tecnalia

MEMBER OF BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

Creating Growth : Improving Society

AI for CIRCULARITY

AI challenges and opportunities for green manufacturing

Brussels 24 May 2023

Luis Usatorre, TECNALIA

INDEX

- **AI evolution**, new methods are available.
- Recent AI advances have the potential to improve performance in Manufacturing. Propose some examples. What have you been working on? **European Research Projects.**
- There are several **challenges** ahead. (Complexity of AI tools? Modeling of the process? Time consuming process?...)
- There are **barriers.** (Need to simplify the technology? Need to prove it in several cases to see how to use it efficiently? …)
- Proposed **way forward.**

MAS4AI CIRMET DigiPrime Circular TwAIn tecnalia

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements No 957204, 820670, 873111, 101058585.

AI evolution

AI Challenges and Barriers

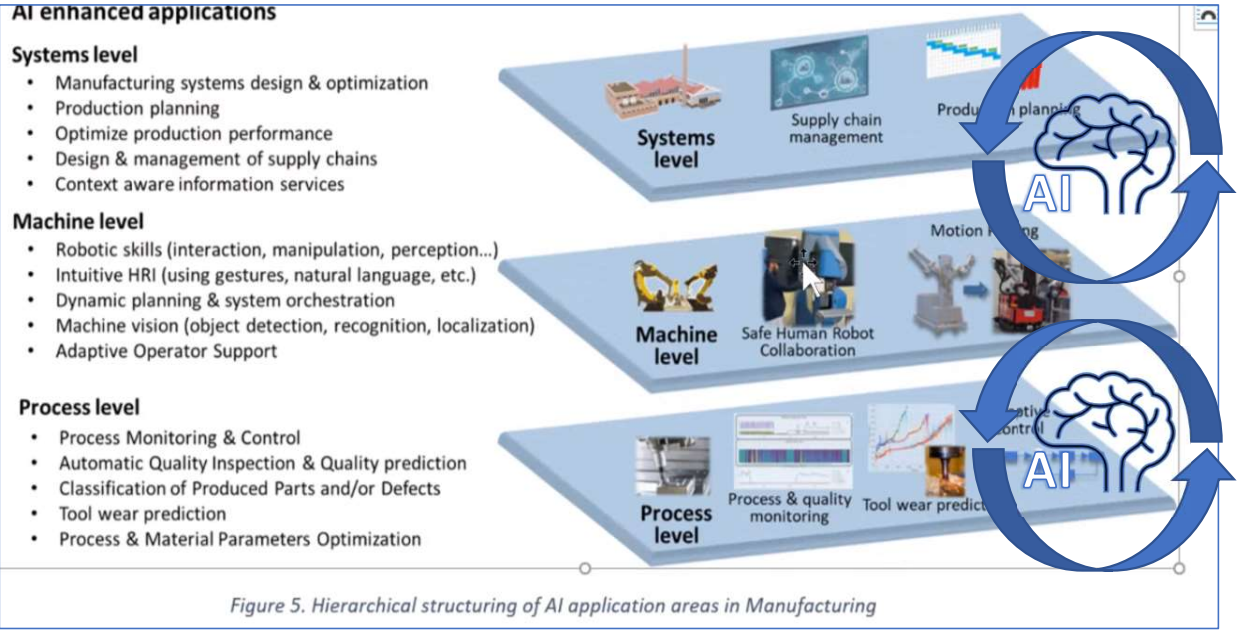
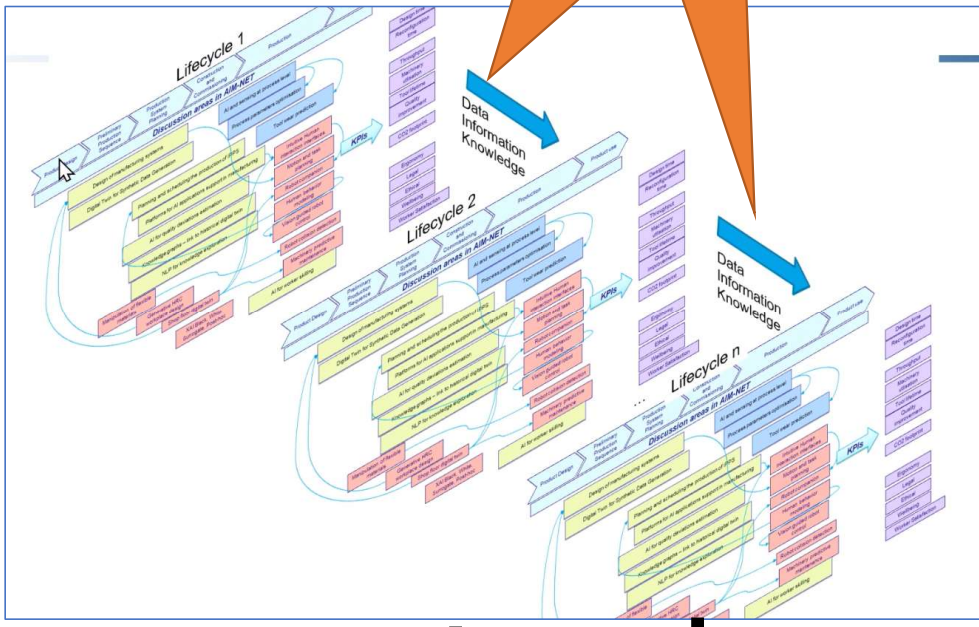


