

PESCO   UP

Digital product passports: The golden thread through textile recycling?

POLICY BRIEF



The ambition of PESCO-UP is to transform the textile recycling industry by creating new raw materials from mixed wastes. It addresses the circularity across the textile recycling value chain, and reduces the industry dependency on virgin materials.

As the objective is to ensure the full circularity of the outcomes and encourage collaboration between industry stakeholders, technologies tested during the PESCO-UP project cover all the textile recycling processes throughout the value chain.

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This policy brief was written by PESCO-UP partners:

Patricia Urban, CEPS
Vasileios Rizos, CEPS
Marika Moreschi, CEPS

and reviewed by PESCO-UP partners:

Carla Fité Galan, Reverse Resources
Traci Kinden, TEXroad
Hannu Tanner, VTT



This policy brief was also reviewed by ECOSYSTEX fellow member projects partners:

Catrine Marchall, RISE, from CISUTAC
Jan Merckx, GS1, from CIRPASS2 and SAGE

The PESCO-UP project is at the forefront of addressing the urgent challenge of recycling mixed textile waste, focusing on developing sustainable and innovative recycling solutions for polyester and cotton fibres. The acronym PESCO-UP is a direct reference to these textile blends, and "PES/CO" is used throughout this document when describing them. PESCO-UP's long-term objective is to identify the most technically, economically, and environmentally feasible recycling routes. In addition to integrating novel recycling technologies into cohesive and circular industrial processes, PESCO-UP will develop digital data sharing tools to enhance the effectiveness of processes in the recycling value chain.

Transitioning to circular textile value chains, where materials are reused, repaired and recycled, depends on reliable, high-quality data. More detailed information on environmental and social impacts would help improve conditions along supply chains. More specifically, textiles sorting and recycling could greatly benefit from information on fibre composition and chemicals, for example.

This information could be provided by implementing traceability and transparency tools like the upcoming EU Digital Product Passport (DPP). In theory, traceability allows stakeholders to track products and materials across complex global supply chains, while transparency ensures that information on composition, supply chain processes and end-of-life pathways is accessible to all relevant actors.

Anticipating the forthcoming DPP requirements, industry and research initiatives, such as PESCO-UP's digital material passport and digital marketplace, demonstrate how traceability tools can function in practice. Stakeholder interviews reveal significant potential benefits: better sorting and recycling, enhanced supply chain visibility, improved sustainability reporting, and more informed consumer choices. Yet major barriers remain, including low digitisation among companies, technological limitations, data gaps, confidentiality concerns, inconsistent policy requirements, a lack of harmonised data standards, and financial burdens.

To enable effective implementation for textile recycling, policymakers should (1) define clear, prioritised data requirements; (2) support consumer-facing communication to build demand for recycled textiles; and (3) strengthen the interoperability of data systems, reporting frameworks, and policies.



Why we need (good) data for circular textiles

The textile industry is a crucial pillar of the European economy, with a turnover of EUR 170 billion and 1.3 million employees across 197,000 [companies](#). While many operations are outsourced to countries with lower wages and laxer regulations, the EU remains a [major producer](#) of intermediate products such as fibres and fabrics, and is the second largest textiles exporter in the world. Yet it largely operates on a linear model, relying heavily on virgin materials, which results in major [environmental and social impacts](#). Around 73 % of post-consumer textiles in the EU are still [landfilled or incinerated](#). Shifting to circular value chains, where materials are reused, repaired and recycled, is thus critical for reducing waste, resource use and emissions.

Circularity depends on access to reliable product data from different lifecycle stages. Here, two concepts are critical – traceability and transparency. Traceability enables [tracking materials and processes](#) throughout the supply chain, while transparency ensures that key information is [available to the relevant stakeholders](#), including consumers. Together, they underpin accountability and enable circular business models (CBMs) by providing detailed insights into product and fibre origin, composition and [lifecycle processes](#). Data sharing enhances coordination among supply chain actors, supporting reuse, repair and [recycling](#).

