|
| • 50 % of the total textile waste will be reused or recycled. | • 75 % of the total textile waste will be reused or recycled |
| • At least 20 %-point of the 50 % total textile waste will be reused, the other 30 % may be reused or recycled | • At least 25 %-point of the 75 % total textile waste will be reused, the other 50 % may be reused or recycled |
| • At least 10 %-point of the 20 % reuse will be reused in the Netherlands | • At least 15 %-point of the 25 % reuse will be reused in the Netherlands |
| • At least 25 % of the recycled material must be fibre-to-fibre recycled | • At least 33 % of the recycled material will be fibre-to-fibre recycled |

## 3.2 European circularity and textile policies

In December 2015, the European Commission adopted the First Circular Economy Action Plan. The plan aims to stimulate the development of lead markets for climate-neutral and sustainable products in the EU and beyond. A revision and adaptation of this plan led to the New Circular Economy Action Plan (CEAP), which has been adopted in March 2020. The CEAP establishes a sustainable product policy framework, including measures in three broad areas: fostering sustainable product design; empowering consumers and public buyers; and promoting circularity in production processes.

In March 2020, the European Commission adopted the Industrial Strategy for Europe. The policy sets out the EU's overarching ambition to foster a transition to climate neutrality and digital leadership. It echoes the European Green Deal, which was adopted in December 2019, in highlighting the leading role that Europe's supply chain must play, by reducing its carbon and material footprint and embedding circularity across the economy. It underlines the need to move away from traditional models, and revolutionize the way we design, make, use, and dispose of products.

As part of the Circular Economy Action Plan and the Industrial Strategy for Europe a proposal for Ecodesign for Sustainable Products (ESPR) and the EU Strategy for Sustainable and Circular textiles were presented in March 2022. Building on both documents the European Commission will develop binding product-specific eco-design requirements to increase textiles' performance. To understand the policy context of this initiative this section will describe successively the *Ecodesign for Sustainable Products (ESPR) and the EU Strategy for Sustainable and Circular textiles*, including related other policy measures.

### 3.2.1 Ecodesign for Sustainable Products (ESPR)

The objectives of the ESPR initiative are to reduce the negative life cycle environmental impacts of products and to improve the functioning of the internal market[13]. It therefore lays down a framework for setting Ecodesign requirements, such as product durability, reusability, upgradability and reparability, the presence of substances of concern in products, product energy and resource efficiency, use of recycled content in products, product remanufacturing and high-quality recycling, and for reducing products' carbon and environmental footprints.

The ESPR replaces and builds on the existing Ecodesign Directive of 2009 but expands the scope of products from energy-related products to most physical products. The European Commission will prioritise product groups for which ecodesign requirements will be established. This will be done in the ecodesign working plan. A report, published by the Joint Research Centre, which is closely affiliated with the European Commission, names the following product groups as potential priorities: Textiles, furniture, bed mattresses, tires, detergents, paints, lubricants, and chemicals. Energy-related products for which the measures need to be revised or newly defined and ICT-products will also be prioritised[14].
Although the ESPR is not yet final and still subject to change it now includes the following main elements:

- All products regulated under the ESPR which are put on the EU internal market will have to comply with the set eco-design requirements. The ecodesign requirements are expected to build upon the voluntary EU Ecolabel criteria for Textile Products, which already includes requirements related to environmental aspects of textile products such as chemical use, fitness for use (quality) and best production practices. Furthermore, by developing criteria for safe and sustainable by design for chemicals and materials, the Commission will support the industry to minimize the substances of concern in textile products, as announced in the Chemicals Strategy for Sustainability

**A Digital Product Passport (DPP)** will be developed, helping to allow easy and convenient access to and sharing of product data. When Ecodesign requirements apply to textiles, it will be mandatory to make a Digital Product Passport available. The DPP will give supply chain actors, consumers, and public authorities access to detailed product information. The DPP is a tool which can include guidance on how to repair or recycle products. The passport can also facilitate tracking substances of concern along the supply chain.

- The General Approach of the member states agreed on in May 2023, contains a direct **ban on the destruction of unsold clothing and clothing accessories**. The European Parliament has also indicated to be supportive of this ban on destruction
- **Green public procurement.** The Commission would be empowered to adopt delegated acts establishing ecodesign requirements for public contracts, including mandatory technical specifications and selection criteria. This builds upon the EU GPP criteria for textiles products and services, prescribing criteria for the purchase of goods, services and works with reduced environmental impacts

[13] Ecodesign for sustainable products (europa.eu)
[14] Carriages preview | Legislative Train Schedule (europa.eu)

### 3.2.2 European strategy for Sustainable and Circular textiles

The *EU Strategy for Sustainable and Circular Textiles*[15] sets out the vision and concrete actions to ensure that by 2030 textile products placed on the EU market are long-lived and recyclable, made as much as possible of recycled fibres, free of hazardous substances and produced in respect of social rights and the environment. To reach this aim six key actions are proposed:

- **Introducing mandatory Ecodesign requirements.** Extending the life of textile products is the most effective way of significantly reducing their impact on the climate and the environment. To achieve this, product design plays a key role. Increased durability will enable consumers to use their clothes for longer and at the same time support circular business models. In addition, material composition, including the fibres used and their blending, or the presence of chemicals affects the environmental performance of textiles. Whether chemicals are desirable in textile items is a fine line. Although chemicals might be harmful to the environment, they add functionalities to textile items, increasing the performance and lifetime[16]
- **Stopping the destruction of unsold or returned textiles**. The General Approach the member states have agreed on does already include a direct ban on the destruction of unsold clothing and clothing accessories. It remains to be seen whether this provision will be included in the final agreement. In the future, the Commission could introduce a ban for other types of textiles products
- **Tackling microplastic pollution.** By introducing binding design requirements, being introduced under the ESPR, the Commission plans to mitigate the shedding of synthetic fibres in the environment, together with the *Microplastic Pollutions Initiative*
- **Introducing information requirements and a Digital Product Passport.** Clear, structured, and accessible information on the environmental sustainability characteristics of products empowers businesses and consumers to make better choices and improves communication between actors along value chains for example on substances of concern, on repair or on the fibre composition. Therefore, as part of the measures under the ESPR, the Commission will introduce a *Digital Product Passport* for textiles for textiles, which will contain mandatory information on circularity and other key environmental aspects. Which information requirements apply will be determined in the secondary legislation under which textiles are regulated
- **Green claims for truly sustainable textiles.** Consumers willing to purchase more sustainable products are often discouraged from buying them by the unreliability of claims: a recent screening of sustainability claims in the textile, garment and shoe sector suggested that 39 % could be false or deceptive17. The initiative on Empowering Consumers for the Green Transition18 will result in a ban on misleading generic claims and in new rules which ensure that consumers are provided with information at the point of sale about a commercial guarantee of durability as well as information relevant to repair. To complement the Empowering Consumers Initiative by setting requirements for the substantiation and communication of explicit environmental claims, the Commission has presented the

[15] Textiles strategy (europa.eu)
[16] Ecodesign for sustainable products (europa.eu)
[17] Sweeps (europa.eu)
[18] Proposal for a Directive on empowering consumers for the green transition and annex (europa.eu)

Green Claims Directive19. The Green Claims Directive sets requirements for the substantiation and communication of explicit environmental claims on products and traders. The proposal also presents requirements for environmental labelling schemes

- In addition, the Commission will review the *EU Ecolabel criteria for textiles and footwear* to support its uptake among producers and offer consumers an easily recognizable and reliable way to choose eco-friendly textile products
- **Extended producer responsibility (EPR) and boosting reuse and recycling of textile waste.** Making producers responsible for the waste that their products create is essential to decouple textile waste generation from the growth of the sector. EPR requirements have proven to be effective in improving separate collection of waste and its subsequent management in line with the waste hierarchy. In this context, the Commission will propose harmonized EU extended producer responsibility rules for textiles with eco-modulation of fees, as part of the forthcoming revision of the Waste Framework Directive[20]. The revision is to monitor the developments in waste generation, composition, and treatment the Commission has also launched a dedicated study with a view to proposing mandatory targets for preparing for reuse and recycling of textile waste. The Waste Framework Directive already obliges municipalities to separately collect textile waste from its inhabitants from 2025 onwards. A sharp increase in the amount of separate collected textile waste is therefore expected

## 3.3 Design requirements and Dutch and EU policies

Figure 3.1 shows a timeline, which presents all discussed policy measures regarding textile ecodesign requirements. The left-hand side presents all Dutch policy measures and the right-hand side all European policies.

[19] https://environment.ec.europa.eu/topics/circular-economy/green-claims_en
[20] Expected summer of 2023

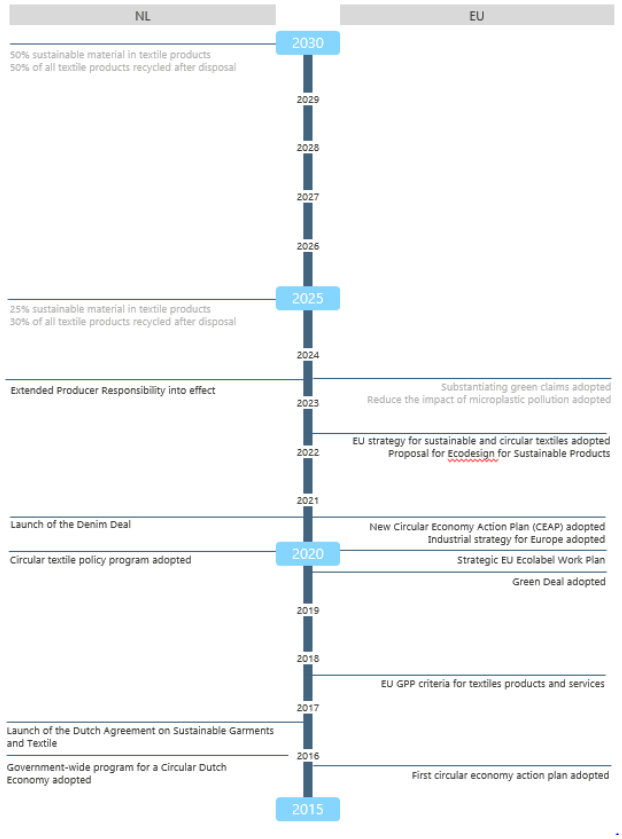


*Figure 3.1* Timeline of all discussed policy measures

### 3.3.1 Comparison between Dutch and EU policies

The timeline and policy study above suggest that, in general, European, and Dutch policies complement each other on circular textiles. This is understandable due to the international nature of the textile industry. The Dutch policy focuses on the phases where the government has direct influence, which are the retail, use, and post-use phases of the textile chain. The Dutch government demands of the textile retail sector to increase the share of recycled and sustainable content in textile products that are put on the Dutch market. In the post-use phase, the goal is to reuse and recycle as many textile products as possible. See also the visualization in figure 3.1.

However, the Dutch circular textile policy program acknowledges that some issues cannot be regulated at the national level. To address these issues, the Dutch government is actively lobbying at the European level for a transition to a more circular textile industry.

In general, the Netherlands takes a leading approach vis-a-vis European circular textile policies. For example, with the Extended Producer Responsibility (EPR) the Netherlands acts as one of the frontrunners. As discussed in section 3.2.2 the European Union is developing guidelines for a mandatory EPR scheme. The Netherlands and involved producers/importers may contribute to the EU development by sharing their experiences on designing and introducing the EPR and seek for alignment.

