Summary of working document on the 3rd milestone

Preparatory study on textiles for product policy instruments

Joint Research Centre

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This document presents the most important information reported in the working document on the 3rd milestone of the preparatory study on textile, which is available on the project's website at this link. This summary follows the structure of the 3rd milestone working document and is provided to facilitate the discussion with stakeholders on design options. However, this summary **does not substitute** the working document on the 3rd milestone which provides a complete report of all the information and evidence and reasonings gathered presented therein.

Stakeholders are therefore invited to comment **only** the working document on the 3rd milestone.

All supporting references to the information presented in this document can be found in the working document on the 3rd milestone.

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1 INTRODUCTION

1.1 CONTEXT

The Regulation on Ecodesign for Sustainable Products (ESPR) ([1]), adopted in 2024, aims to reduce the environmental impacts of products across their life cycle and to improve the functioning of the EU's internal market. The regulation empowers the Commission to set a range of ecodesign requirements via delegated acts for specific product groups, to improve product circularity, energy performance and other environmental sustainability aspects. Ecodesign requirements can define thresholds related to the product's performance or information that must accompany it.

1.2 AIM

In this context, the Joint Research Centre (JRC) of the European Commission is developing the preparatory study on textile products, hereinafter referred to as the PS. The PS aims to provide the scientific and technical basis for:

- the future development of the ecodesign requirements for textile products to be defined in a delegated act within the framework of the ESPR;
- the possible future development of the mandatory EU GPP requirements for textile products within the framework of the ESPR;
- the future revision of the EU Ecolabel criteria for textile products ([2]), within the framework of the EU Ecolabel Regulation and consistent with developments under ESPR.

This summary focuses on information useful to develop potential future ecodesign requirements.

1.3 METHODOLOGY

The PS follows the structure prescribed by the Methodology for Ecodesign of Energy-related Products (MEErP), which consists of seven tasks:

- **Task 1 on scope** defines the boundaries of the system under analysis.
- **Task 2 on market** investigates the market structure, trends and other market characteristics of the products in the scope.
- **Task 3 on user behaviour** describes how users relate to the products in the scope.
- **Task 4 on technologies** entails a general technical analysis of the products in the scope to describe the average products on the market, the best available technologies (BAT) and the best not yet available technologies (BNAT).

[1] ESPR. Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for the setting of ecodesign requirements for sustainable products. Available at this link.

[2] EU Ecolabel criteria for textile products. Commission Decision of 5 June 2014 establishing the ecological criteria for the award of the EU Ecolabel for textile products. Commission Decision (2014/350/EU). Available at this link.

- **Task 5 on environmental and economic analysis** of the average products on the EU market. It defines base case products, which are a conscious abstraction of the reality for practical reasons, and it represents a specific product category.
- **Task 6 on design options** investigates the economic and environmental consequences of the design options within the life cycle for consumers and society.
- **Task 7 on possible policy scenarios** investigates suitable policy means to achieve the potential improvements in the environmental impacts of the assessed products, as well as estimating economic impacts on consumers and the industry. This task does not belong to the 3rd milestone.

The methodology used was adapted to the specific features of the textile product group and the requirements set by the ESPR.

The development of the PS includes the direct involvement of stakeholders, which will enable the JRC to verify the work under development and collect additional evidence on the investigated topics.

2 SCOPE

Table 1 reports all the initial textile apparel categories and their description, which are aligned with product categories reported by the PEFCR A&F ([3]).

***Table 1**. Initial product categories of textile apparel included in the scope of the preparatory study*

ID	Category	Description
01	T-shirts	Garment to cover the upper body to the elbow (e.g. singlets, vests, t-shirts, polo shirts, other short-sleeved shirts)
02	Shirts and blouses	Garment to cover the upper body including the entire arm (e.g. long-sleeved shirts, blouses, base layers)
03	Sweaters and mid-layers	Garment to keep the upper body warm and covered (e.g. pullovers, cardigans, hoodies, jerseys, sweatshirts, sweaters)
04	Jackets and coats	Garments to put on top of a shirt or sweater or to protect from the natural elements (e.g. blazers, suit jackets, overcoats, other light jackets, rain jackets, outdoor winter jackets, parkas, outdoor vests, anoraks)
05	Pants and shorts	Garment to cover the lower body, may protect from the elements (e.g. casual pants, outdoor pants, dress pants, jeans, sports pants, capri pants, shorts)
06	Dresses, skirts and jumpsuits	One-piece garment that covers both the upper and lower body, or the lower body only, other than pants and shorts (e.g. short- and long-sleeved, strapless, wrap, long and short, one-piece suits)
07	Leggings, stockings, tights and socks	Tight garment to cover the legs and/or feet. (e.g. opaque and sheer tights, pantyhose, fishnets, ankle socks, knee socks, low-cut socks)
08	Underwear	Garment worn under clothes, often next to the skin of the upper or lower body (e.g. boxers, briefs, panties, bras, body-shaping suits)
09	Swimwear	Garment worn for water-based or sun-based activities (e.g. bikinis, bathing suits, racing-style swimwear, board shorts)
10	Textile apparel accessories	Hats – Garment to cover the head for warmth or as a fashion item (e.g. caps, flat caps, woollen hats/beanies, fedoras, panamas, bowlers, newsboys, berets); Scarves and ties – Garment worn around the neck for warmth or as a fashion item (e.g. warm and light scarves, buffs, neckerchiefs, headscarves, shawls, bowties); Belts – Flexible band or strap worn around the waist or over the shoulders used to secure or to hold up clothing such as pants (e.g. dress belts, casual belts, buckle belts, tie-up belts, suspenders);

[3] 'Product Environmental Footprint Category Rules (PEFCR): apparel and footwear', available at this link. Last accessed on 22 August 2025. It sets rules on the calculation and reporting of lifecycle environmental impacts of apparel.

ID	Category	Description
		Gloves and mittens – Articles of clothing that protect hands and wrists from the elements or as a fashion item. Used in pairs (e.g. fingerless gloves, fashion gloves, outdoor sports gloves, mittens).

Technical textile apparel, such as workwear and sportswear are included in the scope of the PS, as long as (1) it is textile apparel (containing at least 80% by weight ([4]) of textile fibres, as defined above) and (2) it does not belong to the list of excluded products reported below. Sportswear could be considered technical textiles due to its high performance in terms of thermoregulatory properties. Workwear textile apparel is also included in the scope of the PS.

Section 3.2.2 of the working document on the 3rd milestone explicitly reports the types of products that are excluded from the scope of the PS.

3 MARKET

The market of textile apparel is characterised by a main consumption in Europe and North America and a production in Asian countries, such as China and India.

The current fibre composition of EU textile waste is mainly made up of cotton and polyester. The composition of textile apparel was sampled in the waste stream in three EU countries, and it shows that 53% of the items were made of single-fibre products, 45% were made of two-fibre products, whereas 2% were made of more than two fibres.

EU companies in the textile value chain are mostly microenterprises, covering all manufacturing stages. However, medium and large enterprises generate most of the total turnover.

The value chain of textile apparel is defined as global, long, complex, fragmented and opaque. The lifecycle stages from raw material for fibre production to retailing are composed of at least 15 nodes, i.e. the production of an item of textile apparel involves at least 15 supply chain actors.

4 USER BEHAVIOUR

There are diverse consumer perspectives and **reasons for purchasing** an item of textile apparel, which are driven by the way consumers approach it: those viewing it as purely functional and those seeing it as self-representational.

Research suggests that the primary purchase motivations include looking good, replacing old items, buying essential wear, staying on-trend, and preparing for special occasions.

Apparel purchases often occur spontaneously, indicating that consumers may not thoroughly inform themselves before making apparel purchases and act on impulse. Discount offers influence impulsive purchases and lead to more frequent buying and increased monthly spending on apparel.

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[4] In the preparatory study, weight and mass will be used interchangeably as it is done in the EU legislation, e.g. the Textile Labelling Regulation (Regulation (EU) No 1007/2011) and REACH (Regulation (EC) No 1907/2006). Nevertheless, the authors flag that from the technical perspective only the reference to mass should be made. The mass is the measure of the quantity of matter expressed in kilograms (kg). Differently, the weight is the force that the mass applies due to the acceleration of gravity. The weight is expressed in Newton (N). In the whole preparatory study, mass and weight are expressed in kg and refer to the quantity of matter.

The main **criteria applied by people when buying textile apparel** are price and the perceived quality, the latter being highly subjective. Sustainability principles rank lower in importance:

- Approximately 33% of 27 498 EU survey respondents express agreement with the notion that they are not concerned about the environmentally-friendliness of their apparel, while 64% disagree or tend to disagree.
- 11 483 consumers from ten European countries prioritize price (68%), perceived quality (61%) and fit when they buy new clothes (56%). Other aspects considered while to a lesser extent include product longevity (30%), the type of fibre (organic, synthetic, upcycled) (24%) and environmental impact of the apparel item (15%).
- Approximately half of the 27 498 respondents of a survey indicate that apparel should be offered at the lowest possible price, irrespective of the environmental impact or working conditions during its production.

The main **causes of apparel disposal** are loss of intrinsic properties, change of perceived value and fit issues. These three causes seem to have equal importance.

