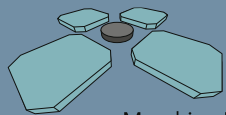




POLITECNICO
MILANO 1863

Remanufacturing: Remanet Project



MUSP

Macchine Utensili e Sistemi di Produzione



REMANET

it remains

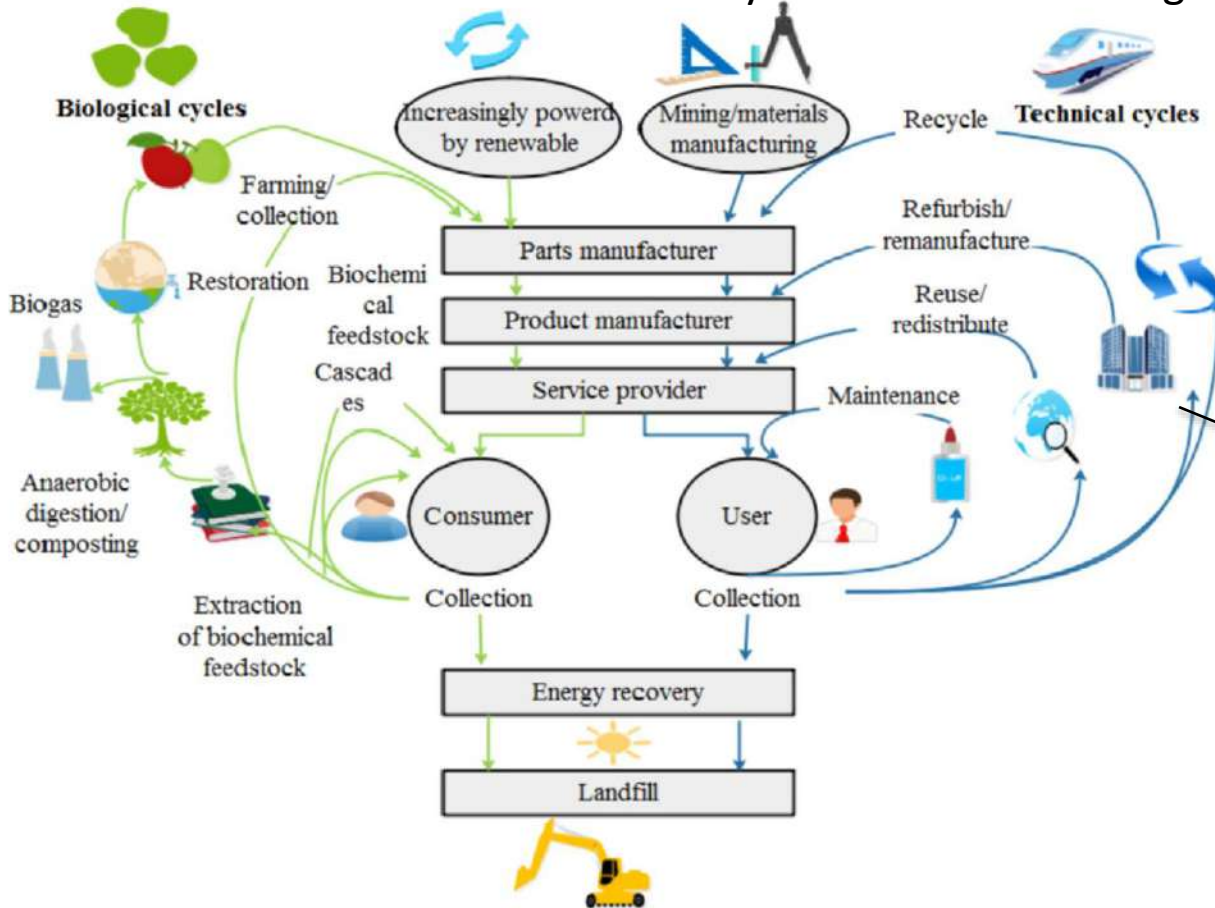
Piacenza (Consorzio MUSP), 14 dicembre 2023 – Paolo Albertelli – Politecnico di Milano
paolo.albertelli@polimi.it

Agenda

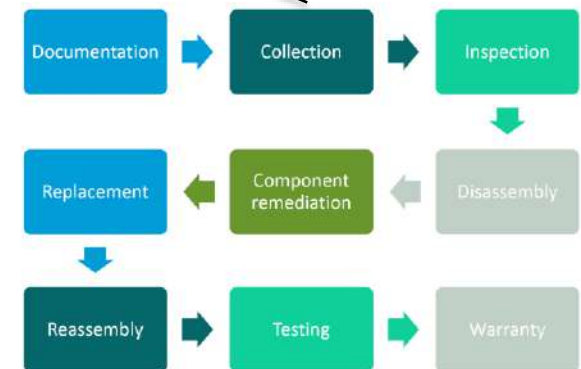
- Remanufacturing – introduction
- Horizon Europe – framework
- Some relevant calls, Trends and keywords
- The Remanet Project
- Examples and test cases presentation
- World Remanufacturing Summit

Introduction

Circular Economy and remanufacturing



Xugang Zhang, Mingyue Zhang, Hua Zhang, Zhigang Jiang, Conghu Liu, Wei Cai, A review on energy, environment and economic assessment in remanufacturing based on life cycle assessment method, Journal of Cleaner Production, Volume 255, 2020



Introduction

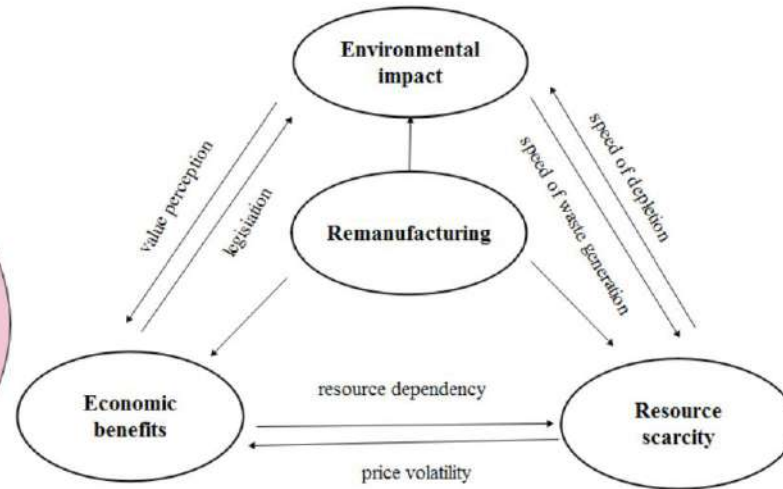
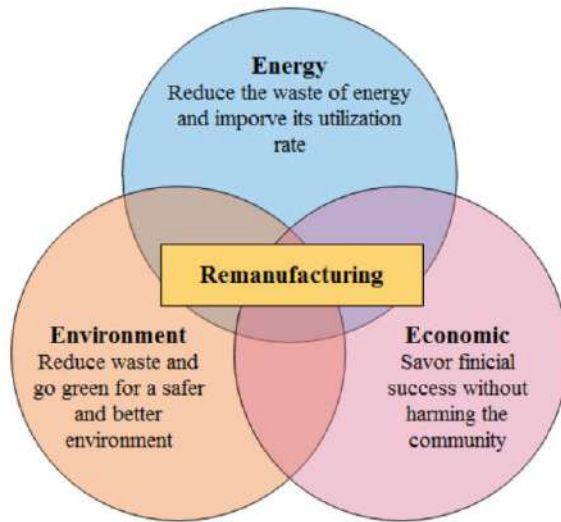


