DPP

Fabricating a Ready-Made Digital Product Passport Solution for the Fashion and Textile Industry

ZEBRA

Introduction

Within the next two years, the fashion and textile industry will be required to publish Digital Product Passports (DPPs), in line with European Union (EU) regulation. This requirement also extends to goods manufactured within or transiting through the EU. This White Paper discusses why DPPs are being introduced, and the type of information to be included in them. It moves on to explain how technologies, including the cloud, blockchain, radio frequency identification (RFID), and mobile devices, combine to create a robust, secure, scalable, and cost-efficient platform for creating and managing DPPs.

Any new regulation can feel onerous. However, DPPs provide a rich opportunity to enhance operational processes, both within supply chains and through to stores. The greater transparency that DPPs bring will also foster trust and brand equity with consumers, while enhanced data insights are the catalyst to identify new business opportunities and partnerships.

Importantly, DPPs will enable consumers to make more informed choices about their buying decisions, with greater visibility of the sustainability, ethicality, and authenticity of a finished item enabling a shift toward better buying behavior.

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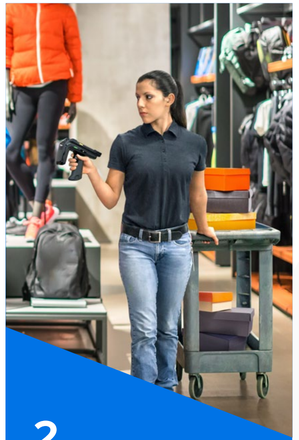
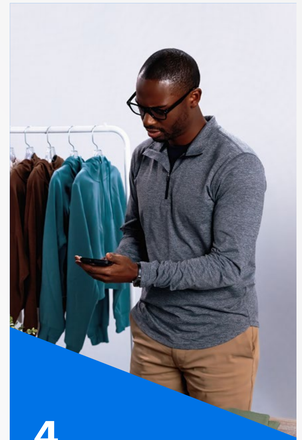
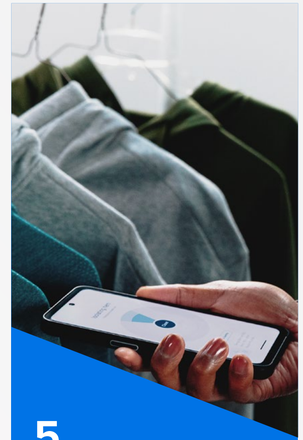
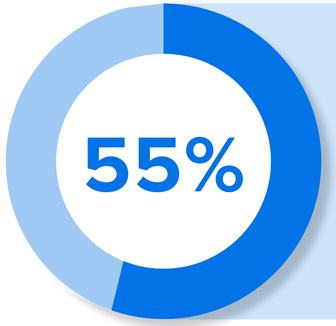






1. Why Are DPPs Being Introduced?

The introduction of DPPs is part of the EU's vision to transform itself into a fair and prosperous society with a modern, competitive, climate-neutral, and circular economy that operates in a toxic-free environment. The pathway to this vision is set out within the EU's Green Deal strategy, with measurable goals including:



A 55% reduction in emissions by 2030

Carbon neutrality by 2050

The requirement to create DPPs comes under the Ecodesign for Sustainable Products Regulation (ESPR). The ESPR is part of a broader package of policies designed to realize the EU's Green Deal vision. DPPs will serve as a detailed digital record that accompanies each fashion or textile product throughout its lifecycle. By promoting transparency around ecological impacts, the EU encourages brands to consider how products can be designed to enhance their onward reuse, resale, and recycling. DPPs will also empower consumers to make informed buying decisions, and will protect their purchases through a digital certificate which verifies the authenticity of goods. This is a significant benefit for the fashion industry, given that counterfeit items, which remain an obstinate issue to resolve, are estimated to have a value of **$3 trillion**[1] a year.

