DiCiM

Digitalised Value Management for Unlocking the potential of the Circular Manufacturing Systems with integrated digital solutions

Digital Solutions for Implementing Circular Manufacturing Systems (CMS)

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Collaboration and WP lead

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Emergence of a new research stream

Europe's Digital Decade

Digital transformation of businesses

Application of digital technologies in Circular Manufacturing Systems implementation

The European Green Deal

Circular Economy Action Plan

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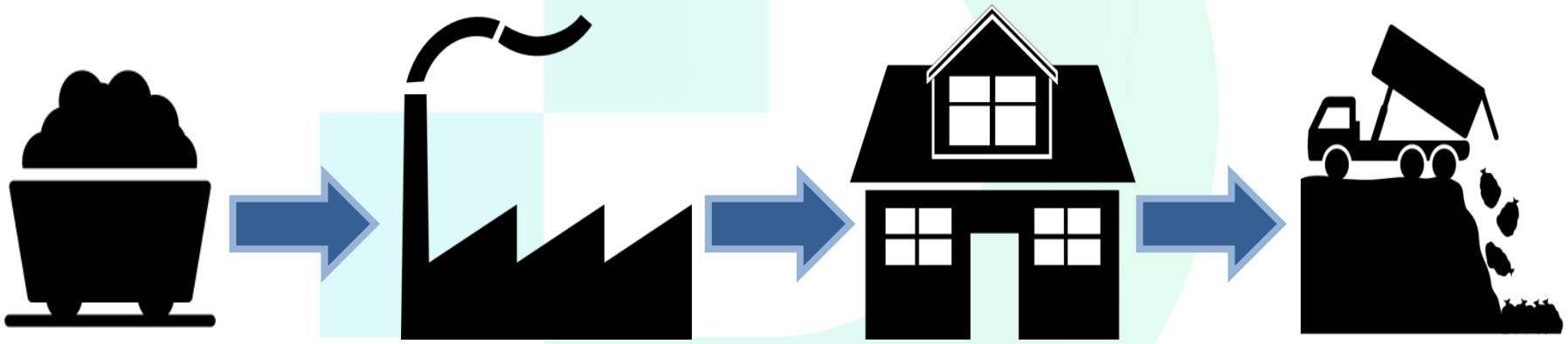
The linear system



