

ReCircE – Digital Lifecycle Record for the Circular Economy

Transparent design of material cycles and optimization of waste sorting with the help of artificial intelligence



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ReCircE

Digital Lifecycle Record for the Circular Economy –
Transparente Gestaltung von Stoffkreisläufen und
Optimierung von Abfallsortierung mithilfe Künstlicher Intelligenz

- Motivation
- Project ReCircE
- Project idea: From digital Product Passport to Lifecycle Passport
- Use-Cases
- Sorting System
- Expected Results

Background:

- The European Green Deal aims to decouple economic growth from natural resources use. (European Commission, 2019)
- Germany aims to be climate neutral by 2045. (Federal Government, 2021)

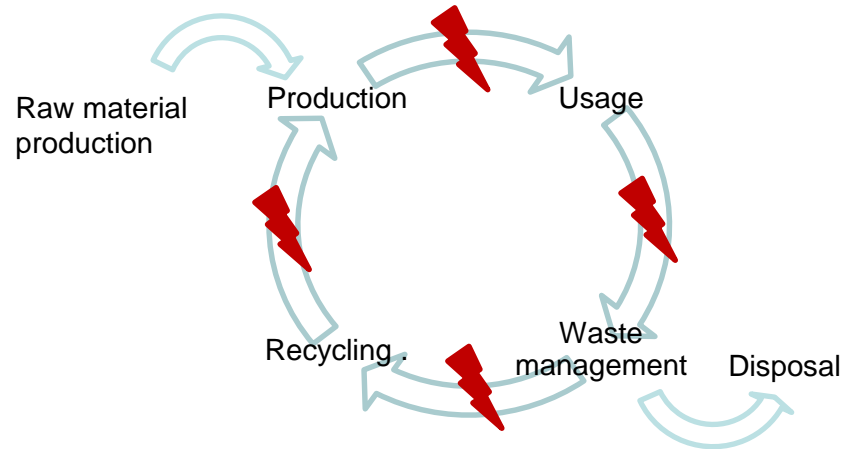
Challenges:

- Lack of essential information missing among stakeholders of the circular economy
 - e.g. secondary raw material availability and quality
- Secondary raw materials are more expensive compared to primary raw materials
- Secure data exchange is missing
- Sorting of waste is still a challenge

The Project Idea

From waste management to the circular economy **using information**

- to design transparent material lifecycles,
- to optimize waste sorting processes with the help of artificial intelligence.



Project ReCircE

ReCircE



Fraunhofer-Einrichtung für Wertstoffkreisläufe und Ressourcenstrategie IWKS

GreenDelta

CIRGEON

Circular Economy Services

Funded by



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für Umwelt, Naturschutz
und Reaktorsicherheit

as part of the "AI Lighthouses for the Environment, Climate, Nature and Resources" initiative.

