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WASTE TREATMENT TECHNOLOGIES AND EPR

Deliverable 1.5

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Author(s)	Ine De Vilder (CTB), Philippe Colignon (CTB)
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TABLE OF ABBREVIATIONS

Abbreviation	Definition
DPP	Digital Product Passport
EPR	Extended Producer Responsibility
ESPR	Ecodesign for Sustainable Products Regulation
EU	European Union
M	Month
PA	Polyamide
PET	Polyester
PRO	Producer Responsibility Organisation
TRL	Technology Readiness Level
WP	Work Package

EXECUTIVE SUMMARY

This document constitutes Deliverable D1.5 "Waste Treatment Technologies and EPR" of the European project "Fostering circularity in textile: innovative interoperable solutions and best practices for implementation and harmonization of EPR schemes", also known by its acronym "Circula-TEX". Deliverable D1.5 outlines the scope of Task T1.5, titled "Collaborative analysis: textile waste treatments and EPR role". EPR stands for Extended Producer Responsibility.

The aim of the collaborative analysis was to identify current gaps and barriers faced by stakeholders involved in textile waste treatment, as well as their needs, and how these barriers and needs could be addressed by implementing an EPR scheme.

The report includes an overview of the current EU landscape related to recycling, and a description of the different recycling techniques (mechanical, chemical, thermo-chemical and thermo-mechanical).

Further, this document includes the analysis from the results from existing studies (CISUTAC, ReHubs and RegioGreenTex), focussing on gaps and barriers and EPR.

A workshop was organised among partners of the Circula-Tex project during which a SWOT analysis was undertaken focussed on EPR, and the results are included in this report.

Lastly, 23 stakeholder interviews were conducted with different European stakeholders along the textile value chain (collectors, sorters, recyclers and disassembly technology providers). Both fashion goods and carpets were in scope. Input was gathered on their view on current gaps/barriers, EPR governance and structure, ecomodulation and financial support.

This report will serve as a basis for developing the guidelines for a harmonized EPR scheme in the following work packages in the project, particularly WP2, where gaps and needs for scalability and harmonization will be further assessed and ecomodulation models will be put forward, and WP6, which will translate the validated outcomes into comprehensive design guidelines for the textile sector.

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1. INTRODUCTION

In the Circula-Tex project the overarching goal is to define the guidelines for a harmonized EPR scheme (Extended Producer Responsibility) on European scale. As starting point, a thorough cocreation analysis is made on the topics listed below, as basis to create the EPR guidelines on a later stage.

- Sustainable design for recycling (output in report D1.2)
- Methods for classification, composition identification, sorting and labelling systems (output in report D1.3)
- reuse, repair, redistribute, refurbish, and remanufacture (output in report D1.4)
- Textile waste treatments and EPR role (output in this report)

By executing the cocreation methodology, which was outlined in D1.1 – Stakeholder engagement and cocreation, the view from different internal and external stakeholders along the value chain was collected by, among others, conducting a series of interviews. Focus was put on the current status of waste treatment, the stakeholders' view on EPR, and the difficulties, gaps, barriers which they are facing nowadays.

Next to conducting workshops and interviews, pre-existing studies were also scrutinized to assess which gaps and barriers were already identified.

2. METHODOLOGY

2.1 STAKEHOLDER ENGAGEMENT METHODOLOGY

The overarching stakeholder engagement strategy was outlined in D1.1 – Stakeholder engagement and cocreation. The internal and external cocreation strategy was elaborated in more detail:

- Internal: workshop to elaborate a SWOT analysis
- External: one-on-one interviews with the pre-defined stakeholders listed in D1.1.

In the first phase of the project, stakeholders were identified and mapped as potential subjects to be contacted to participate in the cocreation analyses, and the overview was listed in D1.1. During this collaborative analysis, additional stakeholders were defined and contacted with respect to the ones listed in D1.1. If the stakeholder was willing to participate, an online interview was conducted of ca. 1 hour, combining the specified questions for all cocreation analyses relevant for this specific stakeholder.

A list of all stakeholders who participated in the interviews is presented in Annex I. No company names are disclosed, but a general description of the stakeholder profile is given, and its origin.

Figure 1 shows the geographical coverage of the respondents. Stakeholders from following countries were interviewed: Belgium (9), The Netherlands (5), Italy (2), Spain (2), Germany (3), Sweden (1) and France (1).

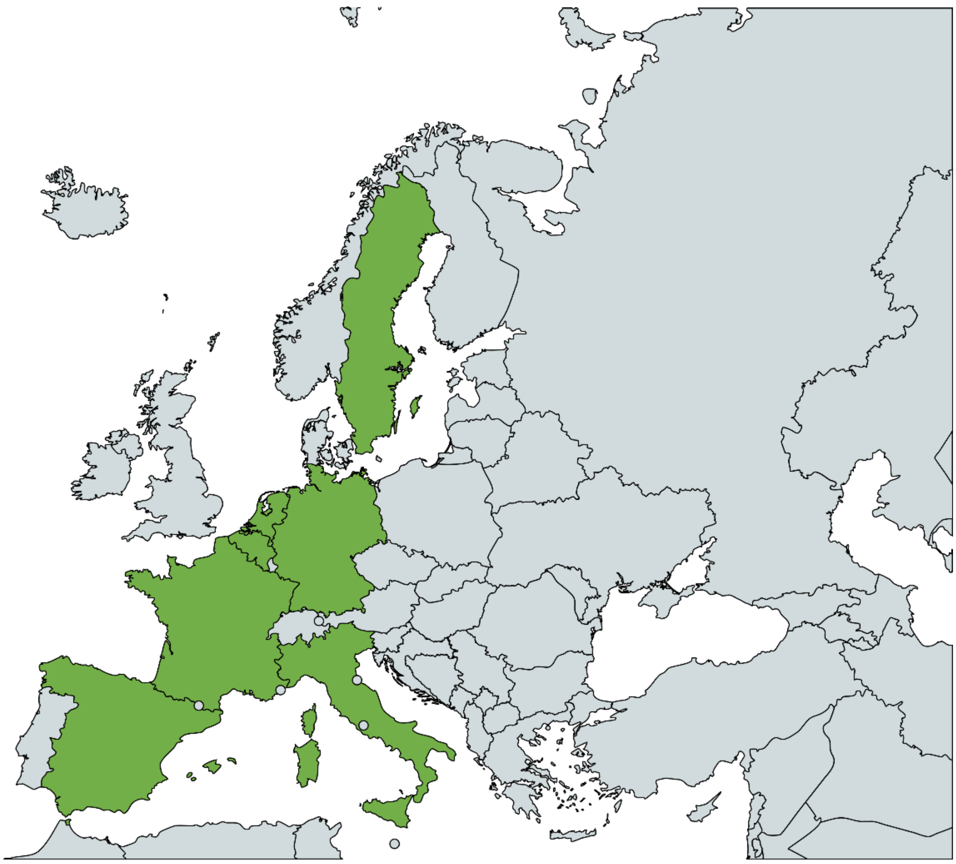

Figure 1: Geographical coverage respondents

2.2 DATA COLLECTION AND ANALYSIS

A predefined list of questions was asked to each interviewee:

- What current gaps and barriers could be solved by implementing a harmonized EPR?
- Who should the EPR scheme be implemented?
  E.g. single/multiple Producer responsibility organisations (PROs), governance by government, etc.?
- How do you see eco-modulation?
- Where should the collected money be spent?
- Do you expect hindrance when different EPRs are in place in different countries/regions?

All responses are presented in an anonymized way, complying to GDPR rules. If feasible, the responses are given in a percentage of the respondents who gave a similar answer.

Next to the one-on-one interviews to identify current gaps and barriers in the waste treatment value chain, a literature study was conducted to scout for existing studies covering this topic. A summary of the findings is presented in the following chapters.

3. TEXTILE WASTE TREATMENT

3.1 CURRENT EU LANDSCAPE

Europe is currently facing a bottleneck crisis in textile recycling. While the amount of waste being collected is skyrocketing due to new laws like the mandatory collection of textiles at end-of-use, the actual industrial capacity to turn that waste back into new clothes remains a small fraction of what is actually needed.

Before 2025, Europe generated approximately 12.6 millions of tonnes of textile waste per year, of which 5.2 millions of tonnes of clothing and footwear[1]. In Europe, 7 million tonnes were collected, but it only has a sorting capacity of 1.5 million tonnes, sufficient to process ca. 20% of the collected textile. With the mandatory separate textile collection, in force since January 1st 2025, the collected amount of textile waste is expected to augment by fivefold in the coming year. Hence the discrepancy between the amount of collected textiles and the recycling capacity in Europe will only augment. ReHubs Europe's original mission, recycling 2.5 million tons of European textile waste by 2030, is currently out of reach, and has been postponed to 2032.

The current textile recycling capacity in Europe is about 0.70-0.85 million tonnes/year. The majority of the textile waste (0.5-0.6 million tonnes/year) is recycled via open-loop recycling and ends up as cleaning wipes and non-woven textiles. Although this is a viable alternative compared to using virgin fibres to make these textiles, it is still a kind of downcycling. About 0.2-0.3 million tonnes/year of textile waste is processed to obtain spinnable fibres (closed loop recycling) which can be used again for apparel or home textiles. However, from these 0.2-0.3 million tonnes/year, only 0.03-0.05 million tonnes/year resulted in spinnable fibres.2 This accounts for less than 1% of the total textile waste. The figure below shows that the recycling capacity in Europe should increase substantially the coming decade, which will be a requisite once EPR is fully implemented.

[1] News European Parliament 20250905IPR30172 20250905IPR30172https://www.europarl.europa.eu/news/en/press-room/20250905IPR30172/parliament-adopts-new-eu-rules-to-reduce-textile-and-food-waste
[2] https://static1.squarespace.com/static/631f2bee92571234987af5a2/t/662fb7f044df2d7be141b9bb/1714403317892/CISUTAC_D2.1_Transition_scenarios_final.pdf

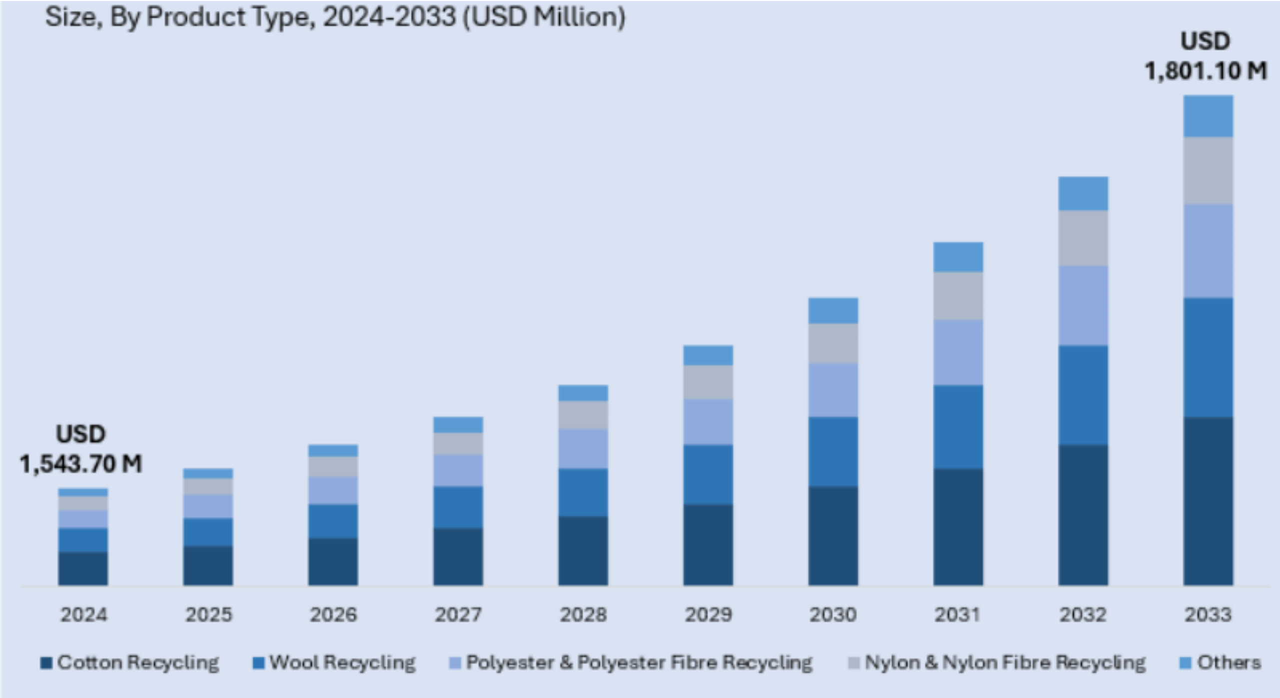

Figure 2: Europe textile recycling market forecast – made by IMARC

When looking at carpets, the estimated figures are different. Yearly ca. 1.6 million tonnes of carpet waste is generated, of which 1% to 3% is recycled (16000 tonnes – 48000 tonnes).[3] Currently, carpets are not in scope of the EPR, but it is expected that EPR will become mandatory for carpets in the coming years.