Take Make Use Dispose

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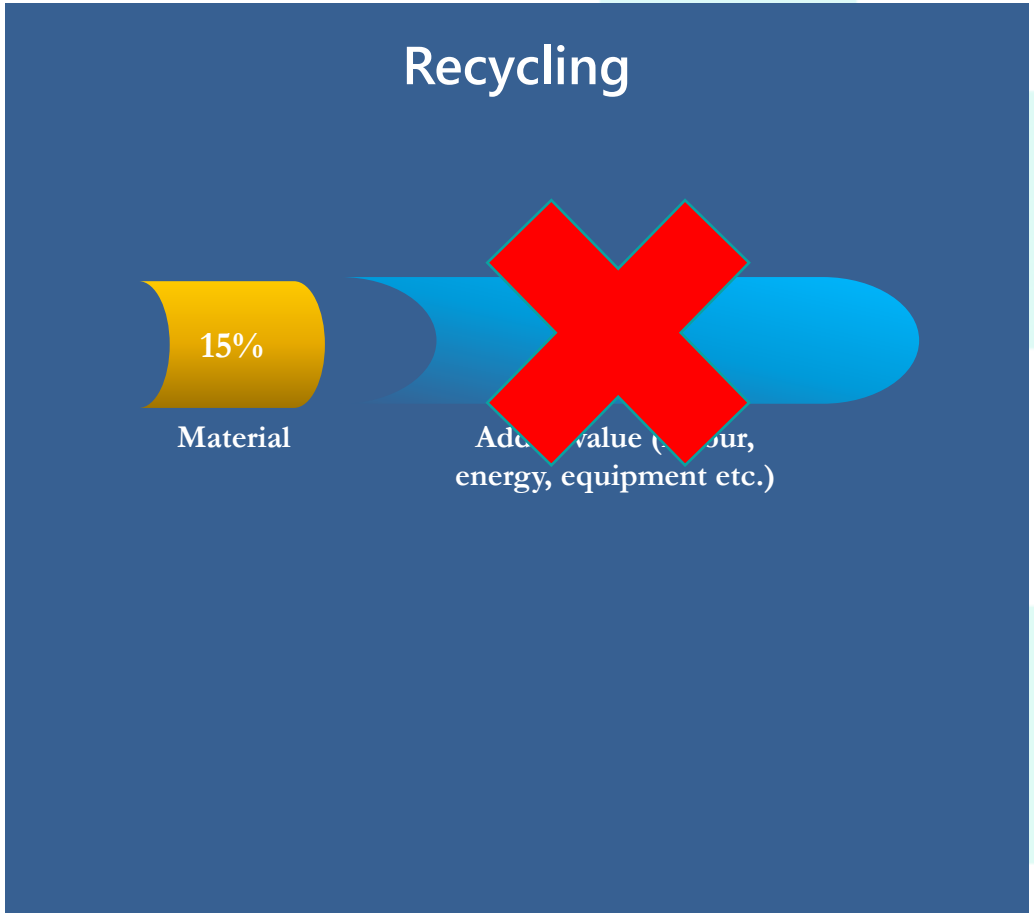
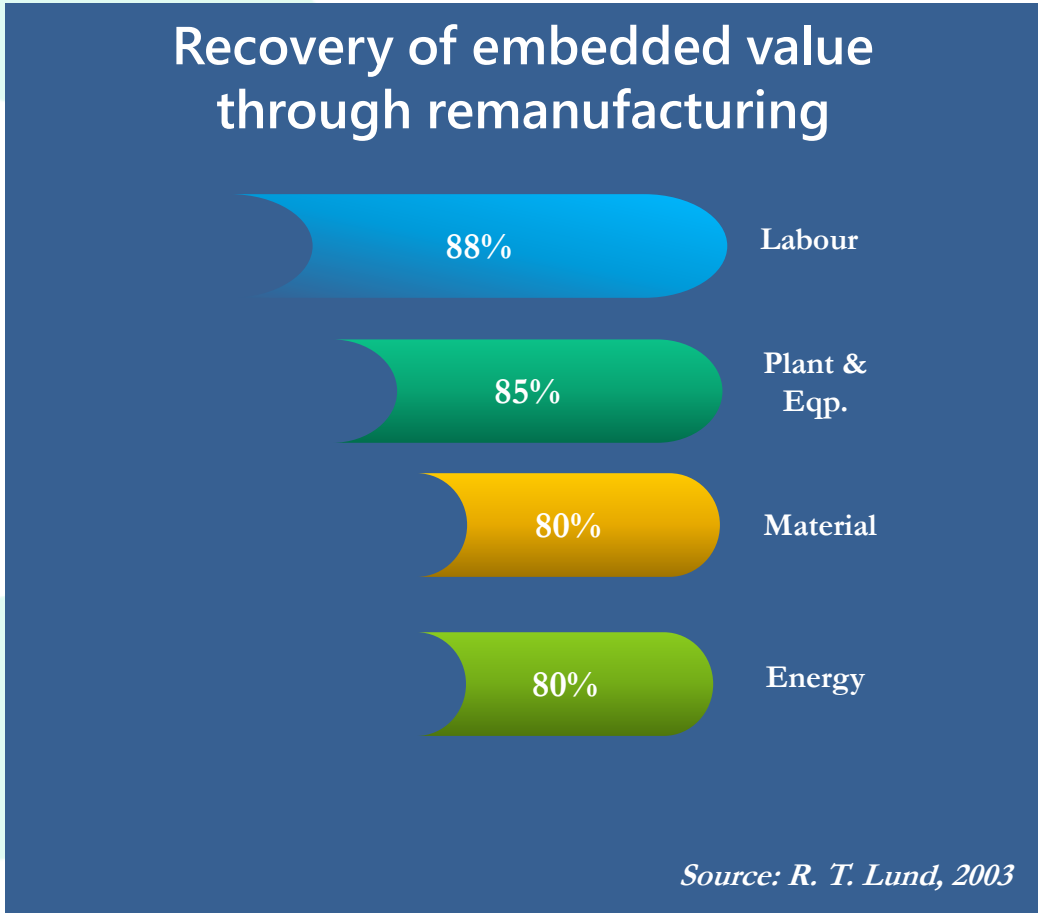
Recycling ==========> High value recovery





