CALiMERO

IMPROVING BIO-BASED INDUSTRIES LIFE CYCLE SUSTAINABILITY

D6.2 Final Exploitation Plan

Due date of submission: 31/10/2025

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LIST OF ACRONYMS

BP – Business Plan

CA – Consortium Agreement

CAGR - Compound Annual Growth Rate

CAPEX - Capital Expenditures

D – Deliverable

EC – European Commission

GA – General Assembly

HE - Horizon Europe: The EU Framework Programme for Research and Innovation

IEB – Innovation & Exploitation Board

IP - Intellectual Property

IPR – Intellectual Property Rights

KER – Key Exploitable Results

LCA – Life Cycle Assessment

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LCC – Life Cycle Costing

LCSA - Life Cycle Sustainability Assessment

LSL - Laminated Strand Lumber

MOO – multi-objective optimization

NPV – Net Present Value

O-LCA - Organisational Life Cycle Assessment

OPEX - Operational Expenditures

PP – Payback Period

SWOT – Strengths, Weaknesses, Opportunities, and Threats

TCO – Total Cost of Ownership

TRL – Technology Readiness Level

UVP – Unique Value Proposition

WP – Work Package

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PROJECT INFORMATION

Project full title: Industry CAse Studies AnaLysis to IMprove EnviROnmental Performance And Sustainability Of Bio-Based Industrial Processes

Acronym: CALIMERO

Call: HORIZON-CL6-2021-ZEROPOLLUTION-01

Topic: HORIZON-CL6-2021-ZEROPOLLUTION-01-06 - Increasing the environmental performance of industrial processes in bio-based sectors: construction, woodworking, textiles, pulp and paper and bio-chemicals

Start date: 1st July 2022

Duration: 36 months (extended to 40 months)

List of participants:

Partner No.	PARTICIPANT ORGANIZATION | ACRONYM
1 (Coord.)	Contactica | CTA
2	WeLOOP | WELOOP
3	European Cellulose Insulation Association | ECIA
4	Swedish Environmental Research Institute | IVL
5	Neovili | NEOVILI
6	Cesefor | CESEFOR
7	Luxembourg Institute of Science and Technology | LIST
8	Technical University of Denmark | DTU
9	Techtera | TECHTERA
10	Essity | ESSITY
11	BIM Kemi AB | BIMKEMI
12	Ereks garment| EREKS

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DELIVERABLE DETAILS

Document Number:	D6.2
Document Title:	Final Exploitation Plan
Dissemination level	SEN – Sensitive, limited under the conditions of the Grant Agreement
Period:	PR2
WP:	WP6
Task:	T6.1
Author:	Lucia Garcia Santos (CTA)
Abstract:	This deliverable D6.2 is the final exploitation plan for the CALIMERO project funded by the European Union under Grant Agreement nº101060546. This report set the structure and pathway to follow in the construction of the exploitation plan that guides the project to its completion and provide the consortium with the tools to exploit the results of CALIMERO. This deliverable aims at presenting the project's results, the exploitation methodology developed, the Intellectual Protection overviewed and the next steps for the exploitation activities after project´s completion.

Version	Date	Description
V1	01/07/2025	Update of methodology
V2	10/10/2025	KERs update
V3	13/10/2025	Version for first partners´ revision
V4	27/10/2025	Final revision
VF	28/10/2025	Final version for submission

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1 INTRODUCTION

This deliverable D6.2 Final Exploitation Plan is the last deliverable of the Task 6.1 that belongs to WP6 "Exploitation, Dissemination and Communication" of the CALIMERO project funded by the European Union under the Grant Agreement (GA) nº 101060546.

According to the provisions of the Horizon Europe program (REGULATION (EU) 2021/695), all CALIMERO partners must, - up to four years after the end of the action (2029) — use their best efforts to exploit their results directly or to have them exploited indirectly by another entity, in particular through transfer or licensing.

This deliverable is part of the WP6 which started in M1 (July 2022) and will finish in M40, (October 2025) at the end of the project. It belongs to the Task 6.1, Exploitation and Business Plan as the last deliverable of the work package and the task. D6.1.