Figure 5. Hierarchical structuring of AI application areas in Manufacturing

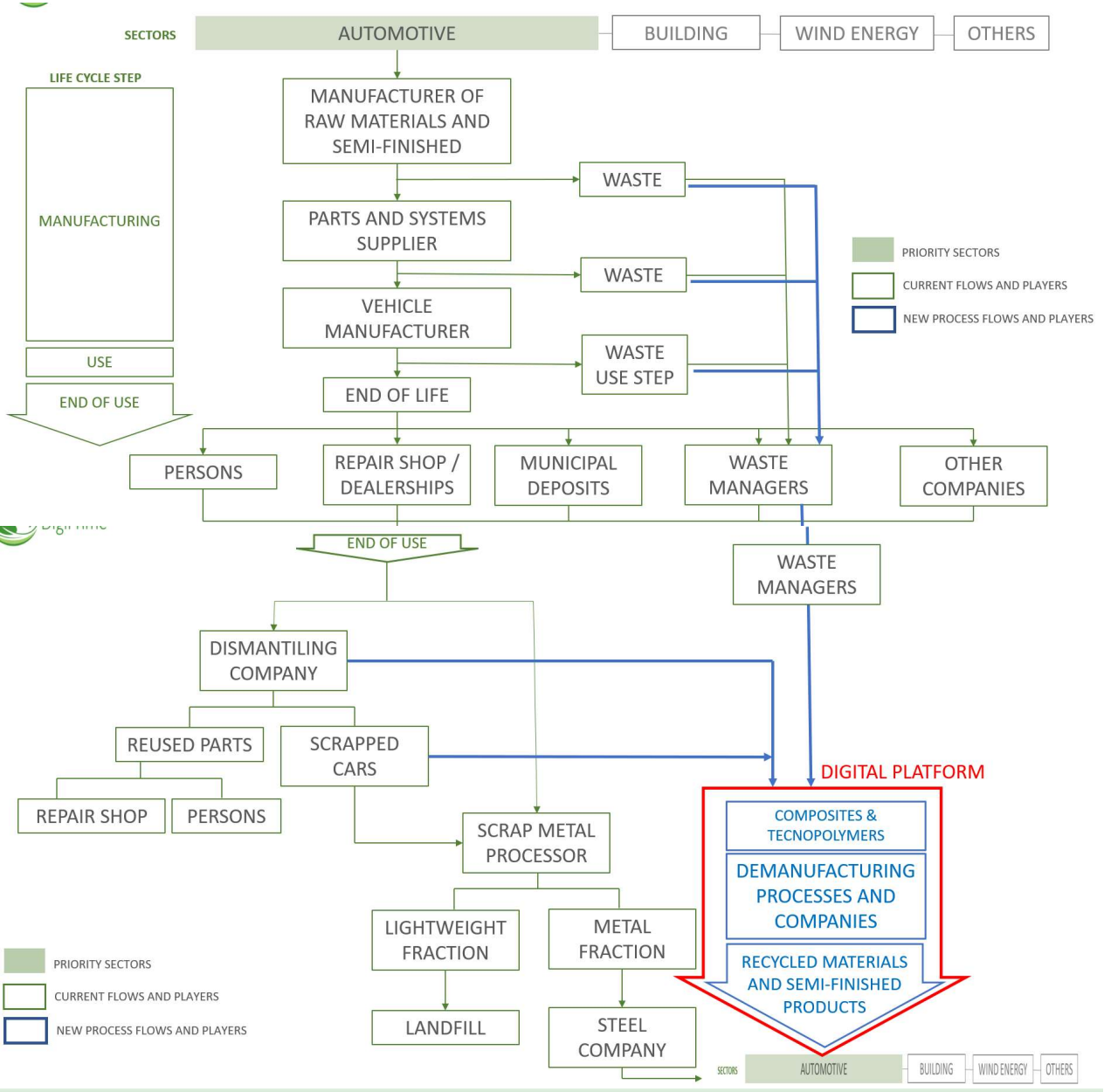
This data transfer process is manual today. AI can have an impact here