Table 6
Environmental pollution during engine manufacturing (Kg/Per) (Mao et al., 2009).

Air pollutant	Emissions	Water pollutant	Emissions
Dust	1.97	Waste water	20510
SO ₂	6.27	Suspended solids	0.31
HCHO	0.01	Oil, grease	0.12
CO	1.45	BOD ₅	0.02
NO _x	2.10	COD _{Cr}	0.06
CH ₄	0.11	Manganese	0.02
CO ₂	996.5	Iron	0.53
NMHC	0.02	Copper	0.01

Table 7
Environmental pollution during engine remanufacturing (Kg/Per) (Mao et al., 2009).

Emissions	Quantity	Emissions	Quantity	Emissions	Quantity
Dust	0.09	CO	0.07	SO ₂	0.126
NO _x	0.028	CO ₂	7.51	BOD	0.0042
Suspended solids	0.007	Hydrocarbon	0.0028	Heavy metal	0.0034

h

Environmental Impact (engine manufacturing)

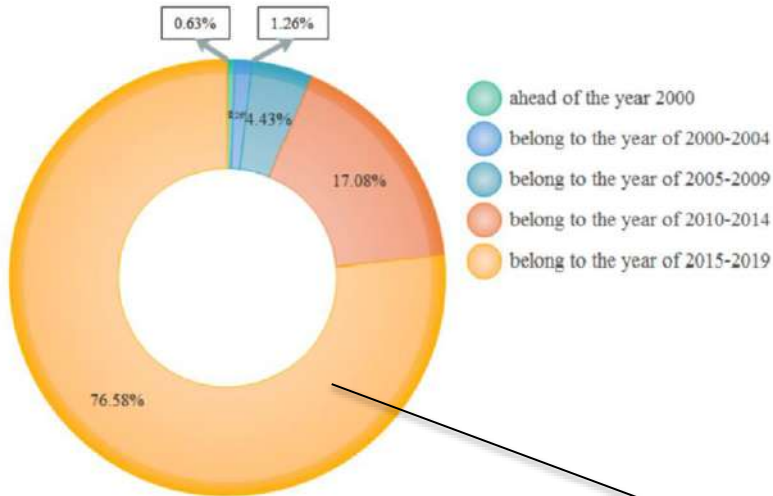
- NO_x: 2.10 Vs 0.028 Kg/per
- CO₂: 996.5 Vs 7.51 Kg/per

Energy (engine manufacturing)

- Saved Energy: 4/5 o the overall energy

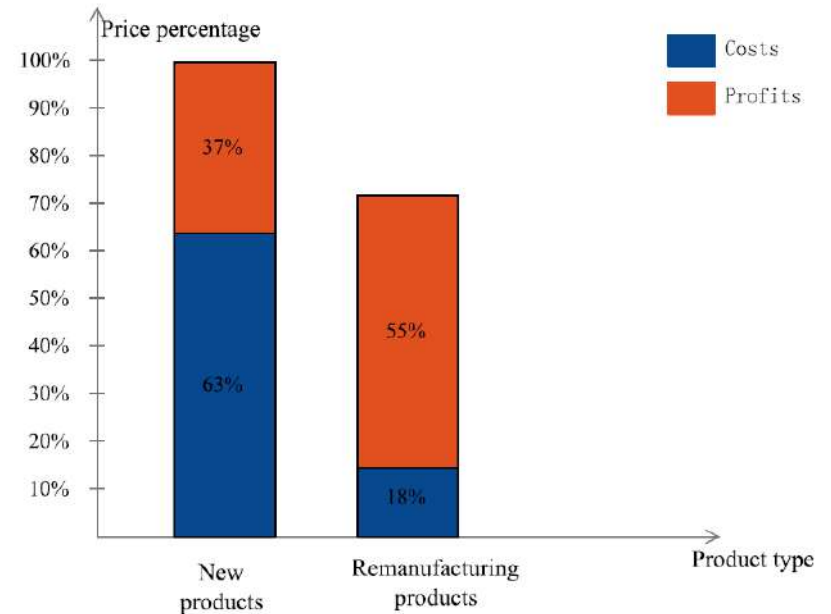
Introduction

Scientific and research activities



last 4 years (2015-2019)

Industrial perspective: Costs and Profits



Xugang Zhang, Mingyue Zhang, Hua Zhang, Zhigang Jiang, Conghu Liu, Wei Cai, A review on energy, environment and economic assessment in remanufacturing based on life cycle assessment method, Journal of Cleaner Production, Volume 255, 2020,

Remanufacturing challenges

Potentialities

- + material saving
- + energy saving
- + CO₂ saving
- + reduced costs
- + lower prices
- + higher profits

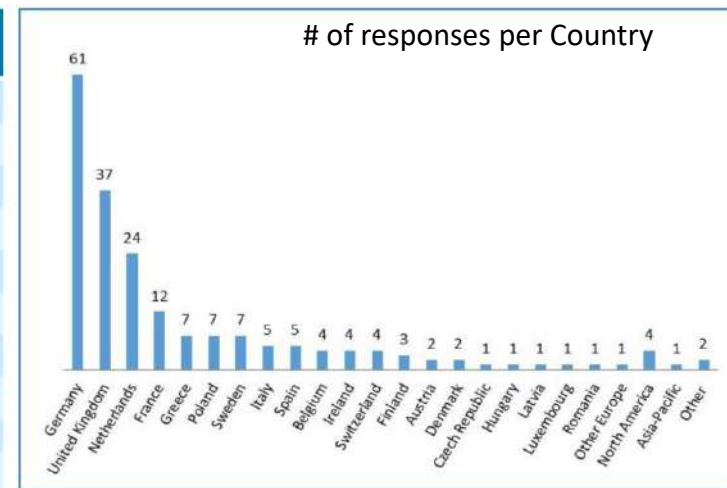
Challenges

- Lack of Data about the Condition of the Returned Product
- Complex disassembly processes
- Lack of a Methodology for Deciding the Best End-of-Life Scenario
- Investment analysis
- Supply chain
- Remanufacturing processes (agile, etc.)