EU policies increasingly acknowledge the importance of data sharing across stakeholders to facilitate circular practices. The Circular Economy Action Plans ([2015](#), [2020](#)) emphasised the need for digital technologies and data-driven approaches to circularity and the upcoming [Circular Economy Act](#) is expected to further strengthen this principle. To tackle the sustainability challenges of the textiles sector, the European Commission adopted the [EU Strategy for Sustainable and Circular Textiles](#) in 2022, aiming to ensure that all textile products on the EU market are durable, repairable and recyclable by 2030. Textiles are a priority sector of the [Ecodesign for Sustainable Products Regulation](#) (ESPR), which introduces the Digital Product Passport (DPP) to promote transparency and circularity through [data-driven approaches](#).

What the DPP could do, theoretically

The DPP is a digital profile holding relevant ecodesign information, accessible via a data carrier (e.g. a QR code or RFID tag). This information could cover products' materials, chemical content, carbon footprint, repairability and [recyclability](#). By making certain data available to the relevant actors, the DPP could support textile circularity on two levels: (1) enabling more informed consumer choices, shifting consumption patterns in the long run, and (2) promoting the circularity and sustainability of supply chain processes.

Embedded in the ESPR framework, the DPP will be implemented in the textile sector over the coming years. An ESPR Delegated Act for textiles is currently expected by 2027, clarifying which data must be provided by the DPP, how it should be formatted and what the responsibilities of the different stakeholders involved will be. Rules will likely be implemented gradually (as is the case for the [digital battery passport](#)).

The European Parliamentary Research Service recommended a phased rollout from a simplified version (in 2027) to a comprehensive 'full circular DPP' [by around 2033](#). By the final phase, it is envisaged that all textile products placed on the EU market – including recycled ones – will carry a comprehensive set of detailed information, extending traceability to use and end-of-life. For instance, the passport would be updated to reflect product changes that might occur during repairs or cleaning treatments, so that recyclers are aware of the product's actual end-of-life material composition. The DPP could also help recyclers scale up their CBMs and support the development of more (cost-) effective recycling methods.

While not enshrined in EU law, the Digital Material Passport (DMP) is also relevant for textile circularity. Compared to the DPP, the DMP focuses specifically on materials rather than entire products, and only targets value chain actors rather than including consumers. This is particularly important for textile recycling, where traceability tools must address data needs such as fabric construction, fibre composition and the presence of contaminants alongside chain of custody data.

While part of the broader DPP ecosystem, DMPs specifically target material-level data to support sorting, feedstock preparation and waste recycling. The DMP concept is not new, as it has already been applied in sectors such as steel and the built environment, though often labelled as DPP for simplification purposes. When transitioning to a circular economy, integration between DMPs and DPPs will become increasingly important to ensure smooth [data flows along the entire product lifecycle](#).



Traceability and transparency in practice

Historically, tracking textile items has focused on [guaranteeing product authenticity](#), particularly in the luxury clothing sector. More recently, traceability and transparency initiatives have been launched to start preparing for the upcoming DPP requirements.

Several private actors offer digital tools for textile companies interested in improving product traceability. For instance, [TextileGenesis](#) is a traceability platform managed by LECTRA, which certifies product authenticity as well as the use of sustainable and recycled fibres. [Reverse Resources](#) provides a software-as-a-service tool that maps textile waste flows from source to recycling, with the goal of fostering a data-driven textile recycling value chain. Some traceability solutions already on the market specifically focus on providing DPPs or related tools for textile companies, such as [circular.fashion's circularity.ID](#), or DPPs developed by [Portia](#), or in the EU-funded [CIRPASS-2](#) project. CIRPASS also provided a list of [existing DPP providers](#) in various sectoral applications.

Different initiatives have been launched through projects funded by the European Commission. EU-funded projects focusing on sustainability and circularity in the textile sectors are coordinated under the [ECOSYSTEX](#) collaborative platform, facilitated by [Textile ETP](#). Among ECOSYSTEX members, notable examples include the [TRICK](#) project, which has developed a standardised platform for data collection based on blockchain technology, and [tExtended](#), which is working to build decentralised digital data collection solutions to support recycling.

Another ECOSYSTEX member, [PESCO-UP](#), is an EU-funded project that is developing new solutions for the recycling of polyester–cotton (PES/CO) blends. These make up a large share of textile waste but are difficult to sort and recycle because they combine synthetic and natural fibres. The project's goal is to create sustainable and economically viable upcycling processes for such textile blends, supporting the textile sector's transition towards circularity. The PESCO-UP consortium includes various stakeholders involved in textile recycling, ranging from raw material providers to tech companies working on fibre sorting, purification, separation and recycling, as well as research institutes and universities.

