CALiMERO

IMPROVING BIO-BASED INDUSTRIES LIFE CYCLE SUSTAINABILITY

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Key information

Industry CAse studies anaLysis to IMprove EnviROnmental performance and sustainability of bio-based industrial processes

contactica innovation

We LOOP

ECIA

ivl Swedish Environmental Research Institute

NEOVILI

ceseFOR

EREKS-ERA

DTU

BIM

techtera

essity

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

36 months 1st July (2022) – 30th June (2025)

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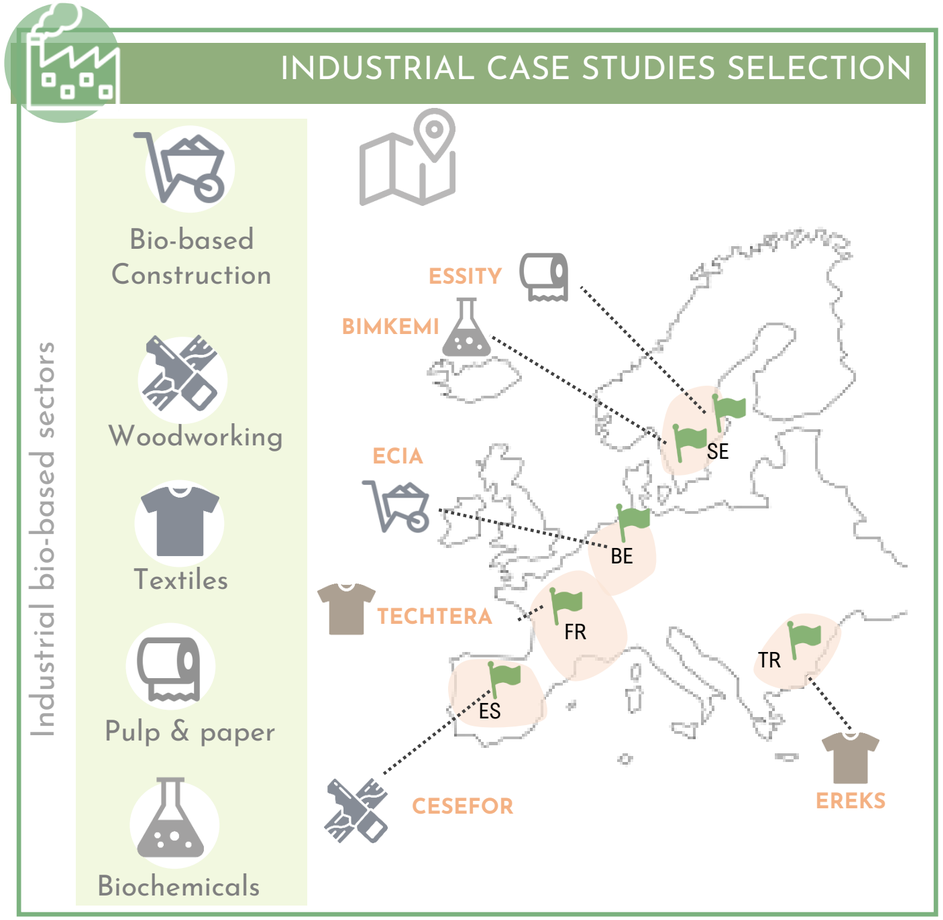
Main aim and context

Paving the way for the transition to a **sustainable European bio-economy** by **improving** the sustainability **performance** of a series of **industrial processes** in the following **five bio-based sectors** (i) construction, (ii) woodworking, (iii) textiles, (iv) pulp and paper, and (v) biochemicals