Industry 4.0 – digitalization and other Key Enabling Technologies: Artificial Intelligence

Sectors	Turnover (€bn)	Firms	Employment ('000)	Core ² ('000)	Intensity
Aerospace	12.4	1,000	71	5,160	11.5%
Automotive	7.4	2,363	43	27,286	1.1%
EEE	3.1	2,502	28	87,925	1.1%
Furniture	0.3	147	4	2,173	0.4%
HDOR	4.1	581	31	7,390	2.9%
Machinery	1.0	513	6	1,010	0.7%
Marine	0.1	7	1	83	0.3%
Medical equipment	1.0	60	7	1,005	2.8%
Rail	0.3	30	3	374	1.1%
Total	29.8	7,204	192	132,405	1.9%



Estimated savings

Sectors	Materials ('000 t)	CO ₂ e ('000 t)
Aerospace	136	356
Automotive	587	2,099
EEE	299	1,070
Furniture	16	129
Heavy duty and off road equipment	42	83
Machinery	76	131
Marine	663	2,724
Medical equipment	192	734
Rail	107	91
Total	2,260	8,255

Source: ERN European Market Study
Horizon 2020

Scenarios and Future Trends

Basic Case (Hp: remanufacturing sectors growing under the following conditions)

- Low (0.5% p.a.) Heavy duty, Machinery and Marine
- Steady (3% p.a.) Aerospace, Automotive, Rail
- High (5% p.a.) EEE, Furniture, Medical Equipment

Stretch (with appropriate policies and promotional activities)

- Low (25% p.a.) Heavy duty, Machinery and Marine
- Steady (50% p.a.) Aerospace, Automotive, Rail
- High (100% p.a.) EEE, Furniture, Medical Equipment



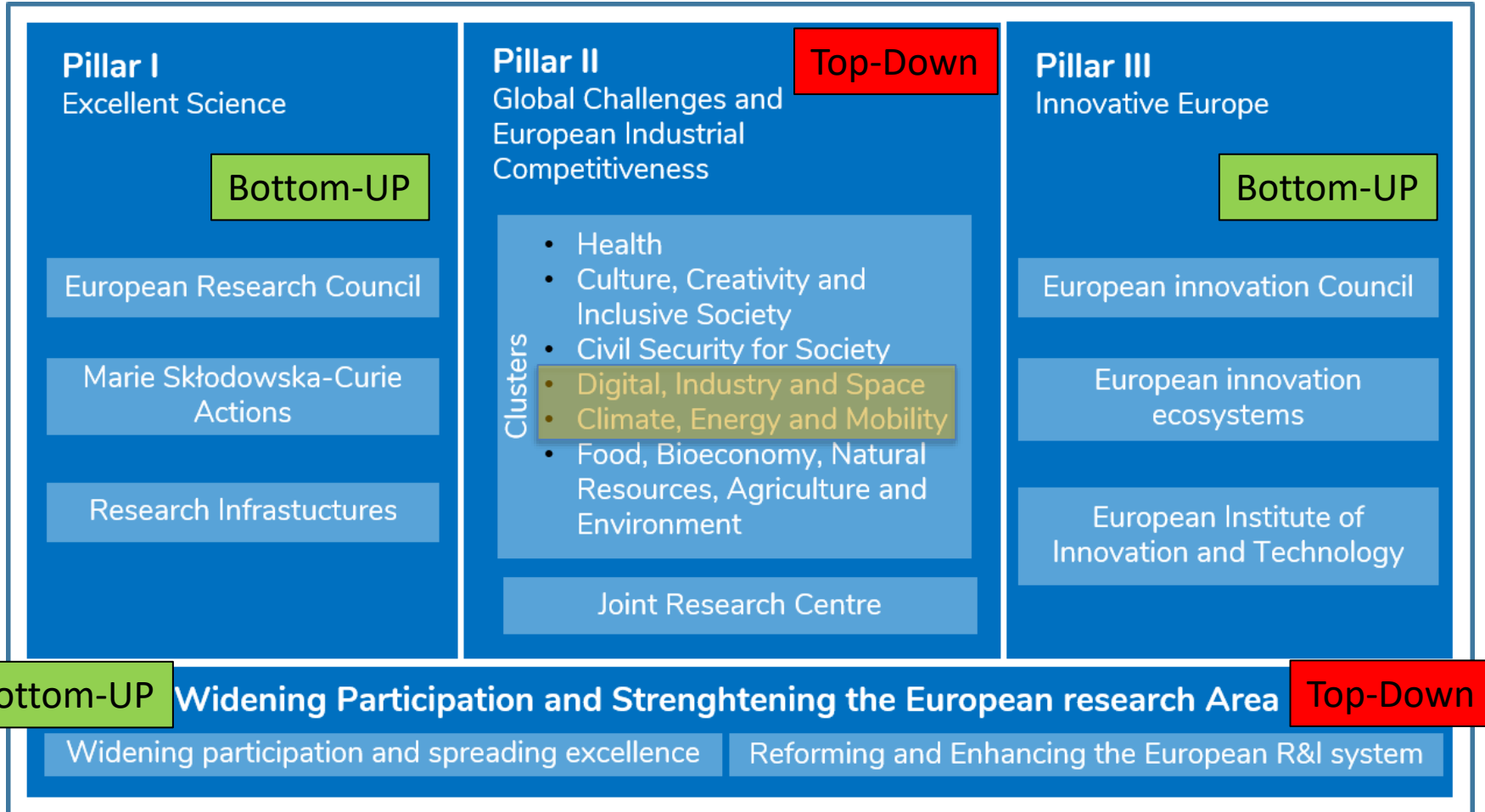
Transformation (characterized by investment, strong policy support, large scale proportion)

- Low (50% p.a.) Heavy duty, Machinery and Marine
- Steady (100% p.a.) Aerospace, Automotive, Rail
- High (200% p.a.) EEE, Furniture, Medical Equipment



Source: ERN European Market Study
Horizon 2020

EU fundings – Horizon Europe structure



Remanet (it remains): Objectives and Ambitions



REMANET

it remains

HORIZON-CL4-2022-TWIN-TRANSITION-01-07:

Digital tools to support the engineering of a
Circular Economy

- The RemaNet paradigm is based on the concept that, through a set of **functionalities, facilitating tools, available guidelines**, networking, **different players** can worthily **contribute to remanufacturing providing their specific knowledge or sharing their facilities/technologies**.
- Basically, the RemaNet **platform aims at making each federated stakeholder**, even without a strong and specific tradition on remanufacturing, to globally **enhance and extend the circular value chains to a higher variety of products**.