There is a slight difference in focus between current Dutch textile policy and EU policy. Where the EU focusses more on longevity of the textile products, Dutch policy focusses more on targets for sustainable and recycled materials. However Dutch policy has a goal of halving the environmental impact of textiles which is more easily reached through lifetime extension than through sustainable and recyclable materials. Future textile policy in the Netherlands will probably focus more on longevity as well[21].

## 3.4 Conclusion

Both the Dutch and European textile policy focus on lowering the environmental impact of the textile value chain. Setting design requirements will play a significant role in achieving the goals set by the Dutch government as wells those set by the EU. Voluntary steps by the textile value chain have shown what is already possible. Now the lessons learned must be put in practice by all stakeholders in the textile value chain. This means that mandatory design requirements must be set which help reach the goals of both policies. The design requirements therefore should be aimed at both the recycled content and recyclability as well as on longevity of the textile products.

Note that although the Dutch and EU policy also focuses on working conditions and income of workers in the apparel and textile supply chain, this will not be negatively affected by establishing design requirements as currently proposed. Socioeconomic effects are beyond the scope of the current eco-design proposal so are left out of scope of this project as well.

[21] National+Circular+Economy+Programme+2023+-2030+Summary.pdf

# 4 Environmental impacts in the textile value chain

This chapter visualizes and explains the value chain of textiles, starting from raw fibre materials. Each section of the textile chain will be outlined in more detail in the next paragraphs and the environmental impact of that section is discussed. Chapter 4 aims to:

- Describe the current situation in the Netherlands
- Identify key issues in the value chain
- Describe the current state of technology now and in the upcoming 5 years, and
- Gain insight in the relevant environmental impacts in the textile value chain

The analysis of the textile value chain starts with describing the production of the two fibres, which represents the largest textile groups. The next paragraphs explain in a more detail how textile fibres are manufactured into products. And how they are being discarded, collected, and processed after use. Some steps in the value chain of textiles are the same for household textiles, consumer clothing and workwear. For other slight differences exist. The differences are explained within the description of each step.

## 4.1 Overall view of textile supply chain in The Netherlands

Figure 4.1 shows the textile supply chain from produced raw fibres materials until the different phases of end-of-use, e.g., reuse, recycling and recover. These phases are a strategic step for a circular economy[22]. This report focuses on circular approaches such as reuse and closed loop recycling which turns waste into value[23] to achieve the circular goals discussed in chapter 3. As with most European countries the production does not take place in the country itself. Production usually is done in the far east. The Dutch textile supply chain differs from supply chains in other EU countries because of its relatively advanced textile collection system. In Europe on average 35 % of all textiles are collected separately, in the Netherlands an average of 45 % of all textiles get collected separately[24,25]. Enhancing technical and social innovations are key factors for a circular textile supply chain[26]. Dutch sorting and consequently reuse and recycling facilities are playing an important role in the processing of waste textile from several EU member states. At this moment, many start-ups are working on fibre-to-fibre recycling technology in The Netherlands.

[22] R-ladder - Strategieën van circulariteit (rvo.nl)
[23] Circular fashion in Europe: Turning waste into value | McKinsey
[24] Circular fashion in Europe: Turning waste into value | McKinsey
[25] Afdanken en recyclen - Afval Circulair
[26] https://www.afvalcirculair.nl/publish/pages/138236/170179-03_vertaling_roadmap_circulair_textiel_en_07.pdf

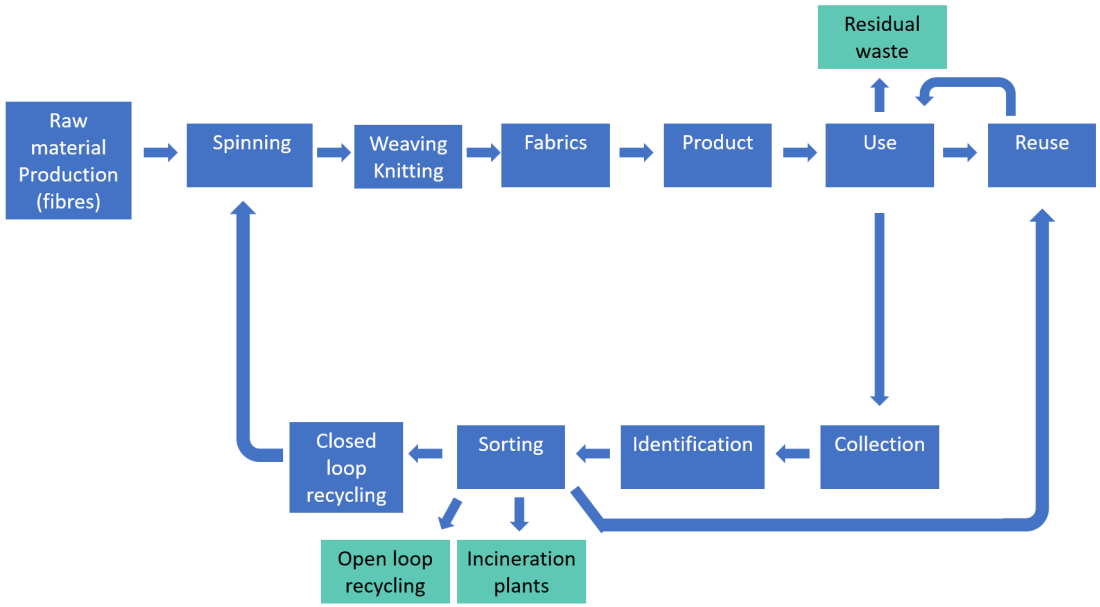


*Figure 4.1 The textile supply chain*

## 4.2 Overview of the environmental impacts in the textile supply chain

Before going into more detail in the textile value chain this paragraph focuses on the environmental impact of the whole textile chain. More detailed information is given in the next paragraphs for each step of the chain.

Textiles have a significant environmental impact, ranking among the top five sectors for greenhouse gas emission and water usage[27]. Additionally, the production and use of textiles have a significant impact on human- and eco-toxicity and the release of microplastics. Therefore, this report explores the environmental impact of textiles in terms of greenhouse gas emissions, energy use, water usage, the potential use of harmful substances and microplastics emissions.

The severity of the environmental impact is described in the tables at the end of each paragraph describing a step in the value chain (paragraphs 4.3). The severity is divided into three colours ranging from low to high, see table 4.1. Labelling the severity of environmental impacts is very complex as there is a large variety of textile products and production processes. Many different studies have been made and each has its own backgrounds and assumptions. Therefore, they are not comparable. This report is based on relevant recent studies to give a value to the severity of the different steps in the value chain. However, it should be noted that the severity as it is given in this report is generalised and might not apply for a single textile product.

[27] Textiles and the environment: the role of design in Europe's circular economy — European Environment Agency (europa.eu)

*Table 4.1 Colour scheme for the environmental impacts*

| The severity of the environmental impacts |
|---|
| High |
| Medium |
| Low |

The following sub paragraphs explain in more detail the environmental impacts and how these impacts relate to each other.

### 4.2.1 Greenhouse gas emissions

It is estimated that the textile sector is responsible for six to eight percent of the global greenhouse gas (GHG) emissions[28]. These emissions occur from energy-sources and non-energy sources, e.g., during farming (use of fertilizers) and production of chemicals. Overall, energy usage in the textile chain is the main driver for GHG emissions in the value chain. Reducing GHG emissions and achieving a carbon neutral textile supply chain is therefore closely related to increasing the use of renewable energy[29].

**Complexity of determining greenhouse gas emissions**

Determining greenhouse gas emissions for the production of a single piece of textile is complex. The distribution of greenhouse gas emissions across the global textile value chain is challenging to quantify, as it is dependent on the specific product, and materials, as well as the emissions-intensity of the country of production and consumer behaviour. Many studies exist which quantify the greenhouse gas emissions of various products made of different materials. Comparing them is challenging as the methodology as well as the input factors differ between the studies.

Another aspect of determining the greenhouse gas emissions is that different methodology is used to measure the amount of GHG emissions globally. Life cycle assessment, Greenhouse Gas Protocol and Higg Materials Sustainability Index are examples of the methodology used in recent studies, each with variable input factors[27]. This makes it difficult to compare literature reviews and draw conclusions to resolve what processes emits the most GHG emissions[30,31,32].

**Focus of this report**

Due to the complexity of determining the GHG emissions within the textile supply chain, this report follows the conclusion of the McKinsey and Company and Global Fashion Agenda report[33]. GHG emissions in the tables include:

- Production phase
  - Each step individually

[28] Taking climate action: Measuring carbon emissions in the garment sector in Asia (ilo.org)
[29] Taking climate action: Measuring carbon emissions in the garment sector in Asia (ilo.org)
[30] Taking climate action: Measuring carbon emissions in the garment sector in Asia (ilo.org)
[31] Beton, A., Dias, D., Farrant, L., Gibon, T., Le Guern, Y., Desaxce, M., Perwuelts, A., Boufateh, I. (2014) *Environmental Improvement Potential of textiles (IMPRO Textiles).* JRC scientific and policy reports
[32] fashion-on-climate-full-report.pdf (mckinsey.com)
[33] fashion-on-climate-full-report.pdf (mckinsey.com)

- Use phase
  - Washing and drying
- End of life phase
  - Machinery used for sorting and recycling
  - Energy recovery

### 4.2.2 Water usage

A key source for our quality of life is water, next to clean drinking water we need water to provide natural habitats and ecosystems. It is important to manage water well, which is a challenging task. Proper water management is affected by several pressures such as water pollution, rendering water unsafe, water 'theft' and droughts.[34] All these pressures lead to long-term (usable) water imbalances or water scarcity. Water scarcity is the result of insufficient rainfall in combination with high water demands from industries and agriculture.

**Focus of this report**

For each step in the value chain of textiles the water usage is estimated. By water usage we mean the aggregate sum of water extracted from its source to be utilized. The approximations of the water usage in each step are based on an article published in Sustainability[35].
Water usage includes:

- Production phase
  - Farming natural fibres (organic and non-organic)
  - Producing polyester fibres[36]
  - Wet processing
- Use phase
  - Amount of water used while washing
  - Amount of washing

### 4.2.3 Microplastics

Microplastics originate from various sources and follow different pathways to the aquatic environment, e.g., atmospheric decomposition and wastewater of domestic washing process[37]. Microplastics below five mm entering the aquatic environment can be mistaken for food by marine animals with fatal ending[38]. This report focuses on the microplastics in wastewater. Microplastics in wastewater are linked to contaminating the marine environment.[39] Following the food chain, these microplastics can accumulate in larger marine animals that in turn can be consumed by humans. This accumulation of microplastics might pose a threat to humans. There is still too little consensus on the effects on microplastics on human health to include these effects into this report.