3.2 Textile recycling technologies

An overview of the different textile recycling technologies is given below, summarising their characteristics, based on the study conducted by DG Grow[4]. For each recycling method mentioned, examples of European technologies are given. A more detailed analysis of all individual technology providers is provided in D3.1 – Report on technology and novel solutions analysis.

3.2.1 Mechanical recycling

Mechanical textile recycling is the most established method for reclaiming fibers from waste. It is essentially a physical process of "unmaking" a fabric back into its raw, fibrous state without using chemicals or heat to change the material's molecular structure.
Textile waste consisting out of natural fibres like cotton, wool, cashmere, flax, etc. are often mechanically recycled, as blends consisting of a high content (e.g. 80%) of natural fibres. Synthetic fibres can also be mechanically recycled, but it is a less common practice, as other

[3] https://fairresourcefoundation.org/en/a-new-toolkit-for-a-circular-european-carpet-industry/
[4] Tom Duhoux, Edwin Maes, Martin Hirschnitz-Garbers, Karolien Peeters, Lise Asscherickx, Maarten Christis, Birgit Stubbe, Philippe Colignon, Mandy Hinzmann, Anurodh Sachdeva; Study on the technical, regulatory, economic and environmental effectiveness of textile fibres recycling, November 2021

recycling technologies lead to higher quality recycled fibres and because the prices of virgin fibres are too low to compete with.

The main advantages of mechanical recycling are that:

- it can process practically any textile waste stream (material and structure),
- it can handle relatively small quantities of waste material,
- it requires a relatively low level of investment and space and less highly skilled personnel than chemical recycling technologies.
- the process uses a relatively low amount of resources (no water, limited electricity, no heat) and preserves the colour of the fibres.

In a mechanical recycling process, the original properties of the fibre remain, although this might be altered depending on the state of the fibre (mechanical recycling tends to shorten fibre length). (Hazardous) chemicals such as additives, dyes, finishes, etc. present in textile products (both through production and product use) cannot be removed in a mechanical recycling process and stay in the output, resulting in a possible disadvantage for the subsequent fibre uses. The quality of these fibres depends on the input product's quality, but is lower than the quality of virgin fibres. Although recycled fibres can replace virgin cotton fibres, they usually need to be blended with virgin material to produce a yarn of an acceptable quality. The remaining output fraction (fluff, filling materials and dust) is of lower quality than the spinnable fibre fraction and can be used in the non-woven industry, as a filling material or as reinforcement in composites of artificial material or burned with energy recovery.

Polyamide is rarely recycled via mechanical recycling.

Of all recycling processes, mechanical recycling is the most mature. The listed technologies / companies are operational on commercial scale.

Current technologies/companies (non-exhaustive): Altex Textil-Recycling GmbH & Co. KG, Associazone Tessile Riciciato Italiana, Belrey Fibres, Bright.fiber Textiles, Clarus®, CYCLO®, Derotex NV, Frankenhuis, Nouvelles Fibres Textiles, Nova Fides, Procotex, Purfi, Recover™, Rester, Säntis Textiles, SOEX Recycling, TEXAID, Texloop™ Recycling, Usha Yarns Limited™, Vanotex NV, Wolkat

3.2.2 Chemical Recycling

Chemical recycling is a process using chemical dissolution or chemical reactions which are employed in polymer recycling (system for disassembling used fibres, extracting polymers and re-spinning them for new uses) or monomer recycling (system for breaking down polymeric textile materials into their constituent monomers and rebuilding polymeric fibres for new uses). There are several possibilities within this recycling technology, and three major technologies can be identified in this respect.

Polymer recycling of cotton via a pulping process generates cellulosic pulp obtainable through via different types of pulping processes: sulphate, sulphite and sulphur-free. The use of sorted textile waste is very important as the efficiency of the recycling process depends strongly on the purity of the feedstock. The tolerance to dyed textiles depends on the process, but most technologies include a decolouring and/or bleaching step, although with varying efficiencies. Knowledge of the applied dyes and additives would allow a more efficient removal.

The output of the pulping process (cellulose pulp) can be used as input in a viscose or lyocell process and can be blended with wood pulp before it can be processed in a traditional spinning process for man-made cellulosic fibres.

A few companies are commercially operational, while other technologies are still at lab/pilot/demo phase.

Current technologies (non-exhaustive): Circulose®, Infinited Fiber, Ioncell, OnceMore®, Refibra®, SaXcell, ShareTex

Monomer recycling of synthetic fibres is a depolymerization process where the polymer chains are broken down into monomers. Polyamide 6 (PA6), polyester (PET), PLA (polylactic acid) or acrylic materials are depolymerized, some after first dissolving the polymer, via different technologies and various reaction conditions (temperatures / pressures / time / catalysts). The applied solvents are typically water (i.e., hydrolysis), alcohols (i.e., methanolysis) or glycols. In practice PA6 is generally depolymerized via hydrolysis. For PET all three of the reaction mechanisms are used for depolymerization, although glycolysis is the most common. In addition to the three solvolysis methods, recently a fourth method has become available, namely an enzymatic depolymerization reaction. This technology can be considered a biochemical recycling process since the chemical reaction is mediated by a biological catalyst, the enzyme. It allows the recycling of all forms of PET plastics and fibres, even in mixtures as the enzyme is selective for PET. Although the final output depends on the reagent, PTA (purified terephthalic acid) and MEG (monoethylene glycol) are the traditional monomers obtained from PET which can be repolymerized to obtain high-purity, virgin grade PET, while for PA6 the output is caprolactam which can be repolymerized to virgin grade PA6. The efficiency of the chemical recycling of synthetic fibres depends highly on the purity of the input material.

A few companies are commercially operational, while most technologies are still at pilot/demo phase.

Current technologies (non-exhaustive): Carbios, ChemPET, CuRe, DePoly, Eastman, Econyl® Regeneration System, Epoch biodesign, Gr3N, H-Tex International, Ioniqa, Loop Industries, Loopamid, Matterr, Noocycle, Poseidon Plastics, Recyc'Elit, Regel, ReJu, Rewin Textiles, Rewind PET, Toray Europe, Syre

Recycling of polycotton blends can be done via different methods as several technologies (can) focus on recycling of both cotton and PET from polycotton blends. A first method applies solvent-based dissolution and filtration processes to separate different materials and extract the desired components (polymer recycling). The recovered cellulose can be applied in a typical pulping and wet spinning process, while the PET polymers remain largely intact. A second type of technology consist of a hydrothermal approach to (partially) degrade either cotton or PET or both. These processes rely on water, pressure, temperature and green chemistry where the final output depends on the specific process applied. Most technologies can deal with a certain percentage of contamination with other materials (nylon, acrylic, wool, elastane, etc.), however hard/metallic accessories such as zippers and buttons and generally also coatings must be removed. Sorting of textiles waste is required as knowledge of the composition is required for a good process efficiency.

Most of the technologies are still on pilot phase.

Current technologies (non-exhaustive): Dissolva, Eeden, Refact (Induo), Phoenxt, Worn Again Technologies

3.2.3 Thermo-mechanical recycling

Thermo-mechanical recycling is a process used in a recycling system that melts a polymer, typically employed to permit polymer recycling. These are technologies for recycling thermoplastic textiles, e.g. polyester, polyamide, polypropylene, etc. by melt processing them into a regranulate and/or new fibres. The process is similar to melt processing of virgin material (except for shredding, cleaning, feeding and degassing steps). Fibre spinning is a very delicate process and the presence of even a small amount of an incompatible polymer can cause problems in processing and reduce output properties. Other contaminants such as pigments, prints, wash residues, flame retardants, coatings, etc. that are present in or on the fibre or textile, can also hinder the spinning process and/or result in severely reduced output quality. Pigments, dyes and other chemicals remain in the material, making the output colour dependent on the colours of the input materials. Another drawback is that the polymer/fibre properties deteriorate after each cycle.

Current technologies (non-exhaustive): Antex, DS Fibres, LoopLife polymers – Despriet Gebroeders, Vanheede Polymers & compounds, Innovate Recycle, Muovi, Cycl-add, erema

3.2.4 Thermo-chemical recycling

Thermo-chemical recycling is a process using partial oxidation reaction of polymers to produce low molar mass components or heat to degrade polymers to monomers that can be used as feedstock for the chemical industry, with the exclusion of fuels used for energy production or other combustion or energy recovery processes. Thermo-chemical recycling is less interesting for closed-loop textile-to-textile recycling but is especially interesting for textile waste that is untreatable by mechanical, thermo-mechanical or (bio)chemical recycling and for textile fractions that are too little in quantity. The technology leads to pure, uncontaminated, virgin-like feedstocks, making it ideal for textiles containing non-REACH compliant chemicals that cannot be removed via other recycling technologies. The main output, syngas, has many application possibilities in chemical synthesis reactions leading to a whole range of desirable products, potentially also building blocks for textile fibers.

Thermo-chemical textile recycling is still in its infancy, no commercial plants are available which process textile feedstock.

Current technologies (non-exhaustive): Eastman Carbon Renewal, MILENA thermal cracking technology (TNO), Axens Rewind Mix

4. LEVERAGING EXISTING STUDIES

In Circula-Tex several already existing studies were in-depth analysed, namely ReHubs, CISUTAC and RegioGreenTex, and identified gaps and barriers have been summarised in the paragraphs below.

4.1 REHUBS

ReHubs is primarily a European initiative focused on transforming the textile industry toward a circular economy, especially focussing on scaling up textile-to-textile recycling. It is an alliance and collaboration hub that brings together companies, organisations and stakeholders across the textile value chain in Europe. ReHubs helps to coordinate industry actions, from innovation and infrastructure to policy and funding, so that textiles can be recycled efficiently and at scale, replacing virgin materials and creating a more sustainable ecosystem.

