Product Information 4.0

Technical pillars of a product information system such as the DPP including access management, verification, product identification and data carriers

Diana Baumgärtel, circular.fashion
Product Information 4.0 System

Aspects of a Product Information System

- human user (consumer, repairer, …)
- website
- resolver / connector
- identifier-URL
- data carrier
- machine-user (automated sorting, app, …)

- forwards incoming requests to the corresponding web source depending on the user
- machine-readable data format

product data
Product Information 4.0 System

Aspects of a Product Information System

- **central components**
  - registry, web portal
  - to support additional use cases
    - customs, market surveillance, comparability services

- **decentralised data storages**
  - product information systems
  - cloud storage by service providers
  - industrial information system

- **standardised vocabulary**
  - taxonomy
  - ontology

- **data mapping**
  - for storage systems that are not aligned (yet)

- **role-based access management**
  - identifier - URL
  - verified data
  - security measures

- Website

- **resolver / connector**
  - forwards incoming requests to the corresponding web source depending on the user

- **machine-readable data format**

- **human user**
  - (consumer, repairer, ...)

- **data carrier**
  - (automated sorting, app, ...)

- **identifier-URL**
Product Information 4.0 System

Alignment with EU Standardisation Requests

- **data carrier**
  - human user (consumer, repairer, …)
  - machine-user (automated sorting, app, …)

- **identifier-URL**
  - resolver / connector
  - forwards incoming requests to the corresponding web source depending on the user

- **website**

- **resolver / connector**

- **role-based access management**

- **machine-readable data format**

- **standardised vocabulary taxonomy ontology**

- **data mapping**
  - for storage systems that are not aligned (yet)

- **verified data security measures**

- **central components (registry, web portal)**
  - to support additional use cases (customs, market surveillance, comparability services)

- **decentralised data storages**
  - product information systems
  - cloud storage by service providers
  - industrial information system

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Methodology
How to Compile & Provide Information for a Circular Economy

1. Vocabulary / Terminology
2. Data Storage
3. Data Exchange
4. Ownership and Data Verification
5. Access management and IP Protection
6. Data Carriers
7. Product Identifiers
## Evaluation of circularity.ID, IMDS, KEEP, PCDS and RAMI 4.0

### What We Can Learn From Existing Systems

<table>
<thead>
<tr>
<th>Sector</th>
<th>Market</th>
<th>Readiness</th>
<th>Vocabulary</th>
<th>Data Storage</th>
<th>Access Management</th>
<th>Identifiers</th>
<th>Data Carriers</th>
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<tbody>
<tr>
<td>circularity.ID</td>
<td>Fashion</td>
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<td>c.ID Open Data Standard</td>
<td>Single server become decentralised service provider</td>
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<td>Different options</td>
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<td>Material Data Sheet</td>
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<td>KEEP Electronics</td>
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<td>Demonstrator</td>
<td>Joint information standard</td>
<td>Decentralised</td>
<td>Role-based sharing + sharing on request</td>
<td>Internal identification</td>
<td>Barcode, QR code</td>
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<td>Cross-sectoral</td>
<td>Data model in use</td>
<td>PCDS Data Sheet</td>
<td>Decentralised</td>
<td>Full insight for supply chain partners &amp; brands</td>
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Data Storage
Why Experts Advocate for a Decentralised Solution

- It may be challenging to implement a central system and force industry players to adopt it.
  Many stakeholders prefer to retain control over their data.

- Storing data in decentralized storages mitigates the risk of a single point of failure, thereby reducing the likelihood of security breaches.

- A decentralized system enables data owners to keep current systems in use. This also supports SME data storage service providers.

- The advantages of a central system, such as facilitating customs and market surveillance, can likely be achieved through a complementary central server.
Validation, Verification, Integrity Control

Ensure Accuracy of Data Stored

**Verification | manual**
- tool to ensure data quality (accuracy)
- can be performed
  - internally by the data owner
  - externally through a third-party auditing process
  - through certification
- either data can be audited directly, or the processes used to gather the data

**Validation | automated**
- tool to avoid small errors and have a good basis for verification
- can check for
  - data availability,
  - reasonability,
  - data format usability with software
- cannot check for accuracy

**Integrity control | automated**
- tool to make sure data is not changed after adding it to the system
- using unchangeable data methods like versioned databases or blockchain technology
1 Define user profiles and information requirements
   - Publicly accessible subset of the data
   - Need-to-know principle
   - Further methods to protect IP such as sharing aggregated data or levels of information depth

