NCDD Greenpaper Circular Electronics

How a Digital Product Passport supports the repair of a monitor

July 2026

Coalitie Duurzame Digitalisering

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Key takeaways

- The ESPR (Ecodesign for Sustainable Products Regulation) and EPREL (European Product Registry for Energy Labelling) are European legislative frameworks that set ecodesign requirements, such as a DPP for consumer goods, including electronics. These passports will also need to contain product data on repair and recycling.

- For electronics repair, the Digital Product Passport (DPP) can play an important role in providing access to technical documentation, improving the availability of spare parts, enabling better diagnosis and making repair processes more efficient.

- The DPP can therefore make an important contribution to extending product lifespans, reducing electronic waste, developing circular business models and professionalising the repair sector.

- Recording and sharing circular product data in a uniform and structured way is a new field with limited standardisation. To provide guidance on how this could work, a working group developed an example DPP for repairing a monitor. The starting point was the opportunities a DPP offers for better, more efficient repairs, rather than regulatory compliance.

- The exact data that legislation will require in a DPP for monitors will be announced in 2027. The supply chain partners in the working group have now identified the data they need for a voluntary DPP.

- The system requirements for data exchange in a DPP were announced in mid-2026 and include technical standards that businesses and their IT providers can use to build a DPP.

- Using GS1 standards, businesses and solution providers can already build a simple, voluntary DPP to support circular business models such as repair.

- Collaboration with all partners in the (repair) supply chain is crucial to establishing an effective and efficient data system and learning together about:

    - the issue of warranties;
    - whether to grant third parties write access to the DPP or maintain a repair log;
    - whether a serialised identifier at individual item level is desirable for repairs;
    - the distinction to be made between what is legally required for a DPP and what is voluntary;
    - the need not to lose sight of the overarching goal of extending product lifespans.

Who is this paper for?

This paper was written by and for supply chain partners involved in the life cycle of electronic products (using monitors as an example) who, within the NCDD working group and sounding board group, are collaborating on, or wish to learn from, the approach to a DPP. Over six meetings (in autumn 2025 and spring 2026), the working group explored the opportunities and obstacles from the different roles and positions within the supply chain.

The content is intended as practical inspiration for organisations that need or wish to work with a DPP (whether voluntary or legally required in the future), and want a concrete understanding of the product and repair data needed to record a repair in such a passport (based on 'nice to know' and 'need to know' information for each supply chain role).

This includes the following parties:

- **producers/manufacturers or importers** (the 'economic operator' that must be able to set up and manage a DPP);
- **retailers and (business) users** who need product and service data for repair processes and warranties;
- **product users** who want to extend their products' lifespans and find out who can repair them and how;
- **repairers/repair centres (authorised and independent)** who need technical information, spare parts information and records of repair events;
- **IT and solution providers** that need to build DPP functionality and connect it to ERP/PIM and other source systems;
- **standardisation and supply chain organisations** (such as GS1) and other partnerships that help businesses agree on uniform data definitions and data exchange.

It can also help government bodies and/or advocacy organisations develop policy, create enabling conditions or inform their members about challenges and opportunities.

1 Towards a circular electronics sector

The European Commission wants to encourage the electronics sector to design products that last longer, are easier to repair and can be effectively recycled. The aim is to extend the lifespan of electrical appliances, conserve valuable raw materials and reduce waste. This requires a well-organised production chain that collaborates within recurring circular production flows.

This also requires supply chain collaboration and agreements on how to record and share data. Data about the product, its origin, composition, components, repairability and recyclability. Data that must be exchanged efficiently, consistently and in a structured way between the separate IT systems of the supply chain partners involved. The DPP is the intended instrument for this. In this greenpaper, we explore what European legislation requires of a mandatory DPP, as well as the opportunities offered by a voluntary DPP.

It is encouraging to see the opportunities the DPP offers for dynamic data and the willingness of supply chain partners to contribute. The ultimate goal is to make ICT fully circular. For the next steps, it is important to identify where we can have the greatest impact in achieving this. Ultimately, we want to be able to trace products right down to the raw material level."

Leonieke Mevius - IT Sustainability Adviser - Digital Services, City of Amsterdam

NCDD working group: collaborating on a DPP

To explore this circularity challenge, the data required and how a DPP would work in the electronics sector, the National Coalition for Sustainable Digitalisation (NCDD) and GS1 Netherlands launched a working group on a DPP for ICT products in 2025.

The NCDD is a broad public-private coalition working to accelerate sustainable digitalisation in the Netherlands. The NCDD is a key partner in the Sustainable Digitalisation Action Programme 2026–2028 of the Ministry of Economic Affairs. Drawing on its network of businesses, knowledge institutions and civil society organisations, and its thematic, pre-competitive working groups, the coalition contributes substantive expertise to implementing the programme's ambitions. The DPP working group focuses on the action point: 'Developing an ecosystem for data sharing and digital product passports for energy efficiency and the circular economy'. An additional aim of the working group is to improve transparency about the circularity of ICT products and clarify the role a DPP can play in this.