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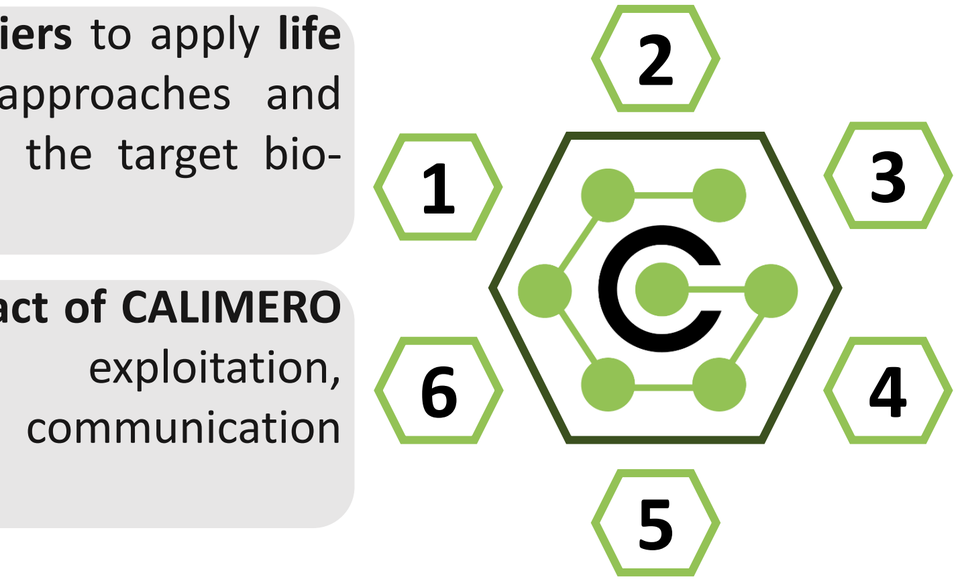
Secondary objectives

To **define reference case studies** in order to improve life cycle sustainability assessment methods and sustainability performances

To **identify main barriers** to apply **life cycle sustainability** approaches and **source of impacts** in the target bio-based sectors

To **maximize the impact of CALIMERO** through tailored exploitation, dissemination and communication activities



To **improve** current **sustainability assessment** procedures

To **develop** a **multi-objective optimization framework** for improvement of bio-based industrial processes with sustainability indicators

To **provide feasible solutions** with **better sustainability performance** and the **procedures to monitor them**

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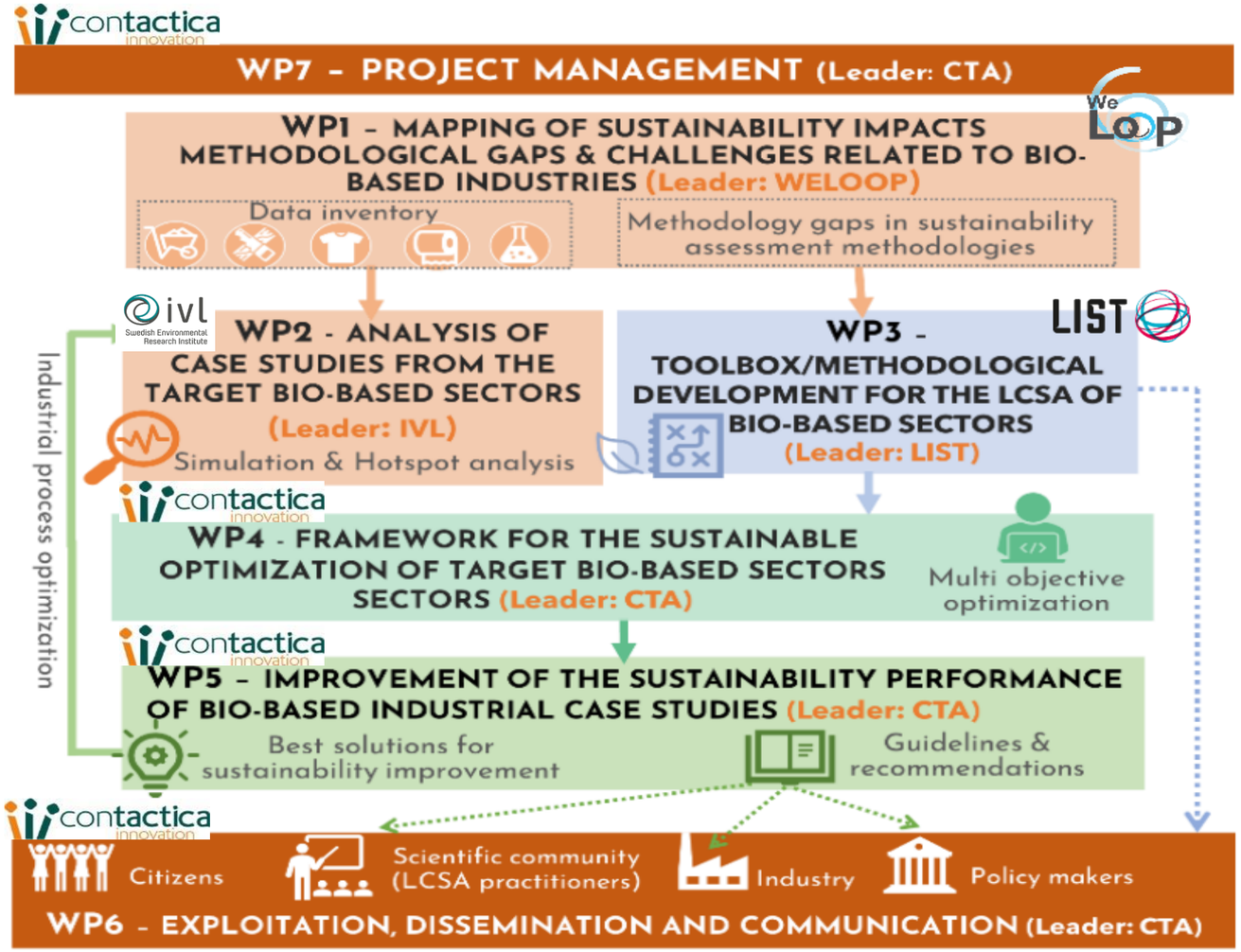
Work packages