ReCircE: From Digital Product Passport to Digital Lifecycle Passport



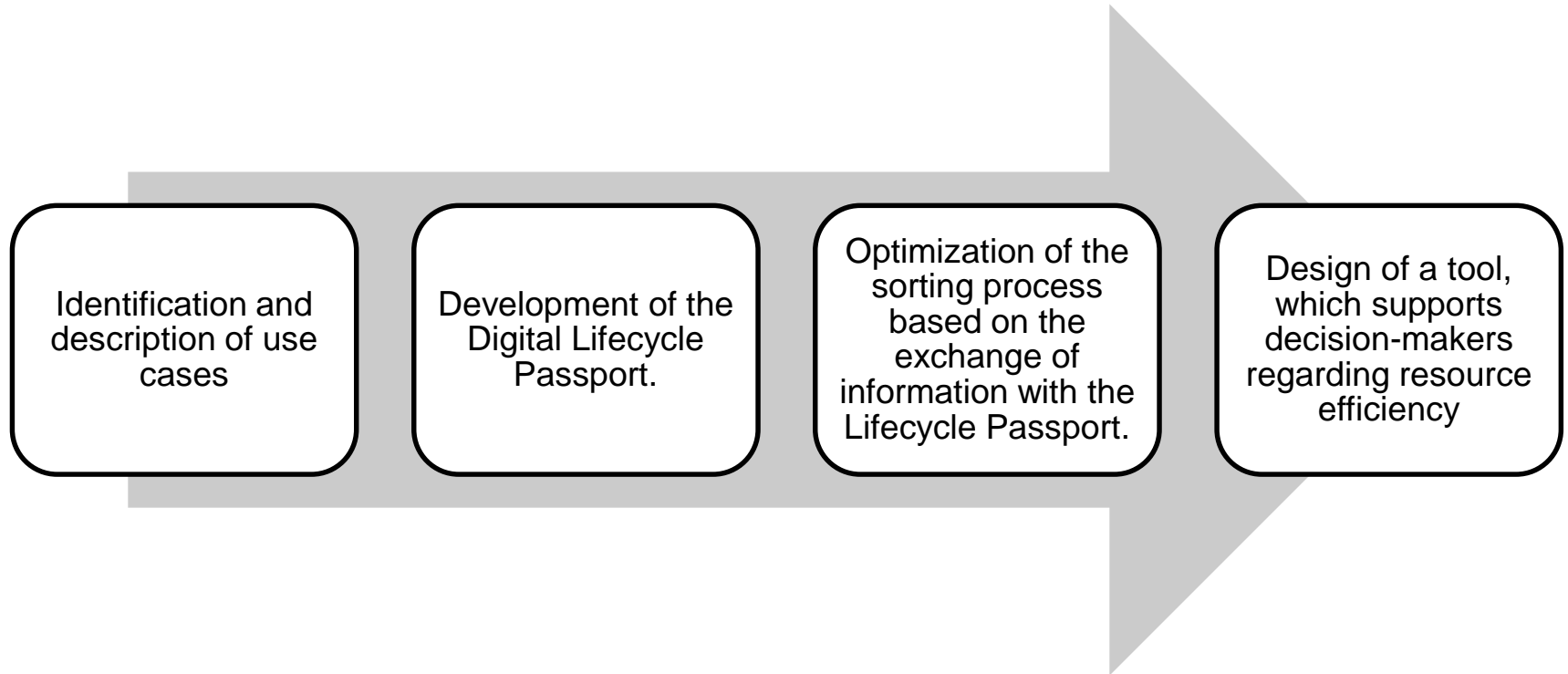
Digital Product Passport (BMU, 2021)

- **set of data** summarising a product's components, ... proper disposal
- **originates from all phases**
- used for various purposes in all its phases (design, manufacture, use, disposal)
- a **standardised, comparable format**
- for **reliable consumer information** and **sustainable consumer choices**

Digital Lifecycle Passport (ReCircE)

- **extension** of the digital Product Passport
- **dynamic and digital center** for the **exchange of information** among all actors
- provides the background information for a tool to **support decision-makers** regarding the **efficient use of natural resources.**





Use case 1: Plastic packaging



Characteristics

- Simple product
- short durability
- relatively low pollutant potential

Aims

- Improving sorting of plastic waste
- Increasing the proportion of recyclates in packaging

Use case 2: Small electrical devices



Characteristics

- Complex product
- medium durability
- medium to high pollutant potential

Aims

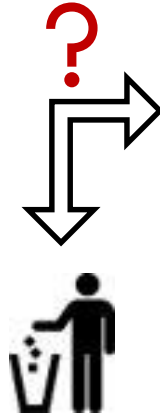
- Recycling of black plastics
- Improving recycling of old display devices such as smartphones

Sorting System – Challenges

Questions based on missing a priori information.

What and how much is coming?

Are hazardous components involved?



Kamera
NIR
Metal Detector



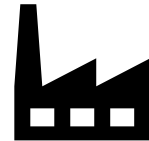
How to optimize the sorting process for a better recycling?



Questions based on missing a posteriori information.

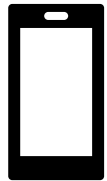
Questions based on the missing downstream information.

What is the most valued treatment?



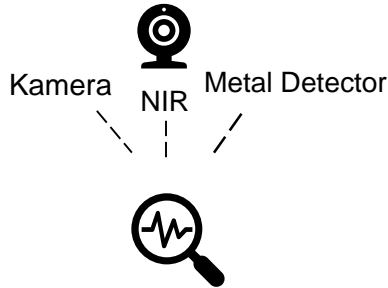
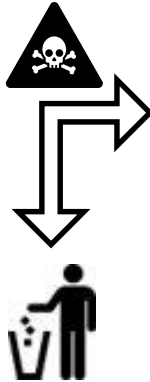
Sorting System – Optimization using AI and Digital Lifecycle Passport

Answers based on a priori information.