5 PRODUCT TECHNOLOGIES

The technical analysis of the products in scope describes the following types of product technologies, for each of the relevant product aspects:

- The Base Case of technologies (BC), which is the average product on the market.
- The Best Available Technologies (BAT), which have the most ambitious performances available on the market. BAT are implemented at scale.
- The Best Not yet Available Technologies (BNAT), which have the most ambitious performances, but they are not implemented at scale, therefore they are considered not available on the market.

Moreover, it analyses the ecosystem related to the specific product aspects (process techniques, business models, user behaviour, legislative framework and industrial best practices) and defines product categories that cluster the products that can be subject to the same future requirements.

5.1 GROUPING OF RELEVANT PRODUCT ASPECTS

The working document on the 3rd milestone identified the following groups of relevant product aspects:

- **Physical durability**, which includes physical durability, reliability and reusability;
- **Maintenance**;
- **Repairability**, which includes repairability, upgradability, possibility of refurbishment, and possibility of remanufacturing;
- **Generation of waste**;
- **Recyclability** and **recycled content**;
- **Environmental impacts**, which include environmental impacts, energy use and energy efficiency, water use and water efficiency, resource use and resource efficiency; and
- **Presence of substances of concern**.

5.2 DESCRIPTION OF ALL GROUPS OF RELEVANT PRODUCT ASPECTS

5.2.1 Physical durability

Due to lack of standardised tests capable to simulate the aging of the textile apparel, a framework describing the **robustness** ([5]) of these products was proposed. Therefore, product technologies are described in terms of their robustness (**Table 2**). The identified key parameters were:

- Visual inspection, which includes the analysis of sub-parameters related to:
  - Colour: colour change, staining, printing pattern
  - Fabric: smoothness, pilling, fuzzing, matting
  - Seams: smoothness, slippage
  - Non textile parts: buttons, press fasteners, slide fasteners, touch and close fasteners, labels, embroidery, and others. This is an assessment of appearance and proper functioning.
- Spirality ([6]), and
- Dimensional change

This approach to describing robustness would lead to the identification of two product categories, chosen considering the fabric construction: woven and knitted products. Performance levels to distinguish the technologies have been defined based on expert judgement obtained via stakeholder consultation.

***Table 2**. Description of product technologies in terms of robustness*

Parameter	ISO standard	Fabric construction	BC	BAT	BNAT
Visual inspection	15487	All	3. Moderate change in appearance	4. Negligible change in appearance	5. No change in appearance
Spirality	16322-3	Woven	5% < spirality < 6%	4% ≤ spirality ≤ 5%	spirality < 4%
		Knitted	5% < spirality < 7%	4% ≤ spirality ≤ 5%	spirality < 5%
Dimensional change	3759	Woven	±3% < change < ±4%	±2% ≤ change ≤ ±3%	change < ±2%
		Knitted	±5% < change < ±6%	±3% ≤ change ≤ ±5%	change < ±3%

BC: Base Case, BAT: Best Available Technologies, BNAT: Best Not yet Available Technologies.

All tests must be performed on the product ready to be bought by the user.

All tests must be performed after 5 cleaning cycles according to directions reported on the care label. ISO 6330 should be followed for washing machine, considering a type A machine, and followed by flat dry. Between washing cycles, the product should be flat dried for a maximum of 12 hours. After the last washing cycle, the product must be completely dry because the tests must be performed on a dry item. Detergent 7 will be used for products mainly made of wool and silk, and for products that need delicate or hand washing. For the rest of the products detergent 3 will be used. The detergent should never include bleaching. ISO 3175-2 should be followed for dry cleaning.

The visual inspection test should not include the qualitative assessment of the spirality because this is quantitatively assessed separately with ISO 16322-3.

When performing the visual inspection, many sub-parameters are assessed. In this case, the performance level of the visual inspection is given by the worst performing sub-parameter assessed.

Products which are designed to change their colour over time should not be assessed for colour change in the visual inspection. This applies only if the economic operator clearly communicates to the user this design choice. An example of this would be a product made of denim fabric dyed using indigo techniques to provide a vintage appearance to the product.

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[5] Robustness is the capability of a product to resist, i.e. maintain its physical structure and appearance, after undergoing external stresses, which could be of chemical or physical nature.

[6] According to the ISO 16322-3, spirality, or torque, in garments is the rotation, usually lateral, between different panels of a garment resulting from the release of latent stresses during laundering of the woven or knitted fabric forming the garment. N.B. The phenomenon is sometimes referred to as twist, for example, denim jean leg twist.

The proposed simplified robustness framework described above is based on what currently the JRC considers feasible, considering the current state of the art. This robustness framework has two notable drawbacks:

1. Since it does not consider product aging, the robustness framework is not capable to describe how many times an individual can use an item before the probable appearance of a physical failure resulting from its normal use. Therefore, the robustness framework is **not capable of describing the foreseeable service lifetime related to the intrinsic properties of the product**. The robustness framework is capable to describe only the resistance to external stresses, therefore not covering all the stresses occurring during product aging.
2. A known increase in performance level of key parameters corresponds to an unknown increase of physical durability. This implies that the consequent estimated **increase in the service lifespan can only be based on expert judgement, which will not be verifiable**. Textile experts cannot base their judgement on direct experience, because currently nobody performs such measurements due to lack of aging test methods.

5.2.2 Maintenance

The European Commission is currently considering the introduction of harmonised and partially mandatory textile labelling rules on textile care, in the context of the revision of the Textile Labelling Regulation (EU) 1007/2001 (TLR).

5.2.3 Repairability

Emotional attachment, fashion trends and repair price strongly affect the repairability of textile apparel. In theory, any item of textile apparel can be repaired, but its degree of complexity cannot be described with an objective framework because the factors influencing the repairability in the design phase are at odds with the creative nature of the textile industry. In this context, the establishment of such an objective framework is hindered by subjective consumer decisions, the nature of the product failure and feasibility of repair.

Acknowledging the lack of a repairability framework, the JRC considers that, from the perspective of the manufacturer, making information available about repair services could facilitate the repairability of textile apparel.

5.2.4 Waste generation

The generation of waste is not an intrinsic property of a single product technology, but rather depends on many elements of its ecosystem, and is driven by the production and consumption of textile apparel. Currently, it is not possible to determine if a product was manufactured using specific process techniques and under particular business models. Moreover, it is unknown how many companies use advanced technologies to minimise their post-industrial and pre-consumer waste.

Notwithstanding, the study of the literature and the consultation with stakeholders revealed that in the EU there are business models that incentivise overconsumption and overproduction. However, other stakeholders related intentional overproduction with inefficient production and claimed that this is not the most common model in the industry.

Thus, the BC, BAT and BNAT related to the waste generation cannot be defined at product-level. The description of waste generation was modelled considering the variability and uncertainties of all factors playing a role.

5.2.5 Recyclability and recycled content

In the framework of **recyclability**, the product technologies could be described as follows:

- BC are mechanically recyclable, which is the most common technique at scale even if the recycling rates remain low, at around 10%.
- BAT are (1) pure cotton textile apparel recycled via chemical recycling for the production of man-made cellulosic fibres (MMCFs), (2) nylon-rich textile apparel recycled via chemical recycling for synthetic fibres, and (3) acrylics and polyester rich blends recycled via thermomechanical recycling.
- BNAT are products that can be processed with techniques that currently have an intermediate maturity level.

The **recycled content** was defined as *the proportion, by mass, of recycled fibres, from post-industrial, pre- and post-consumer waste, in a textile product*.

While the proposed definition includes the use of secondary material coming from sources other than fibre-to-fibre recycling, closed-loop recycling in the textiles sector is a desirable goal so as not to conflict with the targets established for other sectors. Thus, a potential future evolution of the recycled content definition could restrict this content to recycled fibres coming from (post-consumer) textile waste.

At present, textile products including recycled fibres report their recycled content either via a manufacturer declaration, or via a third-party certification system. Since there is no laboratory test at scale capable of determining the recycled or virgin origin of fibres, currently the only possible approach to verification has to rely on chain of custody systems.

The recycled content of a new textile apparel is fibre-specific and depends on the availability of the secondary material and on the characteristics of the garment. A generic approach is followed to ensure that all products included in scope are described by the framework reported in this section, while the specificities of the recycled fibres were considered when proposing and assessing potential ecodesign requirements.

In the framework of recycled content, the base case of the product technologies would have no recycled content. Differently, the identification of BAT and BNAT should distinguish fibres and product functions. In addition, the BAT would consider recycled content coming from sources other than textile waste, while the BNAT would be identified with closed-loop recycling in the sector.

As for the categorisation regarding this product aspect, in general, when constructing fabrics, knitted products are generally better suited for incorporating mechanically recycled fibres due to their more flexible structure compared to woven fabrics. However, a notable exception is represented by products made of denim fabric, which can incorporate up to 20% post-consumer recycled material, or alternatively 30% post-industrial recycled material, regardless of their grammage and their stretchability/elasticity.

5.2.6 Environmental impacts

The analysis of the ecosystem affecting the environmental impact of textile apparel shows the difficulty to identify in a rigid framework the characteristics of specific product technologies. However, the information gathered in the previous sections has allowed the PS study team to obtain a fair understanding of the situation.