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WP1 & WP2: Main challenges and solutions adopted

Methodological issues in PEF method in a bio-economy context

CHALLENGE	SOLUTION ADOPTED
CONCEPTUAL The specificities of biobased systems and key concepts related to bioeconomy strategies (e.g., job creation or skills training) are not addressed	Propose new impact categories (e.g. biodiversity or ecosystem services) or modify existing ones (e.g. inclusion of the time dimension in climate change or proposal of specific characterization factors for toxicity) to adapt them to the specificities of biobased systems
CONCEPTUAL Difficulty in conducting LCA because social and economic dimensions (i.e., S-LCA and LCC, respectively) are not addressed in a standardized way	Suggestion of social (e.g., job creation potential or occupational health and safety) and economic (e.g., net present value) indicators to be included in further standardized procedures
DATA Lack of monitoring of the industrial processes in terms of physical and chemical variables, emissions, etc.	Approaching the reality of biobased systems by simulating industrial processes to estimate the associated behavior or emission of pollutants
MODELLING Trade-offs between the three dimensions of sustainability: (i) environmental, (ii) social and (iii) economic (e.g. improvement of an environmental aspect may be associated with a deterioration in economic performance)	Multi-optimization approach based on the proposal of a multi-objective optimization framework that prioritizes the reduction of social and environmental impacts while improving economic performance

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WP3: Methodology

Product Environmental Footprint method

European Commission

- Partial assessment of the environmental domain (**LCA**)
- Integration of socio-economic aspects (**S-LCA** and **LCC**)

Improving **Life Cycle Assessment** methodology (based on the **PEF guide**) and moving towards a **Life Cycle Sustainability Assessment**

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WP3: Sustainability assessment methodology

- Improvement of environmental indicators and proposal of new ones to increase the scope of the study
- Particularization to different bio-based industries to improve the quality of the results
- Integration of the social and economic dimensions to address holistic sustainability analyses