In its report 'ReHubs: breaking the supply-demand deadlock', published in 2025, a roadmap was elaborated to build Europe's circular textile ecosystem. Multiple gaps and barriers were identified, affecting the successful implementation of a circular textile value chain:

1. Lack of sustained demand for recycled fibers and products
2. Collectors and sorters are facing many challenges, some approaching bankruptcy
3. No stable offtake agreements are leaving mechanical recycling capacities idle
4. Virgin materials are cheaper than textile-to-textile recycled, reducing competitiveness for brands
5. High investments and R&D needed for high quality recycling, while low demand is limiting financing
6. Multi-material garments, such as multilayers, require costly pre-processing before recycling
7. Mechanical recycling of post-consumer cotton waste is challenging, often leading to downcycling & restricting higher-value applications
8. Lack of industry-wide standards is creating inconsistencies in feedstock and recycled fiber quality
9. Feedstock quality is inconsistent with contamination, mixed fibres, and lacking efficient material recognition for sorting
10. Fragmented ecosystem: poor collaboration is affecting the entire textile value chain
11. Asian recyclers are gaining ground in both mechanical and bottle-to-fiber recycling
12. EPR schemes are not yet in place, are just few and fragmented
13. PROs partially operational, fragmented, and largely unharmonized
14. Many consumers perceive recycled products as inferior and expect them to be cheaper
15. Brands are facing margin pressure, especially due to competition from low-cost ultra-fast fashion
16. Adopting recycled fibers is more costly and complex; production adjustments and supplier onboarding are time-consuming

When translating this to mechanical recyclers and chemical recyclers, following statements were made:

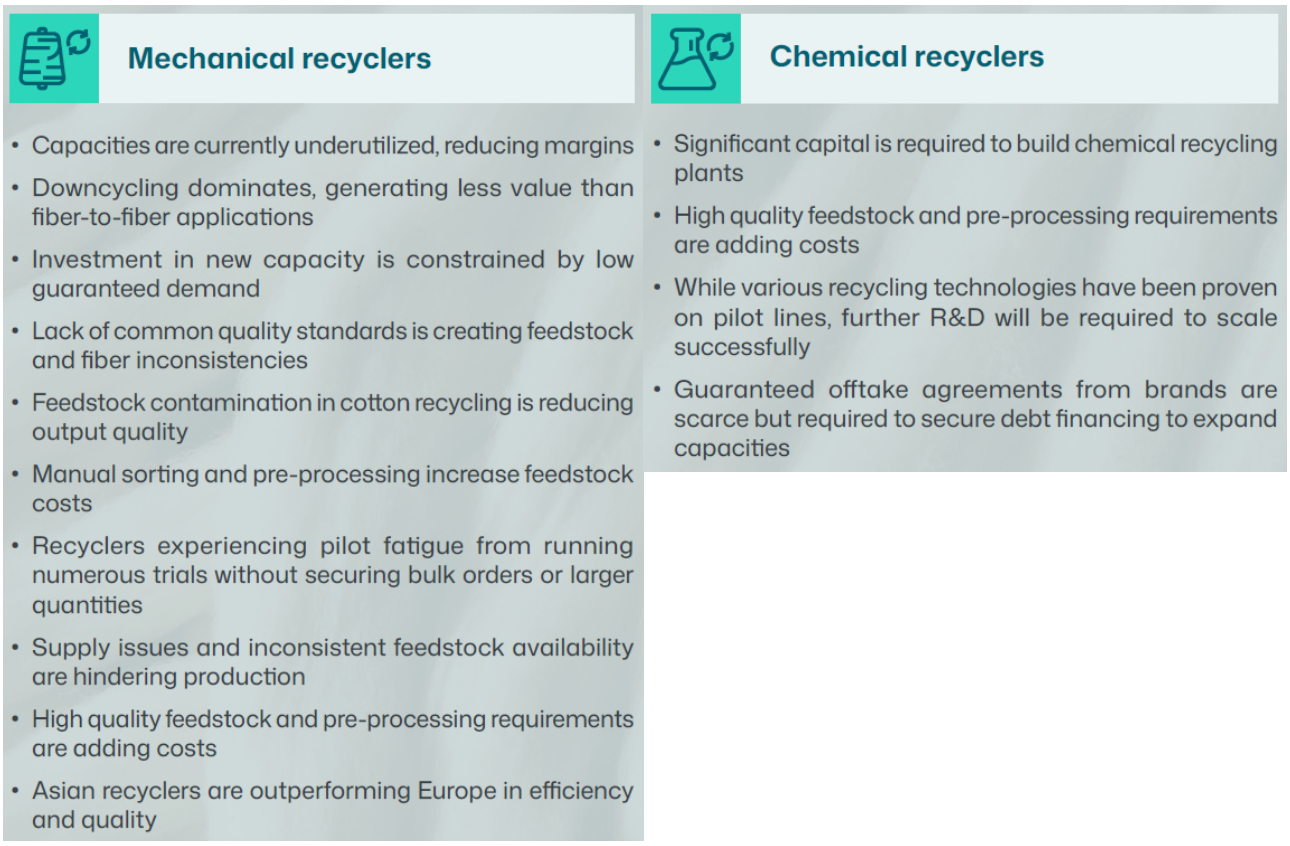

Figure 3: ReHubs statements on mechanical and chemical recycling, published in ReHubs: breaking the supply-demand deadlock

4.2 CISUTAC

The European project CISUTAC[5] – Circular and Sustainable Textiles and Clothing – has as aim to develop capacity and infrastructure for circular textiles and supporting a large scale sector-wide uptake and gain a better understanding of the textile actors and provide them insights on the value of circular textiles. In this view a report was developed in 2024 by CISUTAC's partners, called 'D2.1 Circular transition scenarios & software for post-consumer textile waste channelling'[6]. In this report an overview of sorting infrastructure and recycling capacity was documented.

4.2.1 Infrastructure gaps in sorting and recycling capacity

The most critical bottleneck identified in the circular transition is the lack of industrial-scale infrastructure for the advanced sorting and high-quality recycling of textiles.

It states that no governmental sources have been found that provide information on textile waste **sorting capacity** per country, the data available on European level is based on the capacity of 1 to 3 sorters per country, and their throughput. So the full capacity is

[5] www.cisutac.eu - This project has received funding from the European Union's Horizon Europe research and innovation programme under the grant agreement No. 101060375.

[6] https://static1.squarespace.com/static/631f2bee92571234987af5a2/t/662fb7f044df2d7be141b9bb/1714403317892/CISUTAC_D2.1_Transition_scenarios_final.pdf

underestimated, as smaller sorters were not included in the data. Most of the sorting facilities are located in central Europe.

As already pointed out in section 3, the most mature **recycling technology** is mechanical recycling (TRL 9), which involves tearing and shredding fabrics, and is widely available. However, mechanical processes shorten fiber lengths, leading to a loss of tensile strength and necessitating the blending of recycled content with virgin fibers to produce new garments.

Chemical recycling, encompassing polymer and monomer recycling, offers a route to virgin-equivalent quality but remains largely at the pilot or demonstration scale (TRL 5-8). These technologies, such as the pulping of cellulosic fibers or the glycolysis of polyester, require extremely pure feedstock. For instance, thermomechanical recycling of polyester typically requires 99% purity, a standard that post-consumer waste (frequently containing elastane, dyes, and coatings) rarely meets without advanced pre-processing.

There is also an uneven spreading of recycling infrastructure across Europe: mechanical recycling is more located in Southern Europe and chemical recycling more in Northern European countries.

Their primary gap recyclers are facing today is the lack of a stable, high-quality feedstock supply. EPR can help recyclers by funding the advanced sorting needed to create this feedstock. However, recyclers also face high energy costs and technical challenges in scaling monomer recycling for blended fabrics.

The gap between current recycling capacity (0.7-0.85 million tonnes) and the projected volume of waste that will be available by 2030 (2.6-4.4 million tonnes) represents a massive infrastructure deficit. Bridging this gap requires significant capital investment, which EPR fees are designed to provide.

4.2.2 TECHNICAL AND MATERIAL BARRIERS TO RECYCLABILITY

CISUTAC identifies "**disruptors**" as elements within a textile product that interfere with recycling processes. These are categorized based on the feasibility of their removal. Removable disruptors include hardware such as metal zippers, plastic buttons, and fasteners, which can be removed through manual or semi-automated dismantling before the fabric enters a recycler. Non-removable disruptors include fabric patches, certain types of adhesives, and complex combinations of hardware that are technically or economically impossible to separate from the fiber.

The presence of these disruptors is a major hurdle for mechanical recyclers, where hardware can damage machinery, and for chemical recyclers, where non-fiber materials can contaminate chemical baths and degrade the output quality.[1] Addressing this requires a shift in "Ecodesign," where producers are incentivized to minimize disruptors or design products for easy dismantling.

Multi-material products, particularly those blending natural and synthetic fibers (e.g., polycotton), present a significant recycling challenge. While chemical processes for polycotton separation are emerging, they are more energy-intensive and costly than mono-material recycling.[1] Elastane (Spandex/Lycra) is a particularly problematic fiber. Even in small percentages (1-5%), elastane acts as a contaminant in many recycling streams, reducing the quality of the recycled fiber and complicating the chemical recovery of polymers. Despite its known disruptive nature, brand surveys conducted by CISUTAC show that companies have no immediate plans to phase out elastane due to consumer demand for stretch and comfort.

Textile finishing processes—including dyeing, coating, and lamination—introduce a variety of chemicals that can disrupt circular loops. Coatings like Polyurethane (PU) or finishes like Durable Water Repellents (DWR), particularly those containing PFAS, are unwanted in recycled materials. Some chemical treatments, such as cross-linking agents used for anti-wrinkle properties in cellulosics, can inhibit chemical dissolution processes. Furthermore, the presence of Substances of Very High Concern (SVHC) poses a regulatory barrier; if these chemicals are detected in post-consumer waste, the material may be prohibited from being recycled into new products under EU REACH regulations.

4.2.3 DATA-RELATED GAPS AND IT MATURITY BARRIERS

Sorters currently rely on physical **care labels** to identify fiber composition. However, labels are often missing, cut off by consumers, or rendered illegible through laundering. Even when present, labels are notoriously inaccurate; studies cited by CISUTAC indicate that up to 13.5% of garments may have fiber compositions that differ from what is stated on the label. This lack of reliable data necessitates costly and often inaccurate testing or results in the relegation of high-quality materials to lower-value downcycling streams.

The CISUTAC project's survey of 10 major brands revealed a significant **lack of IT maturity in managing material data**. Many brands still aggregate composition and weight data "by hand" from fragmented internal systems or spreadsheet-based tools. While Product Lifecycle Management (PLM) systems are becoming more common, they are often not integrated with end-of-life stakeholders. Furthermore, brands often lack historical data on products sold 5 to 10 years ago, the very products currently appearing in waste streams. This historical data gap makes it difficult for recyclers to anticipate the material composition of the incoming feedstock.

The **Digital Product Passport** (DPP), a cornerstone of the Ecodesign for Sustainable Product Regulation (ESPR), aims to bridge this data gap by providing a digital twin for every garment. The DPP would carry essential data points identified by CISUTAC as "minimum requirements" for automated sorting:

- **Fiber Composition**: Detailed breakdown including blends and recycled content percentages.
- **Chemical Content**: Presence of specific dyes, finishes, or SVHCs.
- **Product Construction**: Identification of multi-layer or laminated materials.
- **Disruptors**: Data on removable and non-removable hardware.

However, the DPP has inherent limitations. It cannot track use-phase activities or the current physical condition of a garment, such as whether it has been contaminated by the end-user. This implies that the future sorting industry will require a hybrid approach: using the DPP for composition and chemical data while utilizing advanced sensors (AI image recognition and moisture sensors) to assess the condition.

So following gaps and barriers were identified within CISUTAC, which can affect/influence the successful implementation of an EPR scheme:

- No accurate data on sorting capacity in Europe and uneven spreading in Europe
- Higher amount of non-reusable, lower quality clothing when collection rate increases

- Uneven spreading of recycling infrastructure across Europe
- Massive recycling infrastructure deficit
- Products not designed for recycling (multi-material, finishes, (non-)removable parts)
- Data gaps (non-efficiency of care labels, lack of production and use phase data)

4.3 REGIOGREENTEX

In the framework of the European Green Deal, RegioGreenTex (01/2023-12/2025) is a project promoting the collaboration in research and development for the textile industry between the four major sectors of society – industry, government, research institutes, and the public – in establishing a systematic circular economy business model across the EU. RegioGreenTex involved 43 partners from 11 regions in 8 European countries.

