

# AI for a more sustainable and circular EU Manufacturing and Process Industry

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IN COLLABORATION WITH



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UNDER THE AUSPICES OF





# Circular TwAIIn: integrating Data Spaces, Digital Twins and Artificial Intelligence for Sustainable and Circular Manufacturing

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Circular TwAIIn GA n. 101058585



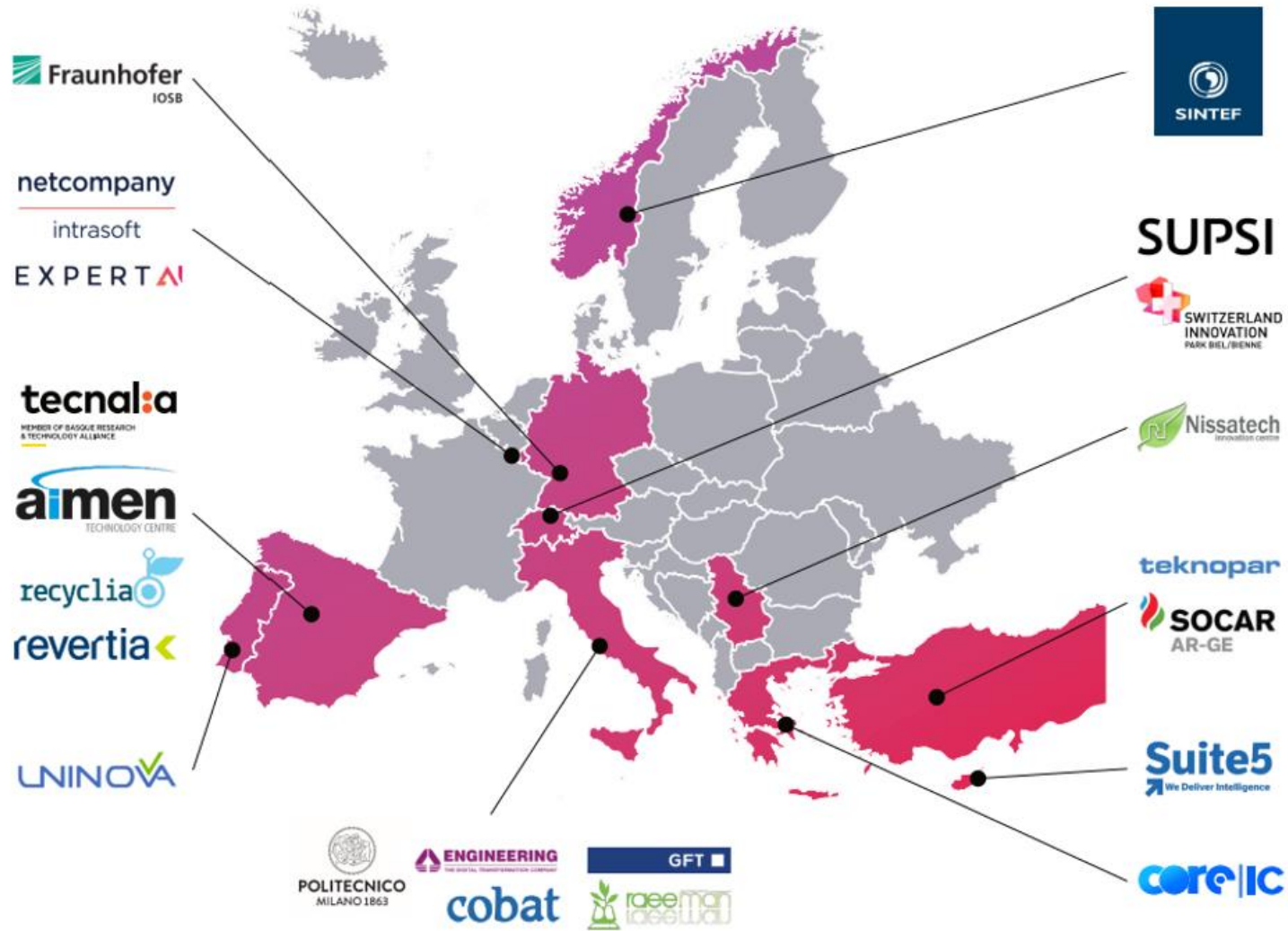
# Project Info



- **Project number:** 101058585
- **Project name:** AI Platform for Integrated Sustainable and Circular Manufacturing
- **Project acronym:** Circular TwAIIn
  