	INDICATORS									
	ENVIRONMENTAL IMPACTS						ECONOMIC AND SOCIAL IMPACTS			
	Time dependent GHG emissions	Emissions to air/water/soil	Water and primary energy use	Biodiversity	Ecosystem services	Toxicity CFs for bio-based industry specific substances	Net Present Value (NPV)	Internal Rate of Return (IRR)	Job creation potential	Occupational health and safety
PEF toolbox	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗
CALIMERO methodology	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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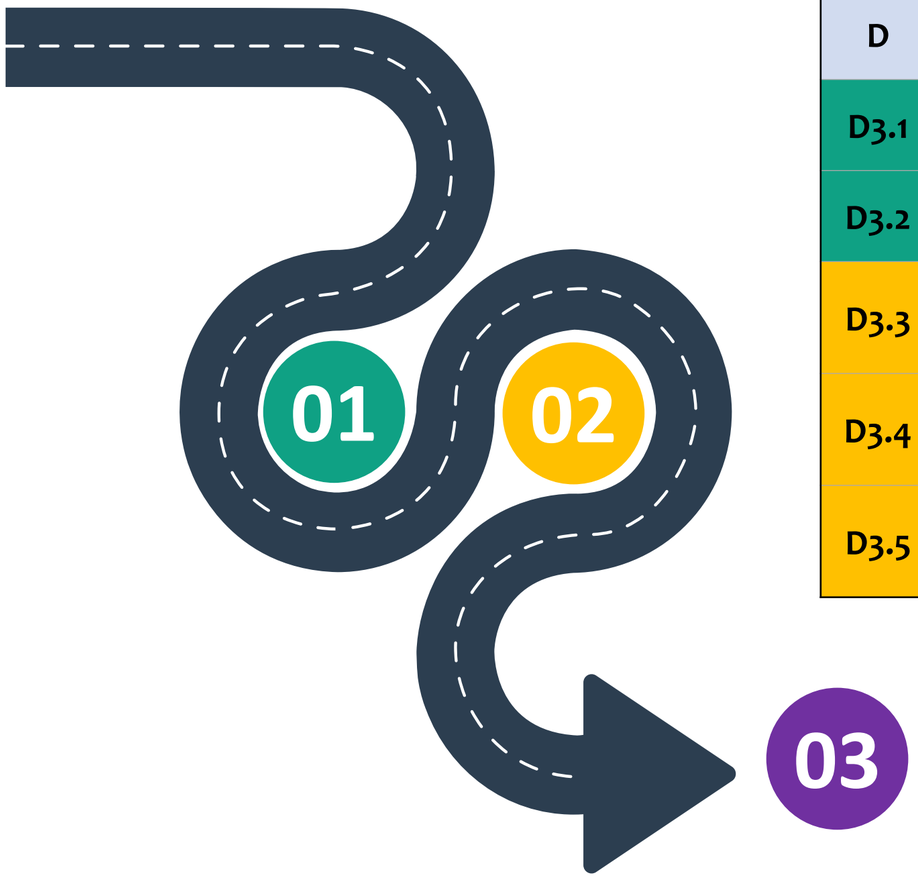
WP3: Workplan and dissemination of results



ACTION PLAN				
D	Name	Type	Due date	Coord.
D3.1	Biodiversity assessment methodology definition	PU	May 2025	IVL
D3.2	Ecosystem services methodology definition	PU	May 2025	LIST
D3.3	Circular economy and criticality assessment methodology definition	PU	Dec 2024	WeLOOP
D3.4	Carbon footprint assessment methodology including temporal dimension definition	SEN	Dec 2024	LIST
D3.5	Definition of relevant socio-economic indicators to include in LCSA of target bio-based industries	PU	Dec 2024	CTA

DISSEMINATION AND COMMUNICATION PLAN		
Activity	Type	Due date
Workshop from academic partners to industrial ones	SEN	May 2025
Workshop from academic and industrial partners to LCSA practitioners, industry, policy-makers, etc.	PU	June 2025