[34] Water use and environmental pressures — European Environment Agency (europa.eu)
[35] Sustainability | Free Full-Text | Life Cycle Based Comparison of Textile Ecolabels (mdpi.com)
[36] WFA_Polyester_and__Viscose_2017.pdf (waterfootprint.org)
[37] A review on microplastic emission from textile materials and its reduction techniques - ScienceDirect
[38] sustainability-10-02457.pdf
[39] A critical review of interactions between microplastics, microalgae and aquatic ecosystem function - ScienceDirect

**Microplastics in wastewater**

Friction and abrasion, e.g., during washing of textiles, leads to shedding of micro fibres due to mechanical stress on the textile fibres[40].The shedding of microfibre can lead to micro plastics (in the case of textiles made of polymers). This report divides textiles into three categories, consumer clothes, household textiles and workwear. Each category has different maintenance cycles, e.g., washing temperatures. The shedding of microfibres depends on the maintenance cycle of the textile products. Factors such as the (amount of) detergents used, amount of water used during washing, and drying cycles influence the number of microplastics in the wastewater. For example, a decrease of water usage during washing results in rising levels of fibre fragments in wastewater due to the increased friction[41]. The presence of synthetic dyes on natural or synthetic cellulosic fibres is another way for microplastics to enter the wastewater and aquatic systems.
In the Netherlands almost all the wastewater is treated in a wastewater treatment plant. However even with treatment a significant amount of microplastics is released into the environment[42]. Current removal efficiency for microplastics is between 76 % and 99 %[43,44]. But even then, a significant amount of micro plastics and micro fibres enter the aquatic environment and will probably remain there forever.

**Focus of this report**

The focus of this report is microplastics in wastewater, and the comparison made in the description of the steps in the value chain is based on the three studies[28,29,45]. The microplastics impact in the tables includes:

- Production phase
  - Wet processing
- Use phase
  - Washing
- End of life
  - Microplastics in wastewater

### 4.2.4 Potentially harmful chemicals

Throughout the entire textile industry substances are used to add functionality to the textile products. Among the substances are auxiliaries, additives, catalysts, and surfactants. While some of these chemicals may not be inherently hazardous, certain conditions such as oxidation or pressure can lead to potential harm to humans. Potentially harmful chemicals can be released into wastewater, into the atmosphere and are disposed through solid waste in different concentrations. They can do harm to the human body through inhalation, digestion, or direct contact.

[40] Cause of microfibers found in the domestic washing process of clothing: focusing on the manufacturing, wearing, and washing processes | Fashion and Textiles | Full Text (springeropen.com)
[41] Cause of microfibers found in the domestic washing process of clothing: focusing on the manufacturing, wearing, and washing processes | Fashion and Textiles | Full Text (springeropen.com)
[42] STOWA 2021-51 microplastics rwzi.pdf
[43] Nederlandse rwzi's verwijderen veel microplastics | STOWA
[44] Significante hoeveelheid plastic komt via zuiveringsinstallaties in milieu | RIVM
[45] Microplastics from textiles: towards a circular economy for textiles in Europe — European Environment Agency (europa.eu)

**Current regulations on substances of high concern**

The use of chemical substances is mainly regulated through the REACH (Restriction, Evaluation, Authorization, and restriction of Chemical substances) regulation. The use of substances of very high concern is strictly regulated and ECHA (European Chemicals Agency) helps textile producers by making a list of banned chemicals to avoid during production and manufacturing of textile products. Besides the Reach regulation other regulations apply to chemicals as well. This includes the regulations on Classification, Labelling and Packaging (CLP), Regulations on materials and products intended to come in contact with food, Regulation on cosmetic products and the Regulation on persistent organic pollutants.

The General Product Safety Directive (GPSD) regulates the safety of products including textile products. The Directive demands that producers cannot put products on the market when risks are associated with that product. This includes risks of chemical substances. Mostly the GPSD refers to national standards for specific product categories.

This report also investigates the ZDHC (Zero Discharge of Hazardous Chemicals) manufacturing restricted substances list (MRSL). This is a list of chemicals of which the use should be avoided in the production of textile products.

**Potentially harmful chemicals related to design requirements**

Design requirements can stimulate substitution by less hazardous substances or negligible use of hazardous substances in a product. This report highlights some of the hazardous substances in each step in the textile value chain based on the Best Available Techniques (BAT) Reference Document for the Textiles Industry report[46]. A comparison between different chemicals and indicating the environmental impact with a colour is not possible.

## 4.3 In depth analysis of supply chain

This paragraph gives an in-depth analysis of the value chain. For each of the steps the following information is given where available:

- Technological processes used to produce, maintain, or dispose of textiles
- Technological challenges in the textile market
- Relevant environmental impacts related to the place in the value chain
- If available volumes of textile on the Dutch market

### 4.3.1 Fibre production, primary raw materials

This paragraph describes the production of the two widely used fibres in textile: Cotton and polyester. Polyester and cotton together share about 75 % of the global market of raw materials. In the Netherlands, this percentage is relatively high as this percentage is above 80 %[47].

[46] BREF News | Eippcb (europa.eu)
[47] Beleidsprogramma circulair textiel (2020)

### Cotton fibre production

Cotton has an annual production of twenty-six million tons worldwide in 2020[48]. It takes about three months to fully grow and harvest cotton fibres after seeding. The fabric feels soft and comfortable, is breathable and therefore is popular for use in textiles. The production of cotton does not take place in the Netherlands as the climate is not suitable. China, the USA, and India are the most important producers of cotton[49]. It is estimated that the worldwide production of cotton will decrease due to the consequences of climate change[50].

*Environmental impact*

Growing cotton is a water-intensive process and uses a large area of agricultural land. Traditional farming uses synthetic fertilizer and pesticides, resulting in the release of nitrogen to the atmosphere and groundwater and plays a role in soil degradation. Production of cotton is comparable to producing any other agricultural crop, so it entails seeding, growing, and harvesting the plants. This can be done with a higher or lower environmental impact. The current market already offers organic cottons and some certification schemes for a more sustainable production.[51] The environmental impact of organic cotton differs from traditional cotton farming as the use of fertilizers and pesticides is prohibited (in the case of GOTS certified organic cotton). Land use in the production of organic cotton, however, may increase due to lower production per hectare as there is more land needed to grow a kg of organic cotton. Water usage largely dependents on location. Comparing environmental impact between organic and traditional cotton production is complex and is affected by local circumstances.

*Table 4.2 environmental impact of cotton production*

| Impact category | Severity |
|---|---|
| GHG emissions | GHG emissions can be linked to fertilizer (NO2) and emissions from producing livestock. In addition, fossil fuel-based agriculture machinery increases greenhouse gas emission; value is high |
| Water usage | Agricultural production is a water intensive process on natural fibres; value is high[52] |
| Microplastics | The production does not use plastics for growing the cotton crops; value is low |
| Potentially harmful chemicals | Traditional farming uses harmful fertilizers, pesticides, herbicides, and defoliants. Organic cotton growers use no chemicals to produce the crop |

[48] Textile-Exchange_Preferred-Fiber-and-Materials-Market-Report_2021.pdf (textileexchange.org)
[49] FAOSTAT
[50] Cotton and Climate Change (wto.org)
[51] All ecolabels on textiles | Ecolabel Index
[52] (PDF) Life Cycle Based Comparison of Textile Ecolabels (researchgate.net)

**Polyester fibre production**

The annual global production of polyester for textile fibre applications is around 61 million tons and is increasing. The production of polyester fibre for textile applications predominantly occurs in China and India.

Polyester fibres have several advantages that make them highly suitable for polyester-fibre-based textile clothing. Examples are their strength, durability, and characteristics such as quick drying, low temperature washing and almost no need to iron the textile[20].

*Environmental impact*

Polyester is a fossil fuel-based plastic. There is plant-based polyester available on the market, but it is available in small volumes and at a relatively high cost, which makes it unsuitable for fibre production. Apart from its fossil fuel origin, polyester production requires a substantial use of energy, generating high volumes of carbon emissions.

The production of plastic is known as a source of microparticles (e.g., pellets) that spill into surface waters and end up in sediment and in the world's oceans.

*Table 4.3 Environmental impacts of polyester fibre production*

| Impact category | Severity |
|---|---|
| GHG emissions | As it is a fossil-fuel based production; value is high |
| Water usage | Used as a cooling functionality for machinery[53]. However, in the production of the monomers and polymers pollution of water is an important factor[54]; Value is medium |
| Microplastics | As water is used for its cooling functionality there will most likely be a small number of nano plastics (e.g., oligomers) in this wastewater; value is low |
| Potentially harmful chemicals | Ethylene glycol is used as antifreeze fluid, if there is a leakage this could be fatal for humas[55]<br><br>Cyclic oligomers can be formed, migrate to the surface, and negatively affect the dying process.<br><br>In some processes Antimony (Sb) is used as a catalyst. Trace elements of Antimony can be found in the polymers. In the production of polymers used for fibres the use of antimony is relatively common |

### 4.3.2 Textile production

The produced fibres are shipped to factories where they are manufactured into yarns by spinning. Those yarns are internationally sold on a global market. By different methods, such as weaving and knitting, the yarns will be fabricated into fabrics.

[53] Ecological Footprint and Water Analysis of Cotton, Hemp, and Polyester (sei.org)
[54] WFA_Polyester_and__Viscose_2017.pdf (waterfootprint.org)
[55] Polyester | Materials Index | CFDA

In the Netherlands, the production of textiles has dramatically decreased and nowadays virtually all yarns and fabrics are imported from producing countries in Asia and Africa[56]. The following subparagraphs give more information on spinning, weaving, and knitting, finishing the fabric, and producing the garment.

#### 4.3.2.1 Spinning

Multiple techniques are available for mixing different fibres and spinning them into yarns. During the process, relatively harmless to rather hazardous, chemicals can be added to dye or coat the fibres. Currently there are a few innovative spinning initiatives in the Netherlands aimed at circular textile applications.

*Table 4.4 Environmental impacts of spinning yarn*

| Impact category | Severity |
|---|---|
| GHG emissions | The energy needed for spinning is relatively high. In addition, transportation also contributes to GHG emissions; value is high |
| Water usage | Water used for the technique as well as a cooling functionality for machinery; value is medium |
| Microplastics | Water technique spinning with polyester fibre will contribute to microplastics in wastewater; value is medium |
| Potentially harmful chemicals | Conditioning agents and spinning lubricants used adds to air- and water pollution |

#### 4.3.2.2 Weaving and knitting

Of all textile-production-techniques weaving and knitting are the most well-known techniques for producing textile fabric. Every technique has its own impact on the characteristics of the produced fabric. For example, the knitting technique provides elasticity in fabrics. When a textile is smartly designed this can reduce the need for yarns that provide stretch, such as elastane. weaving and knitting of the fabrics mostly takes place outside of the EU. Before knitting of weaving yarns are treated with a sizing agent which makes them smoother, which prevents them from breaking in high-speed weaving looms.

*Table 4.5 Environmental impact of weaving and knitting.*

| Impact category | Severity |
|---|---|
| GHG emissions | The weaving and knitting of the fabric are an energy intensive process, where weaving is more energy intensive than knitting. In addition, transportation also contributes to GHG emissions; value is medium |
| Water usage | Hardly any water is used during knitting/weaving; value is low |
| Microplastics | Water might be used for cleaning which might lead to microplastic pollution; value is low |
| Potentially harmful chemicals | Lubricant, oils, and wax is used for protection against mechanical stress, this contributes to the total amount of pollution of the mill |

[56] Interview Jan Mahy

#### 4.3.2.3 Textile finishing

To enhance the performance of textile fabric mechanical or chemical treatments may be applied, for example to textiles are dyed to improve their looks, coated to make the fabric water-resistant, flame-retardant, air and vapor permeable or light blocking. These coatings are important for applications where particular comfort, aesthetics or personal safety requirements play a role. To add these coatings the fabric is pre-treated. Among others the fabric is desized. The sizing (smooth coating) used to reduce yarn breakage during production is removed. Then the fabric is scoured, the impurities found in the textile are removed, this prepares the fabric for dyeing and bleaching. After these steps, the fabric is bleached. The natural colour of the fabric is removed. Another process is dyeing, where synthetic chemicals are used to colour the textiles.

