

TEXTILE WASTE MANAGMENT

Trainer Handbook



VERDEinMED

Interreg
Euro-MED



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the European Union

PREFACE

This document aims to develop a skilled workforce through knowledge sharing, fostering experienced professionals in the Textile and Clothing Industry with a focus on circular strategies and textile waste management. It is a key outcome of the VERDEinMED project, specifically Activity 1.3 – Train the Trainers, which is part of WP1: Reforming the Industry through Sustainable and Circular Practices. This document aligns with the theme “Textile Waste Management”, exploring the challenges associated with textile waste generation and composition, as well as the strategies and recycling technologies that support more sustainable waste management practices. The information is organized by:

1. Textile waste generation and composition;
2. Waste management strategies;
3. Recycling technologies;
4. Case study.



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Textile Waste Generation and Composition

In 2020, the European Union generated significant amounts of textile waste, highlighting the scale of the challenge and the urgent need for improved management systems (Figure 1).

IN 2020, THE EU GENERATED:



6.95 million tonnes of textile waste

16kg per person which 4.4kg are collected separately for reuse and recycling, while 11.6 kg end up in mixed waste streams such as landfill or incineration

82% post-consumer waste such as clothing and household textiles, while the remainder originates from manufacturing processes or unsold stock

Figure 1 - Number of textile waste in 2020 (European Environment Agency "Management of used and waste textiles in Europe`s circular economy")

As the problem of textile waste continues to grow, the Waste Framework Directive (WFD) requires that, from 2025 onwards, EU Member States establish separate collection systems for used textiles. This measure reflects the urgent need to divert textiles from landfill and incineration towards reuse and recycling pathways.

In 2020, the EU generated substantial amounts of textile waste from both households and economic activities, yet a large proportion still ended up in mixed municipal waste streams (Figure 2). Data on mixed waste are often based on estimates from composition analyses, as no harmonised methodology exists across Europe.

For example, Türkiye does not report textile waste within mixed municipal waste, while Italy's data on economic activities may be overestimated, as it includes non-textile fractions such as leather scraps or secondary textile waste.

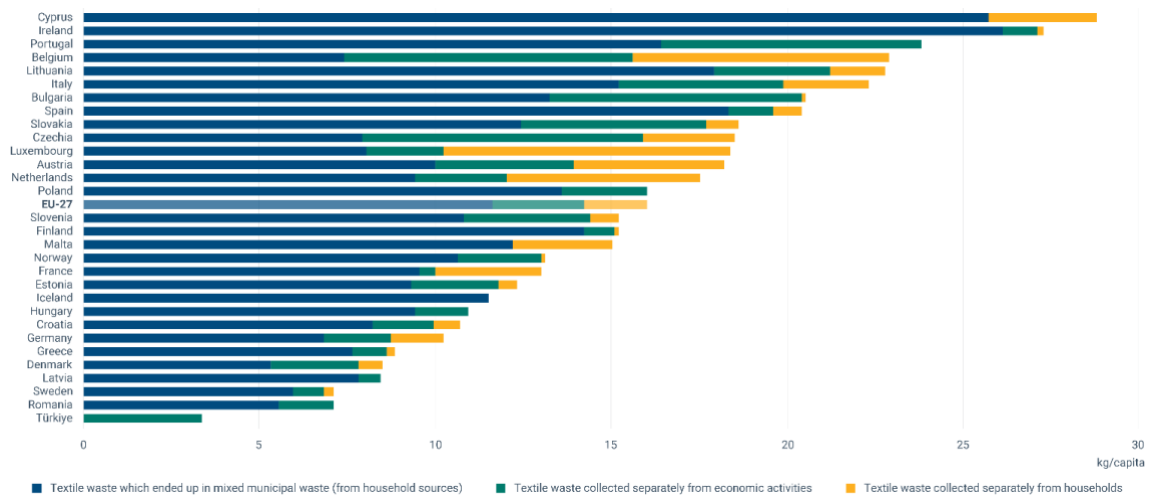


Figure 2 - Generation of textile waste in 2020, in kg per capita (European Environment Agency "Management of used and waste textiles in Europe's circular economy")

