A Digital value chain Integration Traceability framework for process industries for Circularity and low Emissions by waste reduction and use of secondary raw materials

DigInTraCE

Towards Dynamically updated DPP. Exploring the link between DPP and advanced sorting techniques.

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DIGITAL PRODUCT PASSPORT
EVENT SERIES by ICCS

14/11/2024, Digital Product Passport
& Tracing : projects joining forces

Scope

To make a small introduction to the DPP and sorting and try to
investigate their link through a set of questions and answers
based on a demonstrated use case of upcycling wood by-products..

What we will present of course could be transferred to other types of
Products and business domains…

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Dynamic DPP: Beyond DPP

- Typical DPP: Pretty much static info addressing the human end product consumer
  - Product info
  - Circularity
  - Sustainability
  - Traceability
- Dynamic DPP means leveraging on DPP and going beyond
  - Time wise dynamic data which are interesting for both product end users and also intermediate actors **and systems** of the supply chain

Who can benefit from Dynamic DPP data and why?

Human users

- Consumers
  - ✓ Get product info and other interesting information and act accordingly
  - ✓ Trust of the product they are about to consume

- Producer
  - ✓ Create trust regarding the product that will be consumed
  - ✓ Potentially collect data regarding post production product life

Industrial systems

- Supply chain actors
  - ✓ Reinforce current internal practices by processing DPP data
  - ✓ Reinforce current processes with their business partners along the supply chain based on DPP data sharing
  - ✓ Enhance their sustainability and circularity conformance and strategy

Where do human users and DPP processes come from potentially

Manufacturing & Industrial Products

Consumer Goods & Retail

Food & Beverage

Automotive

Construction & Building Materials

Pharmaceuticals & Healthcare

Upcycling

Within Digintrace

- Dynamic DPP design and development mostly from the perspective of the
  - Manufacturing & Industrial Products (Furniture manufacturing, Plastics manufacturing, Textile)

- Targeting both human end users and industrial processes within upcycling processes and specifically sorting

- In other words what we will try to think about is "How can a DPP be created or used when sorting materials?"

- Sorting?
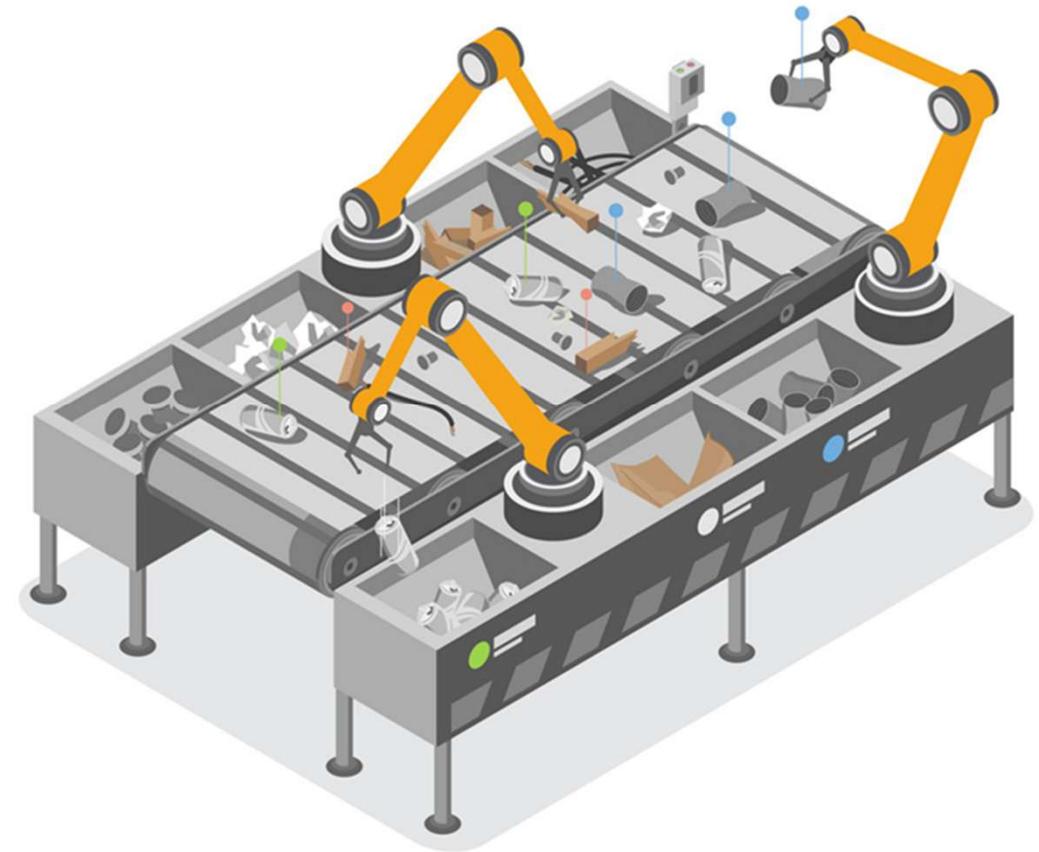
# Exploring the link between DPP and advanced sorting techniques.