*Table 4.6 Environmental impacts of textile finishing*

| Impact category | Severity |
|---|---|
| GHG emissions | The energy consumption of machinery used during manufacturing |
| Water usage | Intensive water usage in certain steps, e.g., dyeing; value is high |
| Microplastics | Wet processing of polyester fabrics; value is high |
| Potentially harmful chemicals | Large amount of strong alkali; PFAS; AOX emissions; formaldehyde emissions; toxicity of dyes; melamine formaldehyde resins et cetera |

### 4.3.3 Manufacturing of the textile product

In the final step of the production, fabrics are turned into textile produce by cutting and stitching or gluing these materials to products. This may also involve adding accessories like buttons, zippers, and sequins. Now the product is ready to be packed, shipped to markets, and sold in the physical or online retail stores worldwide. It is estimated that in the Netherlands in 2019, 349 to 802 million pieces of clothes were sold.[57] This translates to 84 to 190 million kilograms of clothes in 2019.[58]
A particular feature of the online sales model is that it generates a substantial flow of clothing that consumers return after purchase for several reasons, often for free. This return flow is sometimes inspected, cleaned, ironed, and repacked, but it is assumed that a significant volume is not resold but is destructed instead[59]. It is estimated that in the Netherlands 150 to 300 tonnes of unsold clothes are incinerated[60] to however it can be stated that the industry offers very little transparency in this matter [61].

*Table 4.7 Environmental impacts of manufacturing*

| Impact category | Severity |
|---|---|
| GHG emissions | The factory and transportation contribute to GHG emissions; value is low |
| Water usage | Not discussed in literature; value is low |
| Microplastics | Wastewater of product assembly not discussed in literature; value is low |
| Potentially harmful chemicals | No potentially harmful chemicals discussed in BAT report |

[57] Vernietiging ongebruikte goederen (2020) (overheid.nl)
[58] Based on the assumption that the average weight of a garment is 240 grams. This is the same assumption as is made in the previously mentioned report.
[59] Onlinehändler Amazon vernichtet massenhaft Neuware (wiwo.de)
[60] Vernietiging ongebruikte goederen (2020) (overheid.nl)
[61] Retour Rumoer (nos.nl)

### 4.3.4 Product use

In 2018, the sale of textile products amounted to 248 kilotons of consumer clothes, 76 kilotons of home textiles and 28 kilotons of workwear in the Netherlands[62]. When in use these textile products require cleaning and maintenance on a regular basis, including washing, dry cleaning, ironing, and repair, which varies per textile category.

**Consumer clothes and household textiles of consumers**

Consumer clothes and household textile are mostly home cleaned, tumble dried and ironed, although dry cleaning outlets lauder substantial volumes as well. In the Netherlands, the average washing temperature is approximately 40 degrees Celsius. Washing is done on average 143 times a year in a Dutch household. On average 30 % of the laundry will be thermally dried in a tumble dryer and 38 % of the textiles are ironed afterwards[63].

**Workwear and business to business household textiles**

Workwear is often washed in large industrial laundry facilities. These facilities can be in-house e.g., in large hospitals where large amounts of workwear need to be washed. In other cases, workwear is taken to an external industrial laundry facility. In these facilities the workwear is laundered and checked for continued use, and eventually returned to the user. This is the case for many types of workwear and business to business household textiles such as towels and bedsheets used in hotels.

*Table 4.8 Environmental impacts of the use phase*

| Impact category | Severity |
|---|---|
| GHG emissions | Washing machine and laundry facilities require power during operation; value is high |
| Water usage | Washing machine and laundry facilitate use water for washing; value is high |
| Microplastics | Washing products discharges microplastics into wastewater; value is high |
| Potentially harmful chemicals | Type of detergent used |

### 4.3.5 Consumer-to-consumer product reuse

It is important to consider the reuse of clothes as the prolonged use of the textiles is a way to reduce the environmental impact of textiles[64]. Reuse can be stimulated by design requirements aiming at longevity. Therefore, it is important to identify the structure that makes this prolonged use possible.

Public awareness on the environmental impact of textiles has increased. Reuse has been embraced by the public as a crucial step to reduce the environmental impact of textiles. As a result, second hand retail stores and online platforms such as Vinted, eBay or Marktplaats have emerged and become key players that facilitate consumer-to-consumer clothing reuse in the Netherlands.

[62] Monitor beleidsprogramma textiel
[63] Monitor beleidsprogramma textiel
[64] Textile reuse '70 times better' than the production of new garments - letsrecycle.com

**Consumer clothes**

There is an increased interest in the reuse of consumer clothes. In 2018, 5 % of consumer clothes in the Netherlands were reused by a new owner[24]. These clothes were collected and sold via channels such as thrift stores. This amount does not include informal reuse or consumers selling products to other consumers. It is assumed that the last type of reuse has grown over the last years[65]. According to the Dutch mass balance of textiles, 53 % of all separately collected clothes are reusable. Most of these reusables are reused outside of the Netherlands.[66]

**Household textiles**

There is no insight into the reuse percentages of household textiles within the Netherlands. It is assumed that household textiles (used by consumers) are used until the product has reached the technical end-of-life, as such it does not switch owner and is not 'reused.' These textiles are sometimes disposed of for reasons such as becoming 'unfashionable.'

**Workwear**

The business model of workwear is often built upon reuse, and it is assumed that in essence workwear is worn until it does not comply with the standards within the sector. The laundry facilities play a large role in the assessment and reuse of the workwear. Reuse may be hampered when a company logo is added to the workwear, or if the workwear is a particular uniform[67] that must sometimes be destructed to protect the original owner from misuse of the uniform. In addition, reuse is not possible when workwear has been designed for specific events.

Reusing textiles reduces the environmental impact of textiles. Some studies report that the environmental impact of reused consumer clothes is up to 70 % less compared to new clothes[68]. This is only the case when consumers purchase second hand textiles instead of new textiles. When 2nd hand textiles are used as an addition to the existing wardrobe, the environmental impact will not be reduced. Often, clothes will be shipped or mailed for reuse, which adds carbon emissions to the reuse process.

### 4.3.6 Collection, identification, and sorting

The collection, identification and sorting steps are an important step in the value chain of textiles. These steps determine if a textile gets reused, recycled, or used for energy recovery. A deep understanding of these steps can help to identify design options of textiles that can help to circularize the textile value chain. Sorting of mixed materials is more difficult than mono materials. A considerable technology and investment gap in this step has been reported[69] and requires substantial innovations and accelerated scaling to allow for more accurate, faster sorting to provide better feedstock quality.

[65] De markt voor tweedehands kleding groeit als kool, maar hoe duurzaam is het eigenlijk? (trouw.nl)
[66] Massabalans textiel 2018 (ffact.nl)
[67] https://info.havep.com/hubfs/R-Ladder_Infographic_V4.pdf?_ga=2.80836119.1653167666.1675091423-1078526749.1675091423
[68] Hergebruik van kleding leidt tot 70 keer lagere milieu impact blijkt uit nieuwe studie - Duurzaam Ondernemen (duurzaam-ondernemen.nl)
[69] Circular fashion in Europe: Turning waste into value | McKinsey

#### 4.3.6.1 Collection

It is estimated that in the Netherlands 45 % of all consumer textiles are collected separately. The rest is disposed of in the residual waste. Textiles that are collected separately are identified and sorted. Some of these collected textiles will be reused (see paragraph 4.4).

**Consumer textiles (Consumer clothes & household textiles)**

Consumer textiles are collected for reuse through different routes. There are organizations that pick-up clothes from households by door-to-door collection, and municipalities often facilitate textiles collection through dedicated textile containers in residential or shopping areas. In these containers, consumers can drop off their clean textiles. The latter collection method introduces a few challenges. Consumers also drop off other waste in these containers, which contaminates and affects the reuse potential of the clothes inside. The percentage of residual waste and other contaminants determines the quality of the textiles. These contaminants have increased in the last few years[70]. In addition, the system cannot always cope with large input fluctuations[71], although some collection containers are being equipped with sensors to give an alert for emptying the container.

**Workwear**

Workwear is often collected by the supplier of the workwear or the industrial launderer of the workwear. This results in a relatively homogeneous waste stream. In 2020 it was estimated that 33 ktonnes was collected this way. However, it is estimated that 73 ktonnes of textiles from businesses in 2020 were disposed of in the residual waste[72].These residual textiles can include workwear but also other kinds of textiles such as industrial cleaning cloths.

*Table 4.9 Environmental impact of collection of textiles*

| Impact category | Severity |
|---|---|
| GHG emissions | Transportation within the Netherlands or outside of the Netherlands contributes to GHG emissions; value is low |
| Water usage | Not discussed in literature; value is low |
| Microplastics | Misplaced discharged clothes on land; value is low due to geographical reasons |
| Potentially harmful chemicals | Not discussed in literature |

#### 4.3.6.2 Identification and sorting

**Consumer textiles (Consumer clothes & household textiles)**

Textiles that are collected in containers are manually sorted to a large extent into bespoke bales by similar product types, e.g., T-shirts, jeans and household textiles, or colour.

Sorting clothes by material type is difficult and unproductive. The first mechanized sorting facilities are being developed. However, there are some small-scale initiatives to automate sorting based on colour and material.

[70] Steeds meer textiel vervuild: dit gebeurt er als oude kleding in de bakken komt | RTL Nieuws
[71] Kledingcontainers lopen door corona over met kleding: 'Als dit nog even duurt, kunnen we hele sporthallen vullen' | Gouda | AD.nl
[72] Monitoring beleidsprogramma circulair textiel

These initiatives mainly depend on NIR (Near InfraRed spectrophotometry) sorting technology. This NIR technology is capable to identify the material type (e.g., cotton or polyester) and removes some off the 'guesswork' that is involved in manual sorting[31]. This technology is currently in use in the RTT (Regional Textielsorteercentrum Twente) in the Netherlands and installed on the Fibresort equipment of Wieland Textiles.

Sorted and baled textiles are brought to the market. The quality of the bale determines the value of the bale. Some of these textiles will be sold to be reused, either within NL or outside of NL. Other bales are sent to recyclers.

#### 4.3.6.3 Workwear

Workwear is often relativity easy to sort as it is manually collected in bulk streams. The potential presence of Substances of Very High Concern (SVHC) e.g., due to coatings as fire retardants poses a challenge for this sorting process.

*Table 4.10 Environmental impact table on identification and sorting of textiles*

| Impact category | Severity |
|---|---|
| GHG emissions | Transportation within the Netherlands or outside of the Netherlands contributes to GHG emissions; value is low |
| Water usage | Water usage has a cooling functionality; value is low |
| Microplastics | Wastewater of sorting not discussed in literature; value is low |
| Potentially harmful chemicals | During the sorting process of workwear workers might be exposed to harmful chemicals in the waste |

### 4.3.7 Recycling

Approximately 18 % of all textiles after collection is currently being recycled. The quality of recycled textiles depends on the purity of the bale it is sorted in. Waste streams that consist of single materials such as white hotel bedding will have a large potential to be recycled into a valuable product. There are currently two main recycling technologies that can be used to recycle textiles: mechanical recycling and chemical recycling. These recycling technologies can be used in combination. The next paragraph discusses the differences between open-loop and closed-loop recycling, and recycling methods.