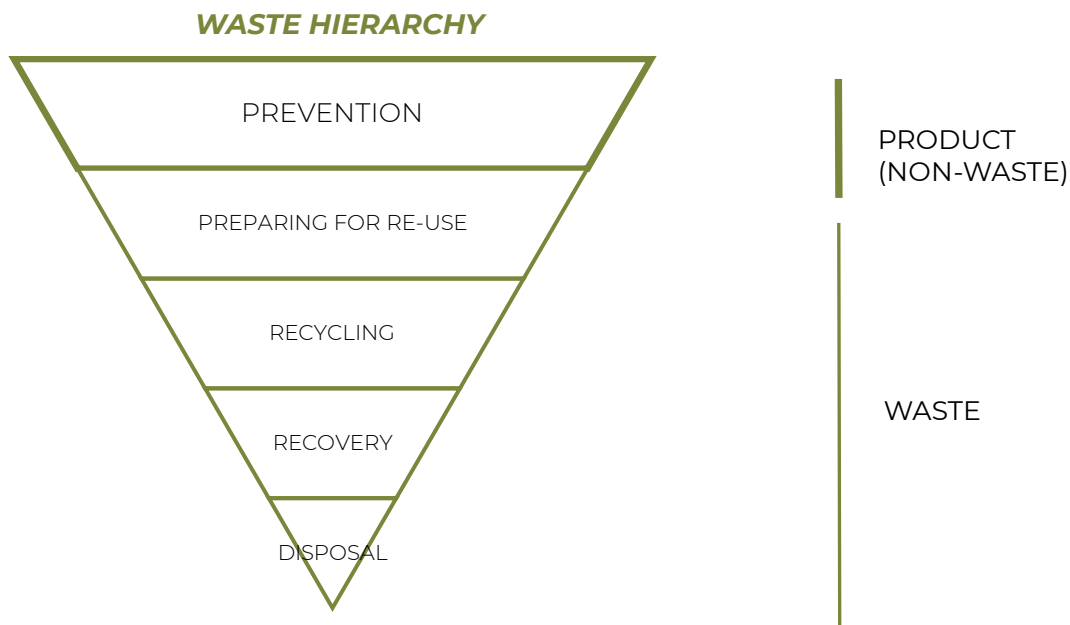


Figure 3 - Waste hierarchy pyramid (Adapted from European Commission, Waste Framework Directive – Waste hierarchy graphic. European Environment Agency.)

One of the most effective approaches to preventing and managing waste is the waste hierarchy (Figure 3). Established under Directive 2008/98/EC, this framework prioritises prevention and reuse as the most desirable options, while landfilling and energy recovery are considered the least favourable (Figure 4). The hierarchy underpins EU waste legislation, aiming both to minimise adverse environmental impacts and to enhance resource efficiency.

	PREVENTION	Measures implemented before a substance, material, or product becomes waste, aimed at reducing the overall amount of waste, for example through product reuse or by extending the product's lifespan.
	PREPARING FOR RE-USE	Control recovery, cleaning, or repair operations.
	RECYCLING	Any recovery operation where by waste is reprocessed into products, materials, or substances, either for the original purpose or for other purposes.
	RECOVERY	Another operation whose main result is that the waste serves a useful purpose by replacing other materials that would otherwise have been used to fulfil a certain function, or that the waste is prepared to fulfil that function, in the installation or in the economics of the process.
	DISPOSAL	Any operation which is not recovery, even where the operation has as a secondary consequence the reclamation of substances or energy (e.g. landfilling, incineration).

Figure 4 - Explanation of the various steps of waste hierarchy

Textile Waste Terminology

According to Regulation (EU) No 1007/2011, a textile product is defined as any raw, semi-processed, or manufactured product composed of at least 80% textile fibres. However, terminology relating to textile waste and recycling is not standardised across stakeholders. The JRC's Techno-scientific Assessment of the Management Options for Used and Waste Textiles in the European Union emphasises the importance of harmonised definitions for fibres, yarns, fabrics, finished goods, and various waste fractions. In this context, textile waste is commonly categorised into three main types: post-industrial, pre-consumer, and post-consumer (Figure 5).



POSTAL-INDUSTRIAL

Waste generated during manufacturing of textile products and their precursors.



PRE-CONSUMER

Waste generated at retail stages.



POST-CONSUMER

Textiles that have been disposed after consumption and use by citizen or end-users of commercial and industrial activities.

Figure 5 - Waste categories by European Environment Agency, 2023

The Mass Flow Analysis, show the fibre, yarns, fabrics and finished quantity along the textiles value chain, as well as pre- and post-consumer waste (Figure 6). The analysis considers textile imports and exports, as well as estimated flows of waste undergoing separate collection, sorting, reuse, recycling, landfilling, and energy recovery. This helps to identify priority areas for improvement within the textile waste management system.