tecnalia
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Circularity

tecnalia.com



CURRENT RESTRICTIONS

1. Insufficient technical and batch **uniformity** guarantees
2. Some critical activities (disassembly, separation and classification) are not **economically feasible**
3. **Technical and industrial limitations** of some demanufacturing processes
4. **Lack of information** between stackholders regarding present needs and opportunities
5. **Lack of knowledge** about new valorization opportunities

tecnalia

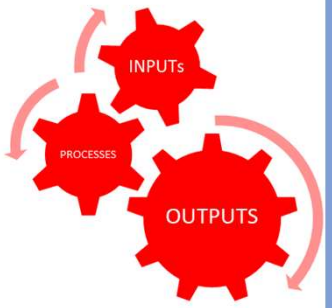
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

DIGITAL PLATFORM

COMPOSITES & TECNOPOLYMERS

DEMANUFACTURING PROCESSES AND COMPANIES

RECYCLED MATERIALS AND SEMI-FINISHED PRODUCTS



SUPPLIES

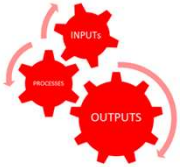
OUTPUTs

PRE – PROCESSES AND POST

- SYSTEMS DEMOUNTING
- CLASSIFY BY MATERIAL FAMILIES
- DECIDE DEMANUFACTURING PROCESS
  - REUSING
  - REMANUFACTURING
  - RECYCLING
  - ENERGY VALOR.
  - DISPOSAL
- PARTS DISASSEMBLY
- SORTING BY SPECIFIC MATERIALS
- APPLY RECYCLING TECHNOLOGY
  - THERMAL
  - MECHANICAL
  - CHEMICAL
  - ETC.
- CLEANING
- CUTTING / GRINDING
- CONDITIONING (SIZING, ETC.)
- COMPOUNDING
- SEMI-FINISHING

INPUTs

DEMANDS



1. Decision support tools ⇔ Match Making Tools
2. Digital Twins and optimization processes for recycling
3. Innovation Services
4. Information (Legal, technological and Market)