Objectives

Present paradigm: only a few highly skilled and capable protagonists can remanufacture advanced products



Distributed and widespread business model, enabled by digital tools, that allows multiple players to interact, in order to gain the same capability as a single highly skilled and capable actor.

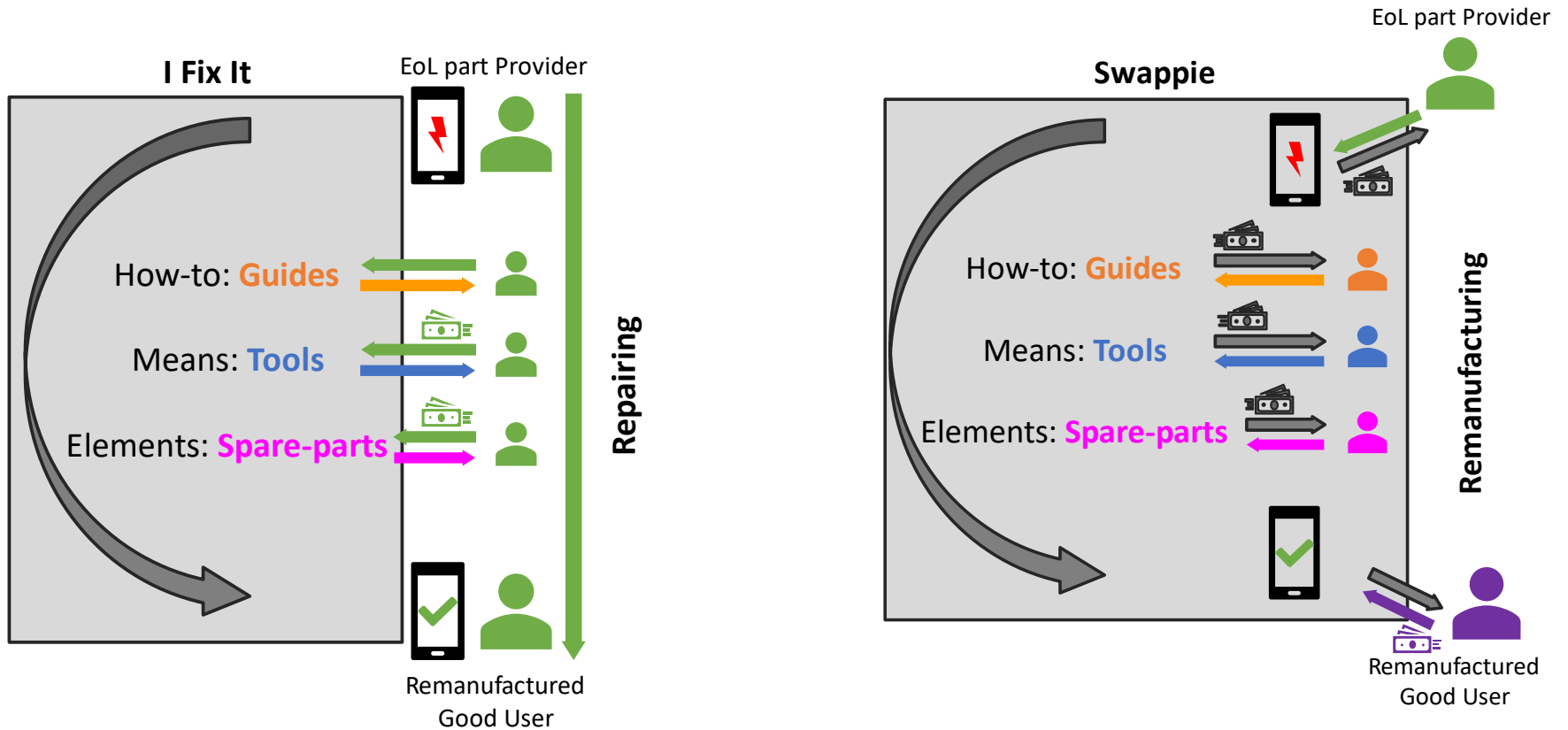


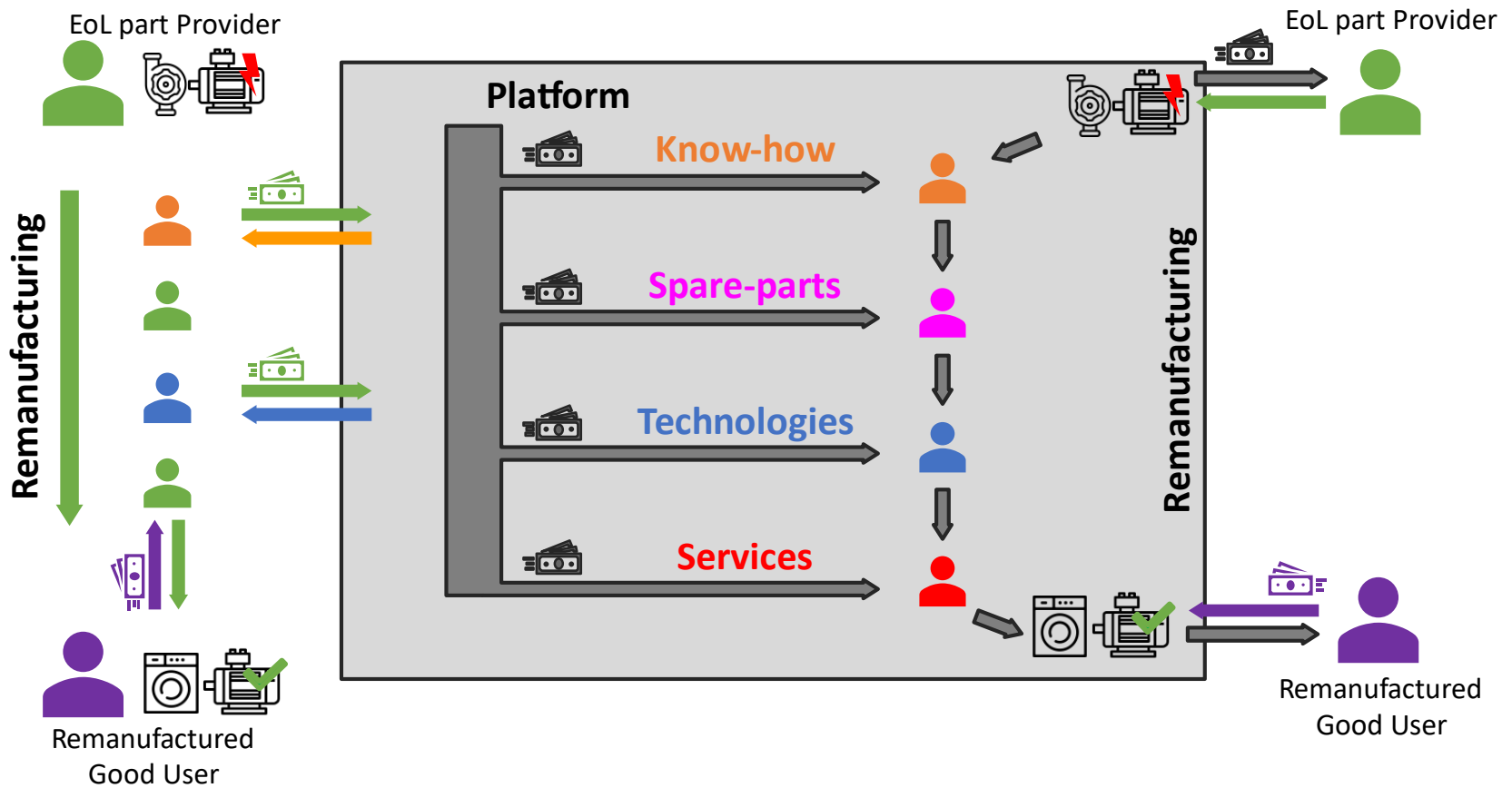
Such a **distributed and collaborative approach can increase the market for SMEs, i.e., allowing parties to perform single steps of the remanufacturing process.**