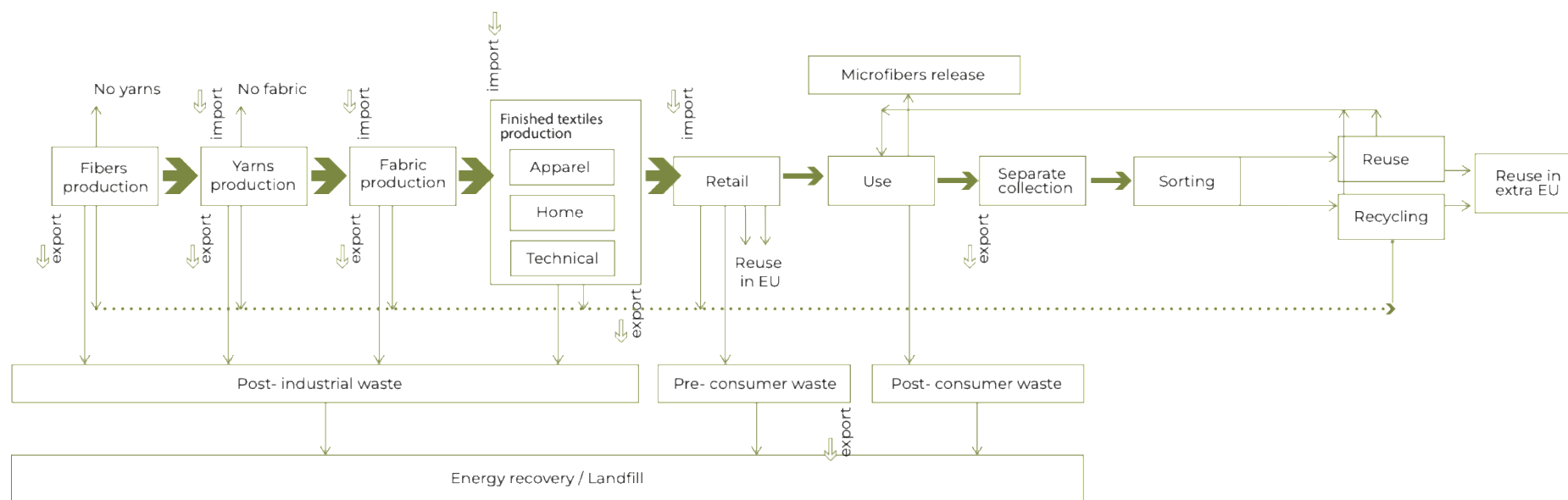


Figure 6 - System boundaries considered in the Mass Flow Analysis of EU textiles (doi:10.2760/6292)

Textile Waste Composition

Post-consumer textile waste is approximately 82% originated from households, mainly clothing and home textiles, while the remainder comes from manufacturing or unsold stock. The composition of post-consumer waste shows, in Figure 7, that:

- 48% is apparel (dominated by jackets, coats, sweaters, pants, and T-shirts);
- 36% is technical textiles;
- 16% is home textiles and carpets.

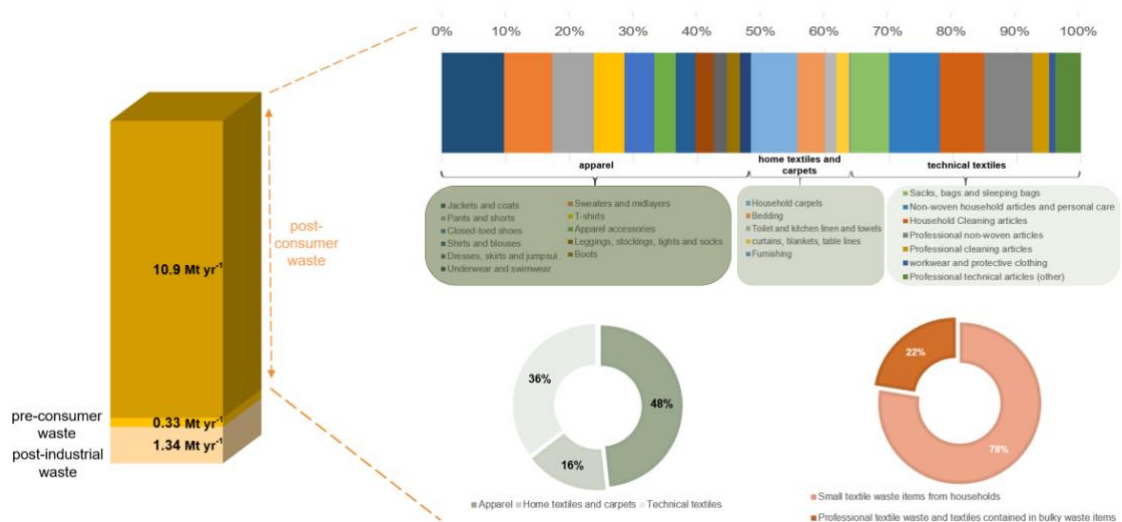


Figure 7 - Overview of the textile waste composition in terms of material categories, with a particular focus on post-consumer waste (10.9 Mt yr⁻¹) (doi:10.2760/6292)

Regarding fibre content (Figure 8), about 70% of post-consumer textiles are made from cotton (34%), polyester (29%), and polyamide (7%). Non-textile elements (e.g., leather, metals from zippers) account for roughly 11% of total waste mass. Cotton and other natural fibres are especially concentrated in clothing compared to home or technical textiles.

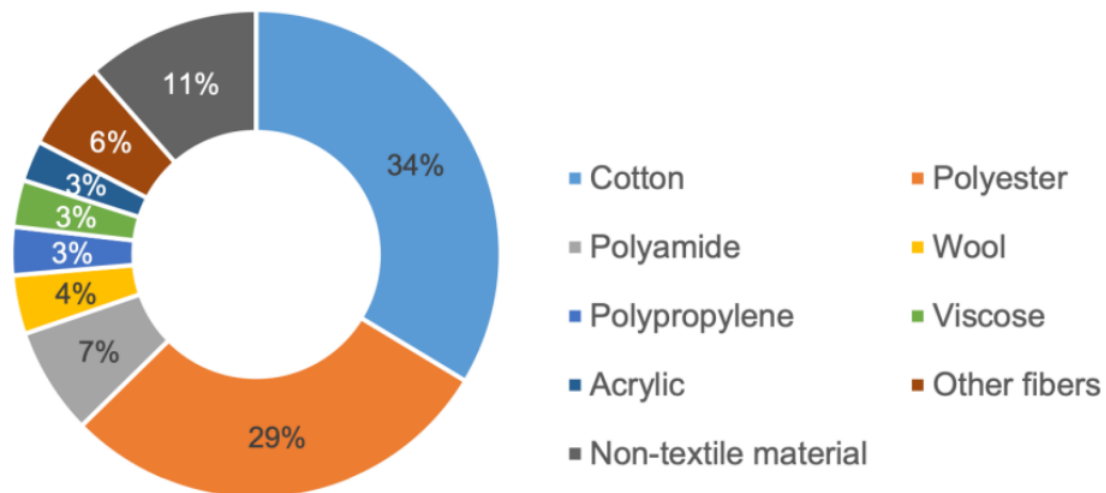


Figure 8 - Fibers contained in the post-consumer textile waste fraction (doi:10.2760/6292)