The BC considers that China, India, and Bangladesh manufacture the largest part of textile apparel consumed in EU. The business model that characterises the BC promotes overproduction and overconsumption, supported by users that tend to change or expand frequently their wardrobe. The end of life of the BC is described by landfilling and incineration of textile waste in the EU as well as in third countries.

The BAT considers EU manufacture and the currently available less-impacting business models, user behaviours and waste management options. The business model that characterises the BAT promotes a production rate similar to that which occurred before 2004, when the apparent consumption of the EU was about half the current one. The end of life of the BAT is described by energy recovery and recycling in the EU of the textile waste.

Since the environmental impacts are affected by very numerous aspects, the description of BNAT is simply described as more ambitious than BAT and considers all the BNAT reported for other product aspects.

This description of the product technologies is suitable for all products in the scope of the PS.

5.2.7 Presence of substances of concern (SoC)

The use of chemicals in textile apparel manufacture is often related to the specific fibre type as well as to specific finishings (e.g. water-proofing) which are generally not product category specific. Consequently, it is difficult to envisage a specific framework.

Building a BC and the definition of products representing the BAT is particularly challenging for chemicals, given the large number of substances used by the sector and the lack of quantitative information on their distribution in products. For certain specific substances and substance families, BAT and BNAT products could potentially be defined in terms of products having switched to non-toxic or less toxic (or in general more sustainable) alternatives – e.g. alternatives to the use of PFAS. Given the current paucity of detailed information on SoCs in textile apparel, the setting of information requirements, as prescribed under ESPR, with justified exemptions and thresholds for declaration of substances, seems clearly warranted.

5.3 PRODUCT CATEGORIES

The analysis of product technologies was performed in the context of specific groups of product aspects, which sometimes were described via categories. However, the adopted product categorization has to be valid for all relevant product aspects. In the case of textile apparel, this exercise is very simple because the only product aspects described via categories were the physical durability, considering the framework of robustness, and the recycled content. This leads to the adoption of three categories of products to be used in the following steps of the development of the PS.

Therefore, the following tasks analysed three representative products, one for each of the defined product categories:

1. knitted products,
2. products made of denim fabric, and
3. woven products made without denim fabric.

6 ENVIRONMENTAL AND ECONOMIC ANALYSIS OF THE BASE CASE

6.1 LIFE CYCLE THINKING ANALYSIS

For each product category, the BC of the representative product was modelled following a Life Cycle Assessment (LCA) addressing the 16 impact categories of the Product Environmental Footprint (PEF), Life Cycle Cost (LCC) and societal Life Cycle Cost (sLCC).

The model described the following Life Cycle Stages (LCS):

- LCS 1: raw material and fibre manufacturing
- LCS 2: production process:
    - LCS 2a: fibre pre-treatment
    - LCS 2b: yarn production
    - LCS 2c: fabric production
    - LCS 2d: fabric finishing processes
    - LCS 2e: confectioning
    - LCS 2f: waste management (post-industrial)
- Transport LCS 1 & LCS 2
- LCS 3: retailing and transport
- LCS 4: use
- LCS 5: end of life (waste management of post-consumer waste).

6.1.1 Contribution

6.1.1.1 All lifecycle stages (LCS)

The most contributing impact categories to the total environmental impacts expressed as environmental points were:

- Water use, contributing 27-42%
- Climate change, contributing 15-18%
- Resource use, fossils, contributing about 9%

The largest environmental impacts are generated by the production of raw materials (LCS1) (60-63%) and the manufacturing processes (LCS2) (21-29%). Environmental impacts generated by the production of raw materials largely depend on the specific fibres used. Each fibre has specific characteristics, which are deployed for specific applications to meet the demands of users in terms of performances and price.

From the economic perspective, the largest societal costs are generated by environmental externalities (external costs) (34-36%) and internal costs due to the manufacturing processes (29-37%). The internal costs due to the production of raw materials and the use stage result in a smaller contribution (14-18% and 6-21%, respectively).

6.1.1.2 LCS1 – Raw materials

When investigating the raw material production stage, 35-43% of the environmental impacts are generated by the use of water, 18-31% by the use of energy, 12-29% by the use of chemicals, and 11-16% by direct emissions into water, soil and the atmosphere. Due to lack of alternative sources of information, the life cycle inventory had to rely on some aggregated datasets accounting for 3-26% of the environmental impacts in this lifecycle stage.

The analysis of the societal LCC showed that internal costs represent 46-49% of the total societal costs generated in LCS1. This analysis could address only the final costs of the fibres used and the external costs due to environmental impacts. The contribution of specific components, such as energy, water and chemicals used, were not assessed due to lack of available data.

6.1.1.3 LCS2 – Manufacturing

When investigating the manufacturing stage, the fabric finishing processes are the largest contributors of environmental impacts (41-63%) followed by yarn production (15-23%) and fabric production (5-27%).

From the economic perspective, the largest societal costs are generated by internal costs due to fabric finishing processes (23-30%), externalities (23-29%), and internal costs due to confectioning (17-20%). The internal costs due to yarn production and transport result in a smaller contribution (12-14% and 9-11%, respectively).

The largest contributors in the manufacturing stage are the use of energy (44-63%) and the use of chemicals (25-41%), which correspond to 10-15% and 5-11% respectively of the environmental impacts of the entire life cycle.

From the economic perspective, about half of the internal costs during manufacturing are due to human resources and capital expenditure (47-49%). The use of energy and chemicals gives a lower contribution: 15-21% and 14-20%, respectively.

6.1.1.4 Waste management

This section focuses on the waste management of the three types of textile waste, which corresponds to 0.6-0.8% of the environmental impacts generated in the whole life cycle.

Post-consumer waste generates half of the environmental impacts associated to waste management, while post-industrial and pre-consumer waste generate 27-35% and 16-22%, respectively.

From an economic perspective, about half of the societal costs are due to externalities (45-53%), followed by the contribution of the internal costs of managing post-consumer waste.

6.1.1.5 Costs borne by the producer and the consumer

About 71-72% of the costs addressed by the producer are due to the manufacturing process, while the largest part of the costs addressed by the consumer is due to the purchase by the consumer of the textile apparel, which includes the first three lifecycles of product (raw materials, manufacturing and distribution).

6.1.2 Scenarios

The scenario analysis investigated: 1) the influence of consumer choice when disposing a product regardless of its physical performance, and 2) the location of raw material production and manufacturing processes.

The choice of the user on when to dispose of the textile product largely affects the environmental impacts and the societal costs. For example, if the user decides to change their textile apparel every year, the environmental impacts and the societal costs increase by about four times compared to the base case. In contrast, the environmental impacts (and similarly the societal costs) decrease by 28% for knitted, 16% for other woven and 11% for denim products, when choosing the maximum number of uses for the products reported by the literature.

The location of the raw material production and manufacturing processes also affects the environmental and economic impacts of the products in the scope. The production and manufacture occurring in EU and third countries was compared.

The production in third countries generates environmental impacts estimated to be 68% higher than those generated when production occurs in EU. This difference is driven by the use of water in LCS1 and the use of energy in LCS2. The use of water in third countries generates more environmental impacts because it is withdrawn from ecosystems that are under more water stress compared those in EU.

Conversely, the production in third countries is estimated to generate societal costs 35% lower than those generated when production occurs in EU. This difference is mainly driven by the higher costs in the EU related to human resources (HR) and capital expenditure (CAPEX). Due to limitations in the dataset, the externalities are likely underestimated. To model chemical inputs (the second leading cause of environmental impact after energy), datasets based on global averages were used, which do not allow for an exhaustive representation of the production reality in the countries considered in the model (e.g., India, China, etc.).

6.2 TEXTILE FRAGMENTATION

The analysis of the literature led the PS study team to conclude that the identification of hotspots where particulate matter is mostly released into the environment, is not currently possible. This is mainly driven by:

- the absence of a standardised definition on particulate matter biodegradability, and
- the lack of standardised measurement methods for the sampling, characterization and quantification of these pollutants in all release points of the value chain.

Without a clear and common definition of biodegradability for the referred particulate matter into specific environmental compartments, the problem cannot be addressed because its scope is not defined. Additionally, without standardised measurement methods, the few current emission rates reported by the literature cannot provide a reliable identification of the main emitting sources upon which to potentially focus the optimised mitigation strategies.

7 DESIGN OPTIONS

A variety of design options were defined with the aim of addressing the identified hotspots and potentially improve the environmental performance of textile apparel without causing disproportionate costs. This was done based on the knowledge gathered and developed on:

- The market analysis (section 3),
- The user behaviour (section 4),
- The product technologies (section 5), and
- The environmental and economic analysis of the base cases (section 6).

For each product category, the design options were based on the identified Best Available Technologies, following the Task 6 of the MEErP, and correspond to potential future ecodesign requirements under assessment. Therefore, the goal of this section was to estimate the potential environmental benefit of implementing different design options first individually and, when in synergy, then in combination. The presented design options are not final proposals. They can be amended and further complemented after considering additional evidence and feedback provided by stakeholders.

The analysis of the design options was developed interrogating and refining the Life Cycle Thinking model built for the analysis of the base cases (section 6).