#### 4.3.7.1 Open-loop and closed-loop recycling

Distinction between open-loop and closed-loop recycling lies in what kind of product is made from the recycled material. Open-loop recycling uses the recycled material as feedstock for other non-textile fibre-based products, e.g., sound isolation material in cars. These recycled products leave the textile supply chain. Closed-loop recycling (also known as textile-to-textile or fibre-to-fibre) aims at using the materials for new textiles production and will not leave the textile supply chain. Currently high-quality recycled fabrics are more expensive than their virgin counterparts.

#### 4.3.7.2 Mechanical recycling

Mechanical recycling turns textiles into loose fibres. This is done by cutting and shredding the textile. After recovering the fibres from the textile, the fibres can be respun into yarns. This type of recycling is the most common type of recycling within the Netherlands. A large player in this field is Frankenhuis in the Twente region, part of Boer Group[73].
Mechanical recycling is a well-developed recycling process, but it has shredding stretchy materials such as elastane and hard accessories such as zippers and buttons remains a challenge. In addition, the shredding process leads to relatively short fibres, which makes it more difficult to reuse the obtained fibres into new textile products. Besides, suboptimal sorting might result in mixed fibres when mono materials are desired. Some initiatives focus on these difficulties and research for opportunities for optimizing the mechanical recycled material to high-grade post-consumer recycled material[74].

#### 4.3.7.3 Chemical and dissolution recycling

Chemical recycling is mainly aimed at polyester-based textiles however cotton can be recycled chemically as well. By dissolving or melting the textile fibres, a pure polymer remains. The polymers can in turn be processed into a new yarn. This is possible for both cellulose based fibres and ‘plastics’ such as polyester. CuRe within the Netherlands is developing a technology to recycle polyester from textiles. It is anticipated that in 5 years this technology is capable of recycling relatively large amounts of polyester. SaXcell is a party in the Netherlands that works to recycle cotton fibres. It is estimated that within 5 years this technology can be widely implemented. In Scandinavia there is more experience with the physical recycling of cotton or other cellulose based textiles.

The CuRe technology is sensitive to certain contaminations e.g., the presence of a small percentage of elastane, as low as 0.5 %, or other types of materials may disrupt the recycling process. Common contaminants are labels, zippers, and threads of a different material. The SaXcell technology reports similar sensitivities and potential disruption but can handle a small percentage of pollutants. This sensitivity to contamination is confirmed in other literature sources[75].

#### 4.3.7.4 Other chemical recycling technologies

Chemical recycling completely returns the textiles into monomers, the basic building blocks of plastics. This is achieved with enzymes or other chemical agents. These building blocks can in turn be repolymerized and processed into a new yarn. Ioniqa in the Netherlands near Eindhoven works to depolymerize PET, to produce new PET from textiles[76]. Just as chemical recycling this type of recycling is sensitive for pollutants and requires thorough sorting and pre-treatment.

[73] Boer Groep neemt textielrecyclaar Frankenhuis over (fd.nl)
[74] Green Deal Circular Denim - Afval Circulair
[75] Textiles for Circular Fashion: The Logic behind Recycling Options (wur.nl)
[76] Ioniqa technology enables limitless PET recycling - Plastic Soup Foundation

A very small percentage of textiles is being recycled into a raw material that can serve as a feedstock for new textile production. Textile-to-textile recycling is only possible when the feedstock is sorted well and has a high quality. It is expected that in the future the amount of textile-to-textile recycling will increase. There are, however, some hitches to overcome[77].

*Table 4.11 Environmental impact table on recycling of textiles*

| Impact category | Severity |
|---|---|
| GHG emissions | The energy consumption of machinery used during manufacturing |
| Water usage | Water usage has a cooling functionality; value is low |
| Microplastics | Water only used as a cooling functionality; value is low |
| Potentially harmful chemicals | Shredding coatings added on products can release harmful chemicals to the environment and might result in exposure of workers. No definitive data available |

### 4.3.8 Waste to energy

Textiles that are not sorted properly and combined with other household waste streams end up in residual waste. These textiles are processed in (waste-to-energy) incineration plants in the Netherlands. Textiles segregated from collection and sorting processes that cannot be reused or recycled follow the same route. For 2020 it was estimated that 59 % of textiles was incinerated, with 35 %-point of waste originating from consumers and 24 %-points from organisations.[78]

*Table 4.12 Environmental impact of end-of-life textiles in incinerated plants*

| Impact category | Severity |
|---|---|
| GHG emissions | Incineration plants contributes to GHG emission, due to energy recovery value is low |
| Water usage | Not discussed in literature; value is low |
| Microplastics | Not discussed in literature if there are microplastics in wastewater, but unburned material in the bottom ash still has microplastics as a solid residue in incinerators[79]; value is low |
| Potentially harmful chemicals | Harmful substances might be produced during this process. When incinerated properly these substances will not leak to the environment |

## 4.4 Conclusion

**Environmental impacts**

- The environmental impact of textiles can largely be attributed to the production phase and use phase of textiles. The production of raw materials and wet processing are the processes with the highest environmental impacts
- GHG emissions is the highest during the production phase for both cotton and polyester fibre

[77] Textielrecycling: wat zijn de mogelijkheden vandaag? (vdp.com)
[78] Monitoring beleidsprogramma textiel
[79] Is incineration the terminator of plastics and microplastics? - ScienceDirect

- Water usage has certain areas in the textile supply chain where the amount of used water is high. Mainly during cotton farming, wet processing and in the use phase
- Microplastics are mainly released during the use phase. Microplastic are released because of abrasion during the washing process
- There are many processes in place to prevent the use of substances of high concern. REACH is already in place, but additionally some industry partners have its own standards (ZDHC). Workwear is one of the industries where Substances of high concern are commonly added. Substances of high concern are added in the production phase but can lead to disturbances in the recycling process and can influence the value and properties of recycled content

*Table 4.13 An overview of the environmental impact value on each step of the textile supply chain*

| | GHG emissions | Water usage | Microplastics | Potentially harmful chemicals |
|---|---|---|---|---|
| Raw material/ polyester | Fossil fuel production | Cooling functionality | Neglectable | Ethylene glycol and cyclic oligomers |
| Raw material/ cotton | Agriculture production cotton | Water intensive process | Neglectable | Fertilizer and pesticides |
| Spinning | Factory and transportation | Technique + cooling functionality | Technique with water | Preparation agents |
| Weaving/knitting | Factory and transportation | Cooling functionality | Water only used for cooling | Lubricant, oils, and wax |
| Additional value to fabric | Wet processing | Wet processing | Wet processing | Strong alkali; AOX emissions; formaldehyde |
| Product | Factory and transportation | Not discussed in literature | Not discussed in literature | Not discussed in literature |
| Product use | Washing and drying | Washing and drying | Discharged wastewater | Type of detergent used; chemicals present in the product might leach out of the product during washing |
| Collection | Transportation | Cooling functionality | Misplaced discharged clothes | Not discussed in literature |
| Identification / sorting | Transportation | Cooling functionality | Not discussed in literature | Can add to harmful chemicals to waste |
| Recycling | Factory and transportation | Cooling functionality | Water only used for cooling | Shredding coatings can release chemicals |
| Waste to energy | Factory and energy recovery | Cooling functionality | Not discussed in literature | Unburned materials leaking into the environment |

**Supply chain**

- In NL there is limited production, mainly of high-quality workwear and technical textiles. The Netherlands does have a solid recycling industry, which however needs accelerated upscaling to commensurate with increasing amounts of (sorted) post-consumer textile streams, which are less and less being exported outside of the country
- Currently mechanical recycling is the most common recycling technology, chemical is an emerging technology and will most likely be established in 5 years
- Following R-strategies is a way to reduce the environmental impact

# 5 Textiles key issues and the complexity of the textile market

Textiles are complex materials from economic, technological, and esthetical aspects. Another layer of complexity is added through the wide variety of textile products and their applications. The functionality and specifications of a sock differs from a coat, and even within the coats segment there is a large variety of purposes, materials, and qualities. Some clothes are meant to last while other textiles are designed with a short life span in mind.

The main goal of the ESPR is to reduce the environmental impact of products. However, it is important to note that only performance requirements cannot stop impactful practices. This should fit within a larger policy structure.

In this chapter the following points are discussed:

- Identified key issues (per defined product category) that hamper the transition to a more sustainable textile value chain
- Best practices that facilitate the transition towards a more sustainable textile value chain

This chapter will be the basis for the performance requirements.

## 5.1 Key issues of consumer textiles

**Fast fashion**

The Netherlands' consumer clothing market accounts for roughly 50 % of the country's textile industry. However, not all garments are designed to withstand the test of time, particularly those considered ‘fast fashion.’ The fast fashion industry thrives on four factors according to the report Fast fashion Onderzoek, published in 2020[80].

- The competitiveness of the market
- The long supply chain of the products
- The dependability on other actors in the supply chain
- Consumerism

These factors show that the impact of fast fashion trend is a multifaceted issue that requires more than just design solutions. It is crucial to acknowledge that fast fashion impedes the development of a sustainable fashion supply chain. While clothing that has a longer life span comes with a lower environmental impact[81], increasing the quality of clothes does not always lead to a reduced environmental impact.[82] Higher quality clothing can result in higher environmental impacts. If the higher quality does not lead to a longer use phase because the product is discarded because of a change in fashion the total environmental impact goes up.

[80] Fast fashion onderzoek
[81] ECOS-REPORT-HOW-ECODESIGN-CAN-MAKE-OUR-TEXTILES-CIRCULAR.pdf (ecostandard.org)
[82] Fast fashion onderzoek

**Durability of textile**

To reduce the environmental impact of clothing a simple measure is to use clothes for a longer period. However, the durability of clothes depends on several factors, of which the technical and emotional factors are most important. Between 50 - 60 % of all clothes are discarded because of technical issues, such as loss of shape, or stains that cannot be removed. But it is essential to note that the remaining 40 to 50 % of all clothes are discarded because of other reasons such as improper fit (the wearer may have gotten another size) or because the consumer is bored of the product.

The lifespan of clothes can be improved by repairing clothes. It is noted that consumers in the Netherlands are starting to be aware of the use to repair clothes. However, to a large majority and due to low quality clothing, it is considered expensive and therefore the consumer still prefers rather to buy new clothes[83]. In addition, consumers often lack the knowledge to repair the textile product at home.

**Fabric design**

The qualities and performance of fabrics can be altered by mixing different type of materials together. This increases the aesthetics, comfort, or the strength of the fabric. These types of fabrics are known as blends. Blends are also created to reduce the costs of the fabric as some raw materials are more expensive than others, e.g., cotton is becoming much more expensive than polyester fibre feedstock. Recycled content can be blended into fabrics. However, the recycled content with a high quality, such as from chemical recycling, is currently more expensive than their virgin counterpart due to limited chemical recycling volumes available in Europe. Blends cannot be recycled as easily as mono materials.

In addition to textile blends, accessories can be added to textiles, such as rivets, prints, and beads. These combinations of multiple materials hamper recycling opportunities significantly.