[1] 2022 – BoF

2. What Information Will Textile DPPs Contain?

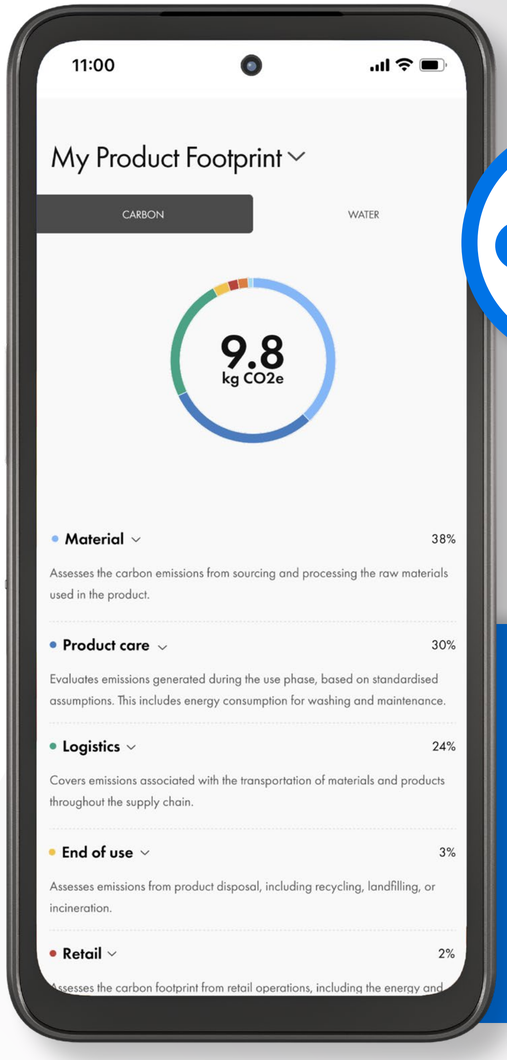
In **2024**, the EU's Panel for the Future of Science and Technology produced a detailed discussion paper on the composition of DPPs for the fashion and textile industry. It proposes three phases of DPP adoption. Initially, there will be a "Simplified DPP Model" in **2027** or **2028**, focused around enhancing environmental labeling. This will be followed by a **2030** requirement for an "Advanced DPP" to provide more details on the supply chain, finished products, and aftersales circularity.

In this phase two, the EU recommends that the industry works collaboratively to enhance interoperability and standardization between systems of information – that is, product information management (PIM), product lifecycle management (PLM), and enterprise resource planning (ERP) systems.

Phase three is slated for **2033** and is referred to as a "Full Circular DPP." Here, the EU envisages that fashion and textile companies will continue to enhance design and end-of-life processes using learnings from DPP data. More information about the timeline and composition of DPPs is due for release in early **2026**.

Before commencing DPP projects, companies should check the status of DPP regulation and implementation timelines, but the core data categories[2] are likely to include:

- **Product identification** – a unique digital ID which is expected to combine the Global Trade Item Number (GTIN), serial number, and batch number for production runs.
- **Materials composition** – a breakdown of the types of fibers and materials used in items and their origin, along with details of any recycled materials, certifications (e.g., for organic cotton), and substances of concern. Any processes used in production that may have a significant environmental impact should also be detailed, such as stitching, weaving, knitting, dyeing, printing, and tannery.
- **Manufacturing** – energy and water consumption, emissions data, production methods, and labor standards certifications.
- **Supply chain/distribution** – analysis of the journey of core materials, and the distance traveled by the product to market.
- **Environmental impact** – the greenhouse gas emissions associated with a product's lifecycle, along with information on the presence of microplastics and an overall environmental impact assessment.
- **Resell, reuse, recycle** – circularity insights, such as options for reselling, reusing, and recycling items, and how to do so.
- **Legal data** – declarations of conformity and associated certificates, along with technical documentation.
- **Consumer information** – care details and advice to extend a garment's life, and potentially animal welfare information (for animal-derived materials).



Shoppers can access DPP information via NFC or QR code scan.