Upcycling processes: wood value chain
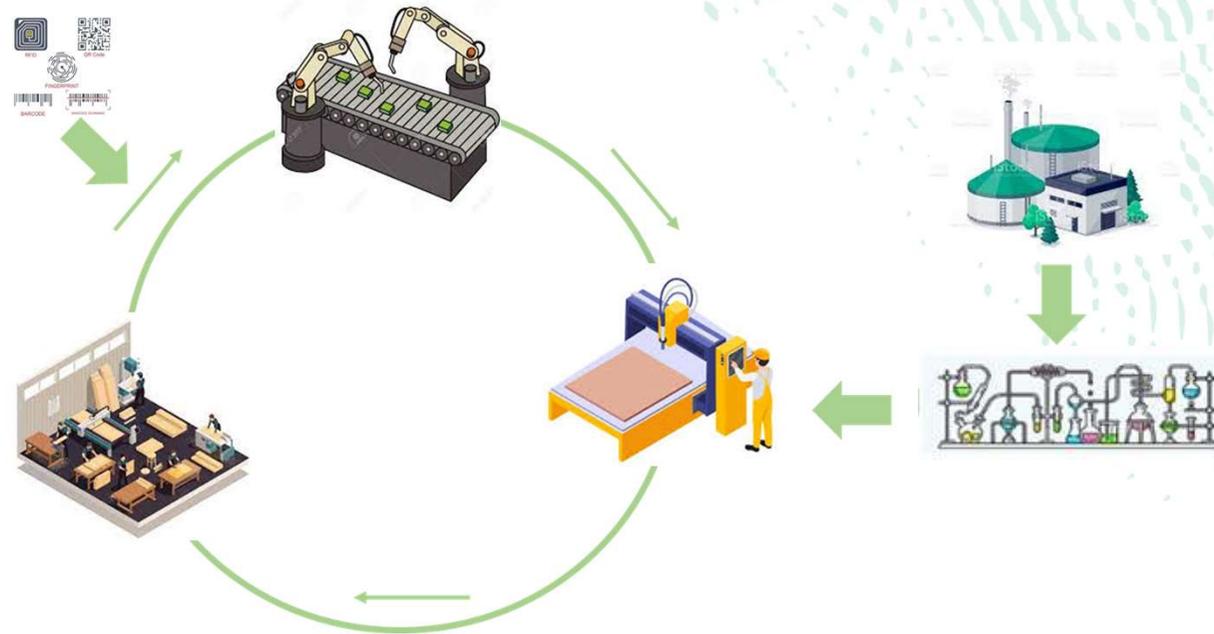
Exploring the link between DPP and advanced sorting techniques: Where do DPP apply? When are they created?

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- End user wood products: Wooden chairs, tables but also intermediate wood by products such as a piece of wood used to manufacture the aforementioned goods.

- The DPP could be created at the production stage ideally. For the case of by products and specifically wood by-products it could happen at the sorting phase, where by-products are classified and therefore are "known" by the DPP creation process.

DPP
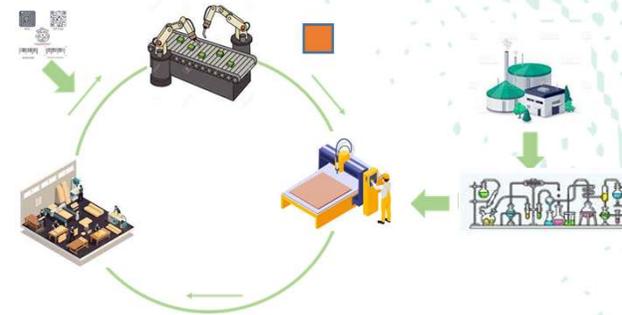
- Thus potentially enabling the creation of DPPs for existing products at a high

level of granularity. In our case the data carrier of wood by products is an UHF RFID tag.