GS1 is an international organisation that works with supply chain partners to agree how product data can be recorded and exchanged consistently and efficiently. These agreements provide a globally adopted approach to identification and data sharing, such as using the Global Trade Item Number (GTIN or EAN) as a product code. As a neutral, not-for-profit organisation, GS1 was appointed by the NCDD to bring together and facilitate the working group.

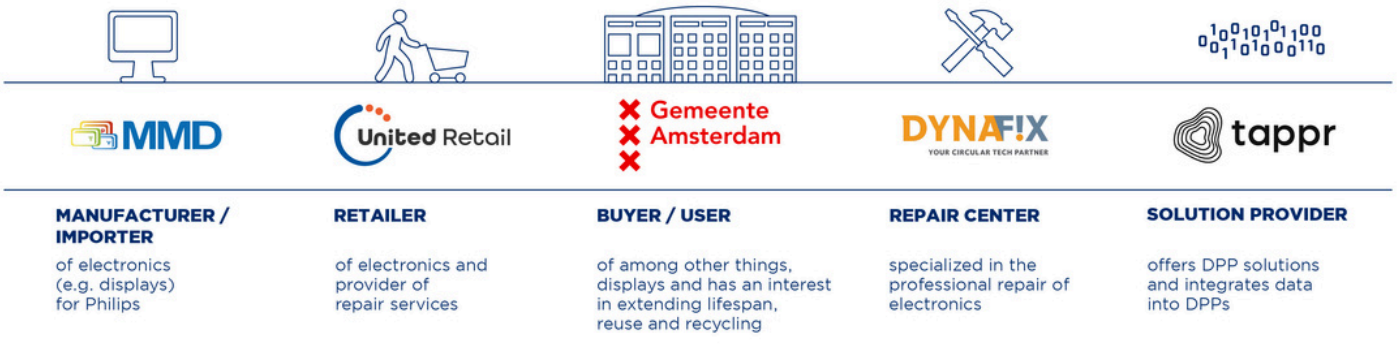
"By working together effectively across the supply chain, we can use devices more sustainably. Understanding the different stages of a device's life is crucial, which is why the DPP is so important. It was very interesting to build a shared understanding of the processes and their interdependencies in order to develop sound recommendations."

Dennis van Moorsel - Programme Manager - United Retail

Composition of the working group

The working group represents electronics supply chain partners with an interest in a DPP.

The working group was deliberately assembled to ensure broad representation across the entire supply chain. In addition to participants from the NCDD network, other relevant parties and areas of expertise were included, so that the entire monitor supply chain is represented: from placing products on the market and selling them through to use, repair and, where relevant, take-back and processing. These are parties that supply, use or record data in practice to ensure repairs run smoothly.



This broad representation was needed to:

1. Discuss all relevant interests and challenges at an early stage (for example, data access, confidentiality and feasibility).
2. Define the data needs of each supply chain role: which information is ‘nice to know’ and which is genuinely ‘need to know’ for diagnosis, spare parts, warranties and recording a repair event in the passport.

To assess whether the approach and findings could apply more broadly and to more businesses, a sounding board group was established with the following parties: NL Digital (environmental policy group), Techniek Nederland, GTDC, TNO, HP-e, Reuzado, TCO development and Closing the loop.

“For me, the biggest positive eye-opener of this process was gaining a better understanding of what matters from the different perspectives and roles. I noticed that these interests and priorities sometimes overlap, but can also differ considerably. This broader understanding helps us see more clearly where we can contribute and provide support from our side.”

Clara Guerra ten Broek - Sr. Manager, Commercial Service Program Management - Monitors & IT Accessories | AOC & Philips

2 Towards a DPP for a monitor – framework for the example case

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- The working group chose to develop a demo DPP for a Philips **monitor** manufactured by MMD as an example product, and to map the data needs and the standardisation needed for data exchange in this context.
- The focus was on the circular business model of **repair,** for which electronics data requirements will be announced in 2027.
- The working group considered what is expected to become mandatory under the ESPR legislation, as well as the opportunities and possibilities for voluntarily offering repair services to increase the circularity of electronics.
- The working group developed an **open, practical and scalable** concept that can also serve as an example for other electronic products and circular business models. Central to this is standardising how product data is recorded and shared, so that it can be exchanged efficiently in machine-readable form between different ERP/PIM systems.
- This was not a scientific approach, but a **practical, exploratory** way to examine the needs of the supply chain partners involved and how these could be captured in a passport.