A crucial project output is the development of a digital infrastructure, including a DMP structure and an accompanying digital marketplace for textile waste and recycled fibres. Project partners VTT, Reverse Resources and TEXroad are leading the design of these digital tools. The PESCO-UP DMP is gathering detailed material information relevant to the

different stakeholders and processes involved in textile recycling. For example, sorters of post-consumer textiles need to know about recyclers' feedstock needs to adjust their sorting lines accordingly. Textile recyclers require information on composition and the chemicals used during manufacturing, as some types of dyes and contaminants such as flame retardants can hamper pretreatment processes. Yarn spinners need to know fibres' length and strength when purchasing recycled materials. Each piece of information constitutes a potential data point in the DMP. The more data is collected and shared, the [more streamlined](#) textile recycling can be.

All this information is shared in a digital commodity marketplace that establishes a direct trading connection between recyclers and sorters or pretreatment actors. Within the marketplace, recyclers can communicate their feedstock specifications to sorters, while sorters can make their demand visible to recyclers. This facilitates bilateral trade where both parties can post offers, request materials or negotiate terms. In this way, data sharing tools are used to address the issue of unmatching supply and demand for textile waste feedstock.

Data contained in the DMP is designed to feed into the upcoming EU DPP for textiles. For instance, DMP data for recycling feedstocks provide evidence for recycled content information that is included on DPPs. The DMP could also provide data to support impact assessments, enabling fashion brands to satisfy their own DPP-related obligations. To ensure complete interoperability, the DMP data structure applicable to the recycling value chain must be mapped to the commonly used data structures used in the broader textile sector. This means that the data model and PESCO-UP-proposed [format is compatible](#) with most systems currently used by the industry, as well as the expected requirements for the textile DPP and the European Commission's Common European Data Spaces initiative.

To understand what opportunities and challenges the textile industry sees in implementing the DMP/DPP in textile recycling value chains, we interviewed 20 companies from across the value chain. These included PESCO-UP project partners as well as external companies.

But what can traceability and transparency do for us?

There are many benefits to implementing such approaches in the textiles sector. Transparency and traceability are crucial for [shifting towards circular textile value chains](#) for different reasons, as pointed out during the interviews:

Technology

Many companies agreed that implementing a DPP (or DMP for that matter) can significantly support sorting, repair and recycling processes. Information on fibre composition and chemicals used for dyeing, coating and chemical finishes is needed for [improving recycling processes](#). The DPP could also help improve sorting efficiencies, for example by reducing misclassifications of textile waste or by automatic sorting processes. This could build on existing technologies, like RFID tags, to maximise feasibility and cost-effectiveness.

Supply chain

Enhancing traceability and transparency can help identify [environmental and social hotspots](#) along the supply chain. If endorsed by the DPP, this could result in more accurate and credible quality assessments of textile products and product prices that reflect their [true social and environmental impacts](#). For instance, it could help with [identifying human rights violations](#) and poor working conditions, especially in the upstream sections of textile value chains. DPP implementation can also improve companies' [understanding of the supply chain](#), allowing for better decision-making on sourcing raw materials, resource consumption and selecting suppliers. This could ultimately support better supply chain collaboration needed for data sharing..

Data

By setting requirements for data collection and sharing, the DPP could address persisting data gaps and improve data quality and general availability. Because data collection and sharing are currently done in a range of different formats and using various systems, a harmonised DPP structure for collecting, aggregating and sharing information would also significantly improve the interoperability of data and systems. This would however depend on how brands or retailers translate DPP requirements into practice as a part of their supplier relationships.

Consumers

Consumers can also benefit, as scanning a QR code on a garment could provide information on its energy and water consumption, expected lifespan, repairability and recyclability. This might lead to more awareness of consumption-related impacts and more ethical purchasing choices, potentially increasing demand for recycled yarns and fabrics..

Policy

DPP-related policy requirements could become an enabler for circularity and the textiles sector. Policy incentivises traceability and helps create demand for recycled textiles. Potentially, it could create synergies between different circularity and sustainability reporting policies – but only if policy requirements are streamlined.