This deliverable represents the final approach for developing an exploitation and business plan for CALIMERO project solutions and results. It includes partner-specific exploitation plans, which have been compiled through contributions from all partners who have developed KERs during the project's duration. This conclusive document presents a comprehensive overview of the project's evolution, achievements, and strategic impact on societal and economic fronts.

It details how resource allocation strategies are planned to be implemented, ensuring the efficient use of the project budget and human capital and aligning with Horizon Europe's responsible research and innovation principles. Moreover, it describes in detail how the project results are intended to be achieved, by which routes they could reach the market/targeted audience and what solutions they can offer.

The exploitation strategy is being carried out transversally in the project and is related to all tasks. At the end of the day, what is sought with these strategies and plans is that all partners and the consortium as a whole find the best practices to exploit the results and generate a greater impact on the industry, society and the economy.

The basis behind this document is to establish the strategies for commercial, non-commercial, and knowledge exploitation, considering the paths employed by the consortium partners, identifying WHAT those results are, WHO will exploit them, and in WHICH WAY they will be exploited. A business plan strategy for each of the commercial KERs is developed using the information provided by partners involved and CTA support. It also encapsulates the realized strategies and outcomes.

1.1 Definition of the document

This document is the plan for the exploitation and business strategy of the CALIMERO project. In it, the consortium is laying down the basis of the exploitation methodology that will be followed within the market and exploitation work package (WP).

This document has two purposes:

1) present the Key Exploitable Results that the different partners have defined and start developing during the project length,

2) prepare the following steps that CALIMERO will have to undertake towards exploitation and IP protection during and after the end of the project.

D6.2 Final Exploitation Plan gathers:

- Key Exploitable Results that the different partners have defined and started developing during the project length, together with an evaluation of the CAPEX/OPEX for commercial KERs.
- The following steps that CALIMERO will undertake regarding exploitation and IP protection during and

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after the project's completion.

- Draft adequate marketing strategies (through a Business Model CANVAS) when applicable for the innovative processing technologies and products containing information on the segmentation strategy.

The finalized exploitation plan allows the CALIMERO consortium to exploit, protect and take benefits from its results.

1.2 Roles and Responsibilities

The CALIMERO project consortium is constituted by 12 partners:

1. CONTACTICA SL (CTA), Coordinator of CALIMERO, is an Innovation Consulting Company specialist in Life Cycle Sustainability Assessment (conducting LCA, LCC and S-LCA) and in communication and exploitation of R&D projects.

2. WELOOP (WeLOOP), a small consultancy company in the field of LCA, circular economy (especiallyin building sector) and critical raw materials expert.

3. EUROPEAN CELLULOSE INSULATION ASSOCIATION (ECIA), provides data ad current practices knowledge concerning the industrial processes and R&D activities in cellulose insulation industry.

4. IVL SVENSKA MILJOEINSTITUTET AB (IVL), coordinates the information exchange with the industry and will collect data and assess the case studies regarding pulp and paper and bio-chemicals industries.

5. NEOVILI SAS (Neovili), leverages in its expertise in the supply chain and in the business community to build the cases and to facilitate the liaison, stakeholder management and engagement.

6. FUNDACION CENTRO DE SERVICIOS Y PROMOCION FORESTAL Y DE SU INDUSTRIA DE CASTILLA Y LEON (CESEFOR), as woodworking sector representative and point of contact, collecting primary data and testing the solutions found, with high expertise in innovation with sustainability potential.

7. LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY (LIST), develops guidelines, methods, metrics, and/or tools (based for example on optimisation techniques and approaches of LCSA) in the fields of environmental and human risk assessment, environmental management and regulations, sustainability and circularity assessment of products, technologies and policies, including natural capital valuation and ecosystem services analysis.

8. DANMARKS TEKNISKE UNIVERSITET (DTU), in charge of developing the adequate models to simulate the bio-based processes addressed in the case studies.

9. ASSOCIATION TECHTERA AUVERGNE RHÔNE ALPES (Techtera), provides contacts in the textile sector for evaluations of case studies.

10. ESSITY HYGIENE AND HEALTH AB (ESSITY), contributes with plant information, data and its expertise in identifying innovative solutions to tackle most relevant sustainability hotspots from their sustainability reports, energy, emissions, waste and water related impacts, as well as, providing a case study to tests the solutions obtained.