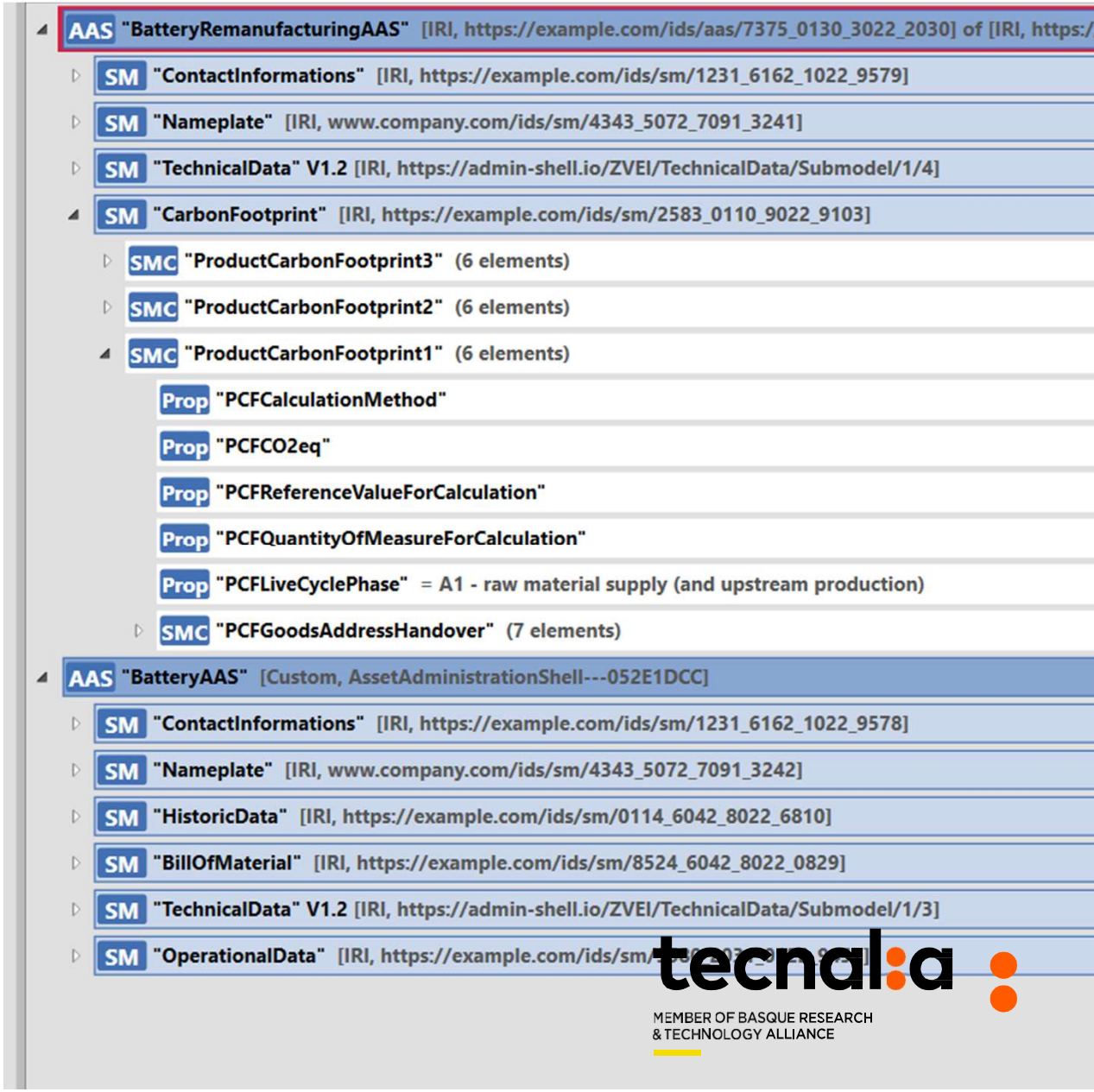
tecnalia
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Data & Next steps

AAS for processes (i.e. battery remanufacturing)

DPP for product (i.e.battery)

- Connect different remanufacturing processes to a **circular Data Space**
- **Implement IDS RA** for AAS integration. Provision of Data Space services required for MVP (Broker, Identity services)
- **Connect to processes and sensors** via AAS connection
  - Power sensors (MQTT)
  - PLC automation (OPC UA)
  - External systems (HTTPS)
- **Re-use AAS submodel templates for circularity** information
- Calculate **Carbon Footprint** based on sensors / systems and store in Process / Product AAS



Circular TwAIn

tecnalia
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE


Referentes en Europa

MAS4AI

Multi-Agent Systems for Pervasive Artificial Intelligence for assisting Humans in Modular Production Environments