- **Call:** HORIZON-CL4-2021-TWIN-TRANSITION-01
- **Topic:** HORIZON-CL4-2021-TWIN-TRANSITION-01-07 - Artificial Intelligence for sustainable, agile manufacturing
- **Type of action:** HORIZON-IA
  
- **Project starting date:** 1 July 2022
- **Project duration:** 36 months
- **Total budget:** 7 156 951.25 €
- **EC funding:** 5 937 356.00 €
- **Partnership:** 21 partners, 11 countries



# Circular TwAIIn Consortium

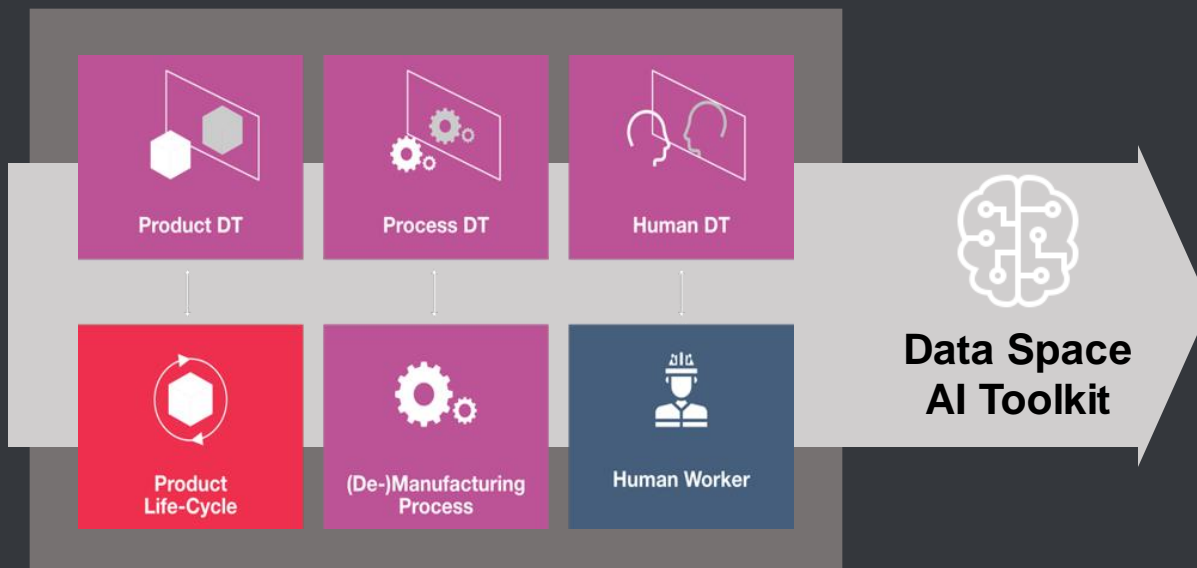


# WHY is Circular TwAIn unique?

A short introduction

# Circular TwAI in a nutshell

Deliver a **unique AI platform** to support manufacturing and process industry towards a **sustainable, eco-friendly and circular production**. The key factor is a full integration among systems, reached through the usage of **AI and Digital Twins** for each level (product/process/value chain) leading to the **Circular Data Space**'.



## OUTCOME1 :: Seamless Data Sharing

Data Spaces with product-specific information on sustainability and circularity (DPP) to improve and transform the overall product/production (life)cycle.

## OUTCOME2 :: Collaborative AI

AI will exploit the knowledge provided by Digital Twins and models built within the Data Space for: (i) product/part recognition through machine vision; (ii) disassembly operations; and (iii) production and shopfloor process optimization.

### BATTERY Pilot



Demonstrating the improvements in de-/re- manufacturing lead by DPP and AI

### WEEE Pilot



### PETRO-CHEMICAL Pilot

Showcasing how the process industry benefits from DT and AI



# Circular TwAI In Unique Value Proposition

**Holistic, domain-agnostic approach** to enhance the sustainability and the circularity of product and process industries, with **tailored** and easy to scale technological solutions, mainly based on **open-source components**.