In the context of circular textile value chains, a 'gap' refers to anything that hinders the achievement of a fully circular and viable model. These gaps can be highlighted at different stages of the value chain; they can be technical, material, economic, regulatory, or behavioural. Several examples are given hereunder.

Identifying and addressing these gaps is essential to advance the transition to more circular and sustainable textile value chains. This requires collaboration between stakeholders across the industry, including policy makers, businesses, consumers, and research institutions, as is the case in the frame of RegioGreenTex. Beyond the direct negative impact, there are situations where finding and implementing solutions may represent an opportunity to develop a new business option.

4.3.1 GAPS' CHARACTERISATION

When analysing a value chain, many types of gaps should be considered.

In addition to material gaps specific to a process or plant (e.g. lack of properly conditioned feedstock), other gaps may be more widespread and affect an entire value chain (e.g. lack of skilled labour, lack of training) or an entire type of business (e.g. waste management regulations).

Since each gap has its own characteristics, its impact on value chain activities may vary. Consequently, the complexity of identifying and implementing solutions to address these gaps can also differ. The following diagram provides key elements for a basic gap analysis by listing different options for the nature of a gap, its impact level, and the level of difficulty to fix it.

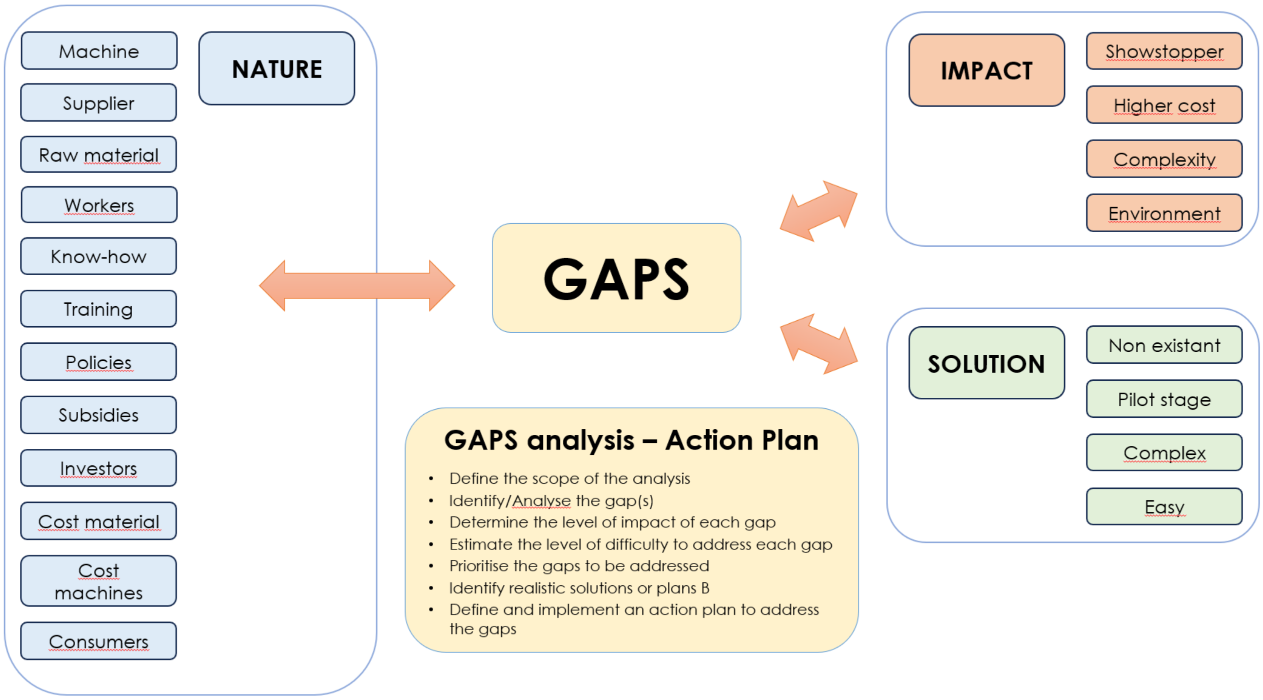

Figure 4: Gaps analysis, published in RegioGreenTex's D1.3 - Mapping and gap analysis of value chains for sustainable and circular textiles

To ensure a broad range of stakeholders could express their thoughts or share their experience, the identification and analysis of gaps affecting the establishment of circular textile value chains was organised multiple ways: an online survey (28 companies and organisations), one workshop during an Ecosystex conference (38 participants), one workshop with RegioGreenTex partners, and an in-depth analysis in the Prato and Biella regions (mechanical recycling hubs).

Three main gap categories were identified, extending beyond the sole technical limitations:

- Gaps related to **CORE FUNCTIONS** – mainly the process steps
- Gaps related to **SUPPORT FUNCTIONS** – e.g. laboratories, machine manufacturers
- Gaps related to **POLICY INSTRUMENTS** – e.g. regulations, regional institutions

Additionally, the following subcategories were highlighted during the analysis:

- **System organisation gaps**, that impact the entire value chain organisation
- **Cultural/skills gaps** in circular practices and products, linked to a lack of knowledge
- **Skills gaps in digital solutions**, leading for example to difficulties in data sharing/analysis

As specific value chains face specific challenges, the list of possible gaps is extensive. However, recurring patterns can be identified in the types of gaps that hinder smooth operation or development of circular textile value chains. Here are some of the main ones:

Core functions gaps

- lack of large-scale precise sorting process
- no efficient industrial process for the complete removal of hard parts
- difficulty to identify partners at local level
- scarcity of qualitative raw materials

- lack of skilled workers

Support functions gaps

- difficulties to share data related to material and production
- lack of knowledge about eco-design and circular business models

Policy instruments

- no standards for recycled products
- lack of certification schemes
- policies not applied consistently across the EU (e.g. waste management)

4.3.2 GAP ANALYSIS APPLIED TO AN EXISTING VALUE CHAIN

A specific study focused on a value chain related to the waste treatment and recycling in the Prato area. Many companies in that region work around the recycling of wool-based products and their transformation in a wide variety of products. This study covered all steps between the collection of waste to the production of non-woven products.

An Excel-based tool, the 'Value Chain Mapping and Gap Analysis Tool', was developed to facilitate a thorough analysis and to help structuring the gap analysis.

GAPS RELATED TO CORE FUNCTIONS

5 gaps were highlighted, all very relevant. If 3 gaps have mainly an impact on 1 company, the other 2 impact 9 or 10 companies. This could also influence the decision to tackle some gaps first. Here are the 3 main ones.

Large scale sorting process

Currently, there is no large-scale sorting activities for the recycling. The work is mostly done by hand to obtain optimal results and would benefit from the introduction of automated processes.

Removal of hard parts

No exception for this region, this activity is challenging and can be a bottleneck. The use of new machinery and a thorough work of eco-design could help improve the situation.

Mapping of regional companies

Companies of Prato district have the capability to cover the entire value chain for recycling wool. However, it is still a disconnected system, that lacks awareness regarding the processes that the companies can undertake.

This issue potentially affects the whole regional textile ecosystem.

GAPS RELATED TO SUPPORT FUNCTIONS

Two gaps were highlighted, both impacting 9 or 10 companies.

Difficulties to share data related to production/manufacturing

Companies struggle with the sharing of info and evolve at different digitalisation levels. An interesting element is that the solutions would be both technical and cultural.

Lack of knowledge about eco-design, circular business models

This type of gap slows down the progress that can be done in terms of transition towards circular economy. The positive is that it is possible to address it relatively easily, for example by organising webinars or training sessions.

GAPS RELATED TO POLICY INSTRUMENTS

Four gaps were highlighted. The difficulties can be linked to the application of existing regulations (e.g. at local level) or the absence of relevant standards or directives, mostly at EU level. For example:

Standards and certification

Two gaps relate to either the lack of standards for sustainable products or the absence of a reliable certification process for products containing recycled (waste) material.

4.3.3 REFLECTION ON THE GAP ANALYSIS

After completing the analysis with a specific excel tool, a broader reflection was conducted on the gaps categories that can possibly impact the entire wool recycling business of the region, and not just a specific value chain.

The gaps were consolidated into 5 different categories:

Technical/Technological gaps

The value chain misses industrial scale solutions to process the wool in larger quantities, at the right quality and standard level. Some companies develop their own innovative solutions that can be worth scaling up. It would be useful to have a system that promotes such innovations, and that also enables newcomers in the recycled wool business to have direct access to the right technology.

System/Organisation gaps

Such gaps are linked to the lack of a unique control "room" that can be a point of reference for the whole value chain. For example, it would be useful to have an organization that maps and knows all the companies that have technological solutions/phases for the wool recycling.

In addition, at system level, transparency and traceability in the recycled wool supply chain is lacking. Without clear information about the origin and processing of recycled wool products, it is difficult for businesses to make informed decisions about their re-worked products.

On the consumer side, supply chain transparency gaps can undermine trust and confidence in recycled wool - based products.

Cultural/skills gaps in circular practices and products

There is a cultural gap that makes it difficult to shift mindsets away from traditional linear models of production and consumption towards circular thinking, adopting new economy concepts and sustainable practices.

The skills Gap involves the absence of specialized skills and expertise required to design, produce, and manage circular products and processes. While companies often invest in high-level plant and machinery, these efforts necessitate support through collaborations between companies, as well as the enhancement of workers' knowledge through workshops and training activities.

The enhancement of the value chain and the resolution of its gaps require greater synergy among industrial actors.

Skills gaps in digital solutions (and in general in Industry 4.0 framework)

In order to create a robust recycling system, data is crucial. Data is the most important element of the Industry 4.0 framework, and in the textile sector, its collection is still a serious deficiency due to a lack of skills in integrating digital solutions into existing processes and in data analysis, both at company and value chain level.

Regulatory gaps

Regulatory challenges, including environmental regulations, trade policies and waste management laws, create barriers to the efficient operation of the recycled wool value chain. Inconsistent or burdensome regulations increase the administrative costs of properly implementing recycling processes that prove uncompetitive with non-recycled alternatives.

There is a high level of complexity in certification schemes as there is no single reference at European/international level to demonstrate commitment to sustainability and quality standards.

5. CO-CREATION ACTIVITIES

5.1 INTERNAL COLLABORATIVE ANALYSIS

In April 2025 a co-creation workshop was organised among the partners of Circula-Tex. In total 39 people participated to this collaborative analysis, representing different stakeholders along the value chain (research, sorters, recycler, PRO, brands, non-profit organisations, sector federation). During this workshop a SWOT analysis (Strengths – Weaknesses – Opportunities – Treats) was elaborated focussed on EPR using Miro board. The output of this co-creation session can be seen in Table 1. All identified statements, either positive or negative, will be taken into account in the following work package on EPR schemes.