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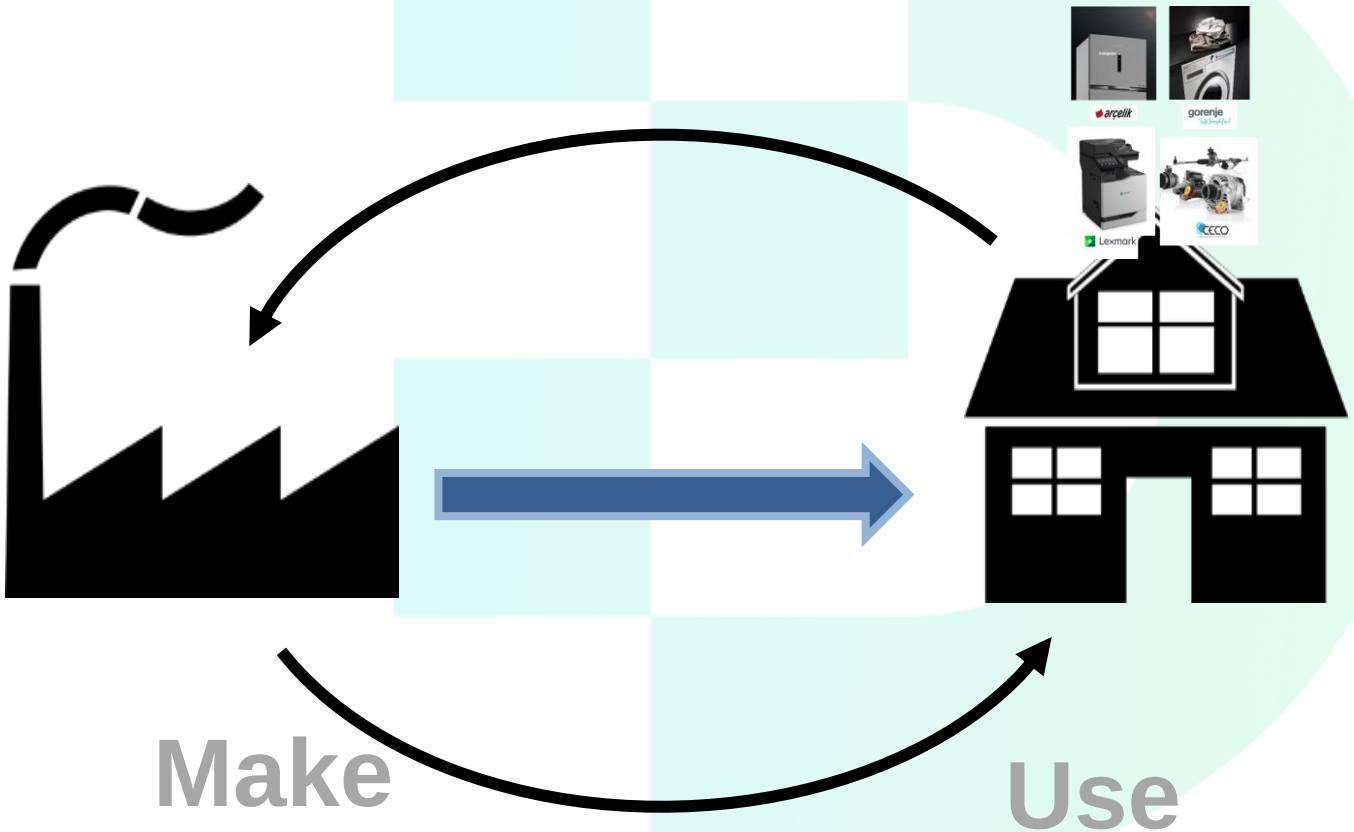
Circular Manufacturing System (CMS)