Starting points for the exploration:
- Monitors as the example product category
- Repair as a circular business model
- Both legal requirements and voluntary data needs were considered
- A step towards an open, practical and scalable standard for data sharing

"Bringing together all the views and interests of the stakeholders involved into a streamlined solution was quite complex. But we worked it out and have now created a DPP framework that will make a positive contribution for consumers in the broadest sense, with widespread support from all supply chain partners."

Danny Murkens - Manager Business Development - DynaGroup

The legislative framework

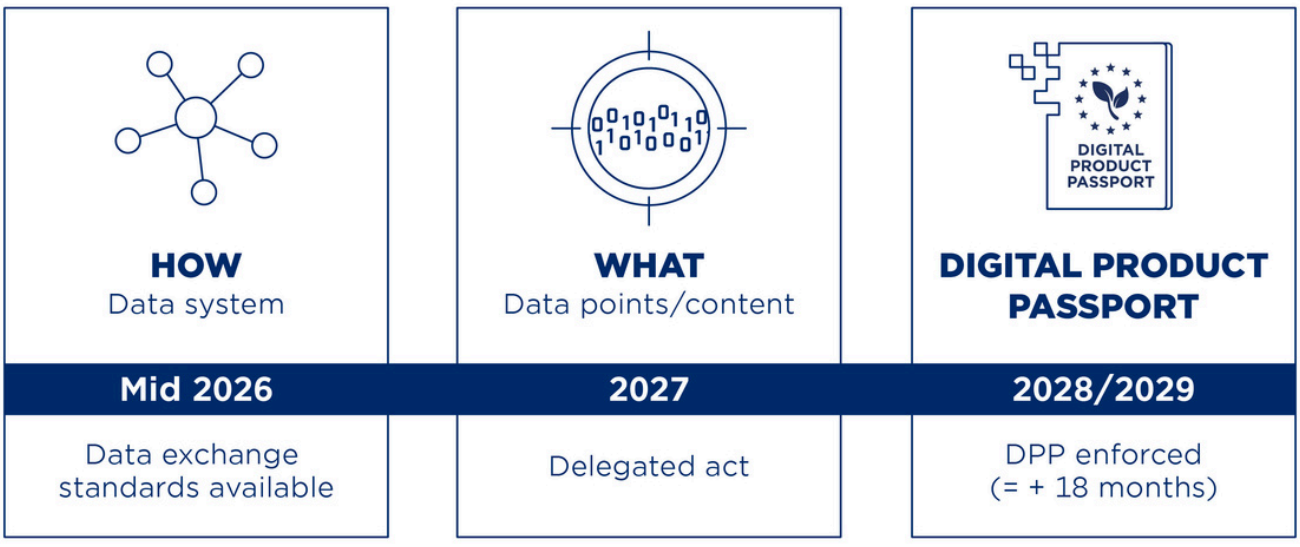
A DPP will become mandatory for various product groups, including electronics. This is governed by European legislation, primarily the ESPR (Ecodesign for Sustainable Products Regulation). The ESPR aims to make products within the EU more sustainable, energy-efficient and repairable. Requirements for electronic products will cover aspects including repairability and recyclability. A number of ecodesign requirements already apply to monitors to make repairs easier.

An update to these requirements will be included in the new ESPR regulation for monitors. This regulation (delegated act) is expected in 2027 and will specify which monitor data must be included in a DPP. Producers or importers of monitors will then have 18 months to create a DPP that meets the legal requirements and link it to the product.

The ‘economic operator’ provides the product with a DPP. In practice, this is the party that first places the product on the European market. This is usually the manufacturer, producer or importer. This party is also responsible for the data in the DPP. Not every supply chain partner may be able to view all the data, and access to some of the data fields below may require authorisation before the data can be viewed.

A DPP plays an important role in repairability. The DPP is a digital dataset – linked to the physical product – containing product information, such as materials, origin and repair options. This makes it easier for producers and repairers to understand a product’s composition and lifespan, and for consumers to find out where the product can be repaired.

In 2026 standards were published by the European CEN/CENELEC organisation – represented in the Netherlands by NEN and facilitated by GS1 – and cover, among other things, how information must be recorded and shared, as well as the technical standards that apply to interoperability and security.



3 Which data is mandatory and which data is desirable?

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Mandatory data

It is not yet clear exactly which data legislation will require in a DPP.
However, the repairability of electrical products is already partly regulated in the EU (repairability reference standard EN 45554). Data requirements relating to repair are already included in existing regulations. See, for example, the design requirements for smartphones and tablets. The ESPR is expected to incorporate these requirements.

Furthermore, the ESPR is an ecodesign directive intended to ensure that products are well designed. This means that data on composition, materials, repair and dismantling is important, as is, for example, information on spare parts and repair manuals. Businesses can already start preparing for this.