[2] Regulation - EU - 2024/1781 - EN - EUR-Lex Articles 9-12 and ANNEX III

While the level of information that will ultimately be collated is extensive, much of it already resides in companies' ERP, PLM, PIM, and sustainability systems or is accessible via third-party organizations. Similarly, elements required to create and manage DPPs often already exist.

Considerations to bear in mind when implementing a DPP solution include:

- **Ecosystem connectivity** – platforms now exist that can connect fragmented data sources and integrate these with the EU's central DPP framework, removing one of the biggest early barriers.
- **Scalability** – the technical infrastructure is available to handle vast volumes of product and supplier data securely.
- **Access control** – fine-grained, role-based access to DPP information is now possible, ensuring stakeholders can view only what is relevant to them.
- **Supplier support** – the perception that global suppliers are unprepared is being actively addressed through onboarding support, data collection templates, and user-friendly tooling.
- **Data accuracy** – mature platforms incorporate automated validation and feedback mechanisms, helping ensure clean, consistent, and accurate data across complex supply chains.
- **Digital link durability** – technology to embed persistent, scannable product identifiers is well established, enabling a reliable connection between physical goods and their DPPs throughout their lifecycle.

In the next section, an approach to a technical platform for DPPs is discussed, with analysis of how London-based ethical fashion retailer Nobody's Child is leading in the creation of a DPP solution for fashion.

The EU states a key reason for the phased introduction of DPPs is that "The scalability of the DPP represents a significant challenge, and it will be crucial to leverage the experience and insights gained from earlier phases of its deployment… [to] ensure that lessons learned are effectively incorporated into future expansions, enhancing the DPP's adaptability and effectiveness across broader applications." [3]

[3] https://www.europarl.europa.eu/RegData/etudes/STUD/2024/757808/EPRS_STU(2024)757808_EN.pdf

3. A Technical Solution

Nobody's Child designs beautiful clothes for everyone, everywhere, while mitigating its impact on the environment. The company's environmental strategy is built around three areas: enhancing product circularity, using fabrics from sustainable sources, and holding itself to account through measurable science-based performance targets. It has been conducting a pilot of a DPP solution, which it expects to roll out across the business in **2025**. The platform comprises the following building blocks, which are likely to be common to all DPP systems.

- **Digital identifiers**

  Digital identifiers (digital IDs) are needed to be able to connect items to their DPPs. IDs create a "unique digital voice," which can be read by fixed and mobile devices and shared with DPP systems. A number of identifier options are available, including quick-response (QR) codes, near field communication (NFC) technology, RFID, and more.

  In fashion retail, where RFID is widely used, there is a strong case for using RFID as the main digital identifier for enterprise stakeholders. As well as offering high data capacity on the identifier itself, embedding RFID deeper into retail operations offers additional benefits (discussed below). As consumer devices cannot currently access RFID, either QR codes or NFC (on wash labels and hangtags) will be used to enable shoppers to interact with DPP data via their devices, both in-store and post-purchase.

  To ensure DPP data is readable for the lifecycle of its clothing, Nobody's Child has sourced an innovative, and unobtrusive, passive RFID solution from RFIDThreads®. The thread, which is a few centimeters long, includes a microchip to store the data, an antenna for transmitting and receiving radio signals, and a housing for these devices. A customizable exterior is available, made from a range of fabrics. The thread is woven into clothing, and is robust and wash-proof.

Open Data Standards

We recommend using the GS1 system of standards to promote DPP interoperability. GS1 is a global, not-for-profit organization that develops open standards for identifying, capturing, and sharing information across supply chains. These standards enable interoperability by providing a consistent digital language that can be applied to technologies such as RFID, NFC, and 2D barcodes (e.g., QR codes).

A central identifier used within GS1 standards is the Global Trade Item Number (GTIN), which helps to uniquely identify products, locations, and assets. In addition to physical identifiers, GS1 also supports GS1 Digital Link, a standard that enables web-based access to product information by converting identifiers like GTINs into URLs. This allows a single 2D barcode (such as a QR code) or RFID/NFC tag to connect users to a wide range of digital content, such as traceability data, user manuals, certifications, or sustainability details, through a structured and standardized web architecture. This capability makes GS1 standards particularly well suited to DPP use cases, providing scalable, interoperable solutions for enterprises, supply chain partners, and consumers.