- Adaptation of current AI/DT (as-a-Service) technologies to **circular manufacturing models**, adopting DPP Semantic and Data Models
- Design and development of **interoperable circular twins** for end-to-end sustainability, exploiting data coming from different sources
- Creation and management of the DT for realizing **sustainable manufacturing** processes along the edge-to-cloud digital continuum
- Create new **circular Business Models** through digitalization along the value chain

# WHAT is a Circular Data Space?

The BATTERY Pilot Example



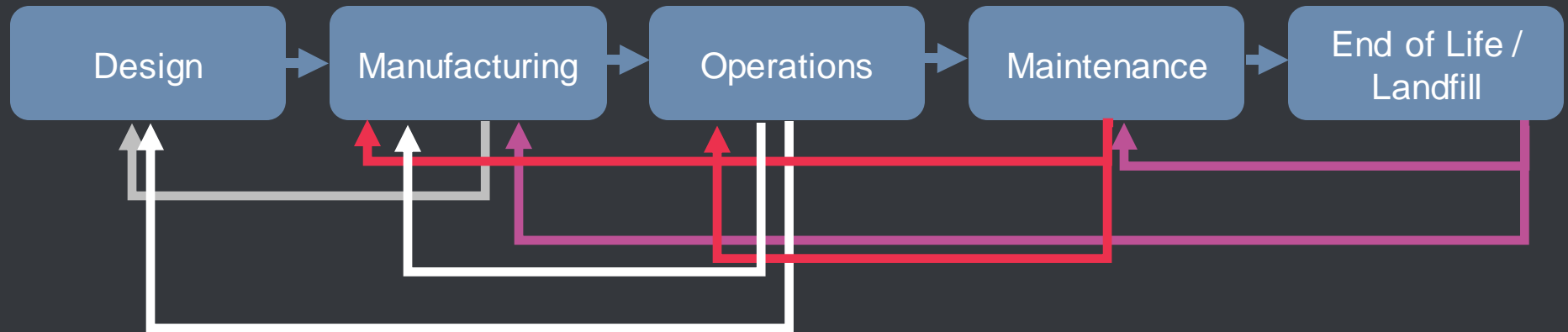
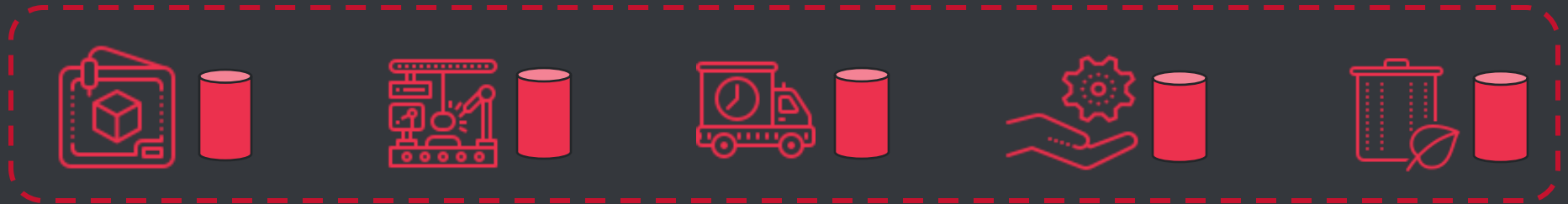
# Circular TwAI – Circularity Value Networks

AI enabled Digital Twins



Circular Manufacturing Data Space (DPP Economic Operators)

Circular Value Chain Stakeholders



# The Circular TwAIn BATTERY Pilot

## De- and Re-manufacturing of Li-Ion battery packs in e-mobility

Remanufacture and the re-use of the disassembled cells with proper residual characteristics into second-life stationary applications