Concept idea: DPP creation based on UHF RFID!

DPP Flow 0
Operator: ICCS - Sorter
Process: Sorting by type of wood
Action: Sort wood by type (Solid Oak, OSB, MFC)
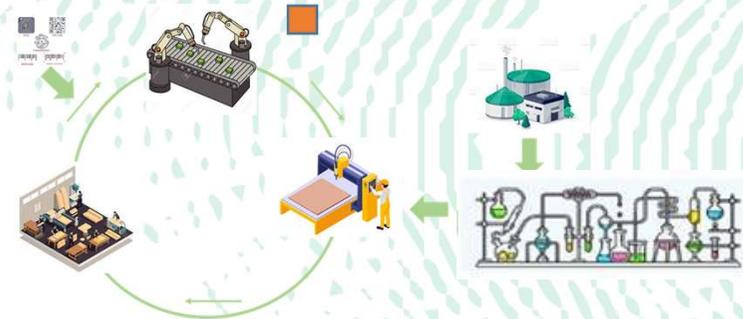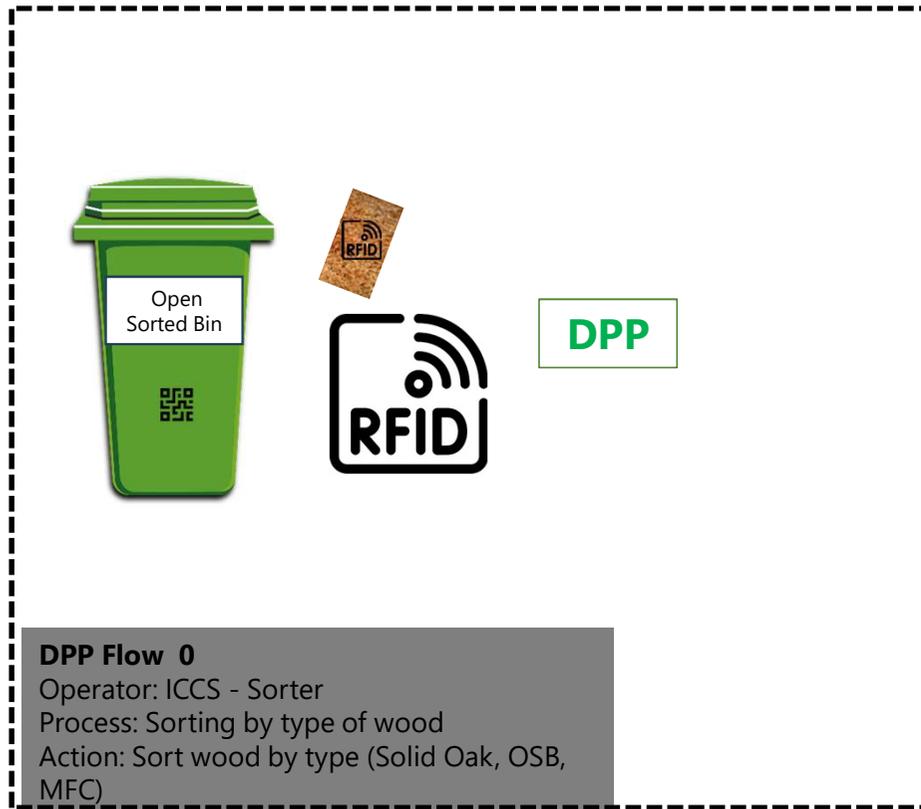
UHF RFID tags are placed on wood by products

And The DPP of a piece of wood coming from a sorted bin is created by an RFID antenna scanning the batch of wood.

The sorted bin can be also considered as a product with it's own DPP comprising the piecewise wood-by products!

Exploring the link between DPP and advanced sorting techniques: How can we use DPP content ?

Concept idea: DPP based AR enable sorting assistant!