***Table 3**. Objectives, design options and potential ecodesign requirements for knitted, denim and other woven products*

Generic objectives	Specific objectives	Design Options (DOs)	(Potential) Ecodesign requirement
Decrease the environmental impact of products by diluting one-off effects	Extend product lifetime	DO1 – Product with an increased robustness	Information requirement on the robustness of the product (robustness score)
Increase the availability of secondary materials	Increase the share of waste going to recycling	DO2 – Product with a higher share of weight going to recycling	Information requirement on the recyclability of the product (recyclability score)
Decrease the environmental impact of raw materials	Increase the use of secondary materials	DO3 – Product with higher recycled content	3.1 Information requirement on recycled content 3.2 Performance requirement on the recycled content
Decrease the environmental impact of manufacturing	Decrease the environmental footprint of the manufacturing	DO4.1 – Product with a decreased environmental footprint	Information requirement on the environmental footprint during manufacturing
	Decrease the carbon footprint of the manufacturing	DO4.2 – Decrease the carbon footprint of the manufacturing	Information requirement on the carbon footprint during manufacturing

One-off effect refers to a unique and singular occurrence that happens only once and is not repeated (i.e. raw materials production, manufacturing, end of life).

Details and reasoning for the design options (DO1 - information requirement on robustness, DO2 - information requirement on recyclability, DO3 – information and performance requirements on the recycled content and DO4 - information requirement on the carbon/environmental footprint during manufacturing) are provided in sections from 7.1 to 7.4.

Design options on other specific aspects (i.e. reparability, sustainable material sourcing and release of particulate matter from textile products) were also assessed, with the limitations reported below.

Although enhanced **repairability** could potentially increase the service lifetime of the product, the establishment of a design option has several challenges. While theoretically, any item of textile apparel can be repaired, the complexity of repairability cannot be objectively quantified. The factors influencing it often conflict with the creative nature of the textile and fashion industry, hence hindering its regulation (see section 5.2.3).

Additionally, mandating the provision of repair instructions appears unwarranted, as the analysis of the user behaviour showed that these services are normally performed by professionals who do not require such guidance, and thereby, in the view of the Preparatory Study team do not justify the administrative burden for manufacturers to produce them across the board, as a general requirement. Moreover, the analysis of user behaviour does not identify the lack of information as a barrier to repair versus discard or replacement decisions. Instead, factors like emotional attachment, fashion trends, and repair costs are highlighted, none of which are addressed by the considered requirements.

Consequently, only **information requirements on available repair services could be considered**. Informing about independent repair services is deemed unsuitable, as these are generally local, small businesses, making it impractical for brands to identify relevant location-specific details without knowing where the garment will be used. Instead, information requirements could rather focus on repair services directly offered by the brand (if any), including their details and contact information, via the Digital Product Passport. This requirement is proposed to be voluntary and to only apply when the service is provided by the retailer, ensuring minimal effort and burden on manufacturers while still offering a benefit to the citizen. Given this requirement is proposed not to be mandatory, its impacts were not modelled in the following sections.

In addition, the offering by the Administrations of financial incentives to subsidise repair services could be a viable approach. Its usefulness could be explored under a legislative framework different from the ESPR.

A design option addressing the **sustainability of fibre production** would be also suitable to be explored as the hotspot analysis showed that this stage is responsible for 60-63% of the environmental impacts over the lifecycle (section 6.1.1.1).

However, setting a preference towards the selection of specific types of fibres would overlook the fact that each type of fibre has specific characteristics to meet the demand of the supply chain and of the users of the textile product. Therefore, this would not appear to be a suitable way to address the problem. Each type of fibre could be produced in numerous ways, which could have different environmental impacts. Identifying the most sustainable way of producing a specific type of fibre is possible, but it is not a straightforward undertaking because specific sustainability parameters should be selected. These parameters should in theory include at least:

- the trade-offs among the several EU strategies and action plans (e.g. Biodiversity strategy for 2030 ([7]) and Zero Pollution Action Plan ([8])) and their objectives and ambitions, i.e. identifying political priorities when addressing environmental and economic problems, and
- the systemic competition with other industrial sectors that use the same resources. This should avoid distortion of other markets.

This complex analysis cannot be performed within the development of this PS and could potentially be addressed by a different study, which could take as a starting point the background analysis offered by the numerous private schemes certifying different sustainable fibre claims.

In this sense, given the Organic Regulation (EU) 2018/848 includes specific ambitious environmental criteria for the production of cotton, wool and silk, it could offer relevant information to consumers that value them. Thus, the voluntary reporting of fibre content compliant with the Organic Regulation (EU) 2018/848 would enable consumers to choose apparel containing organically produced fibres, over others. Since this requirement is proposed not to be mandatory, its impacts were not modelled in the following sections. Nevertheless, verification of reported voluntary information should rely on chain of custody systems supporting the specific declaration made by the economic operator placing the product on the market. This is the case because the Organic Regulation (EU) 2018/848 sets criteria on the production of the fibres, but it does not put in place mechanisms to certify the quantity of these fibres that was used in the textile apparel.

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[7] Biodiversity strategy for 2030. Available at this link. Last accessed on 21 October 2025.
[8] Zero Pollution Action Plan. Available at this link. Last accessed on 21 October 2025.

This PS addresses the environmental impacts generated by raw material production via other design options (DO1, DO2 and DO3).

While the topic of the **pollution generated by the fragmentation of textile apparel** was analysed, a design option addressing it was not defined at this stage because, in the view of the Preparatory Study team, some preliminary technical gaps should be first addressed (section 6.2):

1. The definition of particulate matter biodegradability should be standardised. This definition should specify:
    a) the amount of addressed material,
    b) the presence of living organisms capable to biodegrade the material,
    c) the specific environmental conditions, and
    d) the timeframe required for the degradation.

   This standardisation should consider the numerous environmental compartments which receive this type of pollution.
2. Standardised measurement methods should be agreed for sampling, characterization, and quantification of these pollutants in all release points of the value chain.
3. Standardised measurements should be performed along the whole value chain to identify the main emitting sources of this pollutant.
4. Potential mitigation strategies should be based on points from 1 to 3 and consider the driving factors of the main emitting sources.

7.1 CHARACTERISTICS OF DO1 - INFORMATION REQUIREMENT ON ROBUSTNESS

The service lifespan of products is a key aspect that can influence significantly their environmental performance. Due to the primary contributions of the raw materials and manufacturing stages (81-90% of total impacts – section 6.1.1.1), a longer use-time would seem to have great potential for improving the environmental impact by spreading one-off effects throughout an extended lifetime, thus diluting them.

However, in examining a potential increase of the service lifetime of apparel, it was found that ecodesign has limited influence, as disposal is not solely determined by physical durability or product-specific attributes like robustness and other design features. According to the analysis of consumer behaviour (section 4), one-third of disposal reasons relate to intrinsic quality. Factors such as the perceived value, fit, and fashion trends significantly influence disposal decisions, indicating a complex interplay of factors which, in addition, are not addressable under the framework of ESPR. A scenario analysis assessed the effects of user behaviour on the premature disposal of the products (section 6.1.2).

Nonetheless, to address the share of the disposal related to the physical durability, the impact of potentially setting an information requirement was assessed. The objective of this would be twofold. On the one hand, it would help consumers to make informed purchases of more durable products. On the other hand, it would encourage manufacturers to produce more durable products than those of competitors.

Because measuring the physical durability is challenging due to the lack of a suitable method to simulate the aging process of textile apparel, a potential information requirement is proposed in terms of the robustness of the product. However, the robustness framework has the two limitations described in section 5.2.1: (a) it is not capable to describe the foreseen service lifetime related to intrinsic product properties and (b) the increase of performance level of key parameters corresponds to an unknown increase of physical durability.

The implementation of the durability framework, fully backed by scientific evidence, would require the development of standards that reliably simulate the aging process of textile apparel.

A performance requirement on ‘robustness’ is not considered at this stage precisely because of the reported uncertainties surrounding its applicability as a reliable measure of textile durability. **The setting of performance requirements could be considered following the analysis of potential additional stakeholder input and evidence supporting this aspect.**

A **scoring system** was developed to award products a robustness value in a scale from 0 to 10. It consists in a cumulative points-based evaluation, designed to assess products across selected key parameters: spirality, dimensional change and colour, fabric, seams and non-textile parts as sub-parameters identified by visual inspection (as described in section 5.2.1). Each parameter was assigned a score corresponding to different performance levels based on test results, according to the description of the base cases and best available technologies for knitted and woven products reported in **Table 2**.

Table 4 provides a summary of how the points should be awarded for each parameter. This system enables a comprehensive evaluation by considering both the overall performance and the relative importance of each parameter in the final score, with 0 indicating performance below the Base Case and 10 indicating the BAT level performance across all parameters.

***Table 4**. Points to be awarded for the robustness score*

Parameter	ISO standard	Fabric construction	Test result	Points
Spirality	16322-3	Woven	Spirality > 6%	0
			5.5% < spirality ≤ 6%	1
			5% < spirality ≤ 5.5%	2
			Spirality ≤ 5%	3
		Knitted	Spirality > 7%	0
			6% < spirality ≤ 7%	1
			5% < spirality ≤ 6%	2
			Spirality ≤ 5%	3
Dimensional change	3759	Woven	Change > ±4%	0
			±3.5% < change ≤ ±4%	1
			±3% < change ≤ ±3.5%	2
			Change ≤ ±3%	3
		Knitted	Change > ±6%	0
			±5.5% < change ≤ ±6%	1
			±5% < change ≤ ±5.5%	2
			Change ≤ ±5%	3
Colour, fabric, seams and non-textile parts via visual inspection	15487	All	< 3. Moderate change in appearance	0
			3. Moderate change in appearance	2
			4. Negligible change in appearance	4

The performance level of the visual inspection is given by the least performing sub-parameter.