- Reuse
- Remanufacture
- Recycle

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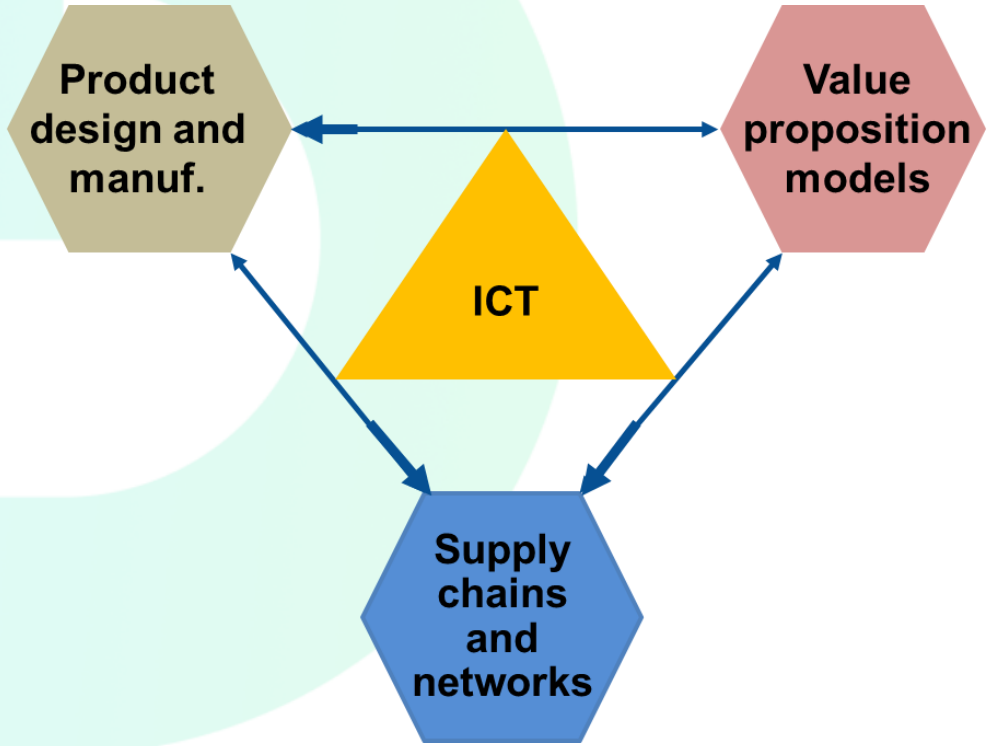
Circular Manufacturing Systems (CMS) Framework

CMS refer to systems that are designed intentionally to close the loop of components or products preferably in their original form, through multiple use & and lifecycles (Asif, 2017)



Source: adapted from Rashid et al., 2020

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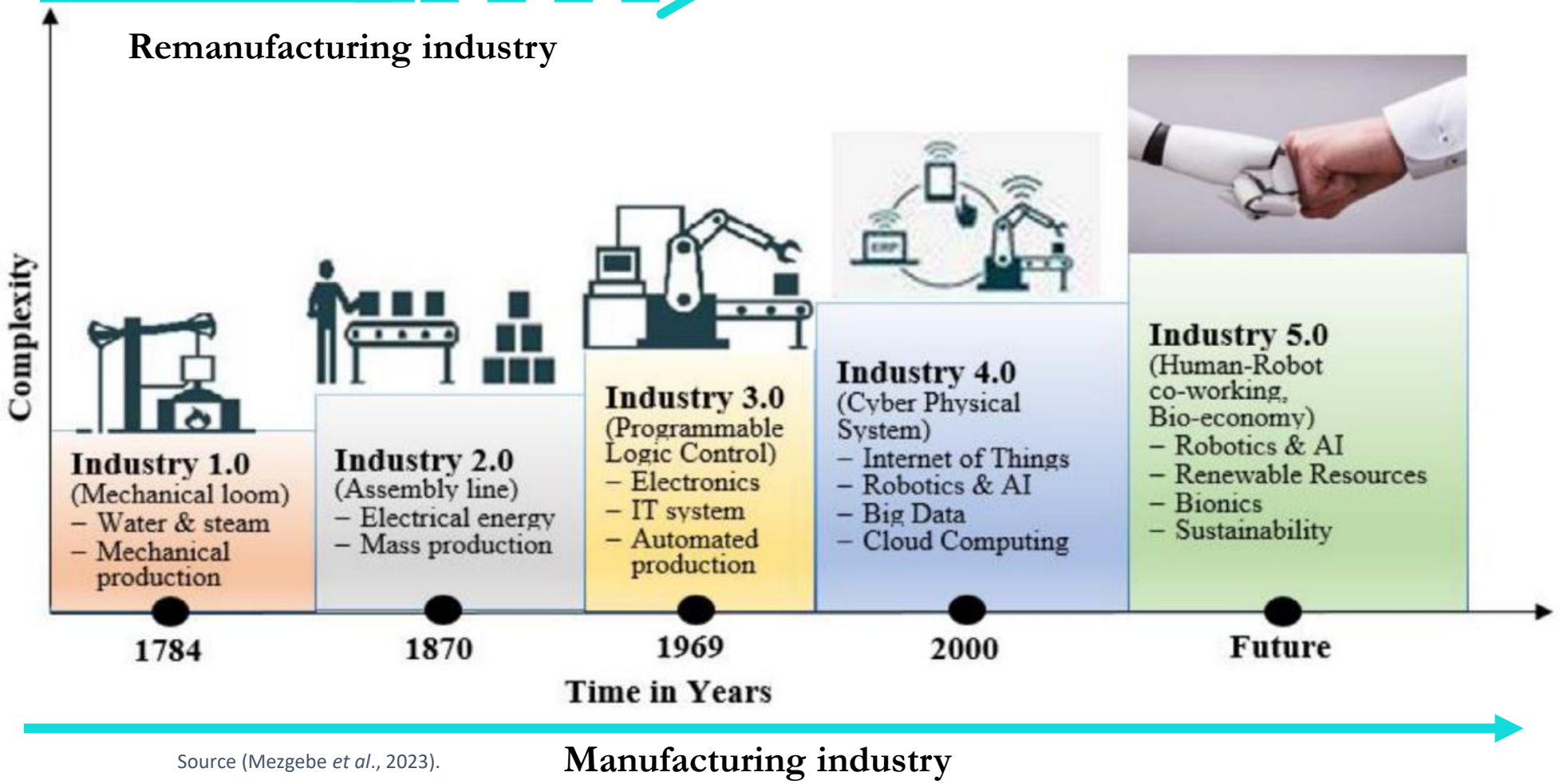
Remanufacturing X Manufacturing Industrial revolution