## The mission of this pilot is implemented in five use cases

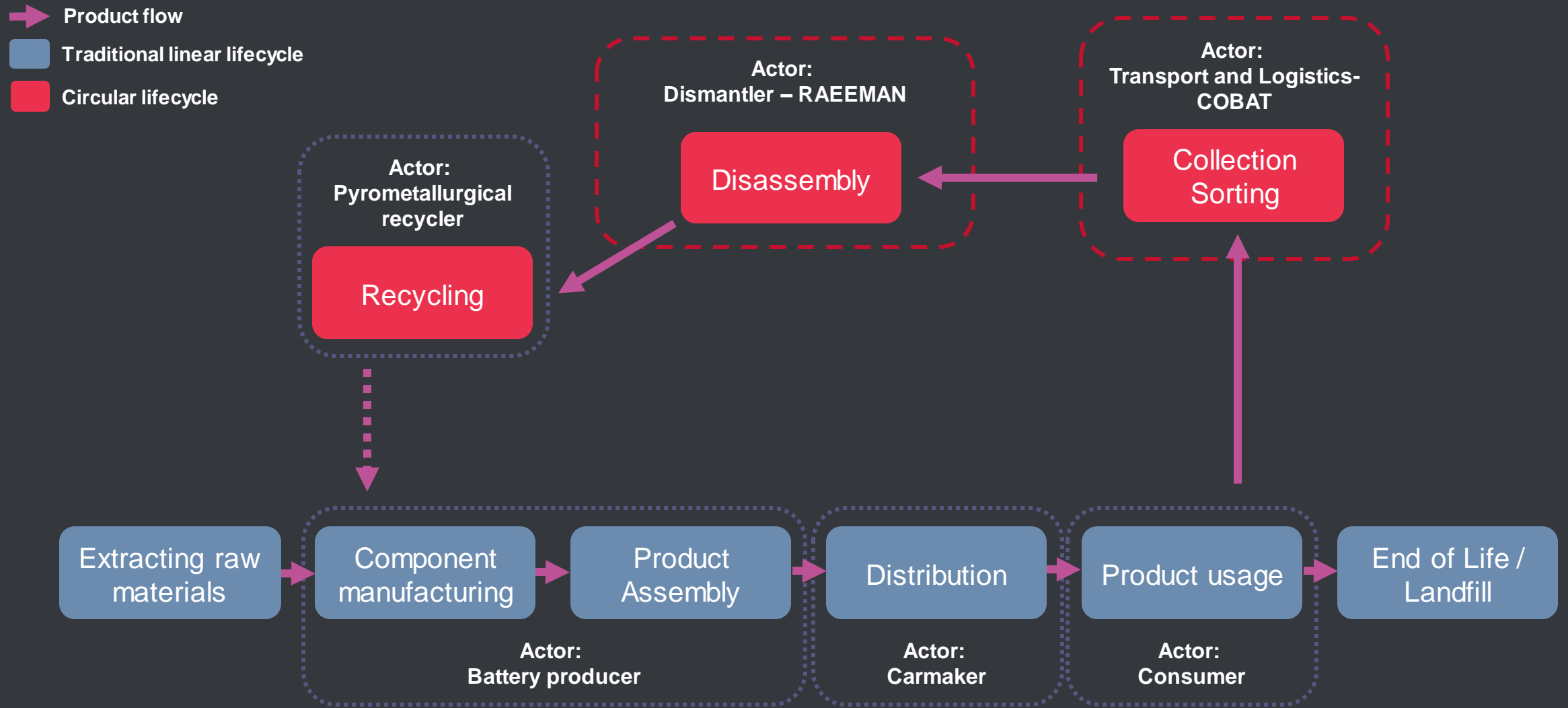
- Computer-vision driven **collaborative robotics** for the disassembly of LIB packs
- Machine learning** aided automated disassembly of LIB modules
- AI tool for the characterization of the **LIBs state -of-health** combining historical and testing data
- AI tool for optimised **mechanical recycling** of degraded LIBs
- Market** oriented holistic decision-support-system for the LIBs de - and remanufacturing