**In conclusion:**

- By setting requirements for consumer textiles, the largest reduction of environmental impact can be established because around four fifths of the textile fibres are used in consumer textiles.
- Environmental impact can be reduced through two circular strategies:
  - Lengthening the use phase
  - Lowering the environmental impact of the production phase by using recycled content and by making clothing recyclable
- These strategies complement each other but can be in contradiction as well. Recycled content can lower the lifetime of a product as the current recycling technology yields shorter fibres resulting in a lower yarn strength. Whereas very strong and durable clothing might consist of multiple materials which can hamper recycling

[83] D&B - Gedragsonderzoek kleding IenW (2).docx (overheid.nl)

- Therefore, we suggest that there should be differentiation between consumer clothes that are made to last and consumer clothing that are made to have a shorter life cycle. The end goal is to extend the use phase of textiles as much as possible, but this goal cannot be reached with only performance requirements. With the current situation overengineering textiles will lead to an increased environmental impact, extending the technical durability beyond the social/esthetical life of the textile product. We suggest the following differentiation:
  - For short cycle textiles the focus will be on recycled content and recyclability. Short cycle clothes are not meant to last for a long time and are typically disposed of within two years of purchases
  - For long cycle textiles the focus will be on durability and repairability. Long cycle textiles are meant to last and will typically be worn for (much) more than two years

  In a later phase the final differentiation should be finalized
- It would be beneficial to limit the number of materials in fabrics as this makes recycling easier
- Recycling should be stimulated by creating a market for recycled fibres with a textile origin

## 5.2 Key issues textiles for household textiles

One of the most notable features of household textiles is their durability. They are less susceptible to fashion influences and often last until the product has reached the technical end of life of the product. It should be noted that household textiles do slightly become more and more susceptible to interior fashion.

Household textiles are affected by how they are used and in particular, how they are laundered. They are often cleaned at high temperatures with detergents with a high PH (~pH 10).
This deteriorates the quality of the fibre over time.

Another key property of household textiles is that they are not made with complicated blends. This makes them easier to recycle since they do not have to be separated into different materials before recycling.

It is important to note that while household textiles used by consumers (B2C) have similar performance specifications as those used professionally (B2B), but the latter often follow the same laundry and cleaning processes as workwear and are used with higher intensity.

**In conclusion:**

- It is important that household textiles keep their long lifespan
- Household textiles can be a good source for recycling because of their relative uniform composition. However, the quality of the fibre is relatively low due to the attrition rate because of the long use phase
- Distinguishing performance requirements between professional and consumer household textiles might be beneficial, to reduce the environmental impact

## 5.3 Key issues textiles for workwear textiles

The workwear sector accounts for approximately 5 % of the Dutch textile market. Workwear is primarily business-to-business, providing essential clothing, uniforms, and protective gear as well as clothing for short events like festivals.

Workwear is often leased to the user in a business-to-business context. Producers/importers work closely together with the professional laundry facilities. These businesses which focus not solely on selling products but on service models often focus on durability within their business models, as they must balance the costs of replacement with the needs of their consumer.

One of the most significant factors influencing the design and production of workwear is safety. Workwear manufacturers and suppliers prioritize the safety of their products when designing and producing workwear. Prioritizing safety might mean that chemicals such as PFAS or flame retardants are added to the textile. This is not relevant for all types of workwear, e.g., hospital workwear has different standards than the protective gear firefighters wear. In general, the workwear industry regulates itself quite efficiently. Therefore, we propose to divide the category workwear into protective and non-protective workwear.

Protective workwear has high standards, specific norms, and regulations for the safety of the end user. For non-protective workwear lower standards are needed, which leaves more room for ecodesign requirements to increase circularity in this category. Most business models in the workwear industry are focused on longevity, although some promotional workwear is designed for one day. To maximize the effectiveness of performance requirements for promotional workwear, overengineering the quality of the textile product should be avoided. Therefore, we make the same distinction between long and short cycle within the non-protective workwear category.

Security is an important issue when disposing of workwear. In some industries, workwear must be destroyed after use due to security concerns. For example, military uniforms and police gear. These clothes are often recycled as they are disposed of in large batches with the same composition.

**In conclusion**

- The workwear cycle is controlled by producers that service the products as well. As such the practices within the Netherlands are relatively sustainable
- Safety of the workwear must be guaranteed and therefore is a category on its own
- The performance requirements should focus on non-protective workwear
- Non-protective workwear is divided into long and short cycle, due to differences between promotional workwear and e.g., hospital workwear
- Disposables are excluded in the development of performance requirements

## 5.4 Best practices and initiatives that work towards a sustainable value chain

Within the Netherlands there are several initiatives that aim to increase the sustainable value of the textile value chain.

**Dutch Circular Textile Valley**

The Dutch Circular Textile Valley works on creating a circular textile supply chain to lower environmental impacts. With hubs in Twente, Amsterdam, Gelderland and Tilburg, the foundation connects, innovates, and speeds up the transition to circular textiles.

**TexPlus**

The TexPlus Foundation is a cooperation between 6 frontrunners in the field of circular textiles. This local cooperation is based in Twente, in the Netherlands. These frontrunners are active in collection, processing, and the manufacturing of end products. The entire supply chain on a regional scale represented within this project. The objective of the TexPlus foundation is to connect and collaborate within the supply chain partners from collection to reuse in other regions in the Netherlands. This objective is achieved by stimulating the reuse of textile products and using innovative techniques to recycle non-reusable textile products to the highest possible quality. They do this by actively involving the market in the development and application of recycled textile materials. Moreover, TexPlus is the 'recycling technology hub' of the Dutch Circular Textile Valley organization.

**Dutch denim deal**

More than 50 different national and international parties have signed the Dutch Denim deal. These parties all have different roles in the value chain. The brand owners and retailers have committed to achieve the specific, joint goal of using 20 % PCR cotton fibres in three million pairs of jeans produced by these parties during the term of this Denim Deal. In addition to this, brands and retailers have committed to achieving a minimum of 5 % PCR content in their denim collections during this period by working together closely with other parties. Higher individual targets for PCR in the denim clothing is set as well.

**In conclusion**

- It is important that the value chain is stimulated to work together in their efforts to reduce the environmental impact
  - Opportunities for reuse and recycling at the end-of-life phase must be considered in the design phase
  - Developing high quality recycled fibres is possible with a good collaboration in the market
- The denim deal has shown that is possible to add 5 to 20 % post-consumer recycled cotton to denim consumer clothes
- Adding recycled content to textiles can reduce the environmental impact of the garment as the production for the raw materials is not necessary anymore

# 6 Performance requirements

Through literature research and the input of textile experts and stakeholders performance requirements have been created in line with the ESPR framework. This chapter elaborates on the performance requirements for textile products in scope of this project: household textiles, consumer clothes and workwear.

Due to the scope of clothing products in combination with fashion, esthetical and economical perspectives, this category is divided into two lifespan cycles, the short cycle, and the long cycle. Each cycle has its own performance requirements. The short cycle is designed for recycling and contains as much post-consumer textile recycled content as possible. Long cycle on the other hand is designed for durability to extend the use phase of the product and may contain pre-consumer recycled textile content.

The same division between long cycle workwear (e.g., uniforms) and short cycle (e.g., festival, or promotional clothing) is made for workwear. We recommend abstaining from performance requirements for protective workwear (personal safety equipment as defined in Regulation (EU) 2016/425 of 9 March 2016 on personal protective equipment). Protective clothing must primarily protect the user from safety incidents and is therefore highly regulated. It is not clear whether the safety levels of protective gears may be compromised by ecodesign requirements. Therefore, we recommend investigating the potential impact of ecodesign requirements on the safety levels before suggesting these for ecodesign regulation. Moreover, the market share of protective workwear in the textile market is relatively small and protective workwear usually already has a long lifetime. Therefore, we propose to exclude the safety work wear category from ecodesign requirements. This subcategory may be added at a later stage.

Household textiles have a relatively long lifecycle as well as a relatively simple composition. Therefore, the division between long and short lifecycle has not been made for this category. The performance requirements should focus on longevity as well as on recyclability and recycled content.

This chapter follows the framework of sustainability aspects of a product as mentioned in the ESPR. Table 6.1 gives these aspects and their relevance for textile products. The following paragraphs describe the most relevant aspects in more detail per textile category and proposes performance requirements based on these aspects. This chapter finishes with recommendations and conclusions.

*Table 6.1 Overview of the ESPR aspects and their relevance for the different textile groups*

| ESPR aspect | Household textiles | Consumer clothes Short cycle | Consumer clothes Long cycle | Workwear Short cycle | Workwear Long cycle |
|---|---|---|---|---|---|
| A. Durability | Yes | Not the main focus | Yes | Not the main focus | Yes |
| B. Reliability | Not relevant | Not relevant | Not relevant | Not relevant | Not relevant |
| C. Reusability | Yes | Not the main focus | Yes | Not the main focus | Yes |
| D. Upgradability | Not relevant | Not relevant | Not relevant | Not relevant | Not relevant |
| E. Repairability | Yes | Not the main focus | Yes | Not the main focus | Yes |
| F. Refurbishment | Not relevant | Not relevant | Not relevant | Not relevant | Not relevant |
| G. Presence harmful substances | Yes | Yes | Yes | Yes | Yes |
| H. Energy use or efficiency* | Not relevant | Not relevant | Not relevant | Not relevant | Not relevant |
| I. Resource use or efficiency | Other regulation | Other regulation | Other regulation | Other regulation | Other regulation |
| J. Recycled content | Yes | Yes | Yes | Yes | Yes |
| K. Remanufacturing or recycling | Yes | Yes | Yes | Yes | Yes |
| L. Recovery of materials** | Not relevant | Not relevant | Not relevant | Not relevant | Not relevant |
| M. Environmental impacts*** | Yes | Yes | Yes | Yes | Yes |
| N. Expected generation of waste | Other regulation | Other regulation | Other regulation | Other regulation | Other regulation |

* Energy use or efficiency by the textile itself is not relevant, however energy usage in production or care is. These are covered under M and should be addressed by care instructions

** Recovery of materials (energy recovery) is a lower step in the waste hierarchy than recycling. Therefore, we focus on recycling (K.)

*** The environmental impact can be made clear through a product passport. One aspect which falls under this aspect is the release of microplastics

Other regulation means regulation through another instrument (discussed in chapter 3) e.g., information provision through material passports.

## 6.1 A. Durability

Durability is the most important characteristic of a textile product when trying to lower its environmental footprint. An extended lifetime should stimulate a consumer to wear or use the product multiple times instead of buying new products, which results in a reduction of the environmental impact. Longevity of a product requires certain quality standards, in which three aspects are important:

1. Technical durability
2. Economical durability
3. Esthetical durability

These aspects have a mutual dependency, see also chapter 5. Regulation through performance requirements based on the ESPR can only focus on the technical durability. In the following subparagraphs the technical durability has been elaborated for each category.
Technical durability is about the mechanical quality of the textile product, e.g., its strength to prevent tears, or its colourfastness and dimensional stability when laundered. To understand how to increase technical durability for an extended use phase, it is important to know the reason(s) why consumers dispose of their products. Having these insights helps setting standardized performance requirement that promote durability and longevity.

If textiles are disposed of due to technical imperfections, the most important reasons are[84,85]:
1. Visual appearance (discolouring or fading, shape/fit, pilling)
2. Stains

Good quality clothing retains a good visual appearance after multiple washes. For various aspects of the visual appearance tests and standards exist. These standards can be applied as performance requirements and a minimum number of washing cycles could be set as a norm.

Prevention of stains is very difficult. Some types of fibre are more susceptible to staining than others. A shift towards more stain-resistant fibres could mean a shift towards more synthetic fibres. This is not necessarily better for the environment. Surface treatment might help in preventing stains; however, this introduces extra materials/substances with consequent environmental impact. Removing stains is done regularly by washing textile products. Although not all stains can be removed, good care instructions might help in the removal of stains. So, design requirements for preventing discarding because of stains could be aimed at good care instructions.

### 6.1.1 Check on ESPR criteria

The performance requirements for durability should comply with the ESPR criteria of article 5.5[86]. The table below shows the check with these criteria.