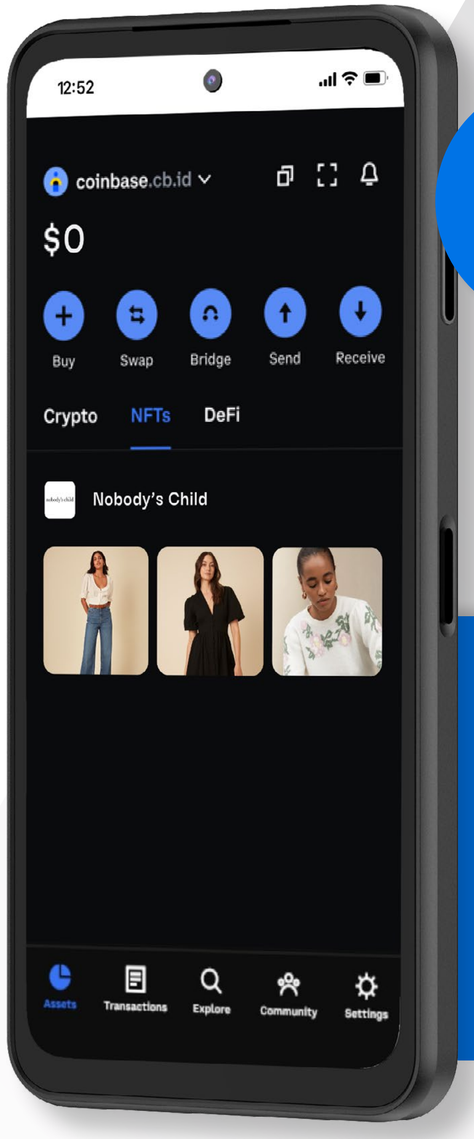
The use of RFID has associated benefits too, including:

- **Efficient supply chain operations:** RFID labels are used on consignments, including boxes and pallets, which enables simple data capture. In its pilot, Nobody's Child used Zebra RFID printers and labels, and Zebra mobile computers, attached to a Zebra RFID sled, to read RFID labels with speed, ease, and accuracy. The use of RFID furnishes supply chain systems with a view of items' progress in transit. Depending on what data is needed by the DPP, this can be updated directly in the Xelacore platform (see *A secure data repository section below*), or via updates from existing Nobody's Child supply chain systems.

- **Streamlining retail workflows:** Store associates at Nobody's Child use Zebra's enterprise mobile computers (attached to the RFID sled) to read the RFID data. RFID delivers several advantages by automating processes that were previously time-intensive. For example, it enables real-time inventory checks, allowing store staff to quickly locate items and replenish stock as needed, to reduce instances of out-of-stocks. The technology also streamlines the checkout process by enabling bulk scanning of multiple items simultaneously, improving efficiency and enhancing the customer experience. Furthermore, RFID supports loss prevention through the real-time view of stock.

- **Digital identifiers for shoppers**

  RFID is not currently compatible with consumer smartphones and tablets. To ensure shoppers can work with DPPs, retailers are expected to use NFC or QR codes. It's likely that codes will be included on swing tags for ease of scanning in-store, and on wash labels for long-term accessibility. In the case of Nobody's Child, which is using both QR codes and NFC for consumer engagement, the DPP is viewable within its app or online via a smartphone tap. This enables shoppers to view and engage directly with each product's environmental credentials. Its shoppers also have the option of creating a certificate of authenticity, which is tokenized using blockchain technology via Coinbase. The certificate resides in shoppers' smartphone wallets.



Shoppers can create a certificate of authenticity using blockchain solutions to digitally validate their ownership and purchase.