The option of defining classes of performances was not further pursued in the working document of the 3rd milestone due to insufficient data on the distribution of products in the market according to this framework. This matter could be reassessed in the future if more detailed information about the distribution of characteristics of products on the market becomes available.

The assessment of the impact of an information requirement on the robustness of the products was based on the following **assumptions**:

- The **average service lifetime** will increase by 5%. This is estimated based on the experience of the Energy Labelling framework, which has showed that products for which information requirements have been defined have improved their performance by 6 – 14% over a period of 5 years, as compared to the Business-as-Usual scenario.
  While acknowledging the differences between energy efficiency and robustness, this assumption was made in the absence of a more accurate benchmark. This estimate is based on the assumption that, regardless of the product aspect reported, consumers would respond similarly to information presented on a label, adjusting their purchasing decisions towards better-performing products. This consumer behaviour is expected to lead to comparable improvements, irrespective of the dimension (or product aspect) being considered. Analogously, the manufacturers are expected to also behave in the same way to avoid showing performance below those of their competitors.
  A higher impact of the requirement on the average service lifetime is not assumed since available information indicated that the criteria mostly applied by consumers when purchasing apparel products are price and perceived quality, which do not necessarily imply longer service lifespan (section 4).
  This estimate could be revised only based on specific surveys analysing how consumers and manufacturers would react to an information label on the robustness of textile apparel products.
- The robustness increase would come with improved performances of key parameters (i.e. spirality, dimensional change and colour, fabric, seams and non-textile parts as sub-parameters identified by visual inspection). A consultation with textile experts revealed that the performances of the key parameters could be improved increasing the **energy** and **water** used during the manufacturing and incrementing the quantity of the **fibres** and **chemicals**. The estimates are shown in **Table 5**, based on expert judgement of the most common processes needed. Nevertheless, they are unverifiable because to the author's knowledge, nobody has ever measured the correlation between the increase of key parameters and the increase of the service lifetime due to lack of tests simulating the aging process of textile apparel.

  ***Table 5**. Percentage increase of parameters related to robustness due to an increase of 5% of the service lifetime*

Product category	Energy	Water	Fibres	Chemicals
Knitted	2	1	0.6	2
Denim	2.5	2.5	0.5	1.7
Woven	2	1.4	0.44	1.25

  Knitted: knitted products; Denim: products with denim fabric; Other woven: woven products without denim fabric.
- The **additional manufacturing costs** for achieving a higher robustness are calculated based on the additional energy, water, mass and chemicals used.
- An **additional cost of testing** is considered and estimated to be of 0.05 €/unit. This is based on practices of the testing labs who reported that the standard price for a set of relevant robustness tests is around 500€, excluding potential discounts related to testing volume, membership status, or other business practices. Considering that brands may test one item per model or the same item in each colour variant, it is assumed that such price could cover around 10 000 units according to the testing labs consulted.

- An **additional cost of labelling** is also considered and estimated to be of 0.02 €/unit. This is based on an analysis conducted by the JRC. The smallest value from their analysis was chosen since apparel products already possess labels at the point of sale in the form of hang tags and, therefore, it would not be necessary to create a new one; the information can simply be included in the existing format.

7.2 CHARACTERISTICS OF DO2 - INFORMATION REQUIREMENT ON RECYCLABILITY

Looking at the results of the contribution analysis, several design options are defined to address the major contribution of the raw materials to the total lifecycle impacts (60-63%). Although this is more directly tackled with a third design option on recycled content, it would go hand-in-hand with the need to increase the availability of secondary materials. For this reason, this design option analyses the potential impact of an information requirement that would improve the recyclability of the products. Moreover, despite the minor contribution of the end of life to the lifecycle impacts, it is expected to also slightly improve the environmental performance of the products given that recycling is the second-least impacting waste treatment pathway for most environmental impact categories after preparing for reuse.

However, the amount of textile waste that goes to recycling is mostly influenced by the (currently) low collection rates, the readiness of certain recycling technologies and the recycling capacities, which are the real limiting factors for textile recyclability beyond design.

Despite some limitations, this information requirement is expected to have an impact by guiding consumer choices towards more recyclable products and encouraging manufacturers to produce more recyclable products than those of competitors.

The concept of a performance requirement that prohibits the entry on the market of products that cannot be recycled was discarded for the following reasons. While the analysis of the recycling ecosystem indicates that certain disruptors currently hinder product recyclability, these can be effectively removed or managed during the pre-treatment stages. The only component found to significantly impede recycling is elastane, when present above a specific threshold. Despite this limitation, a prohibition on elastane use is not considered proportionate nor feasible, as the material imparts essential functional properties to textiles that cannot be eliminated without compromising the performance of certain products. Instead, its use should be minimised and limited to applications where it is most necessary. The established information requirement will indirectly discourage excessive use, as products containing elastane above the defined limit will be labelled as "Non-recyclable", as described in the following section.

A scoring system has been developed to award products regarding their recyclability in a scale from 0 to 10. It consists in a cumulative points-based evaluation, designed to assess products according to the main limitations found in the analysis of product technologies (section 5.2.5).

The scoring considers all ecosystem-related parameters that allow, facilitate or hinder the recycling of textile products, from the sorting to the recycling techniques. It leaves aspects related to the collection out of the scope as these are already addressed in the Waste Framework Directive, requiring Member States to set up separate collection for textiles by 1 January 2025 (Article 11).

A product would be non-recyclable and thus awarded a score of 0 pt if contains elastane in proportions higher than 15% (20% for PA6-rich (> 80%) blends). If it contains less, the product would be considered recyclable, starting with 1 pt and summing points up to 10 pt for the reasons described in **Table 6**. The highest scores would be awarded to those products for which textile-to-textile recycling is feasible in line with the objectives set in the EU textile strategy.

***Table 6**. Points to be awarded for the recyclability score*

Area	Criteria	Points
Because of being recyclable	If it contains elastane in proportions lower than 15% (20% for PA6-rich (> 80%) blends)	1
Because of facilitating Sorting	If it has same inner and outer composition	+1
Because of facilitating pre-treatment	If it is free of printings	+1
	If it is free of coatings	+1
	If it is free of sequins	+1
	If it is free of dyes	+1
	If it is mono-material	+1
Because of the recycling techniques at operational scale	If it can be mechanically recycled (*)	+2
	If it is pure cotton, which can be chemically recycled	+2
	If it is composed of cotton-rich blends (> 60%), which can be thermo-chemically recovered to cotton	+2
	If it is composed of PA6-rich blends (> 80%), which can be chemically recycled	+2
	If it is composed of acrylics or polyester-rich blends (> 80%), which can be thermo-mechanically recycled	+2

(*) Note that all garments containing elastane in proportions lower than 15% can be mechanically recycled, thus scoring at least 2 pt.

The assessment of the impact of an information requirement on the recyclability of products was based on the following **assumptions**:

- The **average share going to recycling** increases by 5%. As in the case of robustness, this is estimated based on the experience obtained from the Energy Labelling framework. While acknowledging the differences between energy efficiency and recyclability, this assumption is made in the absence of a more accurate benchmark. It is based on the assumption that, regardless of the product aspect reported, consumers would respond similarly to information presented on a label, adjusting their purchasing decisions towards better-performing products. This consumer behaviour is expected to lead to comparable improvements, irrespective of the dimension (or product aspect) being considered. Analogously, manufacturers are expected to also behave in the same way to avoid showing performance below that of their competitors. A higher impact of the requirement on the average share going to recycling is not assumed since the criteria mostly applied by consumers when purchasing apparel products are price and perceived quality, which are not connected to the recyclability (section 4).
- An **additional cost of labelling** is also considered and estimated to be of 0.02 €/unit. This is based on the smallest value of the analysis conducted by the JRC since the information could simply be included in the already existing hang tags available at the point of sale.

7.3 CHARACTERISTICS OF DO3 – INFORMATION AND PERFORMANCE REQUIREMENTS ON THE RECYCLED CONTENT

The main measure proposed for reducing the environmental impacts of the raw material production (60-63%) relates to the use of secondary materials by increasing the recycled content in apparel products through an information and/or a performance requirement.

On the one hand, an information requirement is expected to encourage consumers and manufacturers towards products with higher recycled content. On the other hand, a performance requirement would establish minimum thresholds.

In contrast to the scoring systems defined for the other product aspects, a potential information requirement on the recycled content would report the fraction (by mass) of the secondary material used in the product. Further details and rules for its calculation should be defined in a separate study supporting the policy making process.

In addition, including information on the type of waste from which the material originates could further encourage the preference for post-consumer waste recycling over post-industrial, or for fibre-to-fibre recycling over open-loop, such as that derived from PET bottles. This additional level of granularity in the information would, foreseeably, be useful to articulate other policy instruments such as Green Public Procurement and Extended Producer Responsibility modulation fees.