*Table 6.2 Durability performance requirements comply with the ESPR criteria*

| Product category | Significant negative impact on the functionality | Adverse effect on health and safety of persons | Impact on affordability of relevant products also second-hand | Negative impact on competitiveness | Proprietary technology imposed | Administrative burden on manufacturers |
|---|---|---|---|---|---|---|
| Household textiles | - | - | -* | - | - | X |
| Short cycle consumer clothing | - | - | X* | - | - | X |

[84] Making Clothing Last: A Design Approach for Reducing the Environmental Impacts (ijdesign.org)
[85] Interviews with experts of independent knowledge centers and Dutch stakeholders
[86] Proposal for a Regulation on Ecodesign for Sustainable Products (europa.eu)

| Product category | Significant negative impact on the functionality | Adverse effect on health and safety of persons | Impact on affordability of relevant products also second-hand | Negative impact on competitiveness | Proprietary technology imposed | Administrative burden on manufacturers |
|---|---|---|---|---|---|---|
| Long cycle consumer clothing | - | - | X* | - | - | X |
| Short cycle workwear | - | - | X* | - | - | X |
| Long cycle workwear | - | - | -* | - | - | X |

- No negative impact on this subject
-* No impact on affordability of relevant products also second-hand, estimated that the number of washing cycles is already being met
X Complying with durability standards might result in an administrative burden
X* Might increase the impact on affordability of relevant products also second-hand, but probably lowers the total cost of ownership.

## 6.2 C. Reusability

As reusability is strongly linked with durability for textile products, no additional performance requirements for reusability have been included.

## 6.3 E. Repairability

Repairability is most important when one single defect such as a broken zipper or a missing button prohibits the use of the product. Consumers or owners do not always have the skills needed to repair textile products, while outsourcing the repair is sometimes more expensive than buying a new product. But even if repair is possible and cheaper than replacement, consumers may decide to discard a product, for instance because it is more hassle to repair than to buy new or due to the desire for a new product.

Repairability is most important for products with a long technical lifetime and a high value, therefore we recommend focusing on the long cycle categories. Repairability performance requirements should be aimed at making replacement components available and making information available about the correct replacement component. The latter is not so much a performance requirement, but a requirement to accompany the product with the right information. This could be in the form of an online product passport.

### 6.3.1 Check on ESPR criteria

The performance requirements for repairability should comply with the ESPR criteria of article 5.5. This subparagraph shows the check with these criteria.

*Table 6.3 Repairability performance requirements comply with the ESPR criteria*

| Product category | Significant negative impact on the functionality | Adverse effect on health and safety of persons | Impact on affordability of relevant products, also second-hand | Negative impact on competitiveness | Proprietary technology imposed | Administrative burden on manufactures |
|---|---|---|---|---|---|---|
| Household textiles | - | - | X | - | - | X |
| Short cycle consumer clothing | - | - | - | - | - | - |
| Long cycle consumer clothing | - | - | X | - | - | X |
| Short cycle workwear | - | - | - | - | - | - |
| Long cycle workwear | - | - | X | - | - | X |

- No negative impact on this subject

X Repair services and stocking of components could increase the price and the administrative burden on manufactures

## 6.4 G. Presence of substances of concern

The presence of certain substances in textile products is reason for concern. Therefore, the use of chemicals in products and other places in society is addressed by the chemicals regulation, such as the EU REACH-regulation, CLP regulation and other regulations, e.g., the persistent Organic Pollutants Regulation. Regulation of substances of concern through performance requirements is allowed only when the regulation is not aimed at chemical safety and food safety. In the Council of the European Union proceedings[87] it is explicitly mentioned that

*To overcome this limitation (Chemicals legislation cannot restrict hazardous chemicals based on sustainability), this Regulation should allow, under certain conditions, for the restriction, primarily for reasons other than chemical or food safety, of substances present in products or used in their manufacturing processes which negatively affect products' sustainability.*

It says further:

*The Commission, when setting performance requirements, the Commission should be able to prevent substances that hinder circularity from being included in a product. The identification of such substances should be part of the Commission's assessment prior to the setting of Ecodesign requirements for a specific product group and the Commission should in this assessment, for instance, take into account whether a substance makes the re-use or recycling of a product more*

[87] Interinstitutional file 2022/0095 (COD) (europa.eu)

*complicated or negatively affects the properties of the recycled material, for example through its colour or smell*.

Interviews with Dutch stakeholders of the textile supply chain made us conclude that the legislative processes to regulate new substances through REACH are slow. To fast track the restriction of emerging substances of concern in the production chain, the textile industry works with industry standards, e.g., the Manufacturing Restricted Substances List (MRSL) issued by the Zero Discharge of Hazardous Chemicals foundation.

We suggest that restriction of hazardous substances should be regulated through the REACH regulations. As no “substances” were reported that hamper incorporating circularity in a product we do not recommend regulation of substances through ecodesign product requirements. However, the presence of substances of concern should be communicated to the users of textile products and therefore we recommend setting the presence of substances of concern in the information requirements.

## 6.5 I. Resource use or resource efficiency

The resource use or resource efficiency varies widely between different types of products and varies with the supply chain and logistics. As there is not enough information at this moment to set standards for resource use or resource efficiency, we recommend making it mandatory for producers to make this information available in a product passport in due course.

### 6.5.1 Check on ESPR criteria

The performance requirements for resource use or efficiency should comply with the ESPR criteria of article 5.5. This subparagraph shows the check with these criteria.

*Table 6.4 Resource use or efficiency performance requirements comply with the ESPR criteria*

| Product category | Significant negative impact on the functionality | Adverse effect on health and safety of persons | Impact on affordability of relevant products, also second-hand | Negative impact on competitiveness | Proprietary technology imposed | Administrative burden on manufactures |
|---|---|---|---|---|---|---|
| All categories | - | - | X | - | X* | X** |

- \- No negative impact on this subject
- X Might increase the price of a product significantly, depending on the granularity of environmental information required to include
- X* The product passport should be open source.
- X** Administrative burden on manufactures could be high, depending on the calculation method

## 6.6 J. Recycled content

Recycled content can lower the environmental impact significantly compared to virgin materials. As the current production chain of short cycle textiles has a high environmental impact, while the products have a short lifetime, the impact of short cycle products can be reduced significantly by applying a high content of recycled fibres. To make the textiles sector circular the production of short cycle clothing should apply high volumes of recycled post-consumer fibres.

The fibre quality made from mechanically recycled materials will be less than the quality of fibres made from virgin materials, particularly when fibres are recycled multiple times. The lifetime of long cycle products could be substantially affected by adding too much post-consumer recycled content. Therefore, we recommend applying post-consumer recycled content in short cycle clothing and only allowing pre-consumer recycled fibres in long cycle clothing.

Currently less than 1 % of the textile products are recycled into new fibre materials. As mandatory recycled content requirements expect the availability of recycled fibre materials, the recycling industry will have to scale up quickly to produce sufficient volume of fibres. Consequently, mandatory recycled content will have to start at relatively low levels, even though technically higher levels of recycled material can be applied in textile products. With the expansion of the recycling industry mandatory levels of recycled content should increase over time.

### 6.6.1 Check on ESPR criteria

The performance requirements for recycled content should comply with the ESPR criteria of article 5.5. This subparagraph shows the check with these criteria.

*Table 6.5 Recycled content performance requirements comply with the ESPR criteria*

| Product category | Significant negative impact on functionality | Adverse effect on health and safety of persons | Impact on affordability of products, also second-hand | Negative impact on competitive ness | Proprietary technology imposed | Administrative burden on manufactures |
|---|---|---|---|---|---|---|
| Household textiles | - | - | X | - | X* | X** |
| Short cycle consumer clothing | - | - | X | - | X* | X** |
| Long cycle consumer clothing | -* | - | X | - | X* | X** |
| Short cycle workwear | - | - | X | - | X* | X** |
| Long cycle workwear | -* | - | X | - | X* | X** |

- No negative impact on this subject
-* At the proposed recycled content, no impact is expected, when increased in time at a certain point could affect quality
X Products will probably become (marginally) more expensive
X* It is important that transparency on the origin of recycled content is open source
X** Administrative burden on manufactures could be high

## 6.7 K. Possibility of remanufacturing and recycling

The possibility of remanufacturing and recycling will have a high impact on the total amount of textile waste. To create a more circular textile value chain increasing closed loop fibre to fibre recycling is most important. Not only will increasing recycling rates promote circularity, also it will create a fibre volume that allows for the uptake of recycled content. The ideal situation is designing textile products that can be recycled for 100 % when the product is discarded.

While durability is a particular performance requirement for long cycle products, remanufacturing and recycling is a clear goal for short cycle products.

The current state of recycling technology does not facilitate the recycling of a range of fashionable materials such as additional prints, metal rivets, paillettes etc. To achieve high recycling rates such materials should therefore be restricted for short cycle textile products. Mandatory high textile recycling rates will therefore have a negative influence on the designers' freedom and may have commercial impacts. In time, such materials should be restricted for long cycle textile products as well. This should be revised after five years.

### 6.7.1 Check on ESPR criteria

The performance requirements for remanufacturing and recycling should comply with the ESPR criteria of article 5.5. This subparagraph shows the check with these criteria.

*Table 6.6 Remanufacturing and recycling performance requirements comply with the ESPR criteria*

| Product category | Significant negative impact on the functionality | Adverse effect on health and safety of persons | Impact on affordability of relevant products, also second-hand | Negative impact on competitiveness | Proprietary technology imposed | Administrative burden on manufactures |
|---|---|---|---|---|---|---|
| All categories | -* | - | X | - | X* | X** |

| | |
|---|---|
| - | No negative impact on this subject (long cycle workwear category need more research when percentage is high) |
| -* | No negative effect expected for functionality. Aesthetics might be impacted |
| X | Products may become more expensive |
| X* | It is important that transparency on material composition is open source |
| X** | Administrative burden on manufactures could be high |

## 6.8 M. Environmental impact (Emission of Microplastics)

The previous paragraphs have discussed performance requirements that aim to reduce the environmental impacts of textile products. This chapter introduces another way to reduce the environmental impact of textiles by means of reducing microplastic emissions. In addition, two suggestions are made to increase the transparency about the environmental impact and allow consumers to make conscious decisions. Although these suggestions aimed to increase the transparency are out of the scope for the current project, it should be considered in future initiatives.

**Reduce Microplastic Emissions**

One of the key issues in the textile supply chain is the release of microplastics during the use phase of textile products. There is consensus that the bulk of microfibers is released during the first few laundry cycles of a product. One option to contain the release of microfibers is to launder the product before bringing it to the market, using laundry facilities equipped with filters to capture the released microplastics.

**Increase transparency by means of a label and within a product passport**
Another way to reduce the environmental impact is to increase transparency on the environmental impact of textile products and allow consumers to make conscious decisions. This can be achieved through a sustainability label that shows the sustainability score of a textile product, such as an A, B, C, D or E score. The label should be based on the PEF for textiles that will be published in 2024. The label should be understandable for consumers and differentiate between different types of garments, such as underwear, household textiles, and coats.

The full overview of environmental impacts should be mentioned in the to-be-developed product passport for textiles.

# 7 Recommended performance requirements

This chapter provides recommendations for performance requirements for the various product categories. It starts with three general recommendations for all product categories. Paragraphs 7.2 to 7.6 elaborate on the performance requirements for the individual textile categories.