Table 1: SWOT analysis

Strengths
• Deep knowledge of textile production / presence of complete value chain in the EU • Long lasting experience and knowledge base from other sectors where EPR is in place since many years • Promotion of transparency / traceability • Shifts responsibility to producers / accountability of brands on end-of-use • Awareness of EU consumers higher than other geographical areas • Resource efficiency • Brand reputation enhancement (consumers/regulatory/stakeholders) • Regulatory compliance advantage • Eco-design incentives • Waste reduction • Innovation in materials • Cost optimization long-term • Market differentiation • Textile waste minimization • Increased recycling rates • Secondary raw materials growth • Carbon footprint reduction • Extended product lifespan • Consumer awareness improvement • Sustainable business models development • Reduction of landfill dependency • Willingness to pay for recycled products demonstrated in other sectors • Clear goals • Eco-modulation – creating pull effect • Generates funds for collection, reuse, sorting, recycling infrastructure • Bridging the financial gap until the system can commercially work on its own • Mandatory

Weaknesses

- Potential loopholes for companies outside Europe (important to monitor)
- Difficult to track import, online sales, unbranded textiles, etc.
- Potential cost burden transfer
- Limited role in upstream producer decisions
- Fees implemented in some countries too low to finance the gaps
- Lack of standardisation in fees monitoring system
- Transferability of EPR fees – waste mainly generated in higher-income countries and sorted and used as second hand clothing in lower-income countries
- Redistribution of EPR fees to be considered for countries outside Europe (primary importers of second-hand clothing)
- Different systems in different countries
- Inefficiency due to competing PROs
- Increased costs due to EPR contributions and required system adaptations
- Necessity to be economically competitive with non-EU countries
- If EPR are national-based, it could create significant inequality in industries with the same type of garment production
- Lack of harmonized waste streams and fragmented collection systems in Europe
- Companies have production sites in different countries face difficulties when different EPRs are in place
- Operational complexity
- Weak oversight on reporting quantities, targets, etc.
- Lack of investment in eco-design and recyclability
- Limited knowledge on sustainable material innovation
- Complex reverse logistics
- Inadequate financial incentives
- Data gaps on material waste flows and material composition
- Poor coordination between municipalities, producers, and recyclers
- Low recycling rates for (mixed) fibers
- Fragmented industry collaboration on waste management
- Lack of incentives to prioritize recycled content over virgin materials
- Inconsistent sustainability standards across brands

Opportunities

- Stimulates innovation
- Job creation (in green sectors)
- Cross-sector collaboration for circular solutions
- Transparency/traceability via digital tools
  Creation of new data
- Open to new niche markets
- Boosting producer innovation through incentives
- Public-private partnerships and pilot projects
- Increase European production
- Create new business opportunities in the EU
- Making available products with higher recycled content
- Increasing investments in R&D – creating innovation/transition fund for recyclers and brands
- Advance fiber-to-fiber recycling
  Increase the European recycling capacity
- Higher quality waste feedstock for recycling processes - Textile waste feedstock more adapted to recycling processes (because of D4R principle and eco-modulation)
- Eco-modulation can level price difference between recycled and virgin materials
  Rewarding high-value production
- Creation of new service models (e.g. in-store collection, take-back programs)
- Creation of new business models
- Eco-modulation stimulates brands to develop circular textiles – driver for innovation in eco-design
- Regulatory and industry leadership, gaining early-mover advantage
- AI and other industry 4.0 technologies could help the development of infrastructure and simplify the implementation of EPR

Threats

- Free-riders
- Non-harmonized EPR schemes across the member states (different regulations/reporting)
- Administrative burden/complexity of 27 different national EPR schemes (or more national competing PROs)
- Administrative burden on companies along the whole value chain
- Economic penalties for non-compliance, including fines and market exclusion
- Online sellers should also be accountable for what is placed on the EU market
- Slow adoption of end-of-waste criteria
- Risk of imposing more stress on SMEs that have not sufficient economic funds to comply easily with EPR schemes
- High costs to be covered (collection e.g. civic amenity sites, sorting, recycling)
- Limited sorting and recycling infrastructure in Europe
- Risk that companies shift the environmental impact to other countries
- Complex value chains
- Slow or uneven implementation across countries
- Increased exports to countries dumping textiles in landfill
- Profitability of recycling
- Timing EPR versus other EU regulations (e.g. ESPR, selective collection)
- Supply chain disruptions
- Consumer behaviour
- Technological limitations

5.1.1 SUMMARY RESULTS

The extended SWOT analysis elaborated during the internal stakeholder workshop, and which is shown in detail above, is summarized below into the four main domains applicable for each section of the SWOT analysis.

Table 2: Synthesis of the SWOT analysis

Strengths	**Financial**: Generates dedicated funds for circular infrastructure **Environmental**: Drastic reduction in landfill use and carbon emissions **Corporate**: Enhances brand reputation and ensures regulatory compliance **Social**: Capitalizes on high consumer awareness and willingness to pay
Weaknesses	**Governance**: Lack of harmonization and fragmented collection systems across the EU **Global trade**: Difficulty monitoring imports and online sales from outside the EU **Ethics**: EPR fees stay in the North, while waste is exported to the Global South **Technical**: Inadequate technology for mixed-fiber recycling and "reverse" supply chains
Opportunities	**Tech/AI**: Automates complex sorting and reporting, reducing human error **Market**: Makes recycled materials as cheap (or cheaper) than virgin ones **Jobs**: Shifts employment from traditional retail to specialized green tech/logistics **Strategic**: Reshores production by creating a "closed-loop" supply chain in the EU
Threats	**SME burnout**: Small brands go bankrupt due to 27 different sets of paperwork **Eco-leakage**: Waste is "hidden" by exporting it to countries with poor landfill oversight **Market distortion**: Online "free-riders" steal market share from compliant EU brands **Infrastructure lag**: Collection outpaces recycling, leading to "bottlenecked" waste

5.2 EXTERNAL STAKEHOLDERS' INTERVIEWS

During the external stakeholder interviews, the questions mentioned in section 2.2 were posed to the interviewees. The summary of the responses is given below.

5.2.1 Which gaps and barriers could be solved by implementing the EPR scheme?

Across stakeholder interviews, a strong and consistent narrative emerges regarding the potential of Extended Producer Responsibility (EPR) schemes to address fundamental systemic barriers in the textile value chain. While perspectives vary depending on stakeholders' positions (e.g. recyclers, sorters, technology providers) and the product categories they work on (e.g. apparel, carpets), there is broad alignment on the types of challenges that EPR could help overcome and the mechanisms through which it could do so.

A primary gap identified by many stakeholders relates to **insufficient and inconsistent collection of textile waste**, which directly limits the availability of feedstock for recycling processes. This issue is among the most frequently cited, mentioned by an estimated 75% of interviewees. Current collection systems are often fragmented and underperforming, resulting in insufficient and unpredictable volumes to support industrial-scale recycling. In this context, EPR is widely viewed as a key instrument to improve both the quantity and stability of collected materials. By introducing dedicated financial flows through producer fees, EPR schemes can support the expansion and optimisation of collection systems. Stakeholders emphasise that achieving critical mass is essential, as many recycling technologies require **high minimum input volumes** (often several kilotonnes per year) to operate efficiently and reach economic viability.

Closely linked to this is the **lack of investment in sorting and pre-processing infrastructure**, identified by approximately 70% of interviewees as a major bottleneck. Existing sorting systems were largely developed to support second-hand markets and are not optimised for recycling purposes. As a result, the quality and consistency of sorted outputs often do not meet the requirements of recycling technologies. Stakeholders consistently describe a structural "chicken-and-egg" problem: sorting operators are reluctant to invest without guaranteed offtake, while recyclers depend on improved sorting to secure suitable inputs. EPR schemes are expected to break this impasse by providing both financial support and long-term market signals. Several stakeholders indicated that targeted EPR funding could significantly accelerate investment cycles (e.g. enabling upgrades within 3–5 years rather than longer, uncertain timelines).

Another major barrier identified across interviews is the **absence of standardisation and alignment within the value chain**, highlighted by roughly 55% of stakeholders. The lack of harmonised definitions, sorting categories, and material specifications leads to inefficiencies and limits scalability. Requirements regarding feedstock composition and quality often differ significantly between recyclers, creating uncertainty for sorting operators. A harmonised EPR framework is therefore seen as a mechanism to establish common rules and technical standards across countries and actors, reducing fragmentation and facilitating cross-border flows of textile waste and recycled materials.

Economic factors also play a central role in explaining current barriers. The **weak business case for textile recycling** is explicitly mentioned by over 70% of interviewees, making it one of the most critical systemic challenges. High capital expenditure, coupled with uncertain demand and price volatility, limits investment in recycling technologies. Several stakeholders noted that recycled fibres often remain more expensive than virgin alternatives (in some cases 20–50% higher, depending on the material and processing route). EPR schemes are expected to improve this situation by introducing stable financial mechanisms and creating predictable market conditions. Through eco-modulated fees, subsidies, or obligations (e.g. recycled content targets), EPR can help reducing investment risks and stimulate both supply and demand.

In addition to systemic and economic barriers, stakeholders also highlight challenges related to the **quality and suitability of collected textiles for recycling**, mentioned by approximately 60% of interviewees. Textile waste streams are typically heterogeneous, containing a wide range of blends, multilayers, finishes, and contaminants. This mismatch between product design and recycling requirements significantly reduces process efficiency and output quality. EPR, particularly when combined with eco-modulation, is expected to address this issue by incentivising improved product design. Most stakeholders supporting eco-modulation estimate that design changes could improve recyclability rates by 20–40% over time, although this depends strongly on implementation consistency and industry uptake.

The situation with **carpet tiles**, a major product category in construction, is different, yet still problematic. For example, collection before a building's demolition or flooring replacement can target both reuse and recycling. However, while reuse can generate revenue, recycling always comes with a cost. The textile fibres that can be recycled represent only 10–15% of the total weight; the backing is mostly intended for incineration, a costly operation.

Finally, stakeholders point to a broader issue of **fragmentation and lack of coordination across the textile value chain**, raised by around 55% of respondents. Interactions between collectors, sorters, recyclers, and brands remain insufficiently structured, with misaligned incentives and limited transparency. EPR is therefore seen not only as a financing mechanism but also as a governance framework. By defining roles, responsibilities, and operational structures, it can support more integrated and coordinated value chains. Several stakeholders emphasise that effective governance models, particularly those involving **shared responsibility between industry and public authorities** (supported by ~60% of interviewees in governance discussions), are key to maximising EPR effectiveness.

Most interviewees emphasise that the **textile value chain is inherently global**, with much of the production and processing occurring outside Europe, particularly in regions such as Asia. There is a lot of doubt about how the EPR scheme will deal with the import, and how ecodesign will be imposed. When non-ecodesigned goods enter the European market, the European textile waste treatment companies have to deal with the goods at end-of-life. A few interviewees state that as a result, the European sustainability efforts, and specifically policies such as **ESPR and EPR, must extend beyond Europe's geographical boundaries** and actively engage non-European actors. International trade dynamics are highlighted, such as agreements with countries like India, create both risks and opportunities, underlining the need for Europe to set clear regulatory requirements (e.g. on recycled content and sustainability standards) that also apply to imported products. At the same time, a role for Europe is seen in supporting and educating suppliers outside Europe to meet these standards, thereby ensuring that sustainability is embedded across the entire global supply chain rather than confined to European operations. One interviewee even stated that the recycling activities outside Europe should also be financially supported by the European EPR scheme.

Overall, stakeholder responses indicate that EPR is perceived as a **critical system-level enabler**, capable of addressing multiple interrelated barriers simultaneously. The quantitative insights reinforce that challenges related to collection, economics, and infrastructure are the most widely recognised, while issues such as standardisation, product design, and governance are also significant but slightly less uniformly emphasised. By combining financial instruments, regulatory frameworks, and incentives for innovation, EPR schemes are widely expected to play a central role in enabling the transition towards a more circular textile system.

5.2.2 SHOULD THERE BE ONE OR MULTIPLE PROS PER COUNTRY/REGION? SHOULD THE GOVERNMENT PLAY AN ACTIVE ROLE?

Within the stakeholder interviews conducted, interviewees were asked to reflect on both:

- The preferred structure of Producer Responsibility Organisations (PROs) - single versus multiple
- The role of government in the organisation and governance of the EPR system

The responses reveal a diversity of perspectives, with no uniform consensus. However, clear patterns can be identified regarding both organisational structure and governance responsibilities, which are summarised below.

OVERVIEW OF STAKEHOLDER POSITIONS

Across the interviews, stakeholder opinions on PRO structure can be grouped into:

- Preference for a single PRO
- Preference for multiple PROs per country
- Conditional or hybrid approaches
- No explicit opinion

The percentage of respondents in the different categories can be seen in Figure 5. As can be seen, the majority of the respondents is in favour of a single PRO per country.