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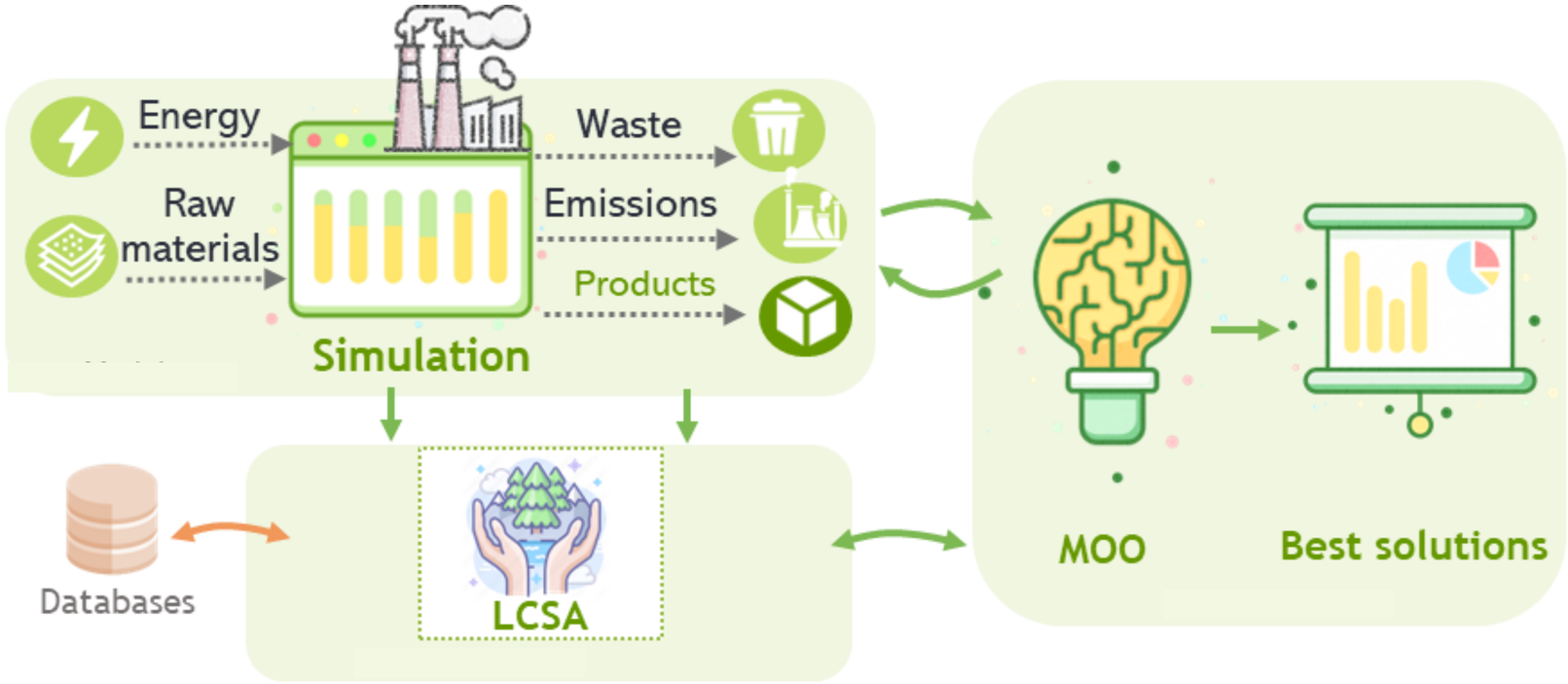
WP4: Multiobjective Optimization



OBJECTIVE

Optimizing conflicting objectives by algorithmically adjusting operational variables