Desirable data

The working group explored the opportunities and possibilities a DPP offers for new circular business models, and the data needed to support them. This concerns data that is not currently required by law but is needed to develop a repair business model.

To gain a better understanding, the physical processes at each supply chain partner were described step by step: from the producer and retailer through use to a completed repair.

The next step was to identify which data is needed for a repair on a 'need to know' basis, to minimise the impact on the organisation and avoid data overload. This 'need to know' information differs for each party.

This concerns information needed for diagnosis, disassembly, parts replacement and software recovery.



INTAKE
Product received at the repair centre: start of the repair process

DIAGNOSIS
Investigation into defect, possible warranty check or analysis

CONNECTING PARTS
Spare parts attached to the product to be repaired

REPAIR
Product repaired by replacement or repair of parts

QUALITY CHECK
Check if the repair is successful (QC passed/ failed)

Information needed for a repair

This information applies to a voluntary DPP and does not (yet) constitute legal requirements.

Need to know

From the producer

- Product ID with serial number (for example, GTIN)
- Product description (manufacturer, model, year, place/date of production, dimensions)
- Bill of Materials (composition, materials and components used)
- Repairability score (when legally required; in France, for TVs)
- Expected average lifespan
- Available spare parts (part ID, CE marking, price category, delivery time)
- Repair manual, instructions, disassembly sequence (including safety instructions)
- Software information (version, firmware, support period)

From the producer & retailer

- Warranty definition (type, duration)
- Warranty status (validity)
- Purchase date
- Reference/link to repairers, for example through the National Repair Register (NRR)

From the repairer

- Repairer ID (GLN, National Repair Register ID)
- Type of repairer (authorised, independent, self-repair)
- Type of repair
- Part status (for example, ‘new original’, ‘new third party’, ‘reused’)
- Recycling manuals and dismantling method

Nice to know

- Repair date and ‘event’ description (EPCIS)
- Maintenance and operating instructions
- Aggregated usage history
- End-of-life return instructions
- Hazardous substances and critical raw materials (rare earth metals, etc.)
- Sustainability labels and certificates (symbols, validity, score, conformity declaration, due diligence declaration, weblinks)
- ESG and footprint data (Product Carbon Footprint, LCA, weblink)
- Energy consumption and energy class (EPREL, not available for all product groups)
- Packaging information (weight, dimensions, material)

For all the data listed, the aim is for the fields to be structured and standardised to enable efficient and interoperable data exchange.

4 Building blocks for recording and sharing data

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Globally adopted standards

If supply chain partners want to record and share data efficiently and in a structured way, an interoperable data infrastructure is needed. This means a system that enables seamless communication and data sharing between different systems and supply chain partners.

GS1, for example, provides standards for this: building blocks that businesses and their IT providers can use to build a DPP that works throughout the supply chain and around the world. These standards fit within the technical framework permitted by the EU for a DPP.

Identifying products and supply chain partners

One of the requirements for a DPP is a unique product identifier. The Global Trade Item Number (GTIN), also known as the EAN code contained in the barcode, is already widely used in the electronics sector, for example to process purchases at the checkout. Businesses can consistently link and share product information – from composition to origin and sustainability – using this product code, without incurring additional costs. Since repairs take place at individual item level, an ID with a serial number is highly desirable. This can be achieved with a serialised GTIN (sGTIN).

Locations and supply chain partners can also be identified using a GS1 standard, such as a Global Location Number (GLN). This enables location data to be recorded for factories, shops, workshops, collection points or third-party registers such as the National Repair Register (NRR). Linking product and location identifiers allows the associated data to be exchanged efficiently. Preferably, choose product and location identifiers that have a register and can always be verified.

Accessing data sources with a single scan

The next step is to link the product identifier to a data carrier, which is also required for a DPP. This could be a QR code or an NFC or RFID tag. This data carrier must be attached to the physical product: in this case, the monitor. A ‘standard’ QR code points to a single web address, usually a product page. The drawback is that if the weblink changes, the QR code on the product also needs to be replaced.