11. BIM KEMI SWEDEN AKTIEBOLAG (BIMKEMI), provides primary data for the case studies on the production of bio-chemicals with application in pulp and paper industry.

12. EREKS KONFEKSIYON SANAYI TICARET AS (EREKS), provides a case study to optimised water consumption in processing, use of chemicals in cotton processing (dying, finishing), occupational health and safety, safe by design, carbon footprint reduction and industrial parameters optimization to enhance circularity (open and closed loop recycling).

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The partners have been chosen in order to provide the suitable multidisciplinary knowledge, skills and expertise to obtain the expected output of scientific and technological results. They complement each other with adequate financial, technical and management abilities for the successful achievement of the project. Partners do not have legal or financial links between them. All the value chain is covered by the CALIMERO partners.

Contactica manages partners to align expertise with project objectives. Key project activities (WPs) include:

- WP1 CHALLENGES RELATED TO BIO-BASED INDUSTRIES. Leader: WeLOOP
- WP2 ANALYSIS OF CASE STUDIES FROM THE TARGET BIO-BASED SECTORS. Leader: IVL
- WP3 TOOLBOX/METHODOLOGICAL DEVELOPMENT FOR THE LCSA OF BIOBASED SECTORS. Leader: LIST
- WP4 FRAMEWORK FOR THE SUSTAINABLE OPTIMIZATION OF TARGET BIO-BASED SECTORS. Leader: CTA
- WP5 IMPROVEMENT OF THE SUSTAINABILITY PERFORMANCE OF BIO-BASED INDUSTRIES. Leader: CTA
- WP6 EXPLOITATION, DISSEMINATION AND COMMUNICATION. Leader: CTA
- WP7 PROJECT MANAGEMENT. Leader: CTA

1.3 Governance

The Board that controls all the Intellectual Property Rights regarding CALIMERO project is the Innovation & Exploitation Board (IEB). The IEB is formed by every partner that produced results during the length of the project or that are prone to IP sensitive issues. The IEB provides technical, legal and economic expertise in technology transfer, supporting guidance on IPR and innovation management, commercial assessment to enable the transfer of project´s results outside the consortium for exploitation purposes.

The IEB is chaired by CONTACTICA and formed by one or two persons maximum for every partner with exploitable results (with commercial interest or not). They deal with the IP management following the IAPED strategy (see Figure 1: IAEPD strategyFigure), project milestones monitoring, benchmarking, approval of dissemination materials, and risk due diligence on the implementation of the Exploitation Plan. The IEB manages the services of a Patent Attorney when prosecuting patents and licensing rights. The IEB also provides guidance to a multi-actor implementation and optimization of project activities, result transferability at industrial scale, and their exploitability to accelerate market access.

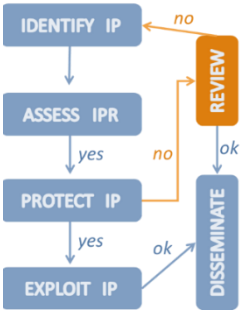

Figure 1: IAEPD strategy

The final list updated in M36 is presented below:

Table 1: CALIMERO Innovation and Exploitation Board M36

PARTNER	NAME	EMAIL	ROLE IN THE PROJECT
CTA	Lucia Garcia	lucia.garcia@contactica.es	Exploitation Manager
CTA	Maria Gallego	maria.gallego@contactica.es	Leadership of Task 3.4, WP4 and WP5
CESEFOR	Tamara Coello García	tamara.coello@cesefor.com	Coordinator and representive from Cesefor
WeLOOP	Naeem Adibi	n.adibi@weloop.org	Main contact, content input.
NEOVILI	Milena Amaral	milena.amaral@neovili.com	Main contact, content input, dissemination and