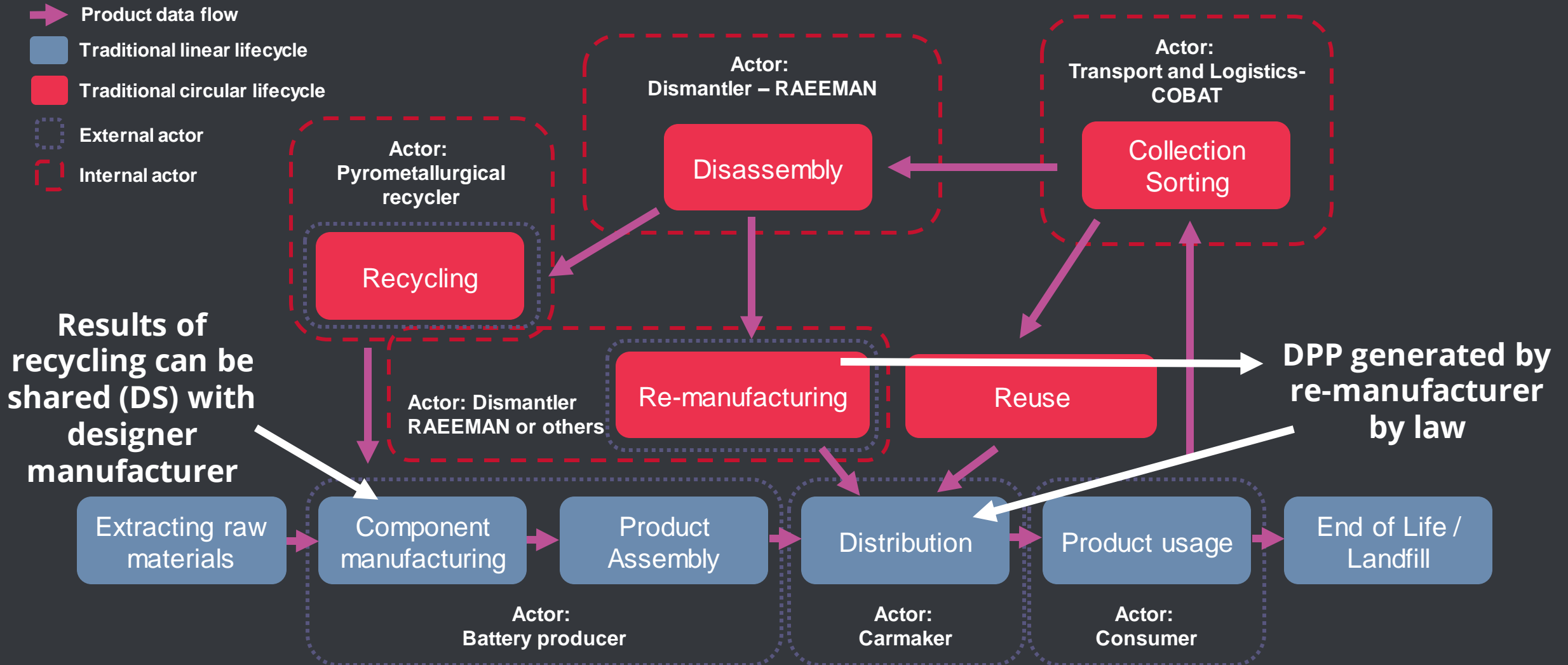
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# BATTERY Pilot: AS-IS Scenario