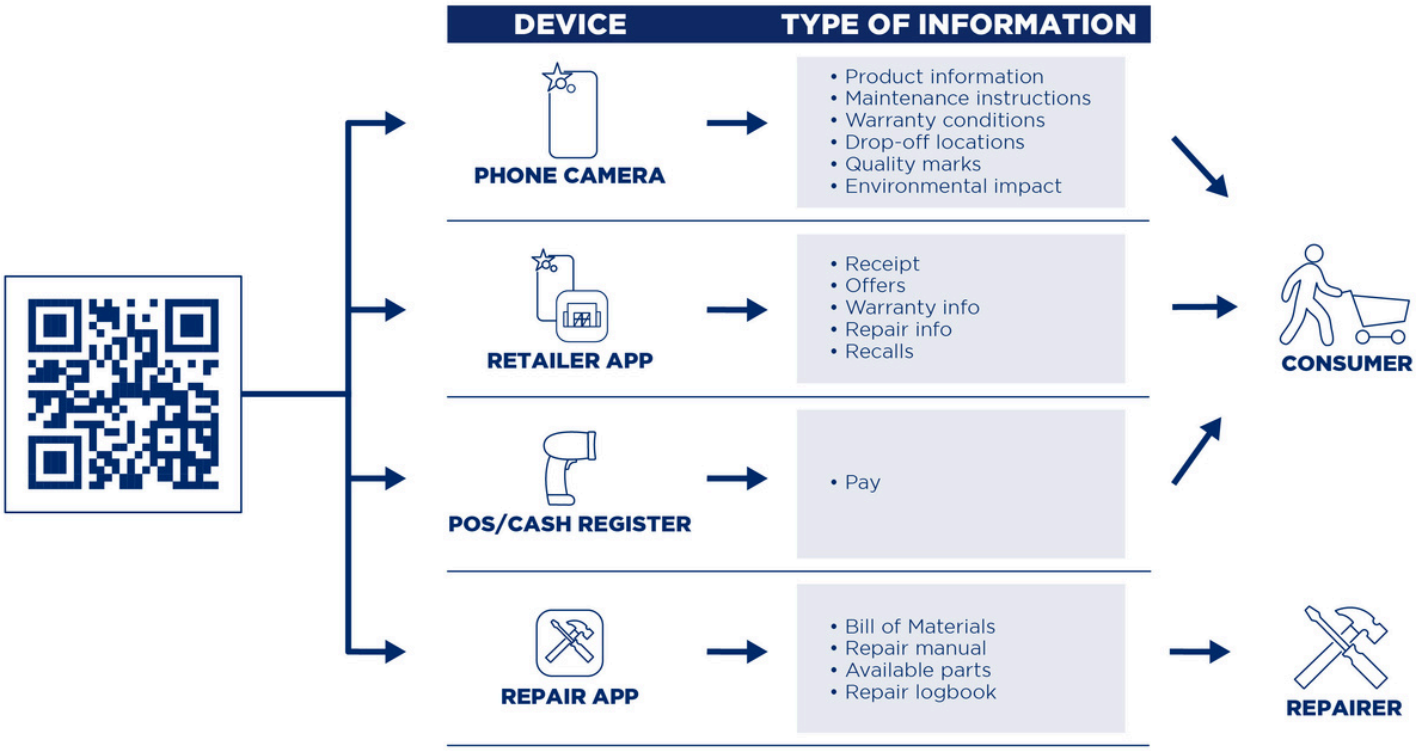
A dynamic QR code with GS1 Digital Link allows different web addresses to be linked to the same QR code without the code needing to change when the underlying data changes. An additional advantage is that checkouts will be able to scan this QR code in future, as it will replace the barcode.

Digital Link makes it possible to access and retrieve information from different decentralised data sources using a single QR code. Depending on the scanner, different information can be displayed.

Sharing structured data worldwide

Open-source Web Vocabulary standards enable data to be shared efficiently and easily worldwide in a structured and standardised way, using a machine-readable (JSON-LD) format. This provides the basis for harmonised data models that provide access to original (primary) data sources. This makes the DPP a reliable data source: a ‘Single Source of Truth’.

The producer remains responsible for managing the data and can link directly to data from its own ERP or PIM system, or to reliable data sources outside its own organisation, such as a National Repair Register or a European DPP register.



5 Demo DPP for a repair

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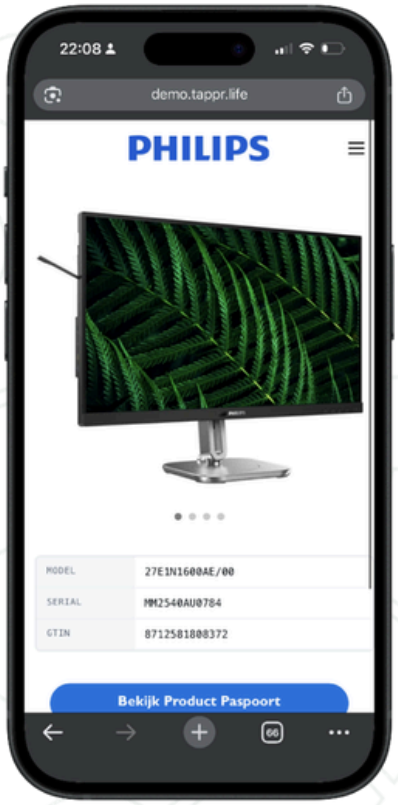
Using GS1 standards and data supplied by MMD, solution provider Tappr created a demo DPP for a Philips monitor. See the images and scan the QR code. This is an example of what a voluntary DPP could look like. (link to demo)