- **A secure data repository**

  All DPP data will need to be securely stored and accessible – from details on materials' origin and product composition, manufacturing processes, energy usage, and emissions, to supply chain events, authenticity, repair, reuse, and recycling advice, and more. Nobody's Child is using the Xelacore software-as-a-service platform from Fabacus for this purpose. Xelacore enables brands to improve their business agility and capabilities through enhanced data management. Given its focus on sustainability, Nobody's Child already has most of the information required for a full circular DPP. And, within Xelacore, a Nobody's Child compliant catalog has been created and mapped to each product. This provides aggregated, validated, and structured data for a holistic view of the information required by DPPs. Critically, Nobody's Child has the confidence to publish the data into the public domain.

- **Data sharing and privacy controls**

  Once a catalog has been built for a product, it will not need significant amendment or dynamic changes. However, there may be instances where information will have to be updated, and different stakeholders will certainly need to be able to view different levels of data. This means solutions will be required to authenticate users, and provide access and privileges relevant to their status.

  The Xelacore platform includes multifaceted data validations and governance checks, along with a single pane of glass through which DPPs are accessible by the global network of companies that sits behind its products. It is also flexible in terms of connectivity, with application programming interfaces (APIs) to ease connections with internal systems, as well as with suppliers' applications and the central DPP database being created by the EU.

Pioneering Digital Product Passports with Nobody's Child

To view the Nobody's Child DPP video case study, visit Zebra's YouTube Channel.

4. Efficiency, Invention, and Transparency: The Benefits of DPPs

While the benefits of DPPs are many and varied, they can be divided into three key areas:

- **Sustainable performance**
  The fashion and textile industry needs to reduce its impact on the environment. It emits about the same quantity of greenhouse gases per year as the economies of France, Germany, and the United Kingdom combined.[4] The focus on designing for circularity and greater awareness of the full picture around emissions and energy consumption will help reduce new materials extraction and lead to more efficient production processes, which will in turn reduce emissions. For example, if attention is focused on polyester use, which needs a lot of energy for extraction and processing (and also lingers in the environment for a long time), the industry could prioritize more sustainable choices. The adoption of more efficient practices also has the potential to save significant costs for retailers.

- **Informed consumers**
  People can use DPPs to easily discover source details and evaluate sustainability credentials when buying products. They can also view recycling and reuse details, accessing simple services to ethically “retire” their items when they have finished with them.

[4] McKinsey

- **Enhanced brands and efficient operations**
  DPPs powered by RFID/NFC technology provide a secure method of verifying product origin and chain of custody. By integrating data on authorized sellers, product warranty details, and manufacturing provenance, consumer confidence will increase, and people's perceptions of brands are likely to be enhanced. Retailers can also leverage this traceability to meet compliance requirements for global trade and environmental reporting. And, across operations, embedding enhanced data capture into workflows can help achieve significant time savings and performance benefits. Furthermore, DPP data will unlock ideas for new business opportunities, such as:

  - **Shopper engagement** – with relevant permissions from shoppers, retailers can be notified of DPP activity (e.g., a resell event) to contact people and offer them discounts on new items, or vouchers for returning products via the brand's preferred channels. Garment data can also be used to power personalized recommendations or exclusive content, further engaging tech-savvy consumers.