# BATTERY Pilot: The Circularity by Design approach

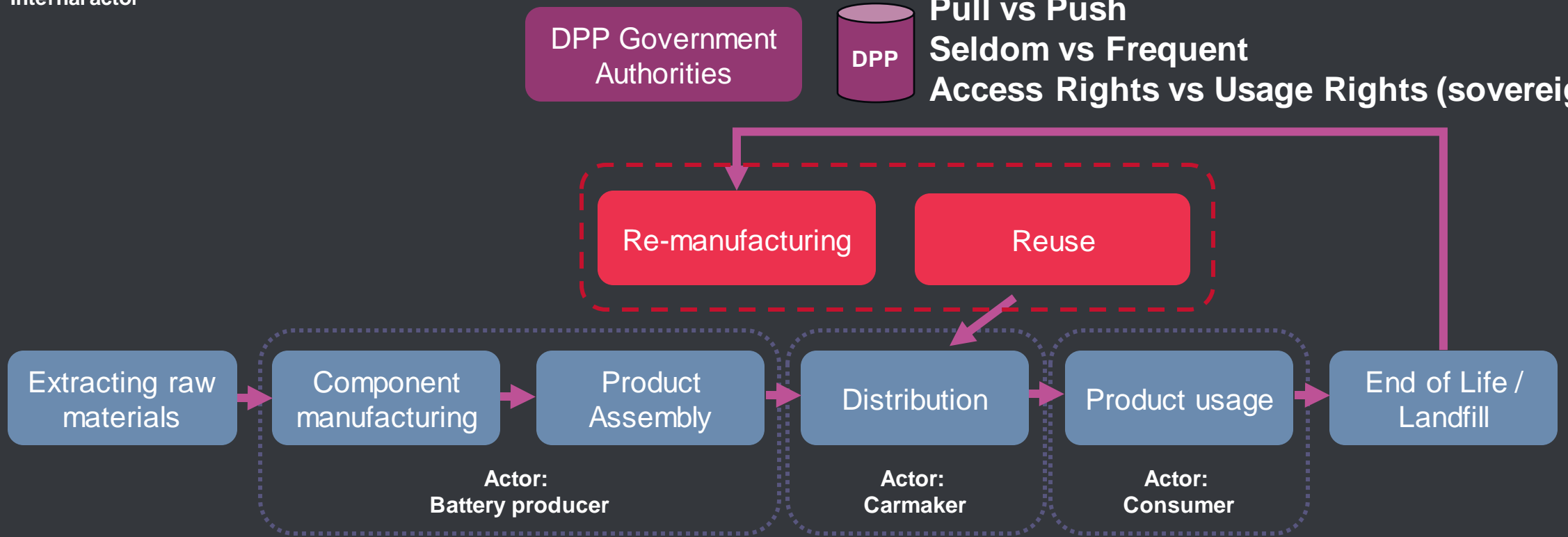


# A BATTERY Circular Data Space with Governmental DPP Authorities for X2G and X2C Data Exchange

- Product flow
- Traditional linear lifecycle
- Traditional circular lifecycle
- External actor
- Internal actor

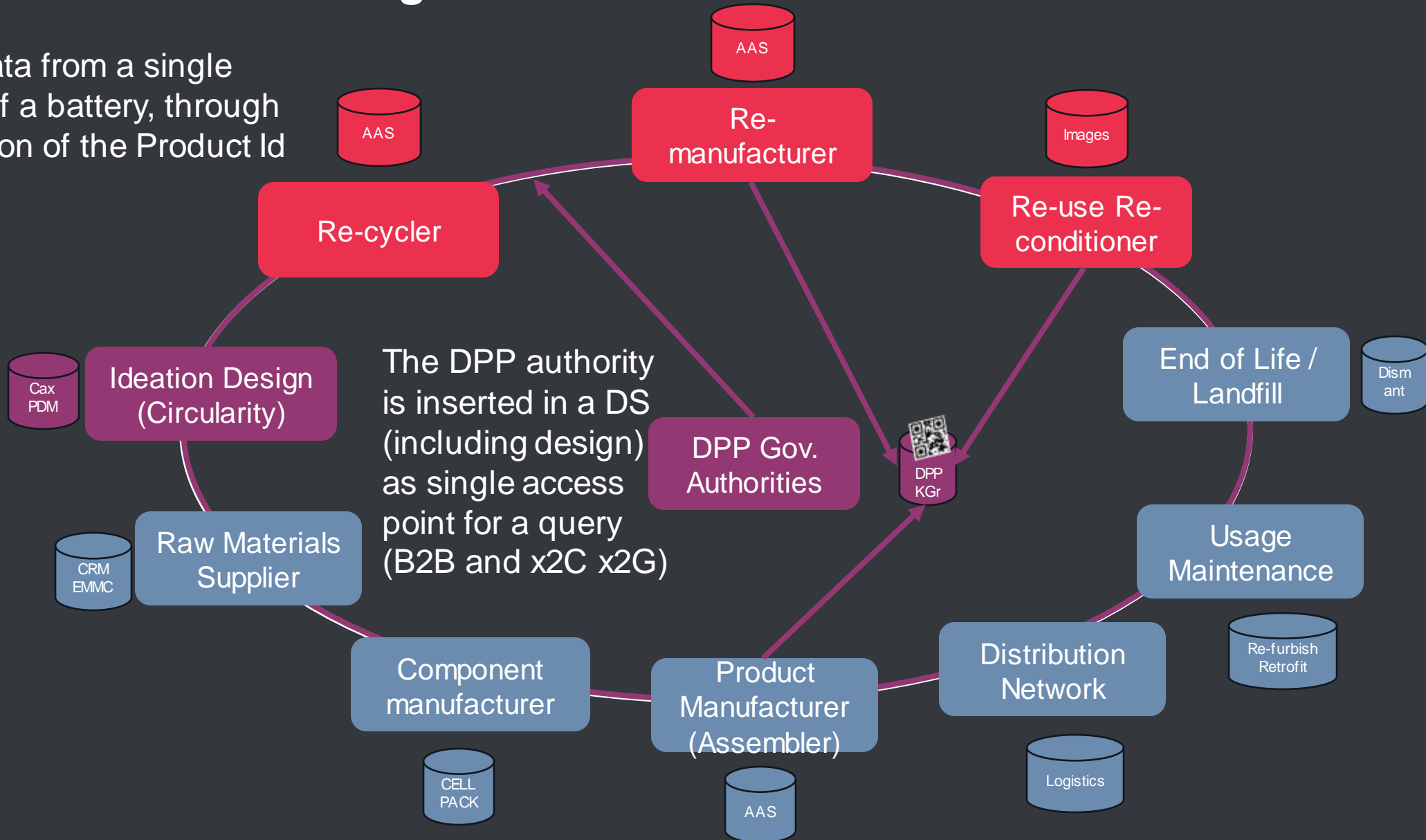
## Data Space Access / Usage features:

- Mandatory vs. Optional
- Static vs Dynamic
- Pull vs Push
- Seldom vs Frequent
- Access Rights vs Usage Rights (sovereignty)



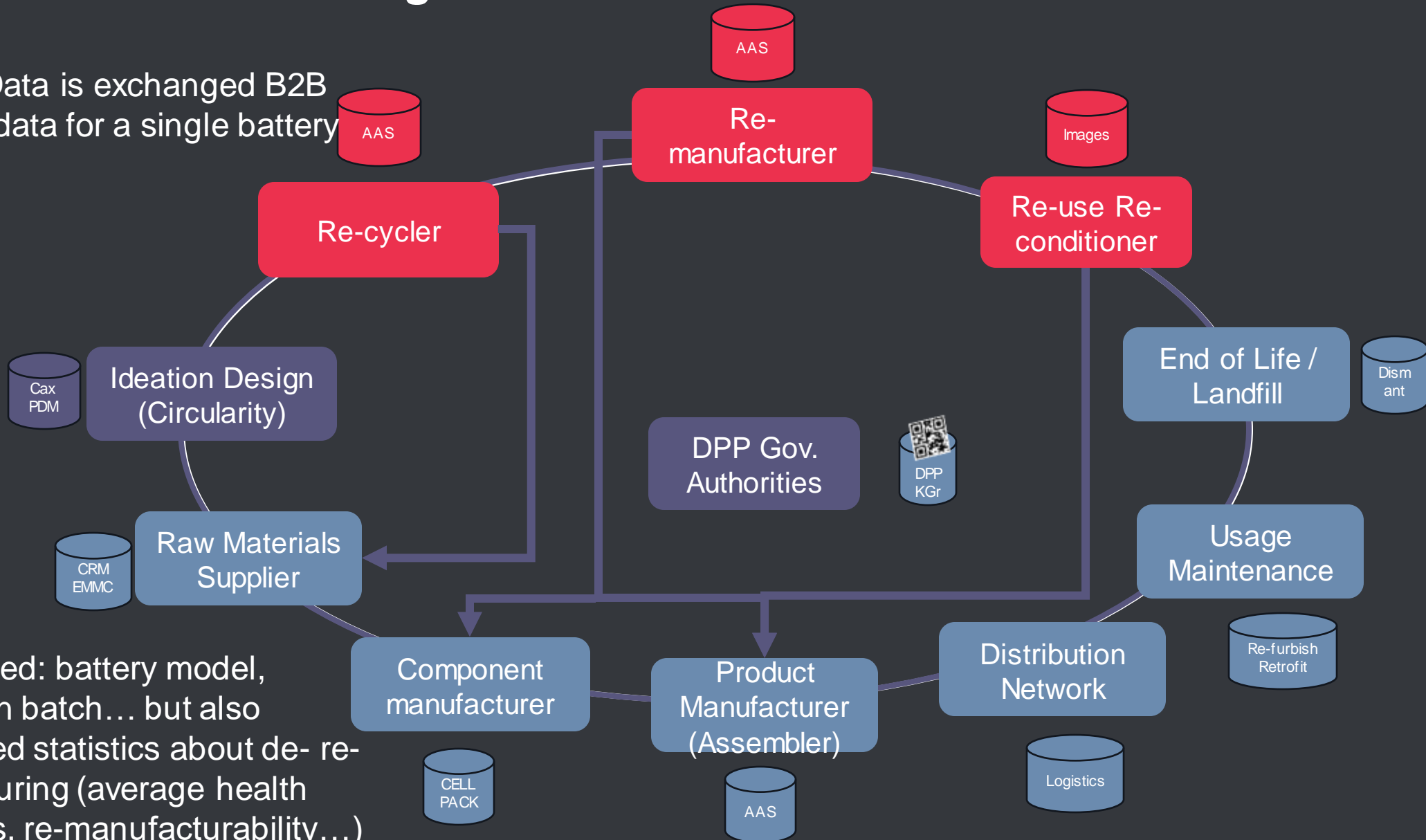
# A BATTERY Lifecycle Data Space with Product data sharing flows