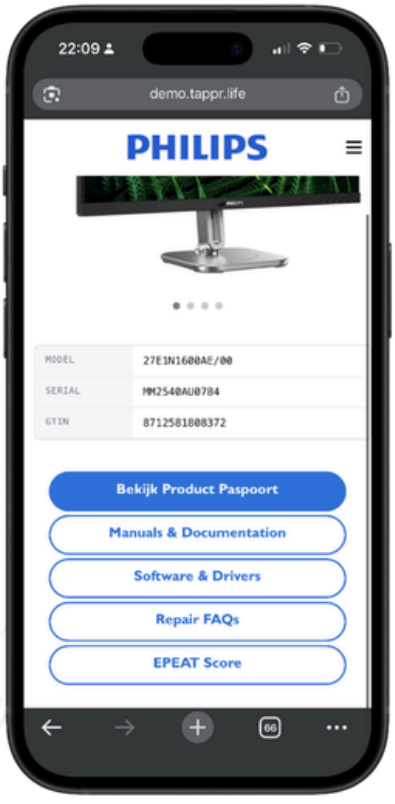
> *"The interesting part was not the build, but the conversations: discovering what a retailer really wants from a DPP, what a repairer wants to record in it, and why 'warranty' means something slightly different to everyone. Ultimately, a DPP is more of a supply chain agreement than a piece of software."*
>
> **Bas van der Pol - CEO - Tappr**

The demo consists of two parts:

1. A section containing much of the 'need to know' and 'nice to know' data, including general product data.

De landing page (model/serial/GTIN)





Menu with all DPP sections

2. A section that tracks a repair and allows third parties (such as a repair centre) to write in the DPP.

The repairer recording information



The repair log that then becomes visible



The added value of a DPP

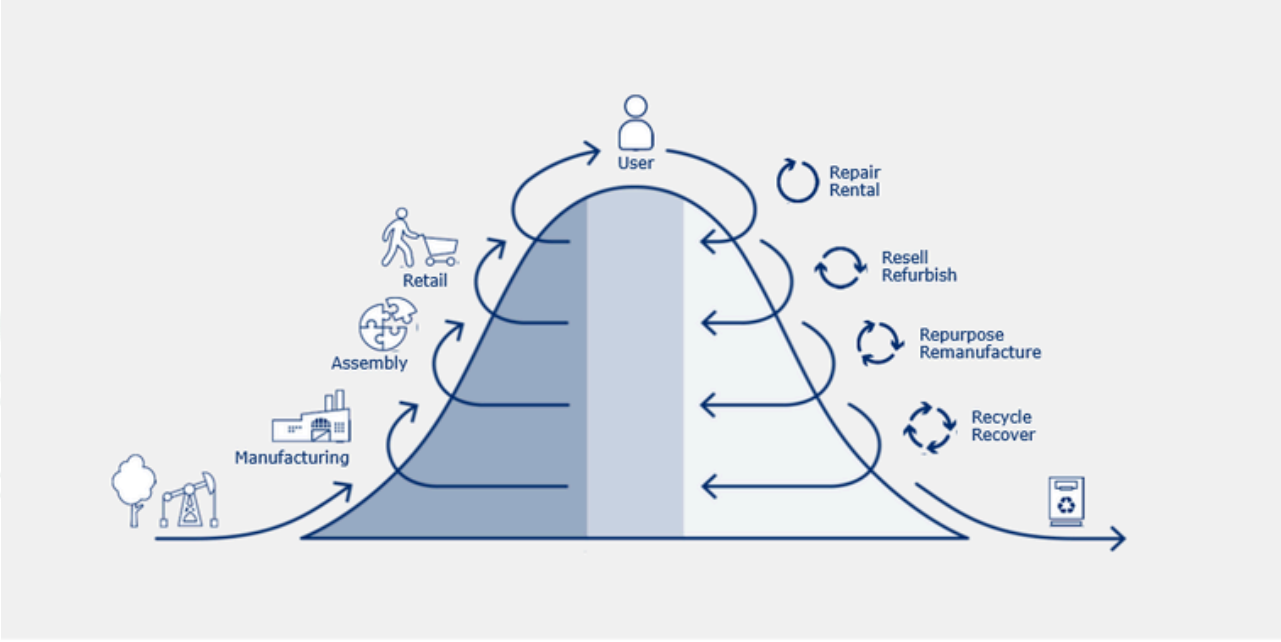
Consistent data integration for all supply chain partners

The working group members see many benefits in a DPP. In particular, it enables data flows to be harmonised and structured so that product information, repair manuals, purchase dates and warranty periods can be exchanged efficiently throughout the supply chain. Currently, this is done using different formats, varying by brand and using different data definitions.

