

The Digital Product Passport and Blockchain Technology

The European Union's Digital Product Passport (DPP) is the data layer of the European Green Deal. Mandated under the Ecodesign for Sustainable Products Regulation (ESPR) and reinforced by the EU Battery Regulation, the DPP will require products placed on the EU market to carry a machine-readable record of their materials, provenance, repairability, and end-of-life pathway. Requirements will roll out progressively to specific product categories newly placed on the market, beginning with batteries in February 2027, followed by textiles and other priority goods through staggered deadlines. The policy goal is straightforward: cut emissions by 55 percent by 2030, hit climate neutrality by 2050, and close the loop on resource use across the single market.

The harder question is architectural. A DPP is only as valuable as the data it carries is trustworthy, and the data must move across thousands of suppliers, manufacturers, recyclers, and regulators in jurisdictions inside and outside of the EU. A centralized registry concentrates risk and creates a competitive choke point; siloed databases concentrate friction and break interoperability. Blockchain—public, permissioned, or hybrid—is the credibly neutral substrate that resolves the trade-off. It is the layer that lets the EU's DPP regime scale without anointing a single gatekeeper.

How it works

A Blockchain-based DPP binds a physical product to a verifiable digital record that travels with it through the value chain.

Identity. Each product, component, or batch is assigned a decentralized identifier (DID) or, where uniqueness matters, a non-fungible token (NFT). Each upstream participant—miner, processor, manufacturer, recycler—holds an organizational digital identity that can sign the data they contribute. This pairs naturally with the EU Digital Identity Wallet and eIDAS trust services.

Data layer. Lifecycle data—composition, carbon footprint, repair history, recycling pathway—is recorded through verifiable credentials (VCs) issued by the relevant authorized party. A hybrid storage model is standard: critical hashes and provenance proofs anchor onchain, while bulk lifecycle data lives offchain (IPFS, enterprise stores) and is referenced by the onchain record.

Trust mechanics. Smart contracts, oracles, and zero-knowledge proofs replace bilateral trust with cryptographic verification. Competitors can prove an act—origin, emissions intensity, recycled content—without disclosing the underlying commercial data.

Access. Consumers, customs officers, and recyclers read the passport through a QR code or NFC tag; downstream participants append new credentials as the product changes hands; regulators audit the full chain on demand.

The result is a single, tamper-evident record that is co-authored by every stakeholder yet controlled by none.

Why it matters

Three live pilots already show the model in practice through working onchain digital product passports:

[Circularise](#). A Dutch supply-chain traceability platform issues DPPs across plastics, critical minerals, and automotive components using a public blockchain combined with its “Smart Questions” zero-knowledge protocol. The model lets suppliers prove material composition or sustainability claims to downstream buyers without exposing confidential formulations—and is already in production with partners across the EU plastics and automotive value chains.

[Circulor](#) has built one of the most mature industrial traceability platforms in the market, recording tamper-proof records of a product’s journey from raw materials to end-of-life across automotive, battery, and critical minerals supply chains. Its production deployments demonstrate that blockchain-based DPPs can scale to OEM-grade volumes today.

[IOTA](#), in partnership with Digimarc, has developed a decentralized DPP blueprint for consumer electronics on a public ledger, combining DIDs and verifiable credentials for data integrity with optional NFT-based ownership and access management. The work is being advanced through the European Blockchain Pre-Commercial Procurement programme and is designed to interoperate with the European Blockchain Services Infrastructure (EBSI), keeping the EU’s public-sector rails in the picture.

These pilots, together with industry implementations from [Spheryty](#), [nChain](#), [Traced](#), [Billion](#), and [Dyne](#), are pioneering the implementation of blockchain technology with the European DPP initiative.

Conclusion

The requirements of the European Digital Product Passport—shared data across many independent parties, tamper-evident provenance, selective disclosure, and cross-border interoperability—align well with what decentralized ledgers, verifiable credentials, and zero-knowledge proofs are designed to provide. Early projects suggest that a credibly neutral, standards-led blockchain layer is a strong candidate to help tie the EU’s climate, industrial, and digital strategies together in a single, verifiable record that consumers can trust, businesses can build on, and regulators can audit in real time.