As far as it concerns the potential setting of a performance requirement for recycled content, setting such thresholds requires an optimisation exercise that examines the environmental and economic impacts of different performance levels that could be proposed for each of the representative products, as well as the analysis of the availability of secondary materials. More details about the assessment are included in section 11.1.3.1 of the main report.

The assessment of the impact of information and performance requirement on the recycled content of the products was based on the following assumptions:

- When only information is considered, the effect of the requirement would be an **increase in the share of secondary materials** for certain fibres. For denim products, a 5% recycled content is estimated for cotton and a 2% for polyester. For knitted and other woven products, a 2% is estimated for polyester and 0.5% for nylon, wool and cotton. The estimates are based on expert judgement reflecting the product's primary composition, the availability of secondary materials and the potential effect of a label on consumer and manufacturer choices.
  When the performance requirements are considered, the impacts were determined for: 20% of the cotton in denim; 5% of the nylon, 10% of the wool and 15% of the polyester in knitted and other woven products. If coupled together with an information requirement, an additional increase of 5% over those fractions is estimated, in line with the assumptions on improvements due to information requirements on the different product aspects in DO1 and DO2.
- An additional **cost of labelling** is also considered and estimated to be of 0.02 €/unit. This is based on the smallest value of the analysis conducted by the JRC, since the information could simply be included in the already existing hang tags available at the point of sale.
- The additional **cost of certification** is considered and estimated to be of 0.13€/ unit This assumption is based on the price of certification declared by existing schemes that report ranges around €2 600 – €4 333. When trying to allocate this cost to one item, the prices would range between €0.26 – €0.43 for small annual facility outputs of 10 000 units; €0.052 – €0.087 for medium annual facility outputs of 50 000 units; €0.026 – €0.043 for large annual facility outputs of 100 000 units; and <€0.0087 and <€0.0043 for even larger annual facility outputs for 500 000 and 1 000 000 units. For the purposes of the PS, a value between the small and medium ranges is used.

7.4 Characteristics of DO4 - Information requirement on the carbon/environmental footprint during manufacturing

The contribution analysis showed the significant impact of the manufacturing stage (over 20% of the whole lifecycle), ranking second following the impact of raw materials. Within this impact, the climate change category contributes the most as compared to the rest of the impact categories (29%-33% of the single score of the LCS2 and 6% of the whole lifecycle).

With the aim of addressing these impacts, two alternative information requirements focussing on the manufacturing stage were investigated:

- on the environmental footprint (i.e., in terms of the single score, which summarises the impacts of all the investigated environmental impact categories) (DO4.1), or
- on the carbon footprint (the most contributing impact category) (DO4.2).

While the former is expected to have a greater effect in terms of environmental improvement because of its broader scope that includes all the impact categories, the latter could represent less effort for reporting and verification of fewer data elements and parameters.

Despite the high impact of the raw materials and thus the interest in capturing it in a footprint indicator to provide a more comprehensive picture to the consumer, this lifecycle stage is left out of the scope of the proposed indicators. The reason for its exclusion is the inequivalent choice of system boundaries used for the datasets available for the assessment of the several types of fibres, which prevent their fair comparison. The design options on robustness, recyclability and recycled content were defined to specifically address the hotspot of LCS1 through alternative requirements.

On the one hand, the information requirement would help consumers to make informed purchases on products manufactured through processes that are less harmful to the environment. On the other hand, it would provide a harmonised framework for manufacturers to assess and present their performance, encouraging them to improve their processes and invest in better technologies and techniques to produce products with lower environmental impacts than their competitors.

The main limitation associated with these design options is the high administrative burdens associated to the calculation of such indicators, motivated by the complexity of the apparel supply chain, which is exceptionally long and geographically dispersed with numerous tiers. This presents significant challenges for manufacturers in obtaining information, as well as in terms of difficulty of verification.

For the calculation of the environmental or carbon footprint indicator, it is proposed that the rules defined in the PEFCR for apparel and footwear are followed (as applicable to lifecycle stage 2 only – manufacturing stage). This allows the use of secondary datasets and default values that facilitate the calculations in absence of primary data.

Since displaying the absolute value of the environmental / carbon footprint as a standalone indicator might be challenging for consumers to interpret (mainly in the absence of a benchmark), an information requirement is proposed that would simply indicate whether a product's performance is better than the average (and to which extent, in %). The underlying concept is that manufacturers who achieve high performance would be motivated to calculate the environmental / carbon footprint to showcase their 'excellence'. Specifically, a system could be defined whereby a label element or some other distinction could only be used in products where the manufacturer demonstrates that their manufacturing environmental / carbon footprint is superior to the benchmark set by the PEFCR for the representative product in that product category.

The approach proposed would allow the voluntary reporting of the footprint indicator. Those not providing the calculations would simply not be eligible for the 'excellence' labelling. This would alleviate administrative burdens for manufacturers compared to requiring everyone to report absolute values.

The manufacturers reporting the footprint indicator would be required to also indicate whether primary or secondary data was used. A different label or label elements would be used for the former, thereby encouraging the use of primary data.

This approach provides manufacturers with an incentive to assess their performance accurately, while allowing consumers to easily identify products that exceed average performance standards.

The assessment of the impact of an information requirement on the environmental and carbon footprint of the manufacturing of the textile apparel products will be based on the following assumptions:

- For the environmental footprint (DO4.1), the average **impact of the manufacturing processes** will decrease by 3%. This results from assuming that all the impact categories improve homogeneously. Compared to the impacts of the robustness and recyclability scores, the effect of this information requirement is estimated to be lower for two reasons. On the one hand, the manufacturers may opt not to calculate their footprints, as the current definition of the requirement allows that only those wishing to showcase above-average performance do so. This voluntary nature could reduce the effect of the requirement. On the other hand, allowing the use of secondary data may not accurately reflect real performance. Manufacturers might exploit this by presenting their performance better than it actually is, in the cases where their primary data reflects worse performance than that calculated using secondary data, thereby limiting the potential effectiveness of this requirement.

  As regards the carbon footprint (DO4.2), the average impact of the manufacturing processes under the climate change category is assumed to decrease by 3%. Compared to the impacts of the robustness and recyclability scores, the effect of this information requirement is also estimated to be lower as the rationale described for the DO4.1 also applies in this case.

  A higher impact from these requirements is not assumed since the criteria mostly applied by consumers when purchasing textile apparel products are price and perceived quality, which are not connected to the environmental impacts of the product (section 4).

  For an improved appraisal of these estimates, specific surveys would need to be performed to analyse how consumers and manufacturers would react to an information label on the carbon and environmental footprint addressing about 6% and 20%, respectively, of the product lifecycle environmental impacts of textile apparel.
- An **additional cost of labelling** is also considered and estimated to be of 0.02 €/unit for both design options. This is based on the smallest value of the analysis conducted by the JRC, since the information could simply be included in the already existing hang tags available at the point of sale.
- Additional **administrative costs** for the implementation of these design options are considered and estimated based on the impact assessment carried out in support of Regulation (EU) 2023/1542 concerning carbon footprint thresholds for industrial and EV

batteries, as these measures would require similar calculation and verification of indicators. It is however acknowledged that the differences between the value chains of batteries and textile apparel could largely affect the uncertainties of these estimates.

In the case referred, the impact assessment estimated one-off costs per battery type in the range of €100–5 000, depending on the availability of the company-specific data needed and consultancy fees. Additional verification costs would be €2 000-7 000 per battery type with additional small follow-up costs.

To adapt cost assessments for the apparel sector, an average cost scenario is assumed, with an initial cost of €2 550 and a verification cost of €4 500 per garment model (representing the mean values of the figures provided in the batteries report). However, attributing these costs to individual products is challenging due to variations in production volumes influenced by manufacturer size, market demand, and product type.

Knitted fabrics are very common in garments, which generally imply higher production volumes (with some 100 000 items per model). Woven fabrics are common in products like shirts and pants and production volumes may be lower than for knitted fabrics due to less frequent style rotations (with some 80 000 items per model). Finally, denim products are typically higher-cost items, with less dynamic production cycles focused on quality and timeless designs, resulting in lower production volumes (with some 50 000 items per model).

Thus, estimates for the medium cost and medium scenario for each product type would result in €7 050 / 100 000 = €0.07 per item for knitted products, €7 050 / 50 000 = €0.14 per item for denim, and €7 050 / 80 000 = €0.09 per item for other woven products.

Since the approach proposed allows manufacturers to omit reporting their footprint indicator when they do not want to showcase a superior performance, they would not need to incur in the administrative cost of their calculation and verification. Thus, when assessing the average additional costs associated to these design options, it is important to consider their proportionality in relation to the percentage of manufacturers who would adopt them. Assuming a 50% adoption rate, the costs per item would be halved to €0.035 for knitted products, €0.07 for denim, and €0.045 for other woven products.

Nevertheless, it is important to note that costs can vary significantly based on production volumes and levels of spending on implementation and verification. In low-cost, high-production scenarios, the cost per item can be minimal. Conversely, with high implementation costs and lower production volumes, the cost per item increases substantially.