When all data from the original source is recorded reliably and consistently in one place, this leads to greater efficiency, faster repairs, fewer errors, insights into product use and greater transparency.

The DPP as an opportunity for circular business cases

The working group specifically examined the business opportunities a DPP offers. This concerns how a voluntary DPP can contribute to establishing circular business models.



GS1 Nederland

In circular business models, a product's value is used several more times after its initial use, following the 'R-ladder'. Repair ranks highly on the R-ladder and offers an immediate potential business case for all supply chain partners. Repair is particularly attractive for valuable products such as electronics.

After repair, a monitor can still go through ‘resell’, ‘refurbish’ and ‘repurpose’ stages before its components are ultimately recycled and valuable raw materials are recovered. A characteristic of these R-models is that they require continuous return flows. This makes it necessary to trace where an individual product is, who has it, when and why.

The importance of supply chain collaboration

Supply chain collaboration is an important prerequisite for developing a DPP for new business models, because partners depend on one another for information and processing.

- Partners can learn a great deal from one another and share knowledge. Key lessons included, for example:
    - the ambiguity and complexity of the concept of warranty;
    - understanding which ‘must have’ data one partner needs from another;
    - differing views on including a repair log in a DPP;
    - the level of unique identification (model, batch or individual item);
    - above all, thinking ‘beyond compliance’ by considering both sustainability and commercial opportunities, rather than only legal requirements.
- By sharing data, supply chain partners become more transparent and therefore more trustworthy to consumers, business users and regulators. This makes a positive contribution to brand value, provided that the data is reliable.
- Sharing consistent data enables partners to work more efficiently, achieve cost savings, make sustainability data more accurate and comparable, and reduce the risk of false sustainability claims.
- Access to and reliability of repair data and information on available parts improve, as does information about which components fail more quickly or need to be redesigned.
- Supply chain collaboration is easier when a neutral party brings the supply chain partners together and guides the process. GS1 fulfilled that role in this working group, but other parties can also facilitate pre-competitive agreements with stakeholders.

Taken together, supply chain collaboration and data analysis lead to better-designed products that last longer and make it possible to generate value from the product, its components and (repair) services multiple times. This results in higher revenue/lower costs for all partners.

“The biggest eye-opener for us during this process was understanding the volume and level of detail of the data needed for a Digital Product Passport to function effectively. At the same time, it became clear that these data requirements bring together different needs: from regulation and compliance to the information needs of stakeholders across the supply chain, with different authorisation levels for each stakeholder group.

The DPP can therefore serve as a central point where this information is brought together and made accessible. In the longer term, this offers significant opportunities for greater transparency, better supply chain collaboration and more efficient data management."

Stefan van Sabben - Global Director CSR and Sustainability – TPV (AOC, MMD en TP Vision)

Conditions for supply chain collaboration

The working group also identified several risks and translated them into conditions for fully realising the potential of a DPP and data sharing:

- Sharing data is not an end in itself and can lead to data overload. It is important to agree across the supply chain on which data is needed. For SMEs in particular (retailers and repairers), it is essential that the DPP remains practical to implement.
- For confidentiality reasons, access must be considered for each data attribute without hindering the repair process. Apps and authorisations can be used to restrict access to certain data. Technical information for repairers must be accessible through professional access levels.
- Everything depends on data quality and the level of IT development among supply chain partners. When important data is missing or outdated, repair services provided by the retailer or repair centre become more difficult, or certain claims may subsequently prove to be false.
- The interests of individual supply chain partners may differ, requiring an understanding of one another’s positions and a focus on the benefits for the entire supply chain to jointly develop a functioning system.

Discussion points and recommendations for a DPP

Providing clarity on warranties

It is important to define a term such as ‘warranty’ consistently. The warranty period indicates who has which warranty, what it covers, until when, and who ultimately bears the costs of a repair. In practice, a lack of clarity on this can be a barrier to repair and therefore also to circularity.

European regulations distinguish between different types and periods of warranty. The new harmonised European warranty label (mandatory from 27 September 2026) distinguishes between:

- **Legal guarantee** - A minimum of 2 years under EU rules, although Member States apply this differently. The harmonised label will refer to this.
- **Commercial guarantee -** A guarantee offered by the producer and shown on the harmonised label if it lasts longer than the legal guarantee.

To provide clarity, the warranty information in a DPP must match the guarantees stated on the harmonised warranty label.

Defining types of repairers and deciding who may write in a DPP

The different definitions of types of repair need to be harmonised:

- Professional repair authorised by the producer: for example, by an approved repair company appointed by the producer.
- Professional independent repair: for example, by a repair provider appointed by a retailer or the retailer’s own repair department.
- Non-professional repair or ‘self-repair’: for example, by a repair café, a DIY repairer or the consumer.