Source (Mezgebe *et al.*, 2023).

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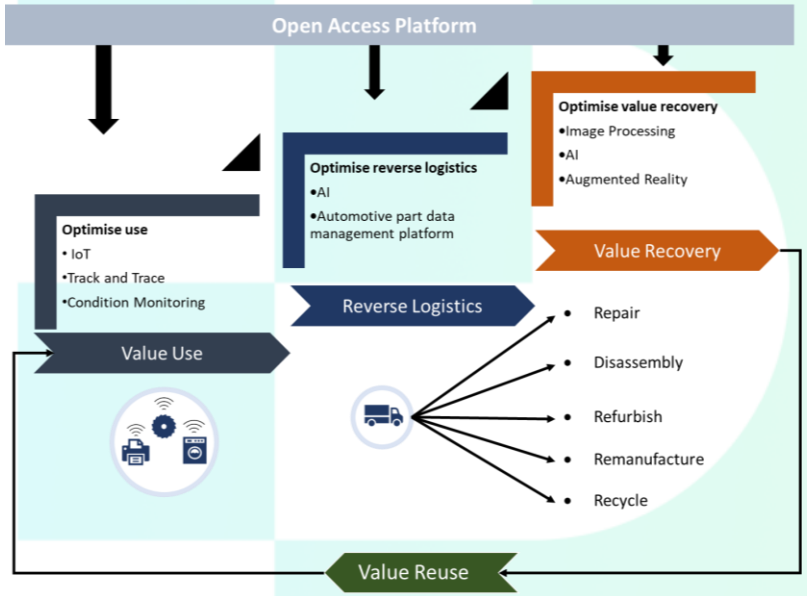
DiCiM- Digitalised Value Management for unlocking the potential of Circular Manufacturing Systems with integrated digital solutions

arçelik

gorenje
Life Simplified

Lexmark

CECO



Technologies:

- AI for decision support in product collection
- IoT-based tracking, tracing and condition monitoring
- Image processing and AI for part sorting
- AR for disassembly and part sorting
- Open-access digital platform

Knowledge providers

Technology providers

Dissemination partner

Associate partners

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AI for decision support in product collection

Lexmark™

Source: Google

Current state:

- More than 80% of the printers are sold with the option to sell back at the EoL/EoU
- No access to embedded usage information in the printers
- High uncertainty about whether the printers bought back can be remanufactured

DiCiM development:

- AI generates the right purchase price based on the condition of the printers
- AI determines if the printers are fit for remanufacturing, part recovery, or recycling

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Develop condition monitoring capability of the washing machines

gorenje
Life Simplified

Source: Gorenje

Current state:

- Limited tracking, tracing, and condition monitoring of washing machines
- Lack of decision support to manage the reverse flows, assess the condition, and recover critical parts of washing machines.
- The process of recovering critical parts from used washing machines is prone to errors

DiCiM development:

- Enhance the IoT capability for tracing, tracking, and condition monitoring.
- AI based decision support solutions to optimize reverse logistics, and improve spare parts availability.
- AR-based solution to achieve a low error rate in value recovery activities