The costs estimates are assumed to be the same for both design options (environmental and carbon footprint) in absence of any reference that would allow fine tuning of these estimates, at the time of writing. It is acknowledged that collecting primary data and verifying it could be more costly for the former, due to the greater scope and thereby the additional flows to be considered.

Finally, the authors highlight that estimation of the administrative costs should include the verification of two types of information:

a) The input data (primary or secondary data) from specific industrial sites, which are representative of the supply chain of the specific product model described. The representativeness of input data should be documented and verified.
b) The correct application of the PEFCR framework.

As a limitation of the study, it is important to highlight that additional costs due to the use of more costly technologies or techniques for achieving a better performance are not considered because of the lack of sufficient data to provide an accurate estimate.

Following the assessment carried out, the idea of setting a performance requirement in terms of the environmental or carbon footprints not further taken forward in this report due to the lack of data, that prevented to appropriately benchmark the products currently on the market.

7.5 COMBINATIONS OF DESIGN OPTIONS: PATHS

In this section, the design options are studied in combination, clustering in paths those that run in synergy and evaluating the possible trade-offs. To validate the cluster, the DOs are assessed in a cumulative way to identify the configuration that provides the highest environmental benefits without incurring in disproportionate costs.

The **first path (P1)** clusters the information requirements on robustness, recyclability, recycled content and environmental footprint, as well as the performance requirement on recycled content.

As an alternative **second path (P2)**, the information requirement on the carbon footprint would replace the environmental footprint. These are understood as mutually exclusive, as the carbon footprint is a subset of the broader environmental footprint. Presenting both metrics simultaneously might confuse consumers, as they essentially convey similar insights into the environmental consequences of the production process. Thus, P2 clusters the information requirements on robustness, recyclability, recycled content and carbon footprint, as well as the performance requirement on recycled content.

In a **third path (P3)**, the focus is narrowed to only consider the requirements on the recyclability and recycled content. This cluster is explored separately as a lower ambition scenario, where the performance requirement is maintained, paired with the information requirements of only the strictly related parameters. The design options on the robustness and environmental/ carbon footprint would thus not be included, relieving manufacturers from the additional efforts and costs of their implementation. Limiting the number of information requirements also reduces the uncertainty of the assessment, as the impact of the path relies less on the consumer choices (which cannot be as predictable as the effect of the thresholds imposed by the performance requirements). The exclusion of the design options on robustness and carbon footprint avoids the challenges associated to the limitations associated to them and described in sections 11.1.1 and 11.1.4. of the 3rd milestone report.

7.5.1 Assessment choices

Although optimising product aspects simultaneously might require design configurations that may not be compatible, most of the proposed measures are limited to information requirements meaning no inherent contradiction between the potential ecodesign requirements. For instance, increasing recycled content could potentially clash with improving robustness. Yet, providing information on both attributes does not as such pose any product design issues. In fact, their synergy could be explored as it may lead to cost optimisation — where at the same cost, a single label accommodates two items of information.

Nonetheless, the information could sometimes be contradictory given a same product could score high in one of the product aspects and low in the rest. Consequently, when assessing design options collectively, it is assumed that the impact of different information requirements will not be simply additive. Instead, a reduction in the label's effect related to the selective choices made by consumers is considered according to the following scenarios:

- **Full Synergy Scenario**: it is assumed that 50% of the time the information interacts synergistically, achieving the full improvement effect of 5% for each product aspect.
- **Partial Adjacency Scenario**: it is assumed that 35% of the time the information is not completely synergistic, acknowledging that the consumer will sometimes choose which product aspects to prioritise. This would lead to a reduced improvement as compared to the full 5% improvement estimate for each product aspect.
- **Independent Choice Scenario**: it is assumed that 15% of the time, the consumer is predominantly influenced by one indicator that conflicts with the rest, achieving a 5% improvement only in one of the product aspects.

With these assumptions and their respective probabilities, the effect of the requirements is calculated as a weighted average for each of the configurations in the defined path:

1. When one design option is analysed alone, a 5% improvement is assumed.
2. When two design options are assessed together, 50% of the time both product aspects would improve by 5%. In 35% of cases, the effectiveness of the information would be reduced due to lack of full synergy. Thus, for instance, while one product aspect would maintain a 5% improvement, the other would be reduced by half to 2.5%. Distributing this equally between parameters results in an effect of 3.75% for each product aspect. Lastly, in the scenario of independent choice, only one of the two pieces of information is considered, resulting in a 5% improvement which, when distributed between both product aspects, provides an improvement of 2.5% for each. Therefore, a 4.2% (0.5 · 5% + 0.35 · 3.75% + 0.15 · 2.5%) improvement is considered per design option.
3. When a third design option is added, 50% of the time all product aspects would improve by 5%. In 35% of cases, the effectiveness of the label would decrease and, while one product aspect would maintain a 5% improvement, the others would be reduced by half to 2.5%. Equally distributing this results in an effect of 3.33% for each product aspect. Lastly, in the scenario of independent choice, only one of the pieces of information is considered, resulting in a 5% improvement, which when distributed between the three product aspects provides an improvement of 1.67% for each. Therefore, a 3.9% (0.5 · 5% + 0.35 · 3.33% + 0.15 · 1.67%) improvement is considered.
4. Adding the fourth design option would decrease the improvement to some 3.7% (0.5 · 5% + 0.35 · 3% + 0.15 · 1.25%). This would result from the combination of the full synergy scenario with the partial adjacency in which a reduced improvement of 3% is estimated for each product aspect and with the independent choice scenario in which the 5% improvement is distributed between the four parameters.

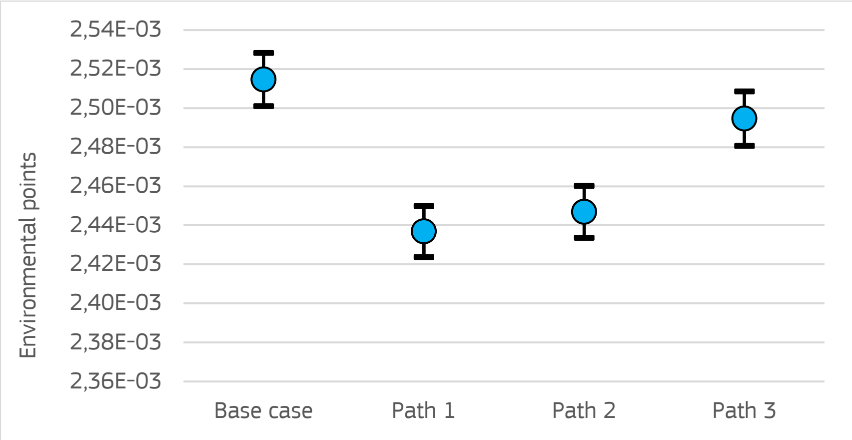
The case of the effect of the information requirements on the environmental and carbon footprints is particular, since a lower impact on the improvement of these product aspects is expected because of its voluntary nature also when studied in combination with other design options. While the impact was estimated to be of 3% improvement when analysed in isolation, it is assumed to be of 2.5% when assessed within the cluster.

7.5.2 Results of the assessment

The combinations of design options in the Paths 1 and 2 achieve improvements of the environmental impacts without any overlap in the uncertainties calculated for the model. **Figure 1**, **Figure 2** and **Figure 3** show that the environmental impact of the base cases is always above the ranges reported for the design options, which are environmental improvements. In the case of the Path 3, the same can be concluded for denim products. However, the lower thresholds proposed for the recycled content in knitted and other woven products do not deliver sufficient environmental benefits to avoid the results to overlap with the outcomes of the base cases once uncertainties are considered.

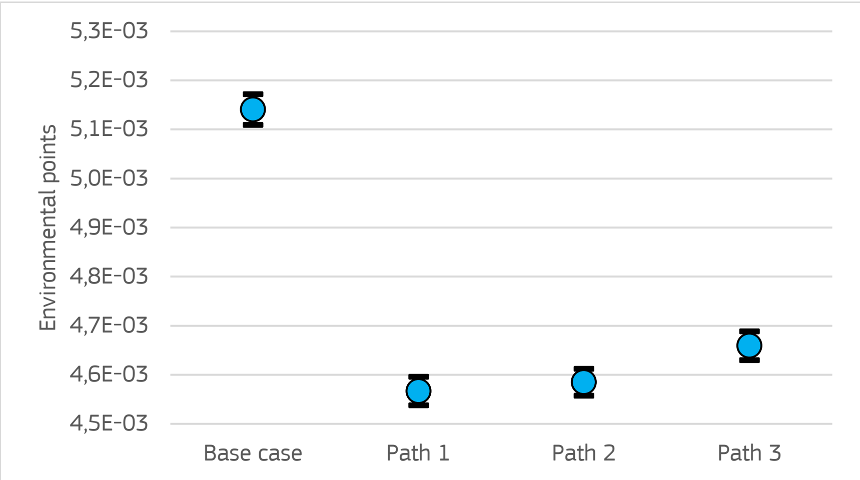
Table 7, **Table 8** and **Table 9** compare the costs borne by the producer, consumer and society, respectively. The three paths have very similar values for all three economic indicators.