Financial and economic factors

Traceability, especially if explicitly enforced in the upcoming DPP requirements, fosters reverse logistic operations, take-back schemes and offers novel [business opportunities](#) if extended to the use phase. [Data on consumer behaviour](#) could be collected when repairing or reselling textiles, which might enable more demand-driven processes. A few companies noted that DPP implementation could lead to cost savings in the long run.

Company organisation

It was also mentioned that the DPP could be used as a simplification tool for administrative processes and might encourage a shift to more sustainable and circular mindsets in companies and supply chains. Monitoring production processes also helps fashion brands in performing sustainability reporting by [providing more accurate data](#) to support their claims – which could ultimately improve their [reputation](#).



Why it might be difficult to get there

Nevertheless, according to our interviewees, it might not be easy to realise these potential benefits, as the textile industry is still [lagging](#) on data transparency and traceability. These are the core concerns that the interviewed stakeholders expressed:

Technology

In practice, certain activities connected to the DPP might be difficult to implement, particularly those related to (automated) data collection. The current lack of digitisation in the textile industry is a major barrier. Many players in the industry are SMEs, for whom it can be challenging and even nonsensical to digitise certain processes, as manual work may actually be more cost-effective in some cases. There can also be instances where such manual processes offer important work opportunities for local communities.

Beyond SMEs, many companies in the value chain lack digital readiness because of a lack of suitable IT systems, data collection schemes and related skills. Large-scale DPP systems, which automatically collect and aggregate large amounts of dynamic upstream data, can be practically difficult to implement and operate. A further technological challenge is ensuring traceability in the recycling process. Some companies argued that they will need to rely on mass balance because materials may be mixed or shredded in the recycling process.

Other issues may arise with traceability tools. Because consumers might cut off labels and RFID tags, some interviewees were concerned that DPPs may face challenges with post-consumer textile waste. Moreover, different data carriers have different drawbacks and may [not be suitable for every purpose](#) (e.g. end-of-life processes) and stakeholder (e.g. value chain actors versus consumers).

Physical tracers, which could be used as an additional measure to support the DPP, [vary in effectiveness](#) depending on fibre type. Digital solutions face challenges, too – while [Blockchain](#) technologies are valued for their decentralised and secure data sharing, they also face issues with energy intensity, transaction costs and [scalability](#). Artificial Intelligence

could streamline data collection across supply chains, but its widespread adoption is limited due to [costs and skill shortages](#).

Supply chain

The complexity of textile supply chains can be a major barrier to obtaining and verifying all the relevant data for the DPP. From sourcing to recycling, the value chain consists of a global network of many different players carrying out the different steps. Sub-contracting and sourcing from different suppliers contribute to making supply chain relationships opaque and difficult to track. Cultural differences and language barriers also play a role in hindering information sharing.

Confidentiality concerns and a low willingness to share data are another key issue. Many companies [hesitate to disclose supply chain details](#) for fear of revealing intellectual property, which could lead to a competitive disadvantage. Although disclosure practices are improving, reporting on processing sites and supply chain relationships [remains limited](#).

Data

Key [data gaps persist](#) on material origin and composition, user phase information and End-of-Life (EoL) practices, which may hinder the scaling up of textile recycling. Environmental reporting often [misses key impact hotspots](#), such as waste generation and water use, focusing instead on direct emissions. Even if data are available, they are often not easily accessible.

Particularly in post-consumer value chains, there is not only a lack of data but also a lack of consistency in what kind of information is processed – and how. Data and IT systems are often company-specific, designed to optimise internal processes rather than to enable cross-sector information sharing, which leads to interoperability issues. The data quality and accuracy do not often meet the input requirements for different actors like recyclers. While this might improve with implementing the upcoming DPP requirements, it could make for a difficult transition. Moreover, verifying the information's accuracy could prove to be challenging in practice, especially since manufacturing is largely done in third countries.

Consumers

Beyond improving circularity processes on the supply side, there is hope that the DPP could also increase consumer demand for recycled textiles. However, other interviewees report both a lack of consumer awareness of the environmental and social impacts of their textile consumption, and generally low demand for recycled fibres among consumers. Because of this, they questioned if the DPP is ideal for increasing consumer awareness and if it might be more helpful for business-to-business operations.