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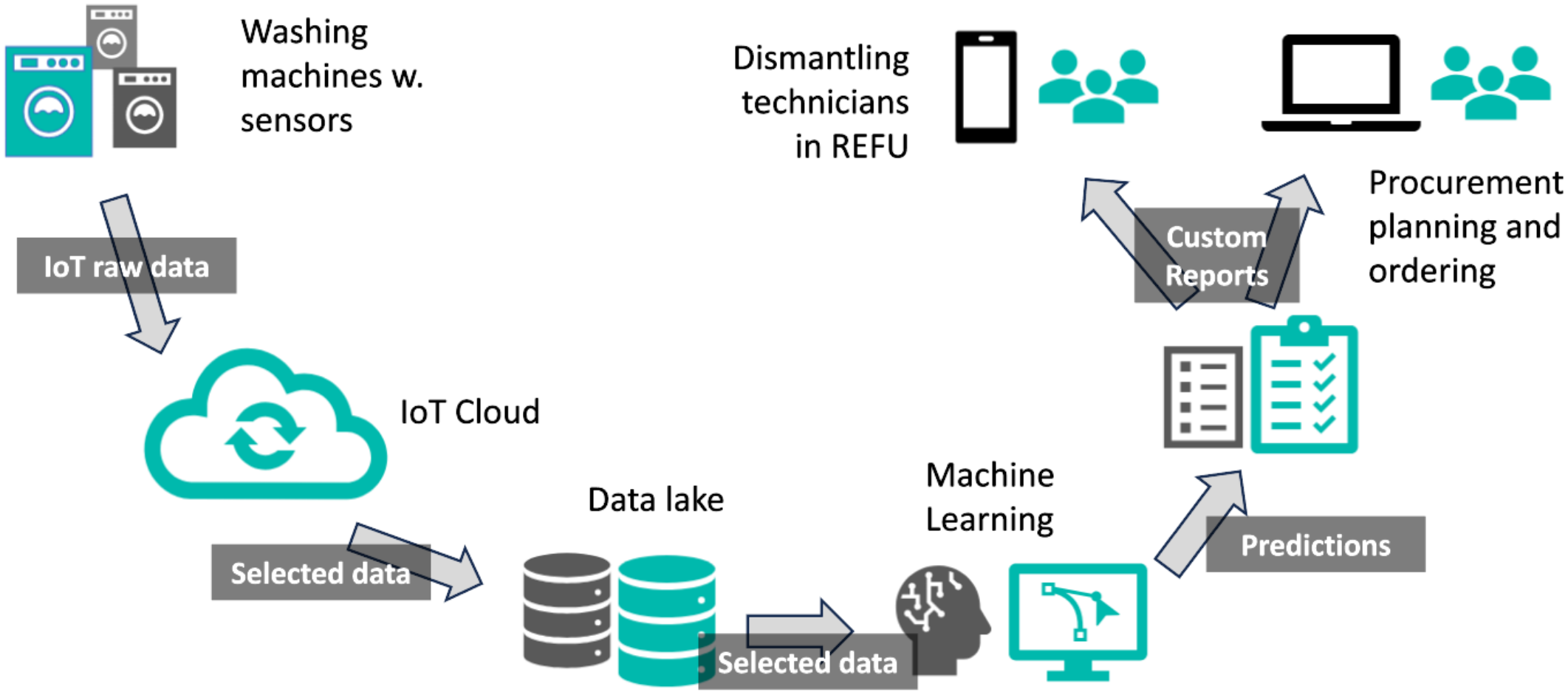
Machine learning for decision making



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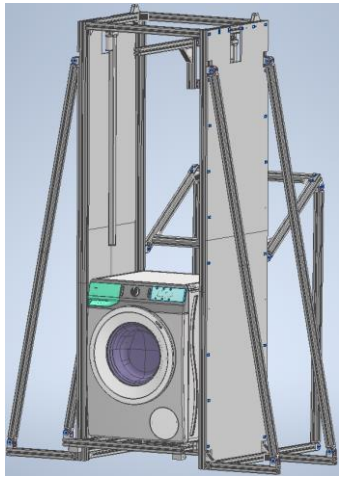
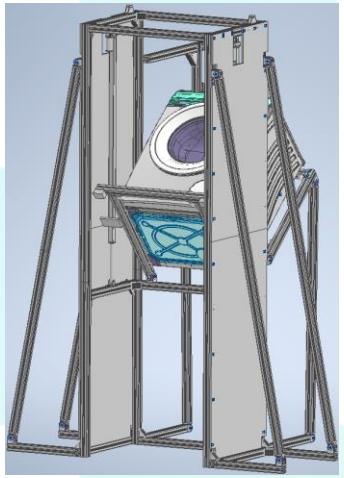
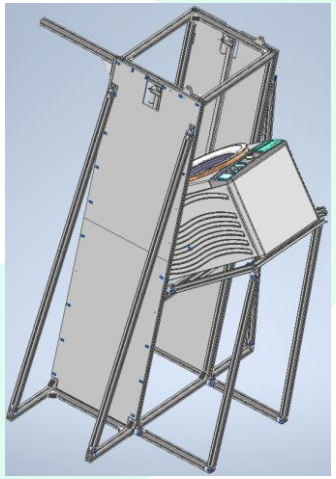
AR supported disassembly