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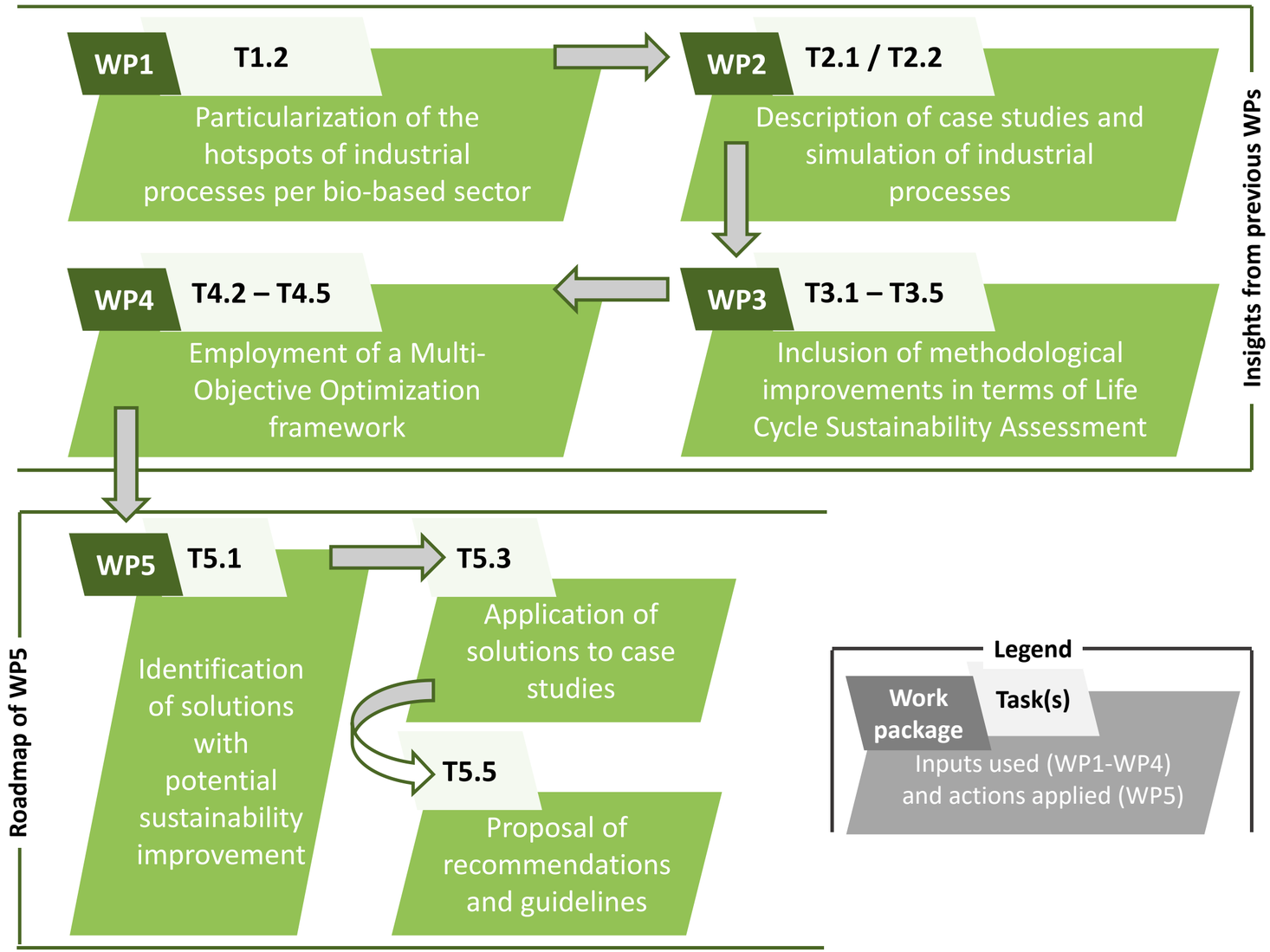
WP5: Improving the sustainability performance