Get the data from a single instance of a battery, through interrogation of the Product Id



# A BATTERY Lifecycle Data Space with Process data sharing flows

Process Data is exchanged B2B including data for a single battery instance.



Data shared: battery model, production batch... but also aggregated statistics about de-re-manufacturing (average health conditions, re-manufacturability...)



## Technical

- Some technologies are still not **mature**
- **Interoperability issues** and poor standard compliance
- Lack of **models** for Circular Applications



## Societal

- Lack of **awareness** on newest technologies
- Many/All stakeholders of the **Circular Value Chain** have to be involved to be successful



## Legal & Ethical

- **AI Act** still to be effective
- Different maturity levels of **DPP regulation** (WEEE vs BATTERY)



# Support Circular TwAIIn and stay up to date!



<https://www.circular-twain-project.eu/>

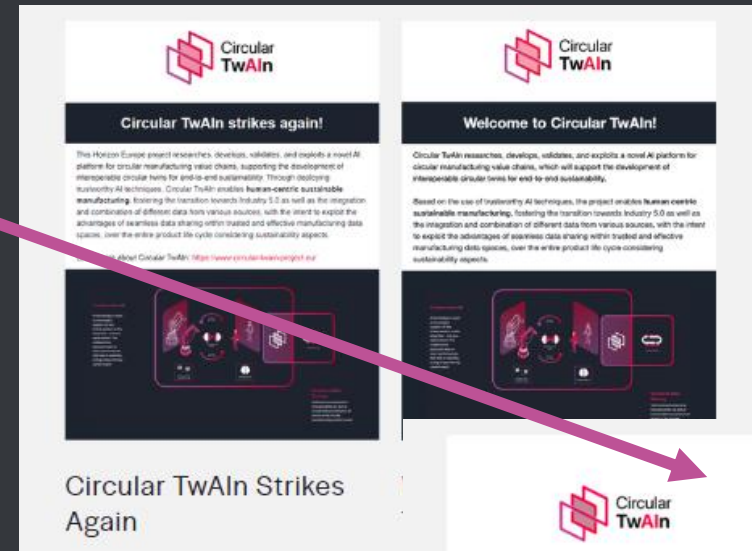


[Circular TwAIIn Project](#)



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## Newsletters



Circular TwAIIn Strikes Again

## Press Releases



## Publications

[On the Role of Digital Twins in Data Spaces](#)

[A Performance Evaluation of OWL 2 DL](#)

[Reasoners using ORE 2015 and Very Large Bio Ontologies](#)

[Open-Source Implementations of the Reactive Asset Administration Shell: A Survey](#)



Thank you!



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