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Open Sorted Bin

DPP Scanning

Closed Sorted Bin

DPP Flow 2
Operator: ICCS - Sorter
Process: Filling or close a sorted bin
Action: Fill | Close bin
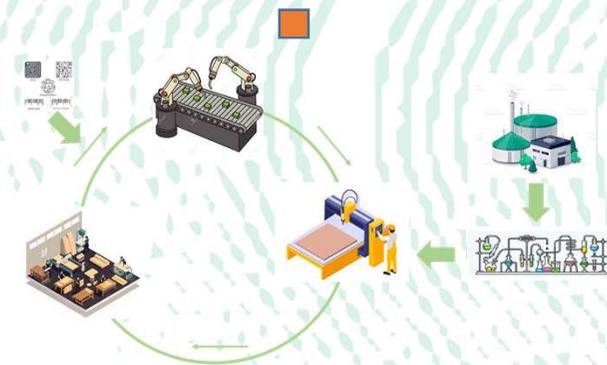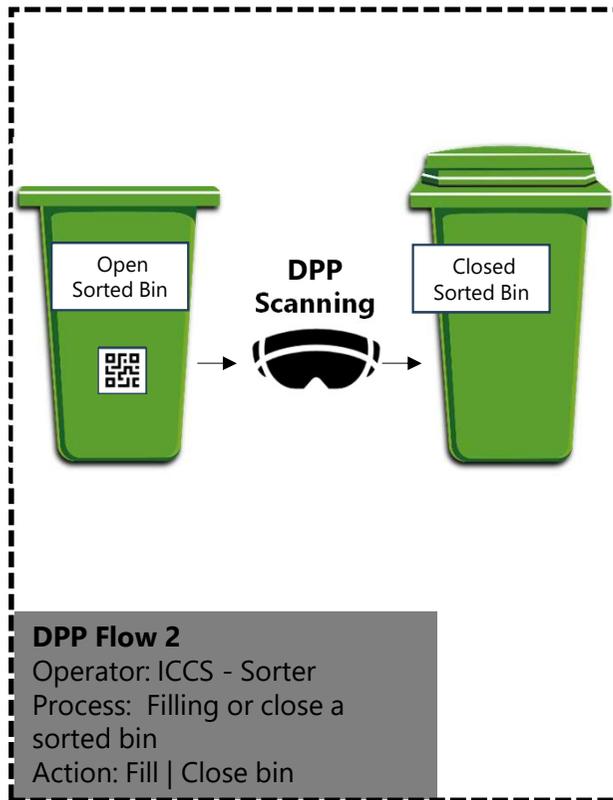
A human operator scans each sorted bin with his AR display. This scan provides information on the of wood by products in the bin, along with their type and status (such as the fill level). Once a bin is full, the operator can close it and update its DPP, marking the bin as ready for dispatch to its destination.

Concept idea: DPP based AR enabled supply chain optimized assistant!

DPP Flow 3
Operator: ICCS - Sorter
Process: Send sorted bins to CHIMAR
Action: Send
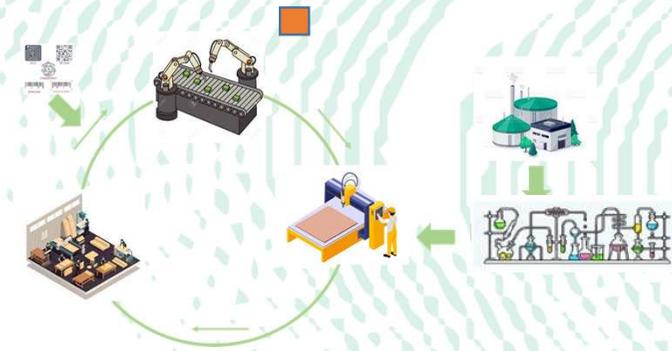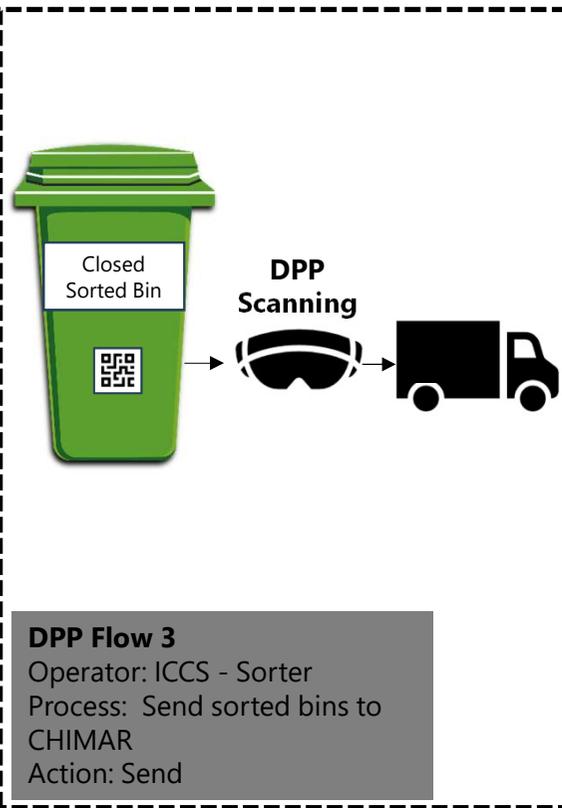
Once the sorted bins are closed, the human operator scans each bin again to retrieve information about the bin's DPP. The system then informs the operator of the next step, which is to send the bin to its destination.

