

Table 1: Definition of characteristics

<i>Characteristic</i>	<i>Definition</i>
<i>Dimension 1: Actor Type</i>	
<i>Service Provider</i>	Provides the technology, infrastructure, or support required to implement a digital product passport.
<i>Economic Operators</i>	Uses the digital product passport system within their business operations.
<i>Dimension 2: Sector</i>	
<i>Automotive</i>	Relates to vehicles, their parts, and associated supply chains.
<i>Electronics</i>	Involves electrical devices and related components.
<i>Fashion / Textiles</i>	Covers garments, fabrics, and materials used in clothing and related products.
<i>Food & Beverage</i>	Pertains to products in the food and beverage industry, from raw ingredients to packaged items.
<i>Luxury Goods</i>	Refers to premium products such as high-end fashion, jewellery, or accessories.
<i>Battery</i>	Encompasses batteries and associated components, including their production and regulation.
<i>Plastics</i>	Involves products made from polymers and other plastic materials.
<i>Cross-Industry</i>	Applies to multiple sectors by offering a universal framework for digital product passports.
<i>Dimension 3: Supply Chain Stage</i>	
<i>Raw Material Sourcing</i>	The stage where basic materials are procured or extracted before further processing.
<i>Manufacturing</i>	Converts raw materials into finished or semi-finished products.
<i>Distribution</i>	Involves the transport and delivery of products from manufacturers to retailers or end-users.
<i>Retail / Consumer Use</i>	The point at which products are sold directly to customers.
<i>End-of-Life (EoL) or Second Life (SL)</i>	Encompasses end-of-life and second life strategies based on circular economy principles, such as

recycling, repurposing, and recovery.

Dimension 4: Certifications

<i>CE</i>	A marking indicating that a product meets European Economic Area requirements.
<i>RoHS</i>	Limits the use of certain hazardous substances in electrical and electronic equipment.
<i>REACH</i>	A regulation addressing the registration, evaluation, authorisation, and restriction of chemicals in products.
<i>GOTS</i>	A standard that sets criteria for organic textiles, covering both processing and social requirements.
<i>ISO Standards</i>	An international standard that defines quality, safety, or efficiency criteria.
<i>EU Battery Regulation</i>	A regulation that sets specific requirements for the design, production, and end-of-life handling of batteries within the EU.

Dimension 5: Geographical Reach

<i>Regional (i.e Europe)</i>	Covers products or operations confined to a specific region, such as Europe.
<i>National</i>	Adheres to one country's standards and consumer requirements.
<i>Global</i>	Involves products or operations that span multiple countries or continents.

Dimension 6: Customer Type

<i>Business-to-Business</i>	Business-to-Business transactions or interactions.
<i>Business-to-Consumer</i>	Business-to-Consumer transactions or interactions.

Dimension 7: Market Positioning

<i>Mass-Market</i>	High-volume, standardised offerings for broad consumer bases.
<i>High-End</i>	Products targeted at a premium or luxury segment of the market.

Dimension 8: Deployment Model

<i>Cloud-Based</i>	Solutions hosted on remote servers and accessed via the internet.
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<i>On-Premises</i>	Solutions installed and operated on local servers or hardware within an organisation.
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<i>Hybrid</i>	A combination of cloud-based and on-premises solutions.
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Dimension 9: Data Modelling

<i>Asset Administration Shell (AAS)</i>	A digital representation model for assets, providing structured data according to a standardised framework.
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<i>No Specified Model / Other</i>	Indicates that no particular data model is defined for representing the digital product passport.
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Dimension 10: Blockchain

<i>Public (Open-Loop)</i>	A blockchain network that is open to anyone and is generally decentralised.
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<i>Hybrid</i>	A blockchain network that combines elements of both public and private blockchains, allowing controlled access while maintaining some level of transparency and decentralisation.
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<i>Private (Restricted)</i>	A blockchain network that is limited to authorised participants, often managed by a single entity.
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Dimension 11: IoT

<i>Sensor-based</i>	Involves devices that collect data through sensors embedded in products.
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<i>Real-Time Monitoring</i>	Systems that provide immediate data updates on product status or performance.
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<i>Smart Devices</i>	Products or components equipped with advanced connectivity and processing capabilities.
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Dimension 12: AI

<i>Predictive Analytics</i>	Uses historical data and algorithms to forecast future events or trends.
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<i>Anomaly Detection</i>	Identifies patterns or data points that deviate from the norm.
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<i>Automation</i>	The application of technology to perform tasks with minimal human intervention.
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Dimension 13: API Integration

<i>Standardized</i>	Uses established protocols (e.g. REST, EPCIS) to
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	connect systems or software.
<i>Custom</i>	Involves tailor-made interfaces designed to meet specific integration requirements.

Dimension 14: Encryption & Authentication

<i>Distribution Ledger Technology (DLT)</i>	A digital system that records transactions across multiple computers, ensuring security, transparency, and decentralisation without a central authority.
<i>Public Key Infrastructure</i>	Public Key Infrastructure that uses a pair of keys (public and private) to encrypt and authenticate data.
<i>Zero-Knowledge Proofs</i>	A method where one party can prove to another that a statement is true without revealing any additional information.

Dimension 15: Product Identification

<i>Serial Number</i>	A unique identifier assigned to an individual product.
<i>QR Code</i>	A two-dimensional barcode that can be scanned to reveal product information.
<i>RFID</i>	Radio Frequency Identification that uses electromagnetic fields to identify and track products.
<i>NFC</i>	Near Field Communication, a short-range wireless technology used for data exchange between devices.
<i>GS1</i>	A standard for product identification and barcoding used in global supply chains (e.g. GTIN).

Dimension 16: Security Measures

<i>Tamper-Proof Detection</i>	A digital system that monitors a product for unauthorised alterations using NFC and RFID technologies.
<i>Digital Watermarks</i>	Embedded digital codes that help verify the authenticity of a product.

Dimension 17: Material Data

<i>Raw Material Origins</i>	The basic substances or ingredients used in the creation of a product.
<i>Bill of Materials</i>	A detailed list of components and materials required for product manufacture.

<i>Hazardous Substances</i>	Materials that may pose risks to health or the environment.
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Dimension 18: Manufacturing Data

<i>Origin & Factory Information</i>	Details about where and in which facility a product was manufactured.
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<i>Event Sourcing</i>	A method of recording data changes as a sequence of events during the manufacturing process.
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<i>Production Batch & Lot</i>	A specific group of products produced under similar conditions.
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<i>Process Data</i>	Information relating to the operational steps and conditions during production.
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Dimension 19: Environmental Impact

<i>Carbon Footprint</i>	A measure of the total greenhouse gas emissions caused by a product.
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<i>Water Usage</i>	The amount of water consumed during the product's lifecycle.
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<i>Energy Share</i>	The proportion of energy used in the production and maintenance of a product.
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<i>Product Emissions</i>	Emissions or pollutants generated during the production or use of a product.
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Dimension 20: Usage & Maintenance

<i>User Manual</i>	A document that provides instructions for product use and care.
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<i>Maintenance Guidelines</i>	Recommendations for the upkeep and servicing of a product.
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<i>Repair Logs</i>	Records of maintenance or repair activities carried out on a product.
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Dimension 21: EoL & SL Info

<i>Recycling Guidelines</i>	Instructions on how to recycle or process a product after its life.
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<i>Take-Back-Programmes /Resale</i>	Schemes for the return or resale of products at the end of their lifecycle.
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<i>Disposal Methods</i>	Prescribed procedures for the safe disposal of a product.
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