CALIMERO in a nutshell

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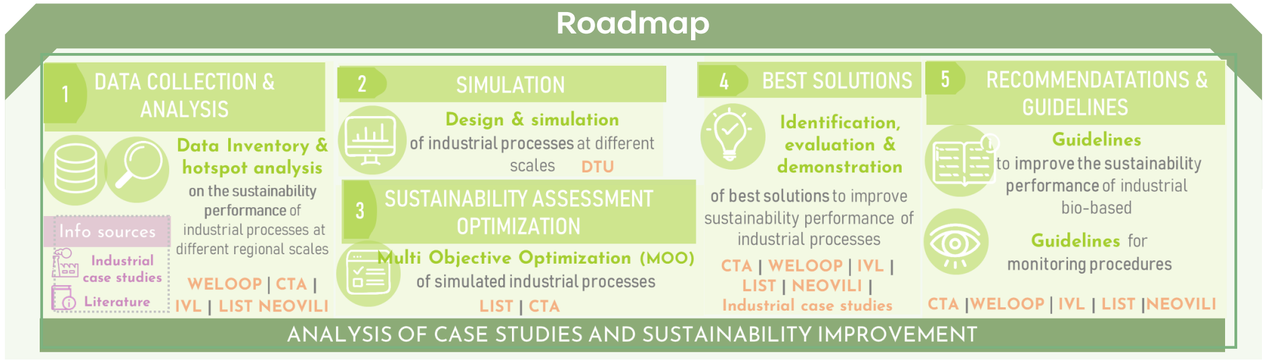
In the **CALIMERO** project, a characterization of **9 topics** relevant to the bio-economy has been addressed in relation to **Life Cycle Sustainability Assessment** methodology. In this sense, a series of **methodological gaps** were identified and classified into three different types (modelling, conceptual and data). This milestone opens the door to expanding and improving the Product Environmental Footprint (**PEF**) **method**, in addition to adapting it to bio-based production and consumption systems. With all this information, an analysis of each of **5 bio-based sectors** will be carried out, focusing not only on **sustainability assessment optimization**, but also on **simulation** with the aim of providing **recommendations and guidelines** which compiles the **best** tailored-**solutions**

Roadmap



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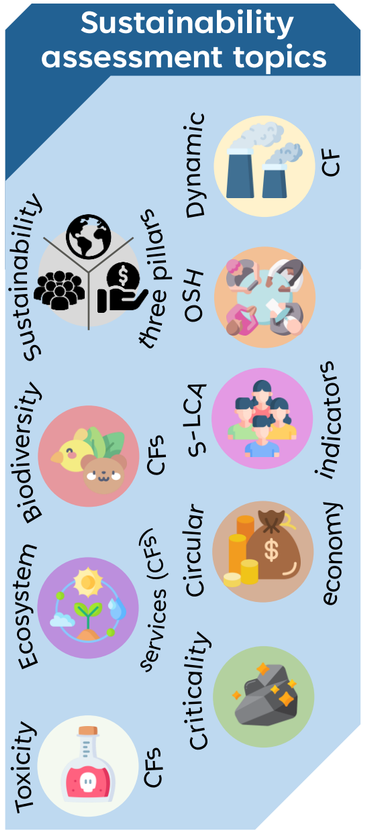
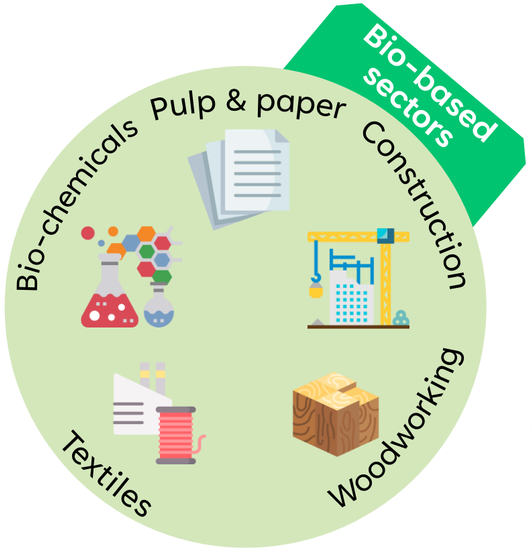
Recommendations & guidelines

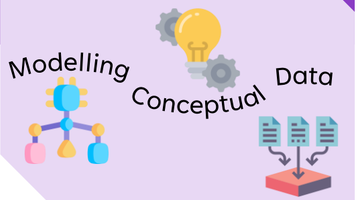
Sustainability assessment topics



Bio-based sectors



Methodological gaps



Alignment with the PEF method

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Thank you for your attention!

Contact us in case you need more information or if you want to know how to participate

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