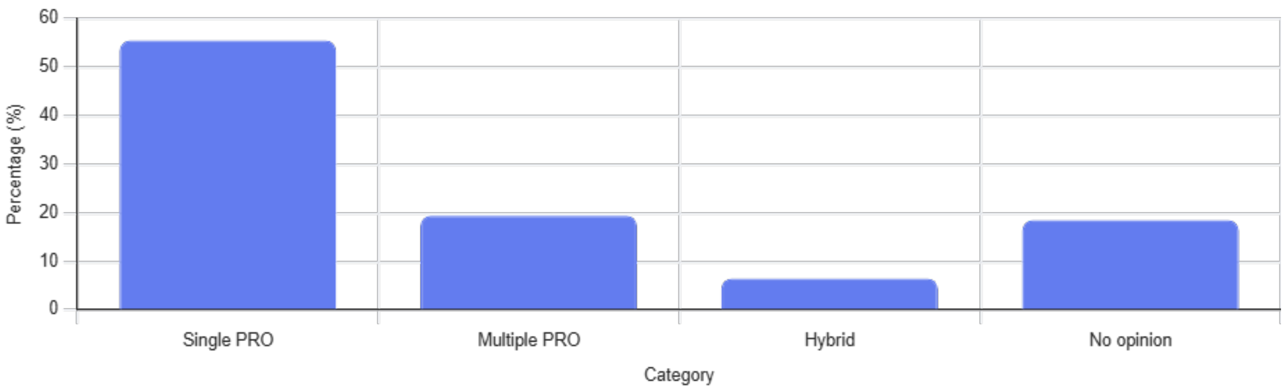

Figure 5: Stakeholder views on PRO structure

In parallel, views on the role of government can be grouped into:

- Support for a strong governmental role
- Preference for a limited governmental role (industry-led system)
- Support for a balanced/shared governance approach
- No opinion

The percentage of respondents in the different categories can be seen in Figure 6.

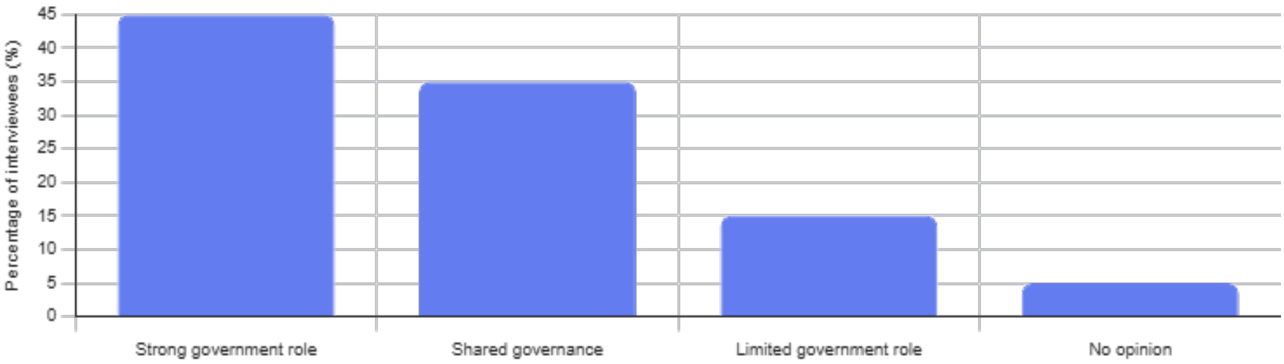

Figure 6: Stakeholder views on government role in EPR System

Overall, stakeholders tend to view PRO structure and government involvement as closely interrelated, with governance design often considered more important than the number of PROs.

ARGUMENTS IN FAVOUR OF A SINGLE PRO

Stakeholders supporting a single PRO model consistently frame their preference in terms of **system efficiency, clarity, and the need to avoid further fragmentation in an already complex textile value chain**. Their arguments are not purely conceptual but are grounded in observed shortcomings of the current system, particularly regarding coordination, investment, and operational effectiveness.

Operational efficiency and economies of scale

A central argument in favour of a single PRO is its ability to operate at scale and thereby increase efficiency across the system. The interviewees repeatedly emphasise that textile waste management requires **large volumes to achieve economic viability**, particularly for sorting and recycling operations. For example, stakeholders highlighted that recycling operations depend on critical mass, noting that efficient processing often requires substantial throughput levels to justify investments in specialised machinery (e.g. fibre-opening lines, sorting systems, etc.).

Within this context, a single PRO is perceived as better positioned to aggregate sufficient volumes of textile waste, optimise logistics and processing flows, and reduce duplication of administrative and operational functions.

By centralising operations, economies of scale can be achieved not only in infrastructure utilisation but also in planning and system optimisation. Stakeholders therefore argue that fragmentation of responsibility across multiple PROs could dilute volumes and reduce overall efficiency.

Clarity and simplicity for stakeholders

Another frequently cited advantage concerns system clarity and simplicity, particularly for producers and downstream actors. Interviewees often refer to the current lack of transparency and coordination in the textile value chain, where responsibilities and flows are not always clearly defined. In this context, a single PRO is seen as providing a clear point of contact for producers, having simplified compliance mechanisms and having more transparent financial and operational structures.

This clarity is particularly important given the diversity of actors involved (brands, collectors, sorters, recyclers). A centralised system is therefore expected to reduce administrative complexity and facilitate engagement, especially for smaller market players.

An interviewee pointed out that the role of PRO could be played by the national sector federation (carpet/fashion), as they have clear views of the needs of their sector.

Avoidance of fragmentation

Stakeholders also explicitly warn against increasing fragmentation through the introduction of multiple PROs. This concern is rooted in the already highly fragmented nature of the textile value chain, characterised by diverse material streams, varying product categories and different recycling and recovery routes.

Several interviewees underline that coordination across these actors is already challenging, and that introducing multiple PROs could exacerbate it. In particular, they highlight risks such as duplication of efforts, inconsistent requirements and standards, and competition for waste streams rather than system optimisation.

From this perspective, a single PRO is viewed as a mechanism to maintain system coherence and ensure that efforts are aligned rather than dispersed.

Stronger investment capacity

A recurring theme across interviews is the need for **significant investments in infrastructure**, particularly in sorting and recycling. Stakeholders stress that current underinvestment is partly driven by uncertainty and insufficient scale.

A single PRO is seen as better equipped to pool financial resources, channel funds strategically across the value chain and support large-scale infrastructure projects.

This is particularly relevant for capital-intensive investments, such as advanced sorting facilities or industrial recycling plants. Stakeholders argue that a fragmented PRO landscape could lead to smaller, less coordinated investments, reducing impact and slowing down system development.

Alignment with European harmonisation objectives

Finally, stakeholders frequently link the preference for a single PRO to broader harmonisation ambitions at European level. One of the key objectives of EPR development in the textile sector is to create more consistent frameworks across countries.

In this regard, a single PRO model is perceived as easier to align with harmonised rules and standards, more adaptable to cross-border coordination and better suited to interfacing with European-level policy frameworks.

Given that textile value chains and material flows are inherently cross-border, stakeholders emphasise that excessive national or organisational fragmentation could hinder the development of an effective European system.

ARGUMENTS IN FAVOUR OF MULTIPLE PROS

In contrast to the preference for a single PRO model, a group of stakeholders highlights the potential advantages of **multiple PROs**, particularly in terms of competition, flexibility, and responsiveness to the diversity of the textile value chain. These arguments are also firmly rooted in challenges identified throughout the interviews, including market immaturity, technological diversity, and the heterogeneity of textile streams.

Competition as a driver for performance

Stakeholders supporting multiple PROs frequently underline the role of competition in improving system performance. Given the current lack of efficiency and limited investment in parts of the textile value chain, competition is seen as a mechanism to stimulate cost efficiency, innovation in sorting and recycling solutions and better service levels for participating companies.

This perspective is closely linked to broader concerns about the current market situation. As one stakeholder noted, *"the current market situation is limiting the investments"*, indicating that stronger performance incentives are needed to overcome stagnation.

Within this context, multiple PROs are seen as a way to avoid complacency and ensure that organisations continuously improve their operations to remain competitive. Stakeholders argue that **competitive pressure could accelerate innovation**, especially in areas such as sorting technologies and recycling processes.

Flexibility and specialisation

Another key argument concerns the flexibility and specialisation that multiple PROs can provide. The textile waste stream is highly heterogeneous, involving different fibre types (cotton, polyester, blends, etc.), varying product categories (apparel, carpets, technical textiles) and diverse recycling technologies with specific input requirements.

Stakeholders emphasise that a "one-size-fits-all" approach may not be optimal in such a complex system. This is illustrated by observations that recyclers often require **very specific input streams and material compositions**, and that alignment across actors is currently lacking. For example, one interviewee noted that *"there needed to be a lot of alignment… to agree on a certain threshold [of input material]"*.

From this perspective, multiple PROs could:

- specialise in specific material streams (e.g. cotton vs synthetic fibres)
- tailor operations to particular sectors or product groups
- adapt more quickly to technological developments

This specialisation is seen as particularly valuable in an evolving landscape where recycling technologies are still maturing and require different feedstock characteristics.

Avoidance of monopoly risks

A further concern raised by stakeholders is the potential **risk of inefficiency in a monopolistic system**. While a single PRO may offer coordination benefits, stakeholders warn that it could also reduce incentives for performance improvement over time.

This concern is indirectly supported by observations on governance effectiveness. For example, stakeholders pointed out that EPR systems can be ineffective if not properly structured, referencing experiences where funds were not optimally allocated or where progress was limited. In light of these risks, proponents of multiple PROs argue that:

- competition can act as a safeguard against inefficiency
- organisations are more likely to remain responsive to stakeholder needs
- performance benchmarking between PROs can drive continuous improvement

Here, the argument is not necessarily against coordination, but against **over-centralisation without sufficient accountability mechanisms**.

Closer alignment with industry needs

Finally, stakeholders emphasise that multiple PROs may enable **closer alignment with the diverse needs of industry actors**. The textile value chain includes a wide range of stakeholders with different priorities, including brands with varying product portfolios, recyclers with distinct technological requirements and collectors and sorters operating in different regional contexts. Given this diversity, some stakeholders argue that a single PRO may struggle to adequately represent all interests. Multiple PROs, by contrast, could:

- offer tailored services to different industry segments
- respond more effectively to specific operational needs
- reflect regional or sector-specific conditions

This argument is reinforced by the broader observation that **alignment across the value chain is currently lacking**, and that different actors are not yet fully coordinated in terms of input requirements and system expectations.

Consolidated interpretation

Stakeholder support for multiple PROs reflects a concern that **flexibility, innovation, and responsiveness may be constrained in a fully centralised system**. The key perceived advantages include:

- stronger performance incentives through competition
- ability to specialise according to material streams or sectors
- reduced risk of inefficiency associated with monopolistic structures
- improved alignment with the diverse needs of industry actors

However, it is important to note that these perspectives are often balanced by concerns about fragmentation and coordination. As such, support for multiple PROs is frequently conditional on the presence of **strong overarching governance and harmonised rules**, ensuring that competition does not lead to further system inefficiencies.

Overall, the preference for multiple PROs reflects a desire to maintain **dynamism and adaptability** in a rapidly evolving sector, while recognising the need for sufficient coordination to ensure system effectiveness.

CONDITIONAL AND HYBRID PERSPECTIVES

A significant number of stakeholders adopt a pragmatic, system-oriented view, indicating that the quality of governance and system design is more important than the number of PROs.

A hybrid approach can be adopted, combining a European central coordination and multiple operational actors. These stakeholders emphasise that harmonisation, transparency, and clear rules are critical success factors, regardless of the organisational model.

A stakeholder also mentioned that a single PRO could be preferable at the start of the implementation of the EPR, but after e.g. 20 years, a switch to multiple PROs could be made.

STAKEHOLDER VIEWS ON THE ROLE OF GOVERNMENT

In addition to PRO structure, stakeholders provided insights into the appropriate role of government in the EPR system. Three main perspectives emerge.

a) **Strong Government Involvement**

A significant group of stakeholders supports an active role for government, particularly in defining the regulatory framework, setting targets and obligations, ensuring compliance and enforcement and guaranteeing a level playing field.