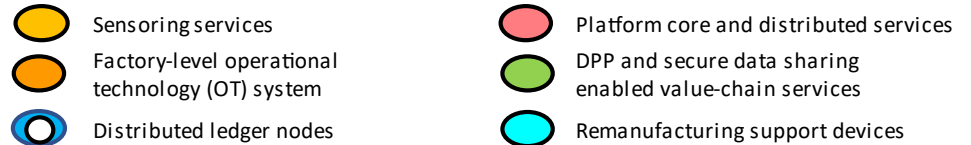
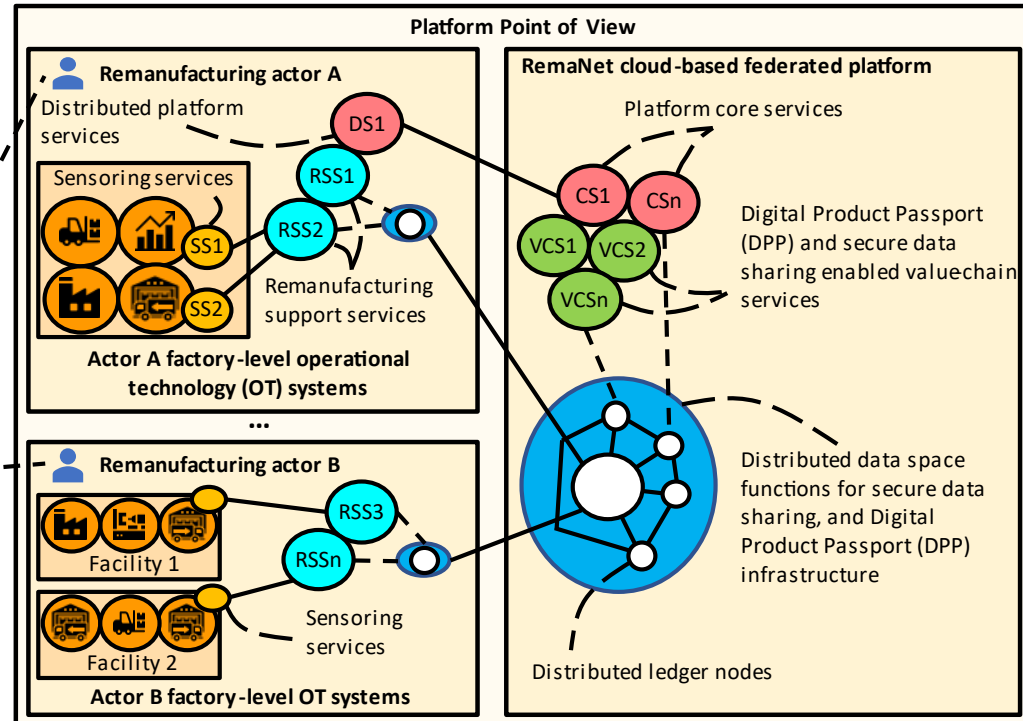
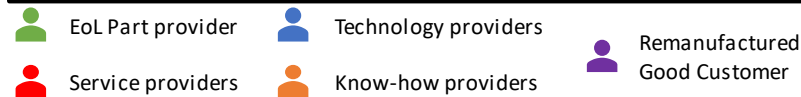
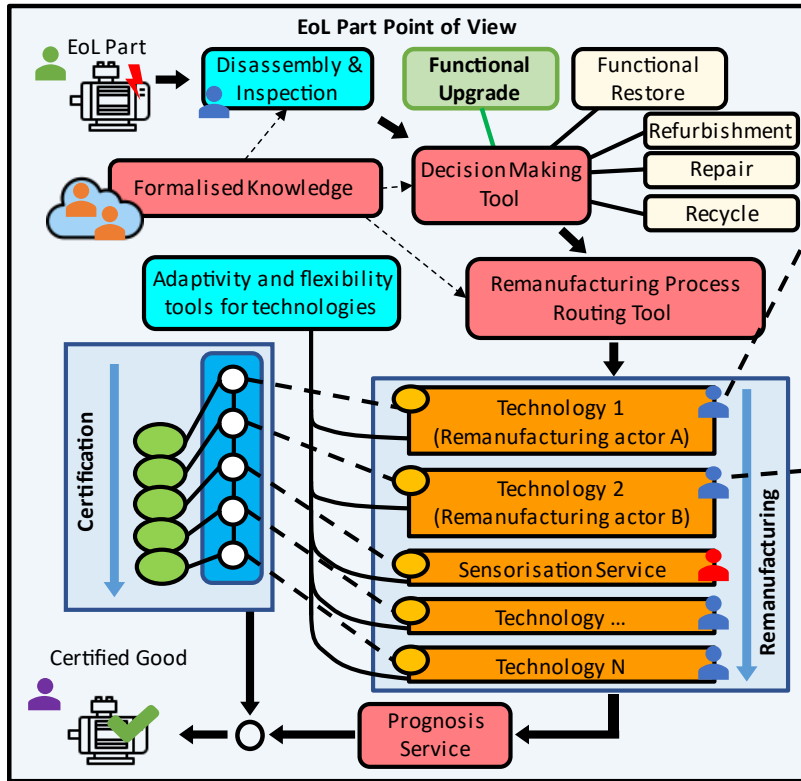
the proposed approach would increase the market for remanufactured products through a **distributed certification approach, increasing the perceived value of remanufactured goods by customers** and, thus, contributing to improve the competitiveness of European companies in the global market, and with the long-term objective, at establishing a European leadership in the remanufacturing market.