Extended Producer Responsibility

Extended Producer Responsibility (EPR) makes producers and importers accountable for the entire life cycle of a product, including its waste phase (Figure 9). Similar regulations already exist in several EU countries, and EPR legislation will become mandatory across the EU from 2025.

In 2023, a new amendment was introduced focusing on textile waste, proposing a mandatory and harmonised Extended Producer Responsibility (EPR) scheme that would make producers accountable for the entire life cycle of their products. Under this framework, manufacturers would incur financial obligations determined by the recyclability and environmental impact of their textile items, a concept referred to as “eco-modulation”.

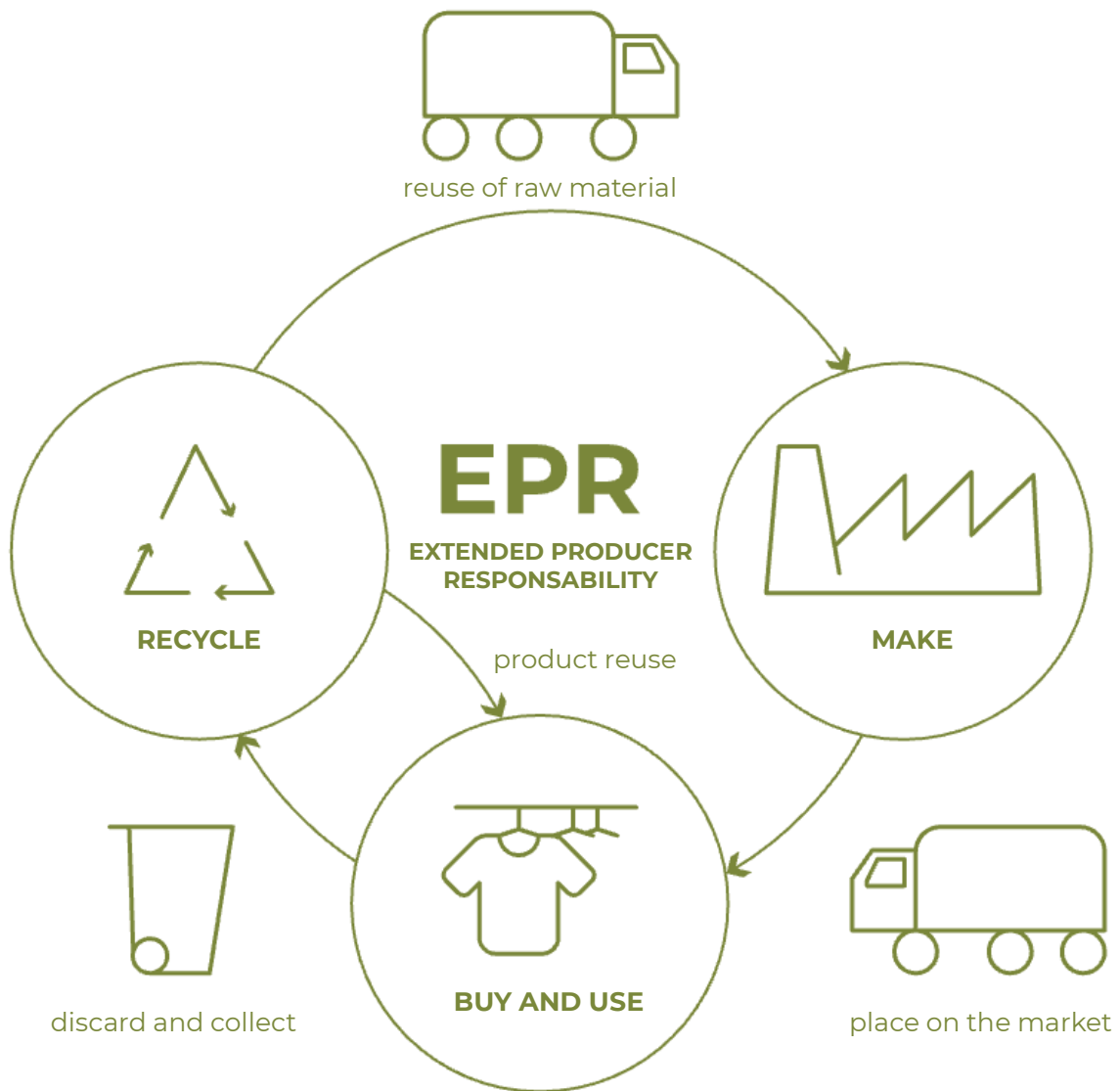


Figure 9 - Scheme how it is possible reuse and repair practices

EPR schemes must promote the adoption of reuse and repair practices, which are recognized as more environmentally sustainable than recycling and offer socio-economic benefits.