Once wood by product DPPs have been created they could continue into other upcycling processes…
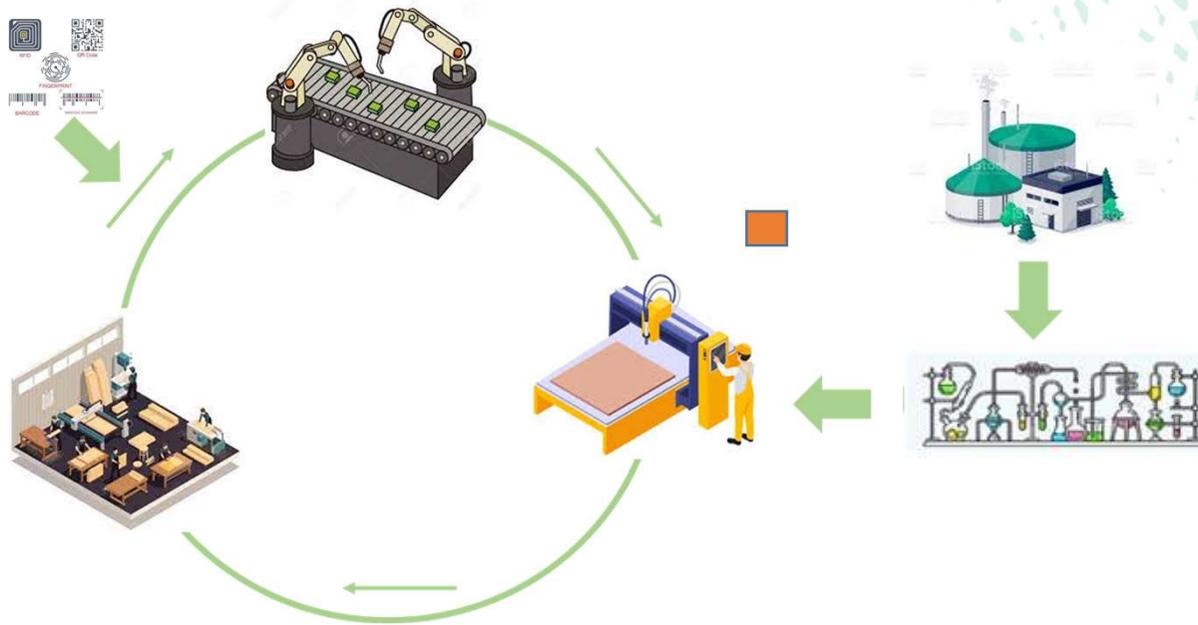
Concept idea: DPP traceability information retrieval!