Figure 1*. Environmental impacts of base case and design options combinations (paths) for knitted products*



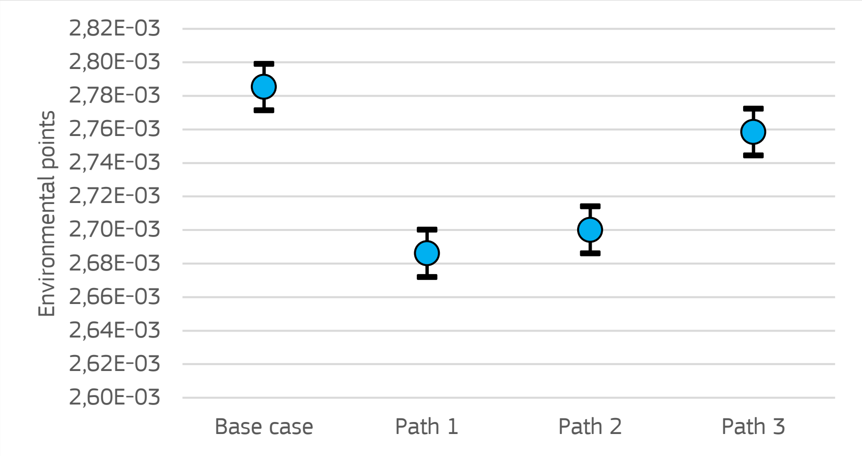
The environmental impacts are expressed as single score, which includes all the assessed environmental impact categories Model uncertainties are reported as 95% confidence interval of 500 Montecarlo iterations of input parameter uncertainties independently propagated in the model.

Figure 2*. Environmental impacts of base case and design options combinations (paths) for denim products*



The environmental impacts are expressed as single score, which includes all the assessed environmental impact categories Model uncertainties are reported as 95% confidence interval of 500 Montecarlo iterations of input parameter uncertainties independently propagated in the model.

__Figure 3__. Environmental impacts of base case and design options combinations (paths) for other woven products



The environmental impacts are expressed as single score, which includes all the assessed environmental impact categories Model uncertainties are reported as 95% confidence interval of 500 Montecarlo iterations of input parameter uncertainties independently propagated in the model.

__Table 7__. Cost borne by the producer expressed as EUR

Value	Knitted				Denim				Other woven			
	BC	Path 1	Path 2	Path 3	BC	Path 1	Path 2	Path 3	BC	Path 1	Path 2	Path 3
Maximum	7.3	6.7	6.6	6.6	8.6	9.6	9.8	9.8	10.9	7.8	7.7	7.7
Central	7.3	7.7	7.6	7.7	8.6	11.3	11.3	11.4	10.8	8.9	9.0	9.0
Minimum	7.2	8.8	8.8	8.9	8.5	13.1	13.3	13.6	10.7	10.5	10.3	10.3

BC: Base case;
Path 1: robustness score, recyclability score, recycled content information and performance requirement, environmental footprint);
Path 2: robustness score, recyclability score, recycled content information and performance requirement, carbon footprint;
Path 3: recyclability score, recycled content information and performance requirement.
Uncertainty values were rounded and calculated as 95% confidence interval of 500 Montecarlo iterations.

__Table 8__. Cost borne by the consumer expressed as EUR

Value	Knitted				Denim				Other woven			
	BC	Path 1	Path 2	Path 3	BC	Path 1	Path 2	Path 3	BC	Path 1	Path 2	Path 3
Maximum	12.2	10.5	10.5	10.3	13.7	15.6	15.3	16.3	20.8	11.8	11.7	11.7
Central	12.1	12.2	12.5	12.1	13.6	19.2	19.1	19.3	20.7	13.8	13.8	13.9
Minimum	12.0	14.3	14.2	14.3	13.5	24.2	24.4	25.0	20.5	16.3	15.9	16.2

BC: Base case;
Path 1: robustness score, recyclability score, recycled content information and performance requirement, environmental footprint);
Path 2: robustness score, recyclability score, recycled content information and performance requirement, carbon footprint;
Path 3: recyclability score, recycled content information and performance requirement.
Uncertainty values were rounded and calculated as 95% confidence interval of 500 Montecarlo iterations.

__Table 9__. Societal costs expressed as EUR

Value	Knitted				Denim				Other woven			
	BC	Path 1	Path 2	Path 3	BC	Path 1	Path 2	Path 3	BC	Path 1	Path 2	Path 3
Maximum	11.7	9.9	9.7	9.7	13.3	15.0	14.8	15.5	22.1	11.0	11.0	11.2
Central	11.7	11.3	11.8	11.4	13.2	19.0	18.9	19.2	21.9	12.9	13.0	13.2

Value	Knitted				Denim				Other woven			
	BC	Path 1	Path 2	Path 3	BC	Path 1	Path 2	Path 3	BC	Path 1	Path 2	Path 3
Minimum	11.6	13.4	13.4	13.3	13.1	24.2	24.8	25.8	21.8	15.1	14.7	15.6

BC: Base case;
Path 1: robustness score, recyclability score, recycled content information and performance requirement, environmental footprint);
Path 2: robustness score, recyclability score, recycled content information and performance requirement, carbon footprint;
Path 3: recyclability score, recycled content information and performance requirement.
Uncertainty values were rounded and calculated as 95% confidence interval of 500 Montecarlo iterations.

7.5.3 Main conclusions of DOs analysis

The results are highly dependent on the assumptions underpinning the expected impact of each of the potential ecodesign requirements, introducing very considerable uncertainty, which should not be confused with the model uncertainty assessed and propagated in the model results. The fact that most of the design option proposed take the form of information requirements further complicates the analysis, as their effectiveness relies heavily on consumer behaviour and choices, which cannot be accurately predicted in this study.

The results indicate that, in all cases, combining design options into paths yields greater environmental benefits than analysing them individually.

Path 1 is the one that achieves the greatest environmental impact reductions across all product categories (knitted, denim and other woven products) followed by Paths 2 and 3.

The environmental improvements compensate for the increase in internal costs associated with implementing the paths. However, these improvements are sufficient to achieve lower societal costs than the base cases only in the case of denim products, which experienced minimal increases in internal costs. For other woven products, the internal costs are only totally offset in the case of the first path. For the rest of the configurations and for the knitted products, the societal costs increase by 1-2%.

The internal costs of implementing Path 3 are consistently lower than those of Paths 1 and 2. Despite offering more modest environmental improvements, Path 3 represents a more conservative approach, as the results are subject to less uncertainty in estimates related to the impact of the requirements.

Paths 1 and 2 show improvements of the environmental impacts of the products even once the model uncertainties are considered. For Path 3, the results after the propagation of uncertainties overlap with those of the base cases for knitted and other woven products.

The design options should be understood as potential ecodesign requirements under assessment and not as final proposals. In the following step of the PS, several policy scenarios will extrapolate the results from one representative product to the total EU stock and scale up the environmental and economic impacts. The analysis of the policy scenarios will be proposed to feed into and inform the envisaged Impact Assessment, in which the policy options to define the ecodesign requirements will be reassessed and finally proposed towards inclusion in a forthcoming delegated act on textile apparel.

8 CHEMICAL SUBSTANCES IN TEXTILE APPAREL

The use and presence of chemical substances in products in the scope of the Ecodesign for Sustainable Products Regulation ([9]), in particular of SoCs, as defined in Article 2(27) of the Regulation, is an important product aspect under the new ecodesign regulation, representing a significant development compared to the depth with which chemicals were addressed under its predecessor, the Ecodesign Directive. The ESPR sets the obligation to set information requirements on SoCs and possible performance requirements on substances.

The proposal included in this PS identified SoCs that could be subject to information requirements and as such, these SoCs are outlined in several tables in the main report, more precisely Tables 100, 101, 102 and 103 for SoCs type (a), (b), (c) and (d), respectively (lists are not exhaustive). Substances of concern identified due to having a negative effect on recycling or reuse (type (d)) are assigned to this category due to regulatory and customer-driven limitations which are already imposed upon them (primarily due to chemical safety considerations). However, no conclusive examples have been found for substances having a negative effect on the recycling or the reuse of the materials in which they are contained due to technical constraints (as specified in Article 5(14)). This was corroborated during the stakeholder consultation, specific to SoCs, of the 2nd milestone of this PS.

Thresholds for the reporting of SoCs on the product are proposed, inspired essentially by the information that is expected to be available in the safety data sheets of mixtures, available internationally, conforming with minimum requirements outlined for their content under UN GHS. No substance-specific derogations are proposed but it is suggested that the focus is to be placed on substances that are added intentionally and remain in the product. Finally, a step-wise approach to entry into application of the information requirements is proposed for different types of SoCs and hazard classes covered, which extends beyond the initial entry into application of a possible future delegated act. For some hazards classes, in particular for those not currently addressed under GHS, long transition times, subject to re-evaluation and the option for a potential exemption, are discussed.

Performance requirements on substances are not proposed at this stage. The chapter provides a discussion on product aspects, as set in Article 5(1) of the Regulation, that could have a direct link to the presence or use of chemical substances, however it is concluded that evidence gathered is insufficient to justify proposing the setting of performance requirements for any specific chemical substance (as identified in the inventory, from stakeholder input and the LCA) associated to apparel textile products.

[9] Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for the setting of ecodesign requirements for sustainable products, amending Directive (EU) 2020/1828 and Regulation (EU) 2023/1542 and repealing Directive 2009/125/EC. Available at this link