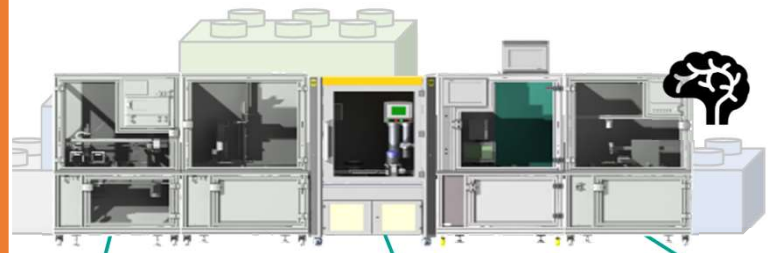
Smart Factories

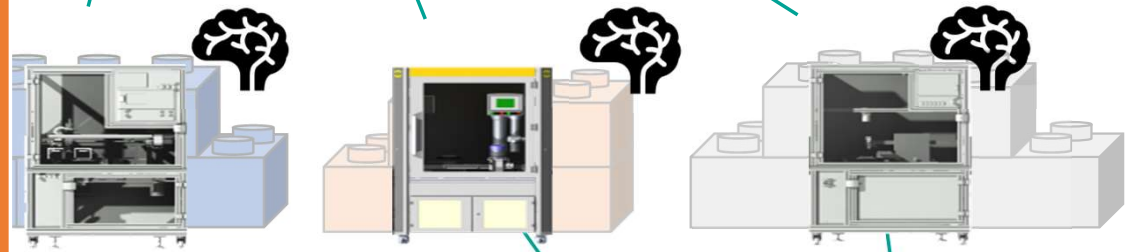
Smart Machines

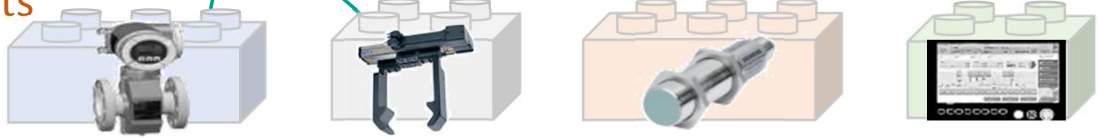
25.05.2023

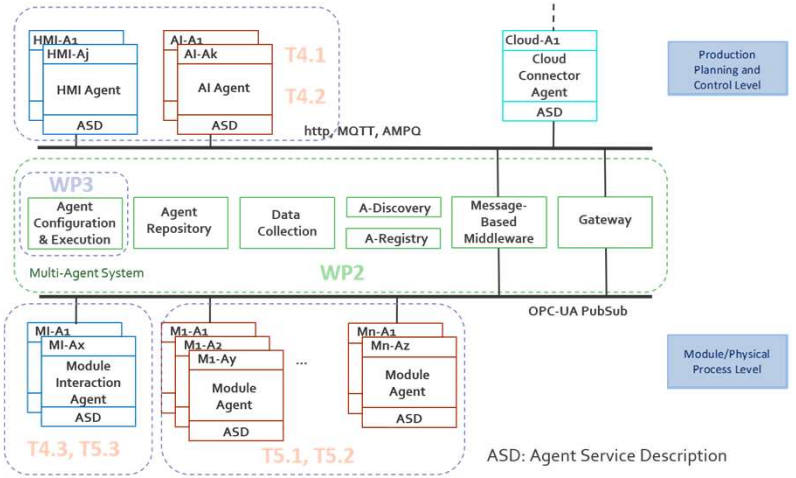
Smart Components

System Composition









Industry 4.0

tecnalia

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Circular TwAIn will increase the performance, resilience and sustainability of discrete manufacturing and process industries by developing a novel AI platform for circularity.