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Closed Sorted Bin
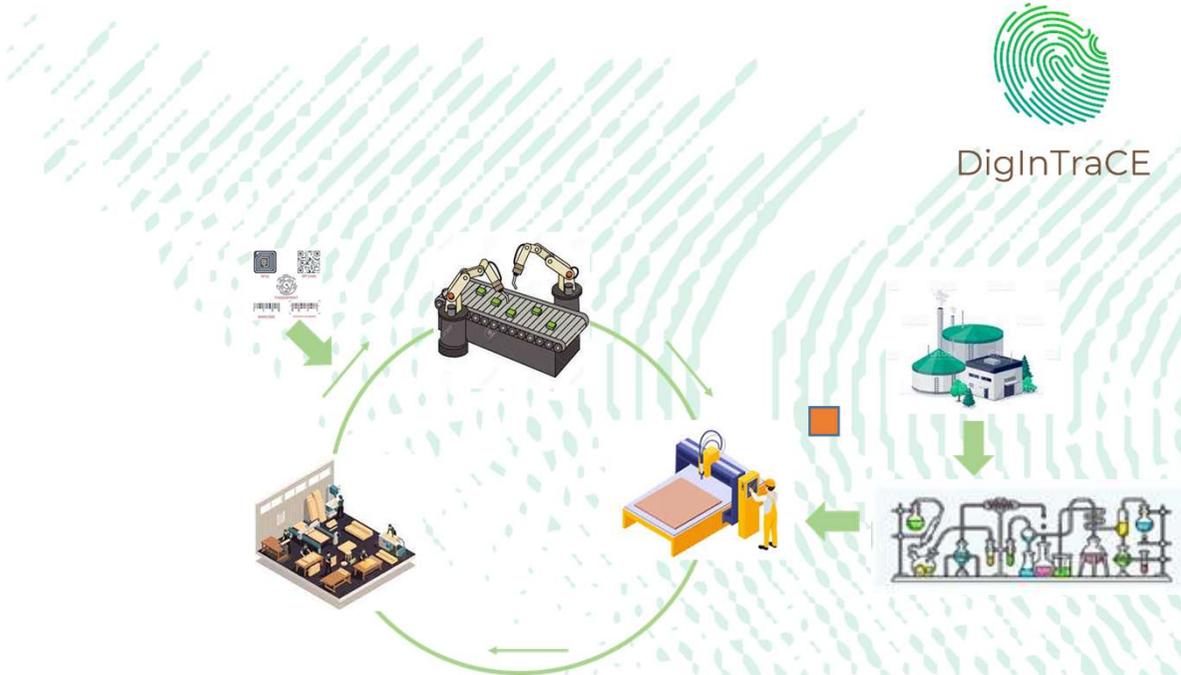
RFID

The bin arrives at the chemical wood by-product processing premises, it is sensed by the RFID antenna and corresponding traceability information is updated

Concept idea: DPP product info retrieval for upcycling optimization!