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AI and image processing in product sorting

Source: Arcelik

Current state:

- Limited throughput of its refurbishment of refrigerators.
- Manual, time-consuming, and costly sorting, inspection, and testing processes.
- Manual inspections prone to causing errors

DiCiM development:

- Automated image recognition and processing
- AI analyses the images and instantly tests PCBs and cooling performance of the refrigerators

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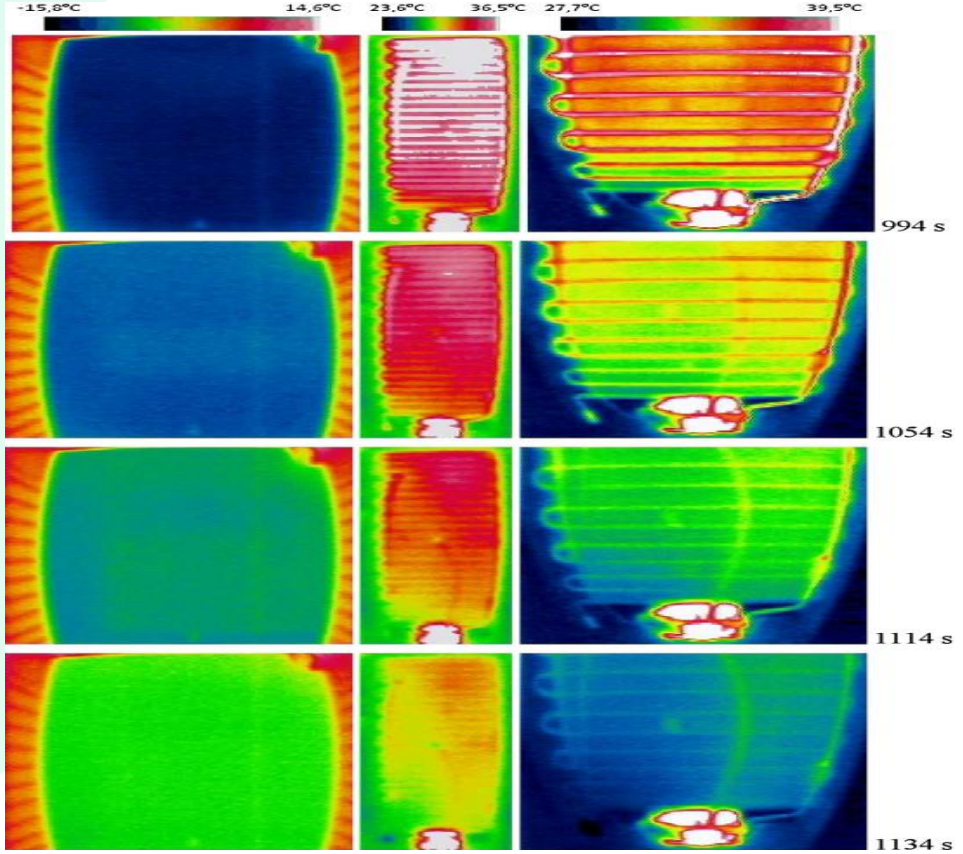
Image processing for automated testing



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Extend and enhance the automotive part Data management platform

Circular Economy Solutions GmbH

Source: C-ECO

Current state:

- Offering services through digital technologies and a global logistics network to collect cores for the automotive sector
- The flow of information for external partners is often inefficient, manual, and untransparent
- Absence of a standardized interface for data exchanges
- Sorting processes rely heavily on the knowledge and skills of individual operators

DiCiM development:

- Platforms and configurators to streamline data management, enhance transparency, and support decision-making
- Extend the platform, to make it more relevant to remanufacturing companies beyond the automotive sector
- Develop augmented reality (AR) application for sorting

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AR supported sorting

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Open access digital platform

A wider value chain actors have access to information on:

- Available used parts
- Trading options for a used product
- Processes of value recovery activities
- Sorting operations