Reference Business Models

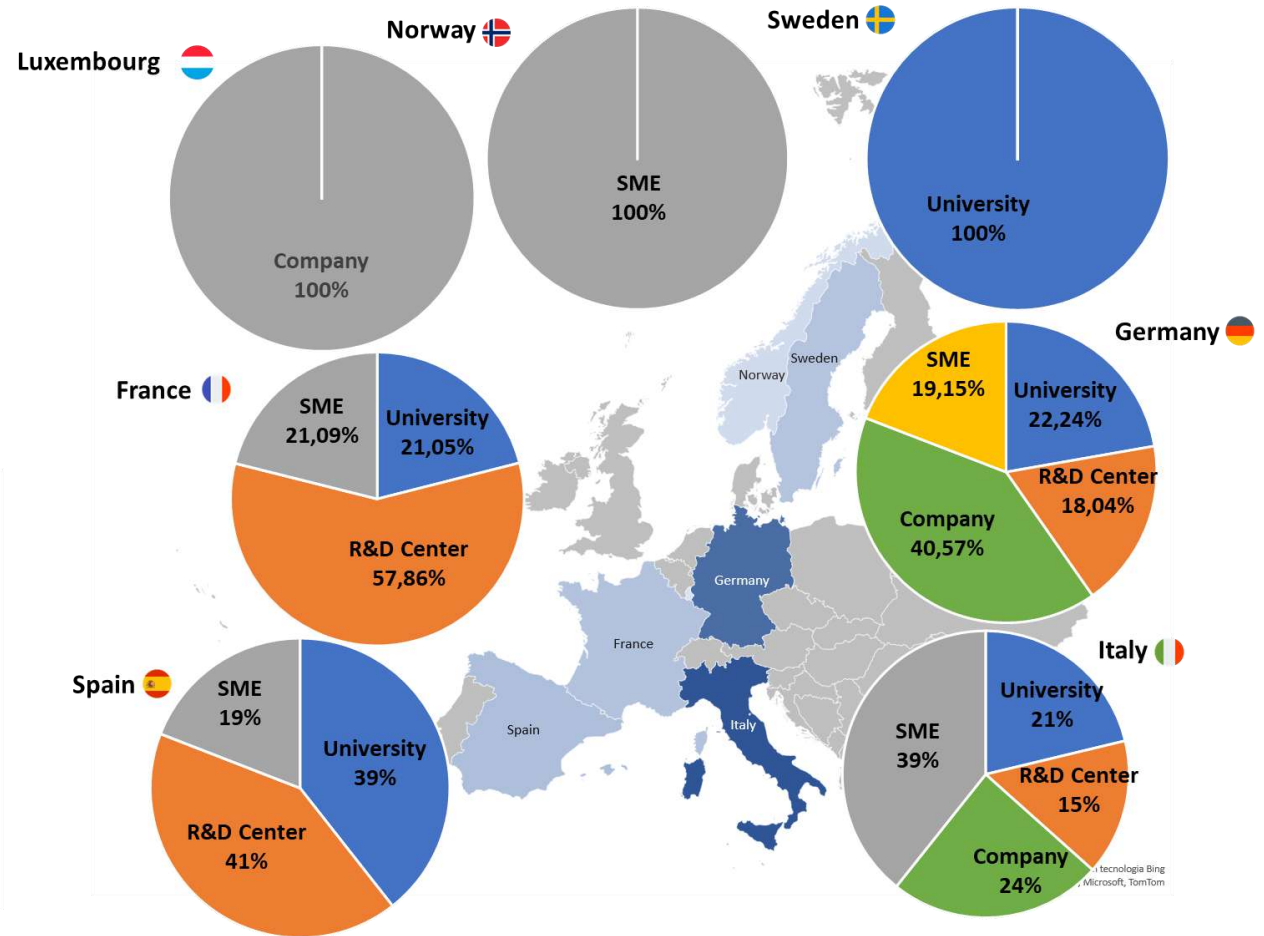
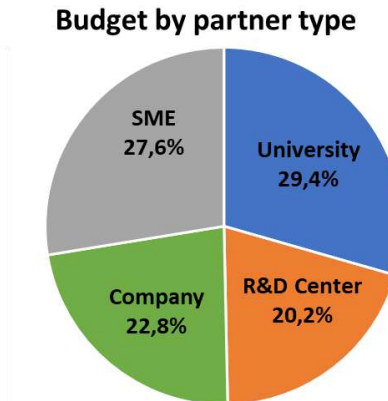
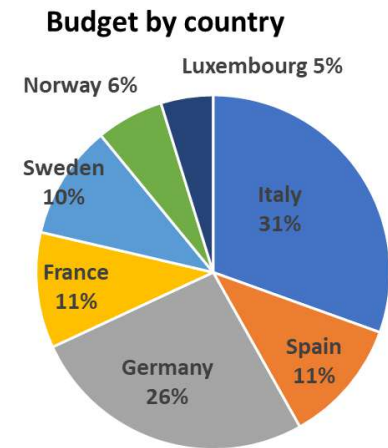