DPP Flow 4
Operator: Chemical industry
Process: Receiving bins and view possible future actions
Action: Receive | Upcycle
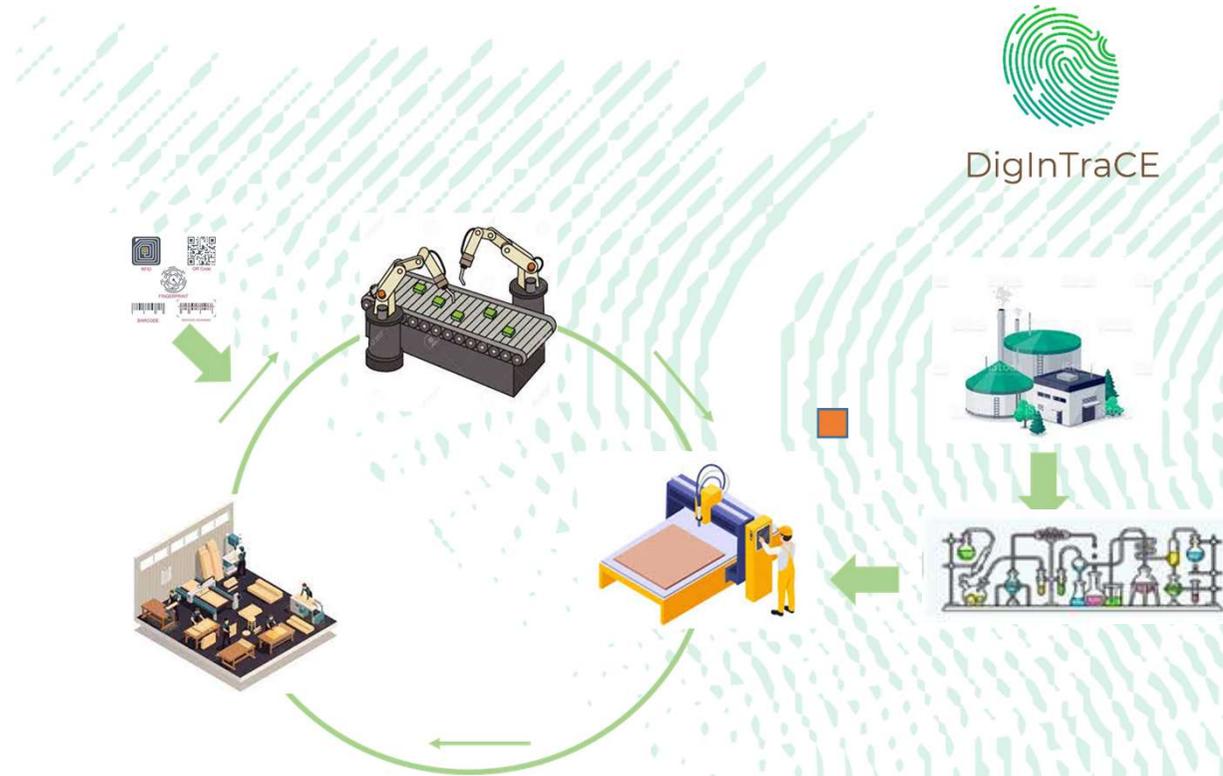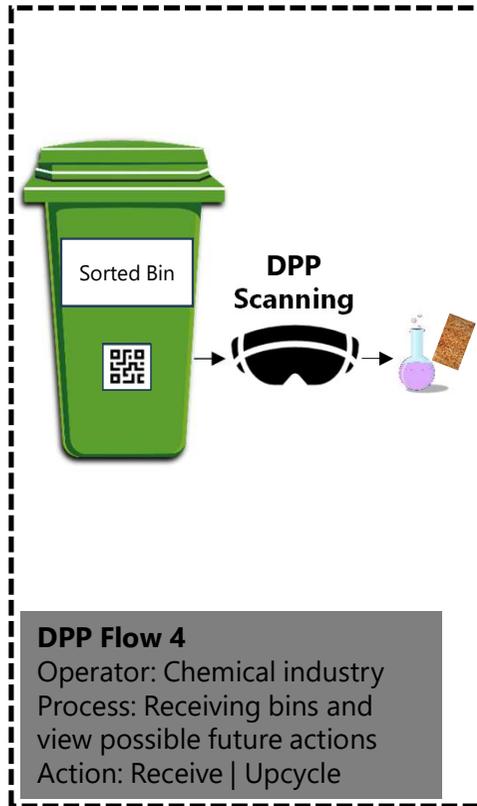
The chemical industry receives the sorted bins and utilizes the wood from these bins to manufacture plywood and particleboards. At this stage DPP's of particleboards could be created!

- At some point it is possible that wood-by products with DPP's arrive at the sorting facilities, and they could be sorted according DPP info....
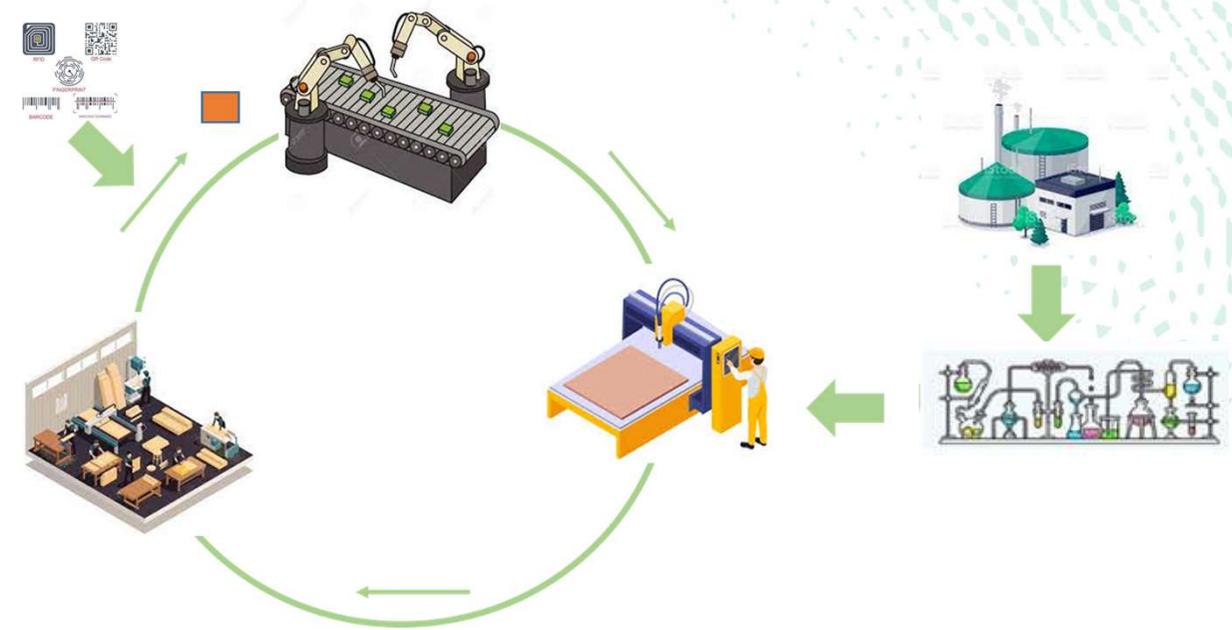
Exploring the link between DPP and advanced sorting techniques: How can we use DPP content to sort wood-by products?