Policy

Three key barriers exist in the policy realm. First, there is a lot of uncertainty surrounding the upcoming DPP requirements, making it difficult for companies to prepare. This has resulted in some companies being sceptical about investing into textiles circularity, which could again lead to a lack of preparedness for implementing the DPP obligations once they are adopted. Second, a lack of [harmonised data standards](#) has hampered accurate reporting practices on material characteristics and environmental and social aspects. The absence of such standards also contributes to the lack of interoperability between the different data formats.

Third, this issue is exacerbated by inconsistencies between different policy and reporting requirements as well as regulatory complexity. [Mismatching data formats](#) between different reporting obligations and overlapping certification and disclosure schemes add confusion for both [companies and consumers](#). At the same time, it can be difficult for industry stakeholders – especially SMEs – to stay up to date on policy developments. This is complicated by the perception that EU policymaking is unpredictable.

Financial and economic factors

A major barrier to implementing traceability and transparency schemes is the cost factor. Many companies reported that the DPP would be both an administrative and a financial burden to them, at least in the short term. It implies regularly collecting data and keeping them updated, adopting an appropriate digital system, communicating with authorities and other tasks – and all this requires time and energy without seeing an immediate return on investment.

Company organisation

A lack of awareness among companies in the (traditional and circular) textile value chains can also pose a challenge to implementing the DPP/DMP. Clothing brands, for example, may prioritise cost-effective material performance rather than ecodesign or design for recycling. On the other hand, even if brands are aware of the need for ecodesign and data sharing, their suppliers may not be. This can exacerbate confidentiality concerns and unwillingness to share data. Such a lack of awareness is also connected to companies' mindsets (which may be difficult to change) and a lack of internal organisation for data collection and sharing.



What policymakers can do about it

To break down some of these barriers and enable the smoother implementation of traceability and transparency in the textile recycling sector, there are three concrete actions policymakers could undertake:

Clear data priorities for a gradual implementation of the DPP

Upcoming DPP requirements should provide clear priorities for mandatory data sharing at each stage of the phased DPP implementation to ensure effective uptake. Too many or overly complex data points could hinder effective implementation. Of course, data priorities depend on the desired outcome. If the aim is to facilitate textile sorting and recycling, there could be a hierarchy of required information included in the DPP/DMP that reflects how decisions are made in practice.

Fibre composition is the most important information for recyclers. Different recycling technologies can process different materials. For example, if a batch of material is identified as polyamide but the recycling technology cannot handle this specific feedstock, it makes little sense to assess additional information.

The second most relevant data point would concern **contaminants**. This refers to the chemistry of coatings, additives, dyes, finishings, etc. Based on these, recyclers can assess recyclability and adjust their approach accordingly. To enable safe recycling processes and determine how recycled fibres will be used in the future, information on substances of concern would also be relevant.

Finally, **chain of custody information** on material origin and supply chain actors would complement data on what may be called the **format and physical properties** of the material – like whether it is post-consumer or post-industrial material, the size, shape, etc. – to facilitate material handling, logistics and certification schemes.