The type of repair or the way a product has been maintained affects its warranty and liability for the product. It is therefore desirable to include the type of repair and the type of repairer in the DPP.

Repairers may eventually be granted write access in a DPP to select the repair performed in a specific data field, including identification of the repairer, for example using the GLN (location code) and the National Repair Register (NRR). All types of repairers (not only authorised parties) must retain access to relevant repair information.

The question of whether only approved and authorised repairers should have exclusive write access led to discussion. This mainly concerned whether recording self-repairs is desirable. In pursuit of the broader goal of extending product lifespans, a DPP should strengthen the position of independent repairers in general.

An overly restrictive design (OEM/authorised parties only) could undermine the intended goal of extending product lifespans. It remains essential that the DPP is always simple and practical, and does not create additional record-keeping burdens or complex administrative processes for recording an extensive repair history.

Serialised product identifiers

When a product has a product identifier, it may be desirable to add a serial number at individual item level. A serialised number, for example the sGTIN (serialised GTIN), uniquely identifies each individual item, allowing its repair history or refurbishment to be recorded for that individual product. This can help determine whether a product is still in its original state or has been substantially modified.

Parts and components of electronic products currently do not need their own identifier or DPP, unless specific EU legislation applies, as is the case for batteries. Relevant component data is included in the DPP of the finished product.

Deciding who may access which data

The 'economic operator' provides the product with a DPP. The manufacturer, producer or importer that first places the monitor on the European market is responsible for this and is also the main data provider. Which data is included – and who may access it on a 'need to know' basis – can be agreed with supply chain partners for a voluntary DPP, or is specified for each product group in delegated acts by the European legislator for a mandatory DPP.

For a voluntary DPP such as the one developed in this project, different applications can be used by specific user groups, such as repairers, to access the DPP. The aim is for repair information to be accessible to all types of repairers and for the DPP not to create barriers to accessing repair information. In addition, repair data must be objective and preferably linked to existing structures such as the National Repair Register (NRR), an existing and useful tool for identification/quality assurance within the DPP ecosystem.

Harmonising data attributes for a DPP at EU level

There is a need for European harmonisation of definitions, such as 'warranty' or a 'repairability index'. Recording data consistently and in a structured way for repair procedures, spare parts and any tracking systems is a prerequisite for efficient data exchange and for making circular business models work in international supply chains. Only then can DPPs be consistent and comparable, avoiding fragmentation, confusion and a lack of trust.

Harmonising and standardising how data is recorded (data models) and shared (interoperability) ensures efficient exchange between parties and avoids costly manual data checks.

Next steps

The working group would like to share the experience documented in this greenpaper with policymakers and NCDD members to explain the conditions the working group considers necessary for an effective DPP for repair, and the potential needs and barriers involved. The working group will share the document in both Dutch and English with Dutch and European policymakers.

The greenpaper will also be shared with various industry associations, including the parties in the sounding board group. The aim is to inspire their members and help them prepare for legislation or support new business models. GS1 Netherlands will do the same for its members in the electronics sector, both in the Netherlands and internationally.

Solution providers can use the insights in this paper to refine their DPP offerings and make them more practical through the use of open standards.

Finally, the working group sees this greenpaper as an initial exploration and would like to continue exploring the following within a broader (NCDD) community:

- setting up a follow-up case involving a repair app and an actual repair;
- another R-cycle business model – for example, refurbishment – to extend product lifespans;
- a DPP for another electronic product, such as a washing machine or headphones.

"An important consideration for further development, however, is the question of templates for data processing, data access and data governance. Different stakeholders have differing interests when it comes to transparency, personal and commercially sensitive information, and responsibilities. Carefully defining who may access which data, under what conditions, and how these interests are safeguarded is therefore important for the successful implementation of a DPP supported by all parties."

Stefan van Sabben - Global Director CSR and Sustainability – TPV (AOC, MMD and TP Vision)

"What I believe still needs attention is making sure we continue to assess whether we are making the project bigger than it needs to be. Sometimes our discussions focus mainly on wishes and ambitions, without giving enough consideration to feasibility and the investment required.

It is also important that the data and information we share remain relevant (GDPR), are placed in the right context and are not misinterpreted. They must also be recognisable, understandable and easy for others to follow, without creating risks for a brand or for personal data."

Clara Guerra ten Broek - Sr. Manager, Commercial Service Program Management - Monitors & IT Accessories | AOC & Philips

Working group

GS1 Nederland

United Retail

Gemeente Amsterdam

MMD

DYNAFIX
YOUR CIRCULAR TECH PARTNER

tappr

Sounding board group

NL digital

Techniek Nederland

GTDC

TNO innovation for life

Reuzado ICT Services

TCO DEVELOPMENT

HPE

CTL CLOSING THE LOOP