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Concept idea: DPP based sorting!

- Pieces of woods are equipped with UHF RFID tags with the iD of the DPP encoded.

- As pieces of wood pass by the UHF RFID reader at the entrance of the sorter, they are scanned and the DPP is fetched by the scanner.

- Both the type of wood and localization information available to the RFID reader are subsequently transmitted to the sorting system which can use it to place the piece of wood in a specific bin of sorted wood

- The DPP data section regarding status information is updated. Also presence of a product at the sorting stage signifies it's potential re-use, critical for circularity and sustainability metrics!
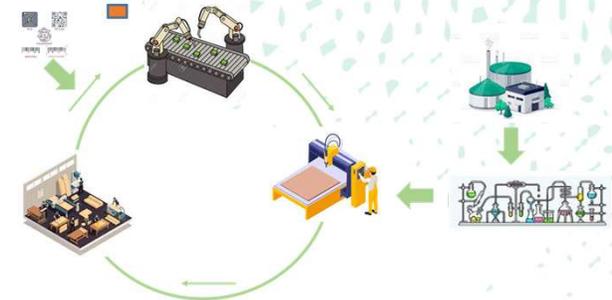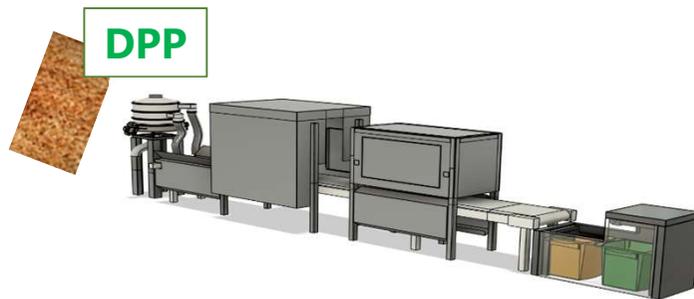
DPP

Tech stack

- In our presented scenario
  - UHF RFID readers
  - Tags, that can be printable and host both QR Codes and RFID
  - Tag printers
  - AR display (Hololens)
- Software
  - DPP blockchain to store each product's DPP evolution and in order to capture relationships between DPPs of various connected products(Hyperledger FABRIC)
    - Wood by products -> Particle Boards,
    - Wood by products -> Chairs, Tables
  - Sensor Integration software
    - Message brokers, wrappers etc..

Conclusions

- DPP data serves as a horizontal plane for mutlicontext applications targeting both humans and machines

- DPP data model interoperability is key for a widespread adoption; DPPs are an opportunity of interoperable data!

- Sorting processes are central to DPPs; Sorting can use DPPs but DPPs can also use sorting!

- DPP indicators regarding product information, circularity, sustainability and traceability must be well defined and ubiquitous to boost the relevant sectors.

- Standardization is very important and will pave

- the way towards widespread DPP based apps

Future steps

- Concept design, development and validation for other domains Textiles, Plastics…
- Expansion of DPP indicators for multiple domains (sustainability, circularity, traceability)
- Input and participation in standardization activities

- ….

Thank you!

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