DiCiM open access digital platform

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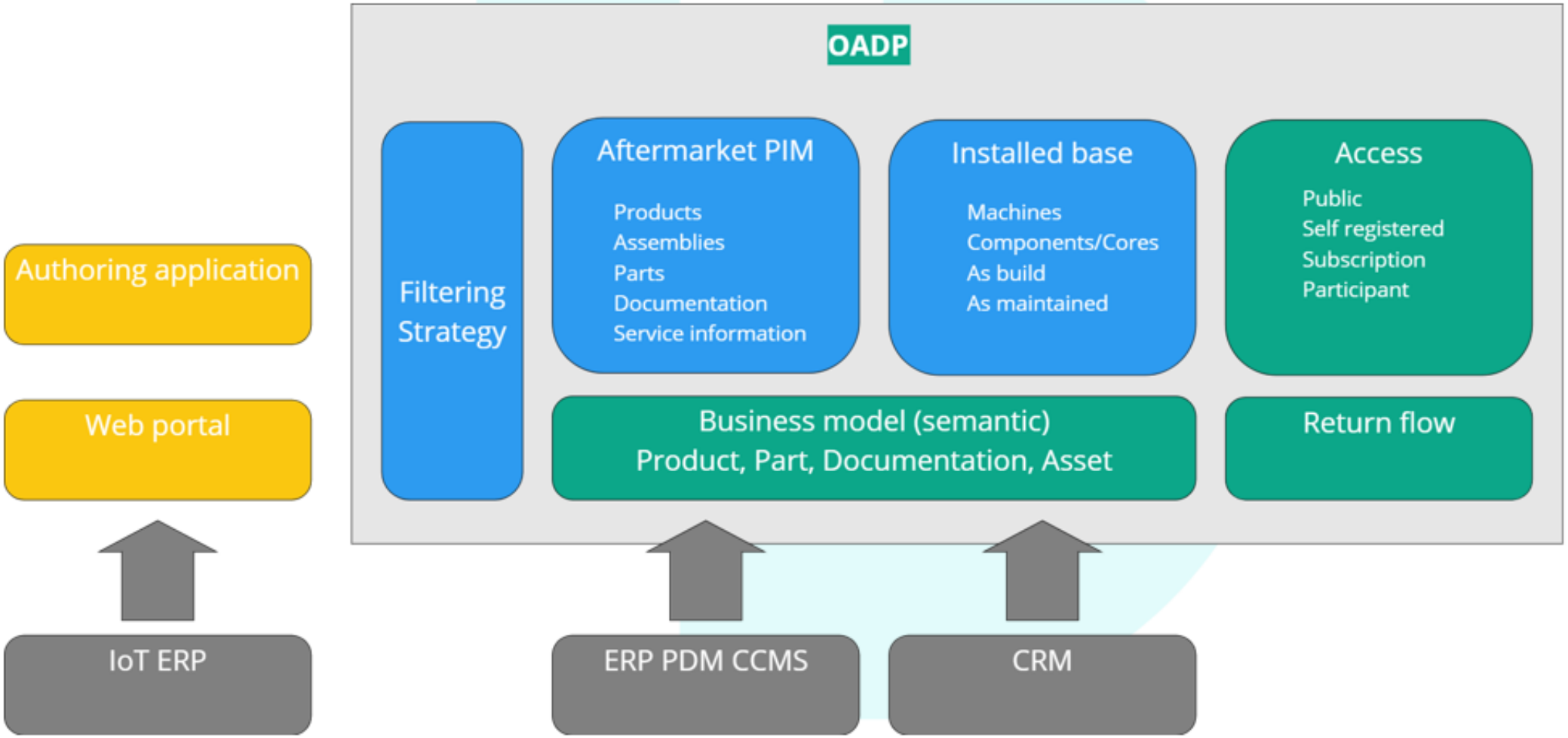
Open Access Digital Platform



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Research partners for collaboration

- MUNI
  - circular business models (and their digital transformation)
  - technology adoption and training
- KTH
  - circular manufacturing systems
- ULFS
  - machine learning
  - IoT condition monitoring
- TUC
  - Augmented Reality support for circularity

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Topics for research collaboration

- Circular Business Models with a focus on CMS
- Decision-making in CMS
- Machine learning and reverse flow predictions
- AR for supported sorting or disassembly
- IoT capabilities for product tracking, tracing, and condition monitoring

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Digital

Information and Communications Technology Components & Systems

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Q&A

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