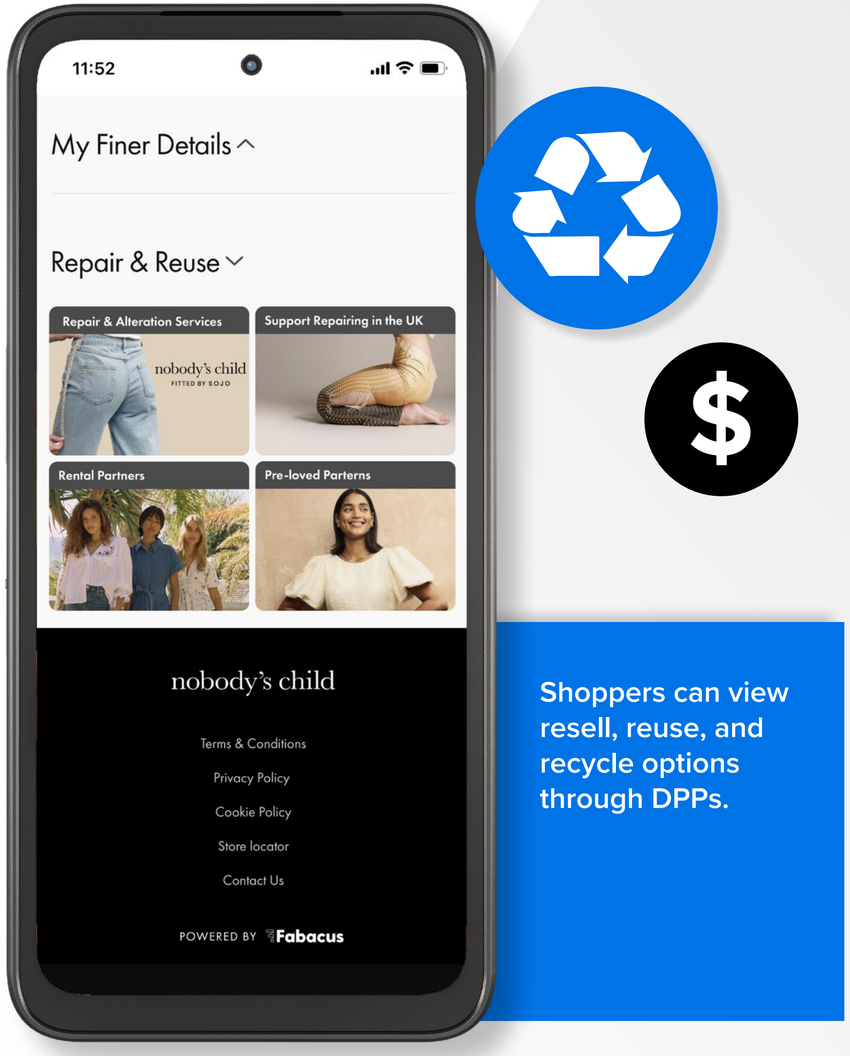
  - **Resell** – partnering with platforms to offer services to shoppers to resell their items.

  - **Recycling** – establishing relationships with recyclers in return for "cashback," depending on the volume of materials reclaimed.

  - **Circular economy business models** – the enhanced interaction with shoppers and the ready-made platform provided by DPPs means that new services can be easily added – for example, product-as-a-service, where clothes are effectively rented for periods of time.

In summary, DPPs present a huge opportunity to rethink and revitalize core retail operations.

As mentioned previously, companies considering DPPs should stay abreast of the latest updates from the EU and via relevant trade bodies. Organizations like CIRPASS-2 are a useful source of knowledge and support. Funded by the EU, CIRPASS-2 is running 13 "lighthouse pilots" to demonstrate functioning DPPs in real settings, including textiles. It welcomes input from organizations, with registration for the stakeholder community available **here**.



Shoppers can view resell, reuse, and recycle options through DPPs.

5. How We Can Help

Zebra Technologies is the market leader in providing technology across different verticals, including manufacturing, transport and logistics, and retail. Devices are specifically designed for retail and include RFID printing and labeling solutions, mobile computing, and tablets. Data captured by Zebra's devices can be securely interfaced with cloud-based DPP solutions through Zebra Cloud Connect software. Our partners also offer proven large-scale data management and DPP platforms. Together, we can help you take the stress away from creating and deploying DPPs to the EU's timetable, which is now becoming pressing.

As with any major technology or data integration project, we recommend starting from a base point of considering what information is needed for your products' DPPs and then assessing what you already have and where gaps exist.

It can be helpful to embark on such fact-finding missions with external support. Zebra's dedicated professional services team – along with similar expertise available across our partner community – is here to help you understand the scope of work and define an appropriate timeline and execution plan for your DPP project.

For more information, please visit zebra.com or contact us below.

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