AI-based object identification based on Lifecycle Passport

Sorting decision e.g. hazardous components based on AI



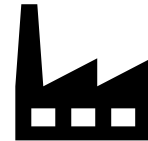
Optimized material-specific sorting

Answers based on a posteriori information.

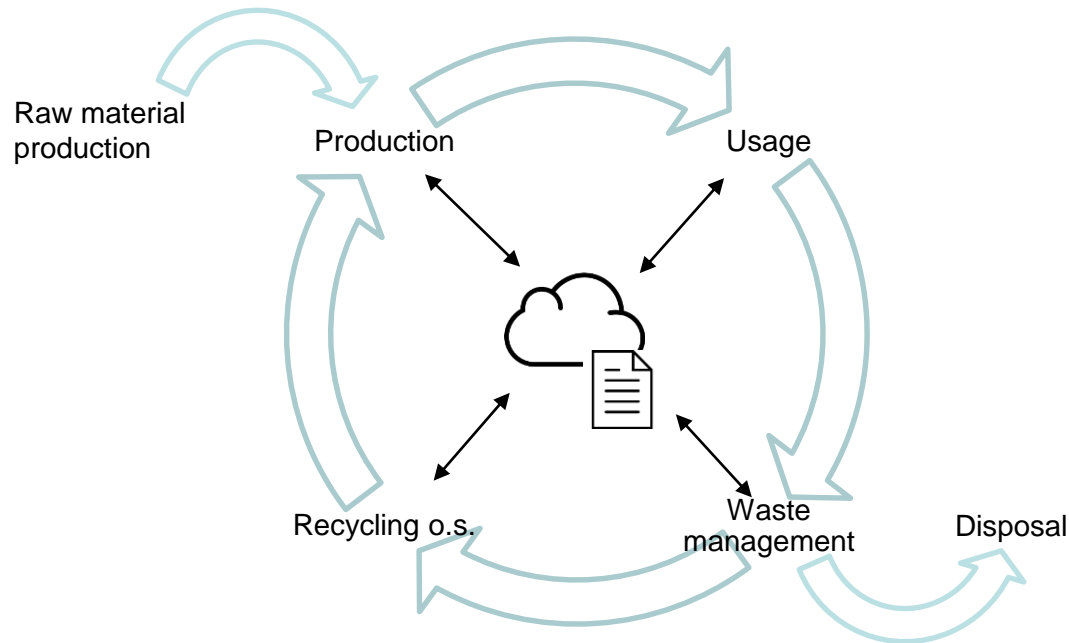
Answers based on the downstream information.



Sorting decision based on the real-time value or cost



Expected Results



- Provision of an information platform
- Development of a user-friendly resource efficiency tool
- Optimized sorting through AI methods
- Collection and processing of LCA-friendly data

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Thank you for your attention!

- We are looking for **interested partners...**
 - for cooperation in our use cases,
 - to test the Digital Lifecycle Passport, the cloud platform and the sorting processes.
- Become a part of it!

www.recirce.de

Together we can close the loop!



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- [1] European Commission. The European Green Deal, 2019.
- [2] Federal Government (2021): Mehr Klimaschutz: klimaneutrale EU bis 2050. Bundesregierung, Online verfügbar unter <https://www.bundesregierung.de/breg-de/themen/klimaschutz/mehr-klimaschutz-in-der-eu-1790042>, zuletzt aktualisiert am 15.08.2021, zuletzt geprüft am 15.08.2021.
- [3] BMU (2021): BMU Digital Policy Agenda for the Environment: Environmentally friendly streaming | Cluster | BMU. Bundesumweltministerium, Online verfügbar unter <https://www.bmu.de/en/service/frequently-asked-questions-faq/faqs-measures-in-the-bmu-digital-policy-agenda-for-the-environment>, zuletzt aktualisiert am 09.08.2021, zuletzt geprüft am 09.08.2021.