<table>
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<tr>
<th>Publicly accessible</th>
<th>Shared with specific stakeholders</th>
</tr>
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<tr>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>● shared openly</td>
<td>● role-based access management (need-to-know principle)</td>
</tr>
<tr>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>● shared openly if desired</td>
<td>● role-based access management (optional sharing)</td>
</tr>
<tr>
<td>● shared on request if desired</td>
<td>● need for bilateral communication channels</td>
</tr>
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</table>

2 Use available technologies to secure the system and exchange channels, e.g.
   - encryption, hashing or digital signatures for basic system security
   - multi-factor authentication and single-sign-on methods for authentication
# mandatory data:
- **product identifier type**: GTIN
- **product identifier**: 012345678901
- **product type**: scarf
- **colours**: white
- **brand**: brand x
- **material composition**: [80% wool, 20% cotton]

# optional data:
- **certifications**: GOTS, Fairtrade
- **production country**: Spain
- **pattern**: unicolour
- **market segment**: premium

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*This example uses fictional data.*
Data Carriers

Data Carrier Requirements | Definition per Product Group

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<td>● process time</td>
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<td>● storage capacity</td>
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+ digital data carriers for e-commerce
Data Carriers

Data Carrier Requirements | Definition per Product Group

**General**

- durability
- process time
- storage capacity
- readability
- implementation guidelines
- privacy protection
- environmental impact

**Textile**

- support reuse and recycling
- water, heat and pressure resistance
- design and comfort requirements
- metals can disrupt textile recycling
- support efficient sorting processes

**Electronics**

- support reuse and recycling
- main sustainability levers: purchasing decisions, reuse, repair
- design and functionality demands
- including electronic tags and metals doesn’t add challenges

+ digital data carriers for e-commerce
### Data Carriers

#### Technologies in Textile and Electronics

<table>
<thead>
<tr>
<th></th>
<th>Textiles</th>
<th>Energy related products / Electronics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purchasing Decisions</strong></td>
<td><img src="https://via.placeholder.com/15" alt="QR Code" /> <img src="https://via.placeholder.com/15" alt="NFC" /></td>
<td><img src="https://via.placeholder.com/15" alt="QR Code" /> <img src="https://via.placeholder.com/15" alt="NFC" /></td>
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<tr>
<td><strong>Use Phase</strong> (e.g. repair)</td>
<td><img src="https://via.placeholder.com/15" alt="QR Code" /> <img src="https://via.placeholder.com/15" alt="NFC" /> <img src="https://via.placeholder.com/15" alt="RFID" /></td>
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<td><strong>Reverse Supply Chain</strong> (e.g. sorting, recycling)</td>
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*Optical 2D Codes (QR, DataMatrix etc.)*

*NFC (RFID HF)*

*RAIN RFID (RFID UHF)*

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*variety of data carriers difficult*
Link the Physical Product to the Information

- unique
- persistent
- small
- URL-formattable
Identifiers

Link the Physical Product to the Information

**identifier**
- unique
- persistent
- small
- URL-formattable

**Model**
Commercial data  
(e.g. brand / product description)

**Variation**
Static upstream data  
(e.g. material composition)

**Item**
Dynamic data  
for recommerce, rental etc.

SERIALIZED (ITEM-LEVEL) IDENTIFIERS ENABLE CIRCULAR BUSINESS MODELS

take-back | online resale | repair history tracking | rental
Details Will Be Published in the Final Report

**Standards**
- Standardisation of product information systems is desirable and recommended.
- Development process should be consensus-driven, including a strong community representing relevant stakeholders.

**Vocabulary, Ontology, Taxonomy**
→ Should be based on aligned and harmonised existing standards

**Data Storage**
- Experts advocate for a decentralised solution
- Central registry is an option for additional use cases

**Data Exchange**
Solution for global interoperability between systems missing
- Central system
- Single data standard
- Map data between all data standards

**Access Management and IP Protection**
- Technical solutions available and recommended for data security, authentication and authorisation
- Need-to-know principle to develop an appropriate access management

**Identifiers and Data Carriers**
- Identifiers can be standardised to a single or multiple solutions
- Different levels of identification granularity possible
- For data carriers, a harmonised solution would be beneficial

**Ownership, Liability and Data Verification**
- Data verification should be accompanied by digital solutions for data validation and integrity checks
- Financial incentives, penalties and legal sanctions can help motivate companies to improve data quality
Product Information 4.0
extension of legal information requirements for products and digital implementation by the example of energy-related products and textiles

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