Waste Management Strategies

Building on the scale and composition of textile waste discussed in the previous chapter, the next step is to understand how this waste is managed. Waste management strategies form the foundation of a circular textile system, determining whether textiles are reused, recycled, incinerated, or landfilled. In Europe, two key processes shape these outcomes: separate collection and sorting.

Currently, collection rates remain low and vary significantly across Member States, while sorting systems face challenges in both efficiency and accuracy. The Waste Framework Directive (Directive 2008/98/EC) requires that, from 2025, all EU Member States implement separate collection systems for textiles, making improvements in both collection and sorting an urgent priority. Strengthening these processes is essential to capture textiles before they enter mixed municipal waste streams, extend their lifespan through reuse, and provide clean feedstock for recycling technologies.

Separate Collection

Textile waste currently collected in Europe is predominantly deposited in street containers. Member States have different schemes for the target textile materials for separate collection.

PICK UP SCHEMES

Door to door and kerbside collection.

Disadvantages:

Kerbside collection is significantly less prevalent in part due to higher costs but also due to risk of theft.

DROP-OFF SCHEMES

Road and underground containers placed on public areas, where households or businesses can deliver waste. Retailers can also set up take back systems for citizens dispose their used textiles.

Disadvantages:

Bring points present a higher contamination risk compared to indoor collection. E.g.mold

The average capture rate for textile waste in Europe is only 12%, indicating that the remainder ends up in mixed municipal waste and is consequently landfilled or incinerated. These figures highlight considerable potential for improving separate collection systems for textiles. Luxembourg and Belgium lead with the highest separate collection rates at 50%, followed by the Netherlands (37%) and Austria (30%) (Figure 10). These countries demonstrate a variety of collection systems adapted to different levels of urbanisation.

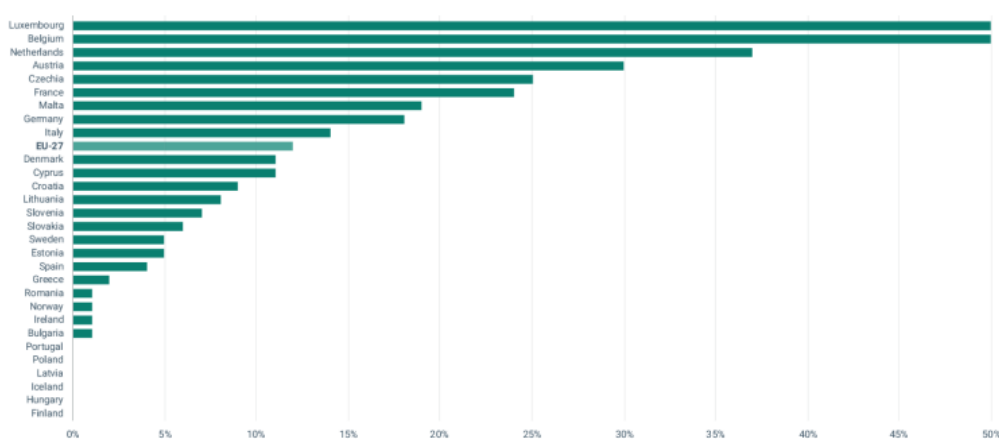


Figure 10 - Overview of the capture rates for textiles and shoes per country, 2020 (European Environment Agency "Management of used and waste textiles in Europe's circular economy")

With the implementation of EU regulation on separate textile waste collection by 2025, the collection rates for textiles from households are expected to increase.

The optimization of collection systems to enable both high capture rates and good conditions for reuse is under discussion. E.g., better pre-sorting by residents to distinguish between reusable and non-reusable textiles.

Sorting

The sorting of post-consumer-textiles is a critical process for assessing its re-use potential and recycling potential (Figure 11).