Key arguments:

- The EPR system requires clear and stable rules to function effectively
- Government involvement is necessary to prevent free-riding and market distortions
- Public authorities are best positioned to ensure fairness and transparency
- Government can facilitate harmonisation across regions

b) **Limited Government Role (Industry-Led Approach)**

Another group of stakeholders favours a more limited governmental role, advocating for an industry-driven PRO system where the government should act primarily as a regulator, not an operator.

Key arguments:

- Industry actors better understand operational and market realities
- An industry-led system allows for greater flexibility and responsiveness
- Excessive government control may lead to bureaucracy and inefficiencies

c) **Balanced or Shared Governance Model**

A large share of stakeholders supports a balanced approach, combining government oversight and regulation and industry-led implementation via PROs

Key arguments:

- Government should define the framework and ensure enforcement
- PROs should manage day-to-day operations and system implementation
- This model allows for both stability and flexibility

CROSS-CUTTING CONSIDERATIONS

Across all stakeholder groups, several recurring themes influence both PRO structure and governance preferences:

- Need to reduce fragmentation in the current system
- Lack of standardisation in sorting, classification, and material specifications
- Economic challenges, including lack of scale and investment certainty
- Need for predictable funding mechanisms
- Importance of enabling infrastructure investments

These challenges explain why stakeholders often prioritise system effectiveness over institutional design, and why governance arrangements are seen as critical.

KEY TAKEAWAYS

There is no full consensus on whether a single or multiple PRO system is preferable.

A preference exists for a centralised (single PRO) model, mainly driven by concerns about efficiency and fragmentation. However, multiple PROs are supported by some stakeholders for their potential to foster competition and innovation.

Stakeholders widely agree that government must play a role, particularly in regulation and oversight. At the same time, there is broad support for industry involvement in implementation

Overall, the findings indicate that the success of the EPR system depends primarily on robust governance, clear rules, and effective coordination, rather than solely on the number of PROs or the degree of centralisation.

5.2.3 WHAT IS YOUR VIEW ON ECOMODULATION?

OVERVIEW

Ecomodulation is a policy mechanism within the EPR system in which the fees paid by producers are adjusted based on the environmental performance of their products. In practice, more sustainable products (e.g. recyclable, durable, or containing recycled content) are subject to lower fees, while products with a higher environmental impact incur higher fees. The main objective is to incentivise eco-design and support the transition to a circular economy by linking product design choices directly to financial consequences.

This ecomodulation concept was discussed with stakeholders as a key instrument within the EPR framework to steer product design and improve recyclability of textiles. Overall, interviewees expressed a generally positive attitude, although this support is often accompanied by important implementation concerns.

Based on the systematic screening of the interviews, stakeholder positions can be grouped as follows:

- Supportive of ecomodulation
- Conditionally supportive
- Critical or sceptical
- No explicit opinion

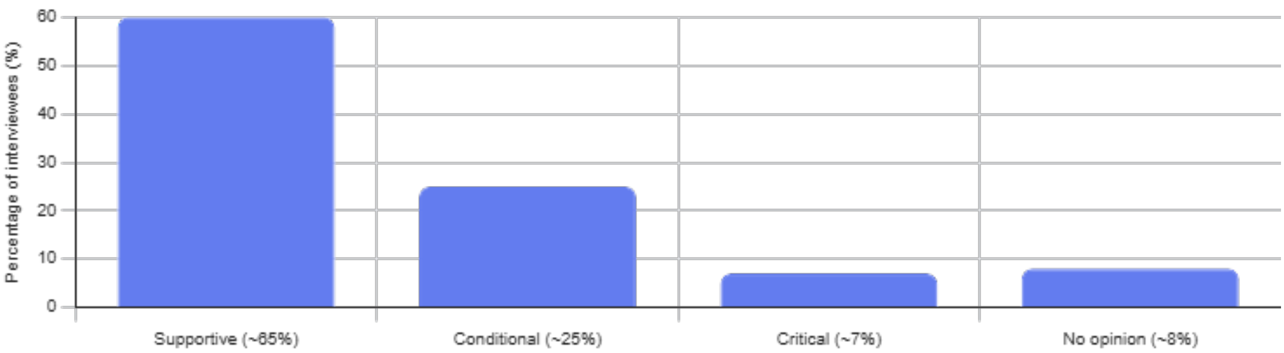

Figure 7: Stakeholder views on eco-modulation

These results indicate a broad recognition of ecomodulation as a relevant policy tool, while also highlighting the need for careful design and implementation.

ARGUMENTS IN FAVOUR OF ECOMODULATION

Stakeholders supporting ecomodulation consistently emphasise its role as a driver for upstream change, particularly at the level of product design.

Key arguments include:

- **Incentivising eco-design**: Ecomodulation is seen as an effective mechanism to encourage producers to design products that are easier to recycle. Current textile products are most often not designed with end-of-life considerations, leading to complex material compositions and reduced recyclability. Through differentiated fee structures, PROs can encourage producers to adopt more circular design principles, such as mono-material construction, reduced use of problematic additives, improved ease of disassembly, etc., hence improving overall product recyclability. In this way, ecomodulation is seen as a key mechanism to improve the long-term quality of textile waste streams and reduce processing costs downstream.
- **Improving feedstock quality:** Several stakeholders expect that ecomodulation will lead to better alignment between product design and recycling processes, thereby increasing the availability of high-quality feedstock.
- **Stimulating demand for recycled materials:** By linking fees to sustainability performance, ecomodulation can encourage the use of recycled content and support the development of secondary raw materials markets. Many stakeholders are in favour of obliging mandatory recycled content (the amount could differ from material to material). It was also emphasized by some stakeholders that ecomodulation should distinguish between recycled content (e.g. recycled fibres) from European origin, which should be preferably traceable and auditable, and recycled content imported from outside the EU.
- **Enabling systemic change:** Ecomodulation is considered one of the few instruments capable of influencing decisions at the design phase, rather than only addressing end-of-life treatment.

KEY CONCERNS AND CHALLENGES

Despite the overall positive perception, stakeholders raise several **important concerns regarding feasibility and effectiveness**.

- **Difficulty in defining criteria:** One of the most frequently cited challenges is the definition of clear and fair criteria for ecomodulation. The complexity of textile products, combined with the lack of standardisation and the diversity of recycling technologies, makes it difficult to establish universally applicable rules.
- **Risk of oversimplification:** There is a concern that ecomodulation may favour simplified product designs (e.g. monomaterials) at the expense of performance, durability, or functionality.
- **Uncertain impact in practice:** Some stakeholders highlight that ecomodulation has not yet been implemented at large scale in the textile sector. As a result, its actual impact on product design and waste streams remains uncertain.
- **Administrative and operational burden:** Companies may face increased complexity in data collection, reporting, and compliance, potentially leading to higher costs and administrative efforts.
- **Level playing field:** It is highlighted that is difficult to apply and enforce the rules to imported products and that there is a risk of free-riding by actors outside the EU regulatory framework, leading to a distorted competition.

- **Fees**: the fees for non-ecodesigned goods should be sufficiently high to induce the change. If only small fees are due, manufacturers might go for the easy solution, and keep producing non-ecodesigned goods and just pay the fees.

Conditional Support and Critical Perspectives

A significant group of stakeholders expresses conditional support, indicating that ecomodulation should only be implemented if certain **requirements** are met. These include:

- Development of clear, transparent, and harmonised criteria, preferably at European level
- Alignment with existing and future recycling capabilities
- Avoidance of excessive administrative burden
- Gradual implementation to allow industry adaptation

This group emphasises that the effectiveness of ecomodulation is highly dependent on its practical applicability and consistency across regions.

A small minority of stakeholders expresses more **fundamental concerns**, including:

- Risk of overly complex or ineffective schemes
- Potential to create market distortions or unintended consequences
- Preference for market-driven innovation over regulatory incentives

While limited in number, these views highlight the importance of designing ecomodulation schemes in a proportionate and pragmatic manner.

Key Takeaways

Ecomodulation is widely recognised as a useful and necessary instrument within EPR systems. The majority of stakeholders support its introduction, albeit often with conditions. The main challenges identified relate to:

- defining appropriate criteria
- ensuring alignment with recycling realities
- avoiding excessive complexity

Overall, the findings suggest that ecomodulation has strong potential to drive eco-design and improve recyclability, but its effectiveness will depend on clear, harmonised, and practically implementable rules.

5.2.4 Where should the collected eco-contribution fees be spent by the PRO?

Stakeholder interviews conducted within the project provide a consistent and structured view on how eco-contribution and ecomodulated EPR fees should be allocated by Producer Responsibility Organisations (PROs). While priorities differ depending on the stakeholder's position in the value chain, a clear hierarchy of spending emerges, reflecting the most critical bottlenecks in the current textile system.

Overall, stakeholders emphasise that EPR fees should not be concentrated on a single stage but rather distributed across the value chain to address interconnected barriers. Nevertheless, a strong prioritisation of downstream system improvements (particularly collection, sorting and recycling infrastructure) can be observed.

Prioritisation of infrastructure investments

The most widely cited priority concerns investment in **collection, sorting and pre-processing infrastructure**, mentioned by approximately 75–80% of interviewees. Stakeholders stress that current systems are insufficient both in scale and in technical capability. In particular, existing sorting infrastructure is often not designed to prepare materials for recycling, but rather for reuse or second-hand markets. As a result, there is a significant mismatch between available waste streams and the requirements of recycling technologies.

Ecomodulated fees are therefore seen as essential to upgrade these systems, including the deployment of advanced sorting technologies and improved pre-processing capacities. Funding in this area is expected to directly increase both the volume and quality of recyclable feedstock, thereby forming the backbone of a circular textile system.

Supporting the scale-up of recycling capacity

A second major spending category, mentioned by around 65–70% of stakeholders, relates to the **scale-up of recycling technologies and industrial capacity**. While numerous recycling solutions are currently being developed, many remain at pilot or early commercial stages. Stakeholders highlight that the transition to industrial scale is constrained by high capital costs and uncertain market conditions.

EPR fees are therefore expected to play a critical role in de-risking these investments. This may include co-financing recycling facilities, technology deployment support, and bridging the gap between research and full-scale operations. Strengthening recycling capacity is considered essential to ensure that increased collection volumes can be effectively processed. Multiple stakeholders mention that once a recycling technology is fully in place and economically viable, financial support should be phased out, allowing this step in the value chain to be self-sufficient.

Stimulating markets for recycled materials

A further priority, mentioned by approximately 55% of stakeholders, concerns the need to stimulate **market demand for recycled materials**. Interviewees consistently highlight that recycling cannot scale without a stable and sufficiently large market for outputs.

EPR fees could therefore be used to support market development measures, such as incentives for incorporating recycled content, support for offtake agreements, or other demand-side instruments. These interventions are considered necessary to improve the economic viability of recycling and reduce the current cost gap between recycled and virgin materials.

Enhancing system coordination and governance

Finally, around 50–55% of stakeholders underline the importance of allocating part of EPR funds to **system coordination, governance, and harmonisation efforts**. The current textile value chain is characterised by fragmentation, with limited alignment between actors and across national systems.

In this context, PROs are expected to play a central coordinating role, supported by EPR funding. This may include the development of data and traceability systems, harmonisation of standards, and facilitation of collaboration between stakeholders. Improved governance is seen as essential to ensure that investments in infrastructure and recycling deliver system-wide impact.

KEY TAKEAWAYS

Taken together, stakeholder responses indicate that ecomodulated EPR fees are expected to support a **balanced portfolio of interventions across the value chain**, with a clear emphasis on infrastructure and capacity building. The prioritisation of spending categories can be summarised as follows:

- Collection, sorting and pre-processing infrastructure (highest priority)
- Recycling scale-up and technology deployment
- Eco-design incentives
- Market development for recycled materials
- Governance, coordination and system harmonisation

This distribution reflects a shared understanding that achieving circularity in textiles requires addressing both **downstream system constraints and upstream design challenges**, while simultaneously creating the economic and organisational conditions for a functioning circular market.