3 USE CASES

Li-Ion Battery Packs in E-mobility

Consumer Electric and Electronic Equipment Waste

Petrol-Chemical Production Plants

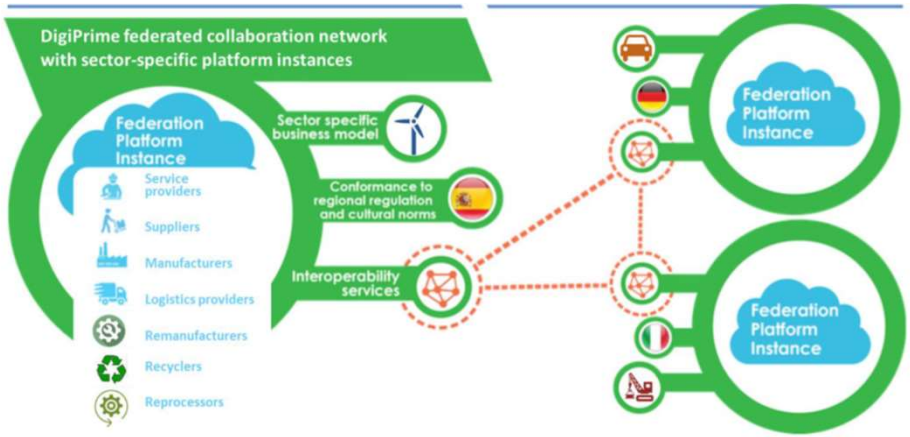
tecnalia

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

tecnalia
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

DigiPrime

Digital platform for circular economy in cross-sectorial sustainable value networks



The overall architecture level of the DigiPrime platform includes:

- A **Multi-node federation** structure, replicable on different existing and additional sectorial platform instances and with easy access for users;
- A **Semantic data infrastructure** based on ontological repositories and semantic search;
- A **Data Policy Framework** to ensure privacy, security, authentication and authorization policies

Un DSS para el reciclado de composites

"DIGIPRIME - DIGITAL PLATFORM FOR CIRCULAR ECONOMY IN CROSS-SECTORIAL SUSTAINABLE VALUE NETWORKS
This project has received funding from the European Union's Horizon 2020 Framework Programme, DT-ICT-07-2018-2019 "Digital Manufacturing Platforms for Connected Smart Factories" topic, under Grant Agreement ID 873111"