Platform description



Remanet (it remains): main actors



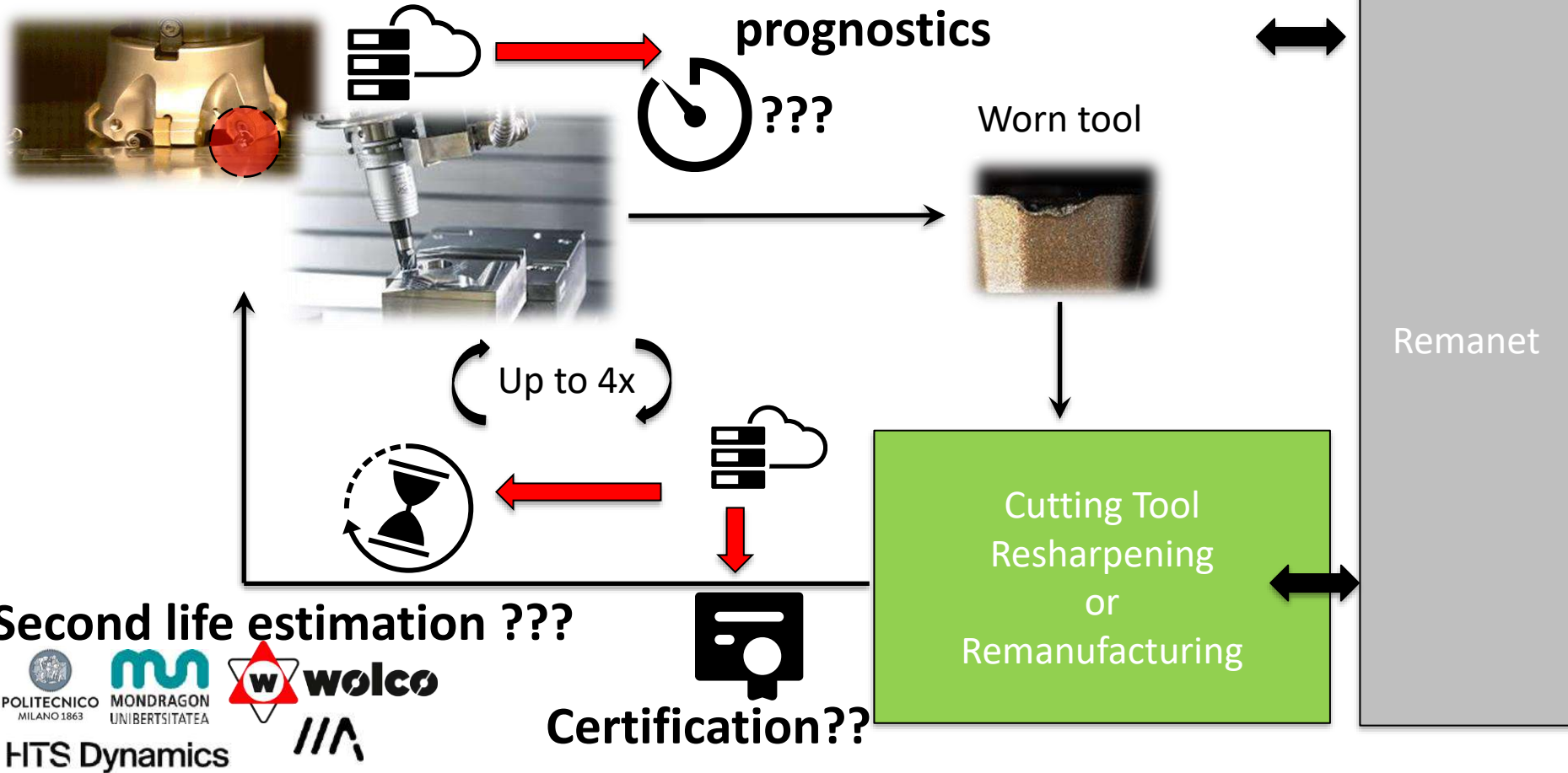
Remanet (it remains): Beneficiaries

Partner No. *	Participant organisation name	Short Name	Country
1 (Coordinator)	POLITECNICO DI MILANO	POLIMI	Italy
2	CONSORZIO MUSP	MUSP	Italy
3	MCM S.p.A.	MCM	Italy
4	BLM S.p.A.	BLM	Italy
5	Spin Applicazioni Magnetiche Srl	SPIN	Italy
6	Holonix Srl	HOL	Italy
7	Ideko S. Coop.	IDE	Spain
8	Mondragon Goi Eskola Politeknikoa J.M.A. S COOP	MGEP	Spain
9	WOLCO	WOLCO	Spain
10	SIEMENS Energy	SIEM	Germany
11	LMT Tools	LMT	Germany
12	Intrasoft	INTRA	Luxembourg
13	ModuleWorks GmbH	MWS	Germany
14	Technische Universität Darmstadt	DAR	Germany
15	Fraunhofer Institute for Manufacturing Engineering and Automation IPA	IPA	Germany
16	ZF Friedrichshafen AG	ZF	Germany
17	SimPlan AG	SIM	Germany
18	Trägerverein UCBeIttechnologie-Cluster Bayern e.V.	UCB	Germany
19	CRITT-TJFU	CRITT	France
20	Deep42.ai	D42	France
21	Extra Red	RED	Italy
22	Université de Lorraine	LGIPM	France
23	Luleå tekniska universitet	LTU	Sweden
24	Winow Automation AS	WIN	Norway
25	HTS Dynamics	HTS	Norway