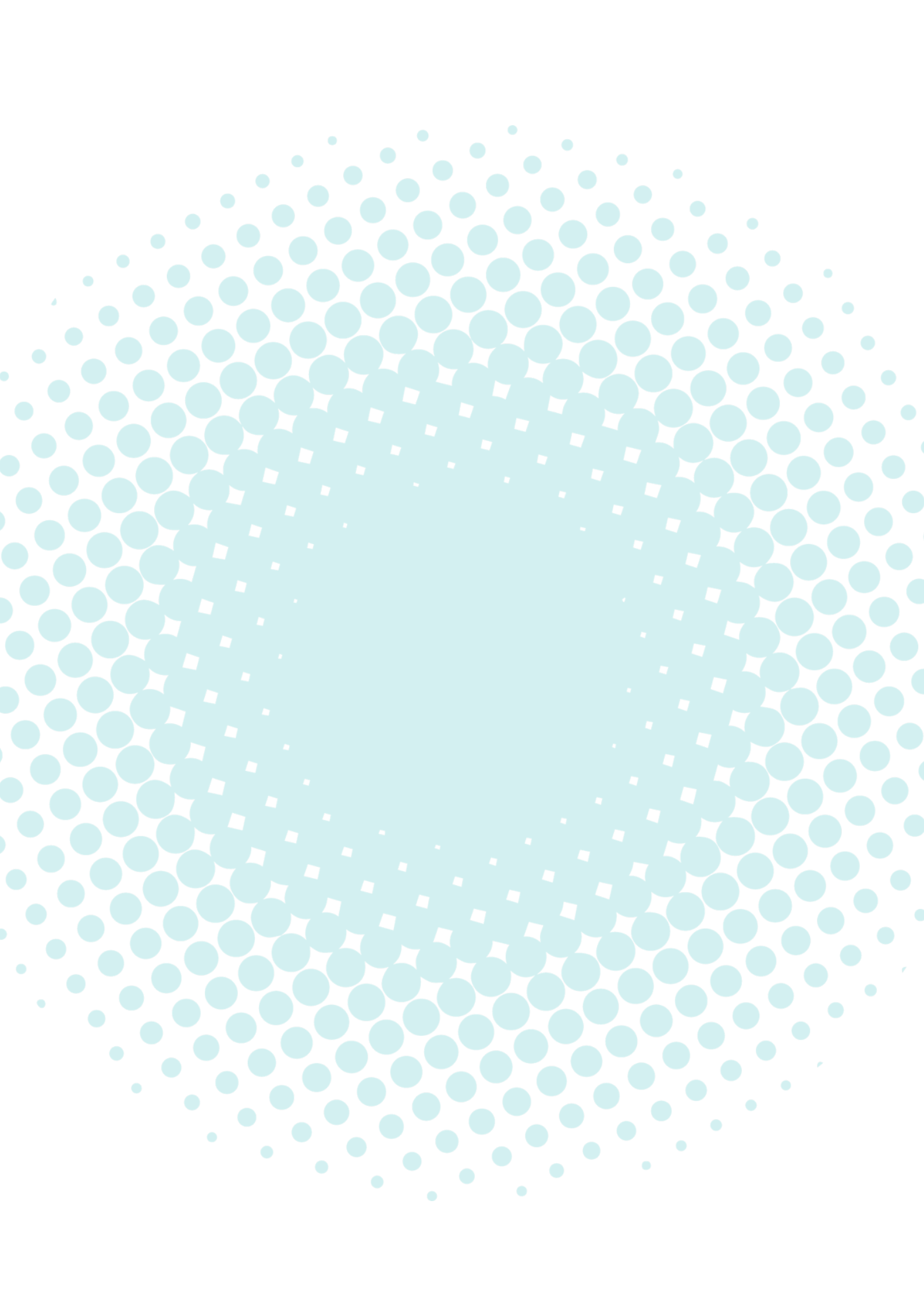
Support consumer awareness and engagement

While legislation is crucial for enabling a sustainability and circularity shift in the textiles sector, consumer demand also has a role to play. To make sure that the DPP can become a useful tool for consumers to make more ethical and informed purchasing choices, they would first need to be aware of its potential. Communicating clearly on why circular textiles and the DPP are relevant to consumers, for example via awareness campaigns, could be a promising way to raise their interest and knowledge.

There are key data points that should be accessible by consumers to support transparency and demand generation. This should include information on recycled content, specifying the type of recycled fibre and whether the product stems from textile-to-textile recycling. Material origin, chemical content and data on environmental and social impacts would also be relevant to consumers. To maximise impact, it is important that the information shared with consumers when accessing the DPP is tailored to their needs and conveyed in an easily understandable way.

Improve the interoperability of data and policy requirements

Introducing effective interoperability standards is crucial for counteracting the current proliferation of company-specific IT systems and data formats. Such standards should ensure that data collection and sharing is done in a harmonised, aligned manner. Interoperability is also important when it comes to the various reporting requirements stemming from the different policies relevant to textile circularity, traceability and transparency, for example the [REACH Regulation](#), the [Corporate Sustainability Reporting Directive](#), the [Corporate Sustainability Due Diligence Directive](#), or the [ESPR](#). Having potentially varying data and reporting-related obligations across these policies may create a large administrative burden for companies, especially SMEs that often lack the resources to track the policy developments most relevant to their business.





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