Servicio de optimización de parámetros de compounding

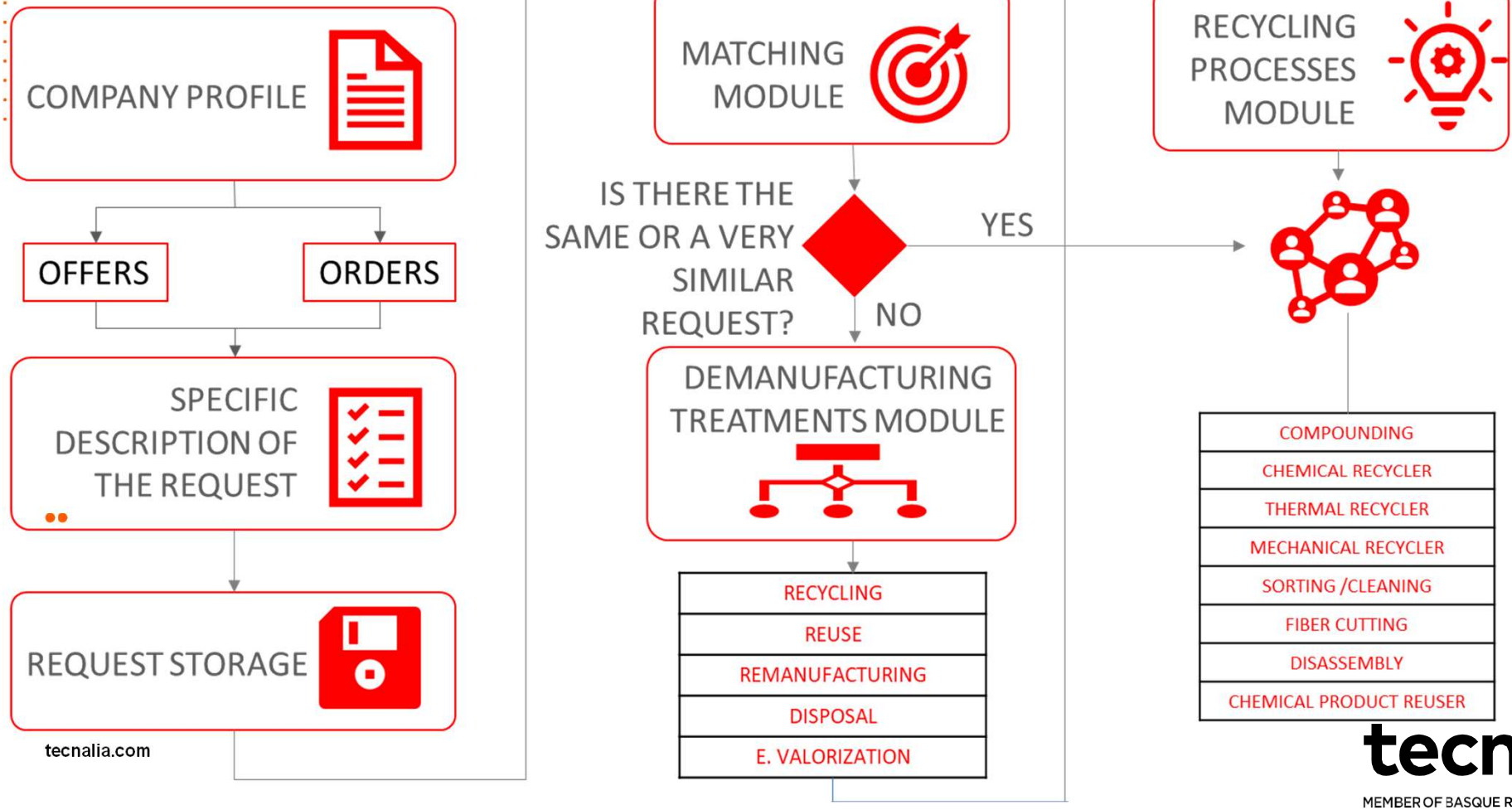
Objetivo del modelo de optimización:

Sugerir la consigna (parámetros del control) en la extrusora para crear nuevos composites que se ajusten a los requerimientos del cliente.

Optimizas el tiempo de producción evitando intentos erróneos.

"DIGIPRIME - DIGITAL PLATFORM FOR CIRCULAR ECONOMY IN CROSS-SECTORIAL SUSTAINABLE VALUE NETWORKS
This project has received funding from the European Union's Horizon 2020 Framework Programme, DT-ICT-07-2018-2019 "Digital Manufacturing Platforms for Connected Smart Factories" topic, under Grant Agreement ID 873111"

DigiPrime



tecnalia.com

tecnalia

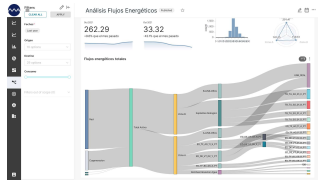
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

CIRMET

		Tools used	Limitations	When to use
Descriptive Analytics	What happened and why?	› Data aggregation › Data mining	› Snapshot of the past › Limited ability to guide decisions	› When you want to summarize results for all/part of your business
Predictive Analytics	What might happen?	› Statistical models › Simulation	› Guess at the future › Helps inform low complexity decisions	› When you want to make an educated guess at likely results
Prescriptive Analytics	What should we do?	› Optimization models › Heuristics	› Most effective where you have more control over what is being modeled	• When you have important, complex or time-sensitive decisions to make

Descriptive analytics helps organizations understand what happened in the past (the past in this context can be from a minute ago or a few years ago).

Predictive Analytics, allows to model the behaviour of (part of) the process, so future outcomes can be predicted or estimated. This capacity to see what will happen in the future, will allow to inform the operator about this situation, which can be desired or undesired.



tecnalia
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Thank you

Luis Usatorre
luis.usatorre@tecnalia.com

tecnalia
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Creating Growth

Improving Society

MAS4AI

DigiPrime

CIRMET

Circular TwAIn

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements No 957204, 820670, 873111, 101058585.