These performance requirements were developed in close consultation with progressive stakeholders. Although garments can be made, and have been made, with more ambitious eco-designs, such as higher recycled content up to 20 %, the presented performance requirements are quite ambitious for the European market as a whole. The global infrastructure to supply recycled materials (collection - recycling - spinning - weaving/knitting) is almost non-existent at this moment, so it needs to be built from scratch. Therefore, the recommended performance requirements on recycled content start at the lowest practical percentage, but quickly ramp up within a few years. This will allow for building and optimizing the required infrastructure.

## 7.1 General performance requirements

The three general recommendations are repairability, substances of concern and environmental impact. Each explained in more detail in the next paragraphs.

### 7.1.1 Repairability

Repairability is most important for products with a long technical lifetime, and a high value. It is important that consumers and repair professionals know what component they need to repair the product and that a replacement for this product is available.

*Table 7.1 Performance requirements for repairability*

| Repairability for textiles with a long lifespan |
| --- |
| For all types of long cycle clothing, spare components must be readily available on the market. In the case of bespoke items, spare parts must be orderable |

### 7.1.2 Substances of concern

For all categories, the application of substances of concern in products should primarily be regulated through chemicals and not through performance requirements at this stage. As this legislation is aimed at chemicals on the European market performance requirements aimed at the use of chemicals in the production chain can be made. These performance requirements should be aimed at sustainability and/or reaching higher circularity. The textile industry already works with such industry standards e.g., the Manufacturing Restricted Substances List (MRSL) issued by the Zero Discharge of Hazardous Chemicals foundation. This list is aimed at protecting workers, local communities, and the environment from the possible impacts of harmful chemicals. Therefore, we recommend adopting this MRSL.

*Table 7.2 Performance requirements for substances of concern*

| Substances of concern through performance requirements |
|---|
| All additional substances of concern in the MRSL issued by the Zero Discharge of Hazardous Chemicals foundation, which are not in REACH, should be regulated through performance requirements. On a regular basis this list should be revised |

### 7.1.3 Environmental impact / Emissions of microplastics

One key issue in the textile supply chain is the emission of microplastics during the use phase of textile products. Various institutes investigate the opportunities to reduce the release of microfibres from textile products, but no standard has yet been developed.
There seems consensus on the fact that the bulk of microfibres are being released in the first laundry cycles of a product. Our proposed performance requirement is aimed at the primary washing cycle.

*Table 7.3 Performance requirement for environmental impact*

| Reduce environmental impacts of textiles |
|---|
| All cloth must be washed before it is brought to the market. This must be done in laundry facilities that are equipped with filters that capture the released microplastics |

## 7.2 Performance requirements for household textiles

Household textiles generally have a long life and can easily be recycled because of their relatively simple (i.e., mono material) design. Therefore, the performance requirements should focus on promoting longevity as well as on recycled content and recyclability. We recommend the following performance requirements for household textiles.

*Table 7.4 Performance requirements for household textiles*

| Household textiles | Performance requirements |
|---|---|
| **Technical durability**<br>After the number of washing cycles, the textile product must still comply with:<br>• ISO 12947-2 (2016) - 'Textiles - Determination of the abrasion resistance of fabrics by the Martindale method - Part 2: Determination of specimen breakdown'[88] | **Minimum requirement**<br>• The household textile must withstand at least 100 washing cycles<br>**Progressive requirement**<br>• The household textile must withstand at least 150 washing cycles |
| **Recycled content**<br>• Only post-consumer recycled content<br>• Closed loop (textile-to-textile) should be the standard | Starting at 5 % per item in 2027, to be raised with 3 % annually |
| **Possibility for recycling**<br>• Aesthetic additions to textiles that hamper recycling are prohibited | • Promote the use of mono materials<br>• No multi-layer materials<br>• No metal rivets |

[88] ecodesign_criteria_for_consumer_textiles.pdf (europa.eu)

| Household textiles | Performance requirements |
|---|---|
| | • No paillettes<br>• No metal/ glitter yarn<br>• No PVC/PU printing |

## 7.3 Consumer clothing - short cycle

For the short cycle consumer clothing the focus is on high levels of recycled content and recyclability. For this category, the recycled content should be sourced from post-consumer textiles (closed loop). The recommended performance requirements are given in the following table.

*Table 7.5 Performance requirements for short cycle consumer clothing*

| Short cycle consumer clothing | Performance requirements |
|---|---|
| **Technical durability**<br>After the number of washing cycles, the textile product should still comply with:<br>• ISO 15487 (2018) - Textiles - Method for assessing appearance of apparel and other textile end products after domestic washing and drying | **Minimum requirement**<br>• Short cycle consumer clothing must withstand at least 20 washing cycles<br>**Progressive performance requirement**<br>• Short cycle consumer clothing must withstand at least 30 washing cycles |
| **Recycled content**<br>• Only post-consumer recycled content<br>• Closed loop (textile-to-textile) should be the standard | Starting at 5 % per item in 2027, to be raised with 3 % annually |
| **Possibility for recycling**<br>• Aesthetic additions to textiles that hamper recycling are prohibited | • Promote the use of mono materials<br>• No multi-layer materials, or easily detachable<br>• No metal rivets<br>• No paillettes<br>• No metal/ glitter yarn<br>• No PVC/PU printing |

## 7.4 Consumer clothing - long cycle

For long cycle consumer clothing, the focus is primarily on promoting durability and longevity of the product. The application of (preferably pre-consumer) recycled textile material in new products is mandatory to reduce the environmental impact of the textile chain, starting at 5 % and growing year-on-year with the expansion of the recycling industry.

*Table 7.6 Performance requirements for long cycle consumer clothing*

| Long cycle consumer clothing | Performance requirements |
|---|---|
| **Technical durability**<br>After the number of washing cycles, the textile product should still comply with: | **Minimum requirements**<br>• Long cycle consumer clothing must withstand at least 40 washing cycles<br>**Progressive performance requirement** |

| Long cycle consumer clothing | Performance requirements |
|---|---|
| • ISO 15487 (2018) - Textiles - Method for assessing appearance of apparel and other textile end products after domestic washing and drying<br>• ISO 105-C06:2010 - Textiles - Tests for colour fastness - Part C06: Colour fastness to domestic and commercial laundering | • Long cycle consumer clothing must withstand at least 50 washing cycles |
| **Recycled content**<br>• Pre-consumer and post-consumer recycled content<br>• Closed loop (textile-to-textile) should become standard | Starting at 5 % per item in 2027, to be raised by 2 % annually |
| **Possibility for recycling** | After 5 years the possibility to set requirements for recycling will be regularly evaluated |

## 7.5 Non-protective workwear - short cycle

Workwear with a short cycle is typically worn during events and on shop floors. As the use phase of this kind of workwear is short the focus is on recycled content and recyclability. The recommended performance requirements are the same as short cycle consumer clothing.

*Table 7.7 Performance requirements for short cycle non-protective workwear*

| Short cycle non-protective workwear | Performance requirements |
|---|---|
| **Technical durability**<br>After the number of washing cycles, the textile product should still comply with:<br>• ISO 15487 (2018) - Textiles - Method for assessing appearance of apparel and other textile end products after domestic washing and drying<br>• ISO 105-C06:2010 - Textiles - Tests for colour fastness - Part C06: Colour fastness to domestic and commercial laundering | **Minimum requirement**<br>• The short cycle non-protective workwear must withstand at least 20 washing cycles<br>**Progressive requirement**<br>• The short cycle non-protective workwear must withstand at least 30 washing cycles |
| **Recycled content**<br>• Only post-consumer recycled content from textiles<br>• Closed loop (textile-to-textile) should be the standard | Starting at 5 % per item in 2027, to be raised by 3 % annually |
| **Possibility for recycling**<br>• Aesthetic additions to textiles that hamper or are not recyclable is prohibited | • Promote the use of mono materials<br>• No multi-layer materials<br>• No metal rivets<br>• No paillettes<br>• No metal/glitter yarn<br>• No PVC/PU printing |

## 7.6 Non-protective workwear - long cycle

The environmental impact of workwear with a long lifecycle, such as uniforms, may be further reduced by increasing the technical lifespan. Therefore, the performance requirements focus on the longevity. The application of (preferably pre-consumer) recycled textile material in new products is mandatory to reduce the environmental impact of the textile chain, starting at 5 % and growing year-on-year with the expansion of the recycling industry.

*Table 7.8 Performance requirements for long cycle non-protective workwear*

| Long cycle non-protective workwear | Performance requirements |
|---|---|
| **Technical durability**<br>After the number of washing cycles, the textile product should still comply with:<br>• ISO 15487 (2018) - Textiles - Method for assessing appearance of apparel and other textile end products after domestic washing and drying<br>• ISO 105-C06:2010 - Textiles - Tests for colour fastness - Part C06: Colour fastness to domestic and commercial laundering | **Minimum requirement**<br>• The non-protective long cycle workwear must withstand at least 40 washing cycles<br>**Progressive requirement**<br>• The non-protective long-cycle workwear must withstand 50 washing cycles |
| **Recycled content**<br>• Pre-consumer and post-consumer recycled content<br>• Closed loop (textile-to-textile) should be the standard | Starting at 5 % per item in 2027, to be raised by 2 % annually |
| **Possibility for recycling** | After 5 years the possibility to set requirements for recycling will be regularly evaluated |

## 7.7 Suggested information requirements

Although this project focusses on performance requirements, information requirements have also been discussed with experts and stakeholders. Although this is not a complete advice on information requirements, this paragraph presents the knowledge gathered on information requirements during this project.

Within the ESPR, the EU has identified digital product passports as a key tool to enhance transparency and traceability of products and product components. We advise to also develop product passports for textiles. The table below gives an overview of the information that should be incorporated within this product passport. It would be valuable if this passport is easily accessible and can be understood by the consumer of the textiles. This would give sustainability-minded consumers the opportunity to make informed decisions. Besides, making a product passport, forces producers to collect the proper information and by being informed about the impacts enables them to lower the environmental impact.

*Table 7.9: Information that should be included in e.g., a product passport for textiles*

| Theme | Suggested information requirements |
|---|---|
| Resource efficiency | Make it mandatory to disclose the resource efficiency of the product in a product passport. At a minimum report the following:<br>• The amount of energy used to produce the product, specifying the percentage of renewable and non-renewable sources<br>• The amount of resources required to produce the product, which can be determined through a mass balance |
| Repairability | Information about the correct replacement components must be provided and accessible for both the user/consumer and the tailor/repair professional |
| Environmental impacts | It should be mandatory to disclose the environmental impacts of the product's production. This should be done according to the PEF textile standard that is currently scheduled to be released in 2024 |
| Microplastics | Make it mandatory to disclose the potential for the product to release microplastics. Differentiate between products that release a lot of microplastics and those that release less microplastics. E.g., differentiate between a synthetic shirt and cotton jeans that has only synthetic stitching yarn. |

# Appendix 1 Organizations that have contributed to this project

We would like to thank the following organizations for their valuable input.

- Ademe Commisariat general du development
- Alcon Advies BV
- ArtEZ University of the Arts
- Cure Technology
- Dutch Denim Deal
- Ellen McArthur Foundation
- EU Commissie
- FTN
- Groenendijk bedrijfskleding
- Havep
- Hogeschool en Universiteit Gent
- Hogeschool Saxion
- Institut fur textieltechnologie Aachen
- Kuyichi
- Loop-a-life
- Modint
- PVH
- Schijvens
- Studio Anneloes
- Sympany
- TU Delft
- VITO
- Wieland
- Wolkat
- Zeeman