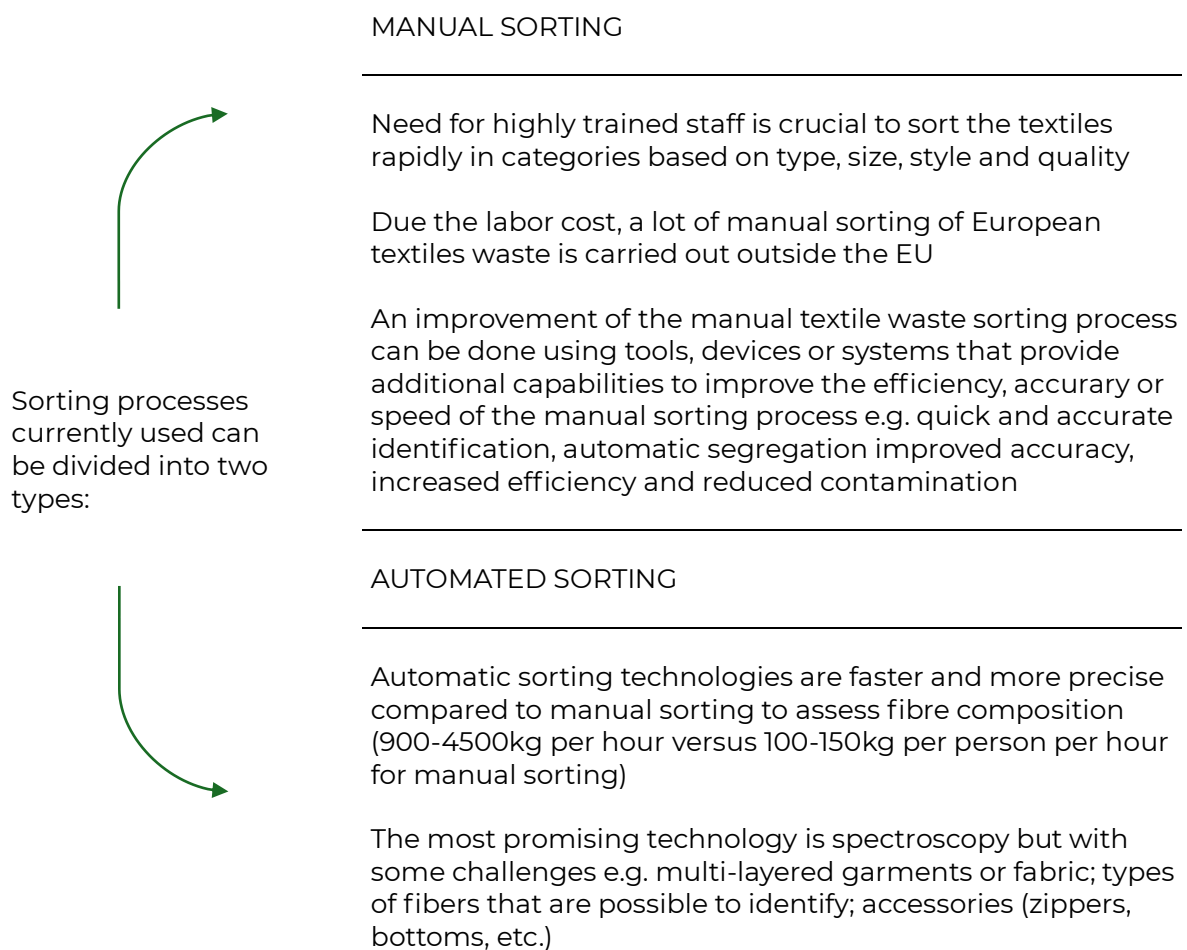


Figure 11 - Two types of sorting processes

Recycling Technologies

Recycling, as defined by the Waste Framework Directive, refers to any recovery operation by which waste materials are reprocessed into products, materials, or substances, whether for their original or other purposes.

Of the 100 billion garments produced each year, 73% end up incinerated or in landfills as textile waste, while only 1% are recycled. According to the Ellen MacArthur Foundation, the equivalent of one garbage truck of textiles is landfilled or incinerated every second.

Textile recycling is essential to reduce waste, circulate materials, and allow natural resources to regenerate. There are two main recycling pathways: mechanical and chemical recycling (Figure 12). Moving forward, both approaches must coexist, each suited to different textile types, in order to maximise overall circularity through tailored application.

Mechanical Recycling

Mechanical recycling is a well-established and widely used process for transforming textiles into e.g. new yarns. It involves physical processing techniques, such as shredding textiles into smaller pieces, to recycle both pre- and post-consumer textiles into recycled yarns, which can then re-enter the fashion supply chain.

Another technology, thermomechanical recycling, involves melting synthetic fibres to produce granules that are subsequently used to spin new fibres. This re-melting process has strict requirements, as it cannot tolerate contamination from surface treatments, dust, or dirt.

Chemical Recycling

Chemical recycling can be closed-loop, where the material is recycled into an identical product, as is the case for pure polyester (PET) and nylon-6. Alternatively, it can be open-loop, where the material is recycled into a different type of product. For example, cotton can be chemically recycled into cellulose pulp, which can then be regenerated into new cellulose-based fibres such as viscose, lyocell, or other forms of rayon. In addition to chemical recycling for pure polyester and cellulose garments, it is important to develop solutions for other textiles. A large proportion of garments are made from blended fibres, combining two or more fibre types. There is currently a strong industry push to foster innovation in chemical recycling to address the challenge of blended, post-consumer textile waste. Upcoming legislation is expected to further accelerate and support these efforts.