Overall, stakeholders perceive ecomodulated EPR fees as a **strategic lever to drive systemic transformation**, rather than merely a financing tool, enabling coordinated progress across all stages of the textile value chain.

5.2.5 DO YOU EXPECT HINDRANCE WHEN DIFFERENT EPRS ARE IN PLACE IN DIFFERENT COUNTRIES/REGIONS?

The large majority of stakeholders indicate that the presence of different EPR schemes across countries or regions would likely lead to hindrance in the functioning of the textile value chain and the scaling of circular business models at European level. Based on a systematic screening of the interview responses, it can be estimated that approximately 80% of respondents expect some level of hindrance. Around 20% of interviewees do not explicitly express an opinion on this issue.

A key argument underlying this expectation is the risk of **fragmentation between national systems**. Approximately 80% of stakeholders highlight that divergent EPR schemes would introduce inconsistencies in regulatory requirements, making it more difficult for companies operating across multiple markets to comply efficiently. Several respondents emphasise that a harmonised EPR framework would help to establish clearer and more consistent rules across the value chain, thereby reducing fragmentation and improving overall coordination.

In addition, a substantial share of interviewees links non-harmonised EPR schemes to **increased uncertainty and reduced investment incentives**. Around 65% of respondents point out that the development of recycling infrastructure depends heavily on stable and predictable conditions. They indicate that diverging national frameworks would complicate long-term investment decisions and could slow down the scaling of sorting and recycling technologies. This concern reflects broader uncertainties already present in the market, which stakeholders identify as a barrier to further development.

Furthermore, approximately 60% of stakeholders expect that multiple EPR systems would lead to increased **operational complexity**, particularly for actors active across borders. Different reporting obligations, fee structures, and eco-modulation criteria are anticipated to create additional administrative burden. These challenges are closely linked to the current lack of standardisation in areas such as sorting and material classification, which is already perceived as a significant bottleneck within the system.

Another frequently mentioned concern relates to the impact on **material flows and economies of scale**. Around 55% of respondents indicate that fragmented EPR systems could hinder the efficient movement and aggregation of textile waste streams. Given that many recycling processes require large and consistent volumes of feedstock to be economically viable, stakeholders warn that fragmentation could undermine the business case for recycling and limit the efficiency gains associated with large-scale operations.

Overall, there is a clear and consistent preference for a **harmonised EPR framework at European level**. Approximately 75% of respondents explicitly or implicitly support such an approach, as it is expected to provide regulatory clarity, reduce administrative burden, and facilitate investments in recycling infrastructure.

In summary, the interviews suggest a strong consensus that non-harmonised EPR schemes would act as a barrier rather than an enabler for circular textile systems. Stakeholders consistently indicate that fragmentation across countries would increase complexity, reduce efficiency, and delay the development of cross-border scalable solutions, while harmonisation is seen as a key condition for a well-functioning and efficient system.

5.2.6 SYNTHESIS OF STAKEHOLDER FEEDBACK

The stakeholder interviews conducted within the Circula-Tex project reveal a strong consensus on the potential of EPR schemes to address key systemic barriers in the textile value chain. While perspectives differ depending on stakeholders' roles, there is broad alignment on the main challenges and on the role of EPR in overcoming them.

The most frequently identified barrier is the **insufficient and inconsistent collection of textile waste**, mentioned by around 75% of stakeholders. Current systems fail to provide the volumes and stability needed for recycling. Closely linked is the **lack of investment in sorting and pre-processing infrastructure** (~70%), which prevents the production of high-quality feedstock. EPR is widely seen as a mechanism to address both challenges by providing stable financial flows and long-term market signals.

In addition, stakeholders highlight the **lack of standardisation and alignment** in sorting, definitions, and material specifications (~55%), as well as the **weak business case for recycling** (>70%), driven by high costs and uncertain demand. EPR is expected to improve economic viability through funding mechanisms, eco-modulation, and demand-side incentives.

Stakeholders also emphasise the importance of **product design** and the need to improve recyclability, noting that EPR—especially through eco-modulation—can incentivise more circular design practices. At the system level, EPR is seen not only as a financing tool but also as a **governance framework** to better coordinate actors across the value chain.

Regarding system design, a **majority prefers a single PRO**, citing efficiency, scale, and reduced fragmentation. However, some stakeholders support multiple PROs to foster competition and flexibility, while many favour a **hybrid approach**, emphasising that governance quality is more important than organisational structure. A **balanced governance model**, combining government oversight with industry-led implementation, is widely supported.

Ecomodulation is generally perceived positively as a tool to drive eco-design and improve recyclability, although stakeholders stress the need for clear, harmonised criteria and practical implementation. Similarly, there is strong agreement that EPR fees should prioritise

investment in collection, sorting, and recycling infrastructure, followed by support for market development and system coordination.

Finally, there is a strong consensus that **non-harmonised EPR schemes across countries would create hindrance**. Around 80% of stakeholders expect fragmentation to increase complexity, reduce efficiency, and weaken investment conditions. In contrast, a **harmonised European framework** is widely considered essential for enabling a scalable and effective circular textile system.

Stakeholders involved in the **textile flooring sector** highlighted that this sector **should have a different EPR system**, and it should not be integrated in the EPR system set up for clothing textiles, shoes and household linen. Due to the bulkiness of carpet waste and different constitution, it will be collected/sorted/recycled differently than standard textile waste.

Overall, EPR is seen as a **critical system-level enabler**, capable of addressing interconnected barriers across the value chain, provided it is well designed, coordinated, and harmonised.

6. CONCLUSION

The analysis of the existing studies (ReHubs, CISUTAC, RegioGreenTex), the internal co-creation workshop and the external stakeholder interviews provide a highly complementary and mutually reinforcing understanding of the challenges and opportunities linked to the implementation of EPR in the textile sector.

A key observation is the **high level of convergence** across the sources in identifying core barriers and obstacles to transitioning to a circular economy, such as infrastructure gaps, weak economic fundamentals, suboptimal product design, data deficiencies and system fragmentation. This convergence is an indication that the sector reached a mature diagnostic stage, where the main bottlenecks are no longer disputed but are broadly recognised across different stakeholder groups and analytical approaches.

At the same time, each source contributes to **different layers of insight**, which together create a more complete system understanding:

- The **existing studies** provide a **structured, evidence-based foundation**, detailing technical, economic, and regulatory barriers across the value chain. They highlight the scale of the challenge (e.g. infrastructure deficits, technological limitations) and underline the systemic nature of the gaps.
- The **internal workshop** translates these findings into a more **strategic and policy-oriented perspective**, explicitly positioning EPR as a mechanism to address weaknesses while leveraging opportunities such as innovation, funding, and improved governance.
- The **stakeholder interviews** add a crucial **operational and market-driven dimension**, confirming the relevance of the identified barriers and providing concrete insights into how EPR could function in practice, including conditions for success, risks, and trade-offs.

This layered approach reinforces the robustness of the conclusions: **what is theoretically identified in studies is confirmed in practice by stakeholders and** further contextualised through strategic reflection.

A second important insight is that all sources implicitly or explicitly point towards the need for **systemic, coordinated intervention rather than isolated solutions**. The challenges identified are highly interdependent:

- insufficient collection and advanced sorting capacity limit feedstock availability,
- which reduces recycling efficiency and investment attractiveness,
- which in turn weakens market development and demand,
- while poor product design and lack of standardisation further exacerbate inefficiencies.

In this context, EPR is consistently framed as an instrument capable of **addressing these interdependencies simultaneously**, by combining financial flows, regulatory incentives, and governance structures. The interviews particularly emphasise this multi-functionality, confirming that stakeholders do not view EPR as a single-purpose tool, but as a **system-level enabler**.

However, while there is strong alignment on what needs to be addressed, there is **less consensus on how EPR systems should be designed and implemented**. This is where the main differences between stakeholders become apparent.

The most visible divergence concerns **governance and system design choices**, particularly:

- the structure of PROs (single vs multiple vs hybrid),
- the degree of government involvement,
- and the balance between centralisation and flexibility.

Whereas the studies largely remain neutral or silent on these institutional questions, and the workshop highlights both risks and opportunities, the stakeholder interviews reveal a spectrum of views. These range from preferences for centralised systems (for efficiency and scale) to more decentralised or competitive models (for flexibility and innovation). Importantly, a significant group of stakeholders stresses that governance quality, clarity of rules, and effective coordination are more critical than the specific organisational model chosen.

Another important difference lies in the **level of attention given to softer, non-technical factors**. RegioGreenTex and the internal workshop explicitly highlight **skills gaps, cultural barriers, and lack of circular mindsets**, whereas stakeholder interviews focus more strongly on **economic viability, infrastructure, and regulatory conditions**. This suggests that while behavioural and knowledge-related barriers are recognised, they may be perceived as **secondary or more indirect constraints** compared to immediate structural and financial challenges.

Despite these differences, one of the strongest and most consistent conclusion is the **importance of harmonisation**, particularly at European level. Nevertheless, a **separate harmonized EPR system for carpets** is favoured, as these are completely different goods than fashion and household goods. All sources point to fragmentation (in regulations, standards, or value chain coordination) as a major barrier. Stakeholder interviews provide especially strong confirmation of this, with a large majority expecting that non-harmonised EPR systems would create inefficiencies, increase administrative burden, and weaken investment conditions. This makes harmonisation one of the clearest priorities emerging from the analysis.

Overall, the combined findings suggest that the textile sector is not facing a lack of awareness or isolated technical barriers, but rather a **complex system transition challenge**. EPR is widely perceived as a key lever to drive this transition, but its effectiveness will depend on several critical success factors:

- the ability to ensure **sufficient and well-targeted financial flows**,
- the establishment of **clear, harmonised rules and standards**,
- the enforcement of defined rules **on all imported products**,
- the creation of **robust governance structures with strong coordination**,
- and alignment with **technological realities and market conditions**.

In conclusion, the analysis demonstrates that while there is a strong and shared understanding of the barriers to circularity, the **design of an effective EPR system remains a dynamic and context-dependent challenge**. The success of EPR will not only depend on its existence, but on **how well it integrates economic incentives, regulatory frameworks and stakeholder coordination into a coherent and harmonised system across Europe**.

ANNEX I – LIST OF PARTICIPATING STAKEHOLDERS

Type	Country	Description
Collector/Recycler	Belgium	Collector of textile waste and producer of RFD
Waste pretreater	Belgium	Disassembly technology provider
Recycler	Italy	Chemical recycler of PA6
Recycler	Italy	Chemical recycler of PET
Recycler	The Netherlands	Chemical recycler of PET
Recycler	Germany	Chemical recycler of PET
Recycler	France	Chemical recycler of PET
Recycler	Germany	Chemical recycler of polycotton
Recycler	Spain	Mechanical recycling
Recycler	Spain	Mechanical recycling
Recycler	Belgium	Mechanical recycling
Recycler	Belgium	Mechanical recycling
Recycler	Belgium	Mechanical recycling
Recycler	The Netherlands	Mechanical recycling
Recycler	The Netherlands	Chemical recycler of cellulosics
Recycler	Sweden	Chemical recycler of cellulosics
Sorter	The Netherlands	Sorter for mechanical recycling
Sorter	Belgium	Sorter for reuse
Producer	Belgium	Carpet manufacturer, internal thermo-mechanically recycling of post-industrial waste
Producer	The Netherlands	Carpet manufacturer
Producer	Germany	Producer and technology provider recyclable carpets
Producer	Belgium	Carpet tile manufacturer
Producer/recycler	Belgium	Fibre producer and chemical recycler of PLA