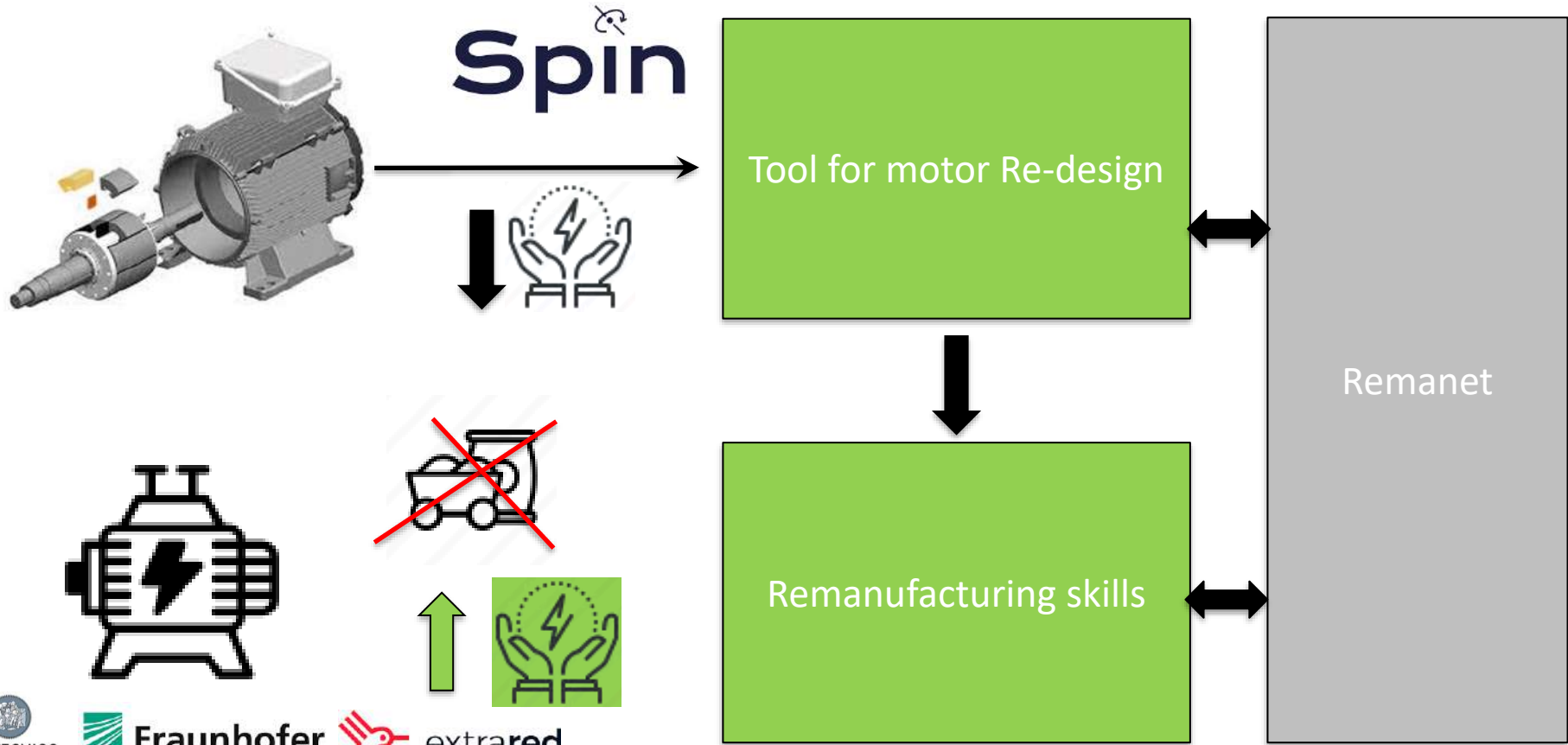
Examples: Tool Resharpener

Remanufacturing of cutting Tools

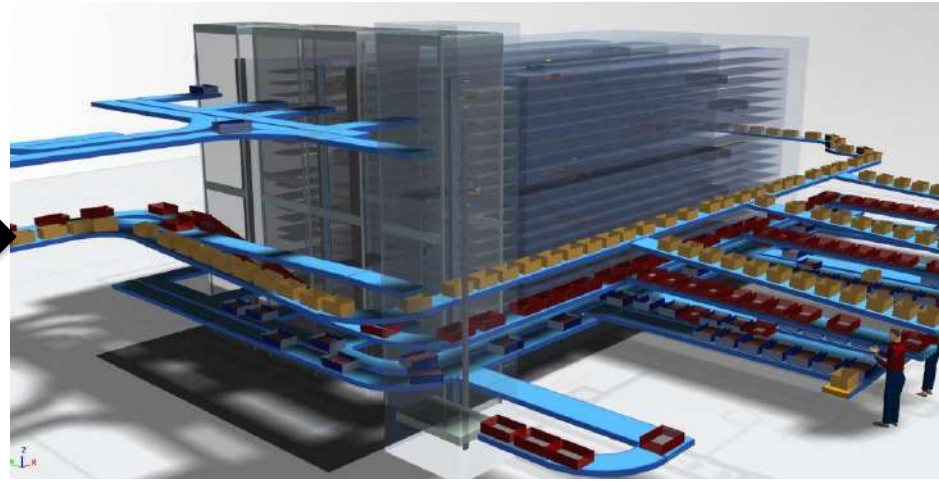


Examples: electrical motors

Refurbishment of low efficiency electrical motors



Examples: Automotive

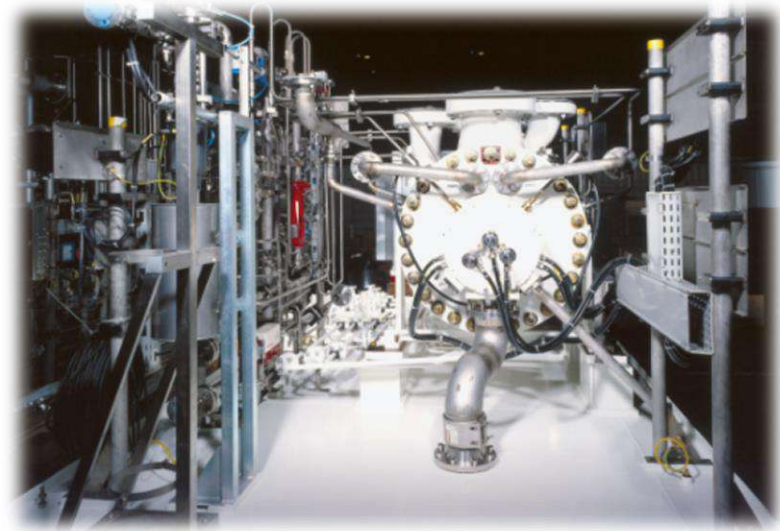
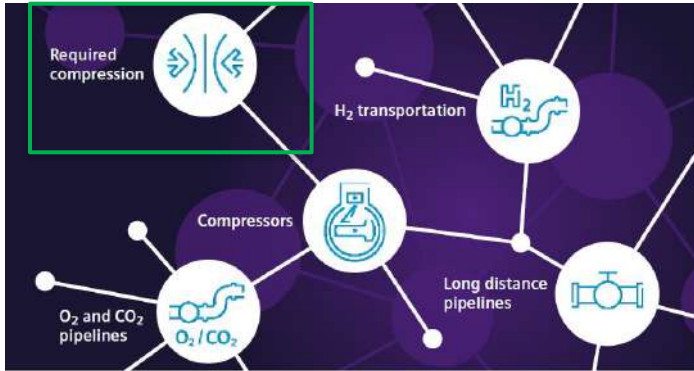


Remanet

Simulation models for the EOL (End of Life parts) arrival estimation



Examples: Energy – remanufacturing of compressors for H2



SIEMENS ENERGY

Repairing and remanufacturing of H2 compressors



World Remanufacturing Summit



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<https://www.wrs2024.com/>

AGENDA

MARCH 12, 2024 - PALAZZO LOMBARDIA

10:30-12:30

Opening ceremony and
institutional sessions

14:00-17:30

Parallel technical sessions

CULTURAL EVENT
WRS2024 DINNER & AWARDS

MARCH 13, 2024 - POLITECNICO DI MILANO

9:30-16:30

Parallel technical sessions and vision for the future
CLOSING CERIMONY

FULL DETAILED AGENDA COMING SOON!

- Partecipazione all'evento
- Sponsorships (gold or silver)

Thanks for the attention

Contacts:

Paolo Albertelli

paolo.albertelli@polimi.it