MECHANICAL RECYCLING x CHEMICAL RECYCLING

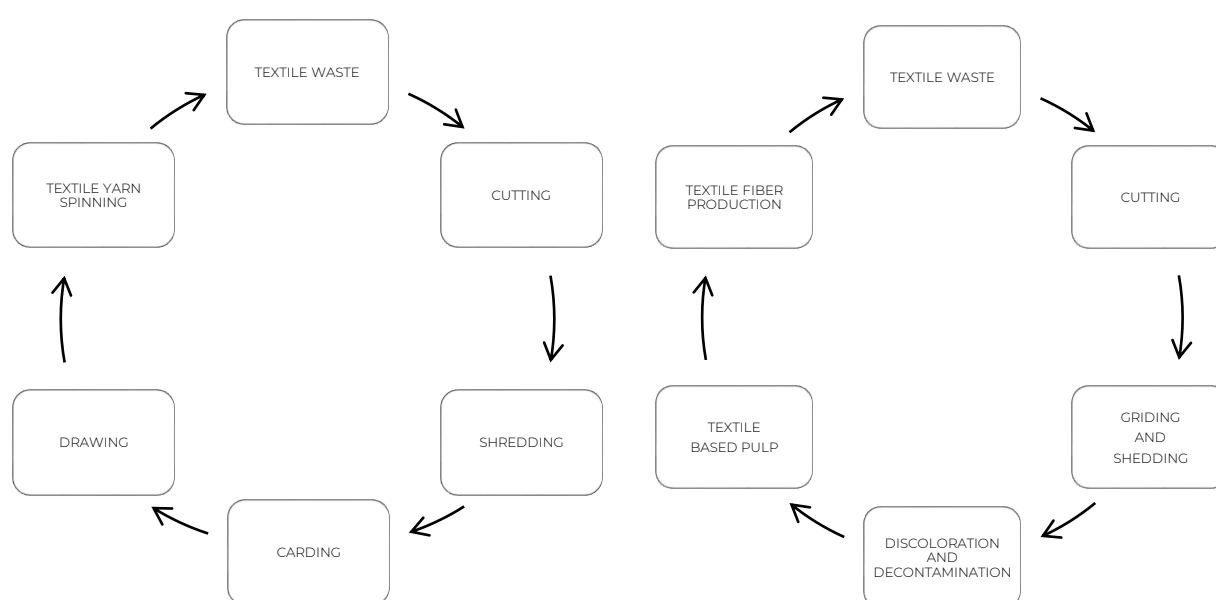


Figure 12 - Mechanical and chemical recycling

Textile Sorting and Recycling Database

WRAP is a global environmental NGO working to transform broken product and food systems and promote circular living for the benefit of climate, nature, and people. As part of its work, WRAP has developed one of the most comprehensive open-source databases mapping over 200 textile sorters, pre-processors, recyclers, and yarn spinners (who work with recycled fibres) operating across the UK and Europe (Figure 13).

Organisation	Website	Region	Country	Main Facility Address	Secondary Facility	Core
1 All - Tex Recyclers Ltd	www.alltexrecyclers.com	Europe UK	United Kingdom Ireland	1 Ballycreagh Road, Clo...		Core
2 Antur Waunfawrj Warws ...	https://www.anturwaunfa...	UK	United Kingdom	Bryn Pistyll, Waunfawr, C...		Cha
3 ARETEX	https://aretex.cz/cs	Europe	Czech Republic	Husova 319, Velká Ves, 5...		Asia
4 Around Systems	www.around.systems	Europe	Norway Netherlands	Kjapmannsgata 37 7011 T...		Core
5 Atelier Riforma	https://atelier-riforma.it/	Europe	Italy	Turin, Italy		Core
6 Baliz Textilerecycling GmbH...	www.baliztextilien.de	Europe	Germany	Ottostr. 14 (Elbboden) 65...		Core
Bank & Vogue	https://www.bankvogue.c...	Europe UK	Germany Spain Italy	1195 Michael St N, Glouc...		Sec
8 BIR (Bureau of Internation...	https://www.bir.org/	Europe	Belgium	24 Avenue Franklin Roose...		Ass
9 Boer Group (Marbo, Gebro.)	https://boergroup.eu/	Europe	Belgium Netherlands	Evadam N.V., Graankaai 1...		Core
10 British Heart Foundation	https://www.bhf.org.uk/	UK	United Kingdom	Greater London House, 1...		Cha
11 Burgenländischer Müllver...	https://www.bmv.at/home...	Europe	Austria			Ass
12 Cannonesri	www.cannonesri.it	Europe	Italy	Via Ospedaletto, 331 761...		Core
13 Cash for Clothes (East An...	https://www.cashforcloth...	UK	United Kingdom	Unit 5, Northey House, O...		Core
14 Choose 2 reuse CIC	https://www.choose2reus...	UK	United Kingdom	Unit 1.2-1.3, South Avenu...		Cha
15 Chris Carey Collections	https://www.chriscareyco...	UK Europe	United Kingdom	Raymond House, Cricket ...		Core
16 CIBUTEX	www.cibutex.eco	Europe	Austria Belgium Cze	Amsterdam		Core
17 Circle-8 Textile Ecosyste...	https://circle8ecosystems...	UK	United Kingdom	142 Station Road, Chingf...		Core
18 Circularis Group Limited	www.circularis.io	UK	United Kingdom	California Dr, Castleford ...		Ass
19 CIRFS - European Man-M...	https://www.cirfs.org/	Europe	Belgium			Ass
20 Climtex	https://climtex.nl/	Europe	Netherlands	Loodstraat 57, 2718RV Zo...		Cha
21 COFIL MANUFACTURA SL	www.recyclingfibers.com	Europe UK	Austria Belgium Bulg	Carrer dolors n 3. 17800 ...		Core
22 Coleo	https://coleo.es	Europe	Spain Finland France	C/ Alcalde Josep Abril 33...		Core
23 Cookstown Recycling	https://cookstowntextiler...	UK Europe	Ireland	36 Magheralane Road, Ra...		Core

Figure 13 - Database page example (<https://airtable.com/>)

Case Studies and Best Practices

The objective of this section is to give each region the opportunity to present case studies and best practices that align with their specific objectives and requirements. By sharing these examples, trainers can demonstrate the practical application of the information presented.

RDD Textiles

RDD – Research, Design & Development – is the “laboratorial company” of the Portuguese textile group Valérius, providing integrated innovative solutions from concept and design to final products, including high-end jersey fabrics, knits, and apparel for global fashion brands.

RDD Textiles, part of the Valérius Group, has established itself as a leader in integrating design, production, and recycling within a closed-loop system. By addressing post-industrial, pre-consumer, and post-consumer waste streams, the company demonstrates how industrial actors can move beyond regulatory compliance to actively support the EU's Circular Economy Action Plan and the Waste Framework Directive requirement for separate textile collection by 2025.

RDD developed the threesixty™ platform, structuring textile circularity into three pathways: Waste No More (mechanical recycling of production scraps), Wear Again (upcycling and reuse of unsold items), and No End of Life (take-back and recycling of post-consumer garments). These initiatives are supported by Valérius 360, a recycling unit with certified processes (GRS, RCS, OCS, FSC) and a capacity to produce approximately six tonnes of recycled yarn per day.

Best practices include segregating waste streams to preserve material quality, designing mono-material fabrics to facilitate recyclability, and conducting independent life cycle assessments (LCAs) to monitor performance. Strategic partnerships, such as with Sântis Textiles (RCO100™), further strengthen the model by ensuring access to high-quality recycled fibres.

RDD's achievements demonstrate how companies can align their business models with EU sustainability objectives while delivering economic, environmental, and social benefits. The table below highlights the company's key achievements and best practices, providing a replicable model for textile waste management across Europe.

Website: <https://rddtextiles.pt/>

KEY ACHIEVEMENTS	BEST PRACTICES
Launched “threesixty™” circular platform (Waste No More, Wear Again, No End of Life)	Segregation of waste streams (post-industrial, pre-consumer, post-consumer) to preserve quality and maximize recycling yield.
On-site mechanical recycling of cutting scraps into new yarns and recycled jersey fabrics (“Waste No More”)	Vertical integration with recycling facilities to close the loop before waste leaves the factory.
Post-consumer garment recycling into new yarns, fabrics, and garments (“No End of Life”)	Design for circularity: prioritizing mono-material knits and fibre-friendly construction to facilitate recycling.
Group-level circular infrastructure (Valérius 360) with ~6 t/day recycling capacity	Proximity of collection, recycling, spinning, knitting, and finishing to minimize transport and ensure traceability.
Certified circular value chain (GRS, RCS, OCS, FSC)	Raw material governance through independent certification to substantiate claims and maintain chain-of-custody
€25 million group investment into EU recycling unit	Strategic capital allocation to build infrastructure that enables scaling of pre-/post-consumer waste recycling.
Partnership with Säntis Textiles to integrate 100% recycled cotton (RCO100™)	Open collaboration with technology and material innovators to expand recycled content streams.
Independent LCA study modeling Valérius Group recycling processes	Data-driven approach: using life cycle assessment to identify hotspots and guide continuous improvement.
Collaboration in regional and EU projects (e.g. be@t – bioeconomy at textiles)	Ecosystem engagement: partnering with research centres, municipalities, and industry associations to scale awareness and solutions.

Conclusions

The handbook's central conclusions and essential points can be summarised as:

- Textile waste generation and composition: On average, 16 kg of textile waste is generated per person, of which 82% is post-consumer waste (clothing or household textiles). Textile waste consists of various fractions, each with potential for reuse and recycling. The main fibre in 70% of the waste is cotton (34%), followed by polyester (29%).
- Waste reduction and prevention strategies: Manufacturers will have financial obligations determined by the recyclability and environmental impact of their textile items, a concept known as “eco-modulation.”
- Recycling and upcycling technologies: Textile recycling is essential to reduce waste, circulate materials, and allow natural resources to regenerate. Two main recycling methods exist: mechanical and chemical.
- Extended Producer Responsibility (EPR) and product stewardship programmes: EPR holds producers and importers accountable for the entire life cycle of a product, including its waste phase. Defined targets include recycling or reusing 50% of textiles released on the Dutch market by 2025, increasing to 75% by 2030.
- Circular waste management systems: WRAP, a climate action NGO, has developed one of the most comprehensive open-source databases, mapping over 200 textile sorters, pre-processors, recyclers, and yarn spinners (working with recycled fibres) across the UK and Europe.



PreVEnting and ReDucing the tExtiles waste mountain in the MED area

Project overview

The VERDEinMED project is an initiative funded by the Interreg Euro-MED programme to promote the circular economy in the textile sector. VERDEinMED is a thematic project that will provide a support service to boost circularity in the textile value chain for businesses, consumers, policy makers and academia.

The project is part of the Innovative Sustainable Economy mission of the Euro-MED programme, which seeks cooperation between Mediterranean countries to promote smarter and greener business models. VERDEinMED project brings together 10 partners and 15 associated entities from Greece, Spain, Portugal, Italy, Slovenia, North Macedonia, Bulgaria, Tunisia, Turkey, Belgium and Lebanon



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Chrysovalantis Ketikidis, Centre for Research and Technology-Hellas, Greece

Consortium

-CERTH – The Centre for Research & Technology, Hellas
-Bulgarian Fashion Association
-CITEVE
-Confindustria
-Consorci de la Ribera
-Corporación Tecnológica de Andalucá.

About us. WRAP. <https://www.wrap.ngo/about-us>

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