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			communication
TECHTERA	Juliette Jaupitre	jjaupitre@techtera.org	coordination. Main contact. WP1, WP2, WP5, WP6, WP7
TECHTERA	Valentin Jacoutot	vjacoutot@techtera.org	Innovation project manager
ESSITY	Pernilla Cederstrand	pernilla.cederstrand@essity.com	Main contact for Essity. Sustainability Specialist
LIST	Thomas Schaubroeck	thomas.schaubroeck@list.lu	Leadership of WP3, Task 1.3, Task 3.3, and Task 4.1
BIMKEMI	Fredrik Nyhlén	fredrik.nyhlen@bimkemi.com	Main competence for case study (product developer at BIM)
DTU	Gürkan Sin	gsi@kt.dtu.dk	Main Contact
EREKS	Pelin Birsen	pelin.birsen@ereksgarment.com	Sustainability Expert
IVL	Tomas Rydberg	tomas.rydberg@ivl.se	Main contact for IVL
ECIA	Pasi Typpö	pasi.typpo@ecia.eu	Representative of Board of Directors

2 AMBITION OF THE PROJECT

CALIMERO aims to increase the sustainability of five industrial bio-based sectors, making them more resource-efficient and low-carbon, in order to mitigate the climate change and its impacts and preserving ecosystems services, natural resources, air/water/soil quality and biodiversity.

From the beginning of the project, CALIMERO partners are working to improve existing methodologies to assess the environmental impacts of industrial processes, adding: (1) characterization factors to assess biodiversity loss and impacts on ecosystem services, (2) the temporal dimension in GHG emissions, (3) criticality indicators and (4) enhanced assessment of circular systems, which can also consider economic and social aspects.

Specifically, CALIMERO's ambition is to identify and analyse the adverse environmental effects associated to five biobased industrial sectors (construction, woodworking, textile, pulp & paper, and biochemicals). Considering relevant trade-offs between environmental, economic and social aspects, the project will identify and demonstrate the best solutions to improve the environmental performance of the abovementioned biobased sectors through the use of a disruptive MOO tool for the simulation and optimization of industrial processes, considering sustainability indicators based on that improved methodology. Likewise, the project insights will contribute to the development of recommendations and guidelines to support bio-based industries for conducting processes modifications by making decisions related to aspects such as resources and energy efficiency, circularity of materials, replacement of toxic substances, greenhouse gas emissions reduction, etc. without causing harm to other impact categories.

2.1 Project objectives

CALIMERO aims at fulfilling the following objectives in its 36-month duration (extended to 40 months):

Technical objectives

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To identify main barriers and incentives to apply life cycle thinking sustainability approaches and source of impacts in the target bio-based sectors.
To define reference case studies and identify levers to improve life cycle sustainability assessment methodologies and sustainability performances.
To improve existing sustainability assessment methodologies and their implementation for the 5 bio-sectors within the scope: (1) Life Cycle Assessment (LCA) methodology, will be improved, aligned with PEF through the consideration of regionalized impacts, circularity and criticality, temporal GHG emissions accounting, impacts on biodiversity and ecosystem services; (2) integrate Life Cycle Costing (LCC) with Social-Life Cycle Assessment (S-LCA) considerations.
To develop a MOO framework of industrial processes that integrates the improved LCSA methodologies based on PEF, for optimization of bio-based industrial processes with sustainability indicators
Economic & Environmental Objectives
To provide feasible solutions with better sustainability performance than the current situation for the five studied bio-based industry sectors and the procedures to monitor their sustainability performance
Communication & Dissemination & Exploitation
To maximize the impact of CALIMERO through tailored Exploitation, Dissemination and Communication activities aiming to pave the way to market of the sustainability assessment tool, build synergies with other R&D projects and transfer the project results to different target audiences.

2.2 State-of-the-art

Nowadays, environmental protection has evolved into a central concern in global policy discussions. Pressing issues such as climate change, waste management, deforestation, and biodiversity loss have attracted public attention. Manufacturing companies, driven by customer demands, competitive forces, and legislative mandates, are increasingly compelled to engage in environmental initiatives and adopt sustainable practices. The prevailing economic model endeavours to dissociate global economic development from finite resource consumption, pivoting away from the linear economy approach.

2.2.1 Role of LCA Methodology

Within this context, Life Cycle Assessment (LCA) methodology emerges as a critical tool for assessing the environmental performance of industrial sectors. LCA serves as a foundation for informed decision-making aimed at mitigating the environmental impacts of products, encompassing the entire supply chain—from raw material extraction and production to product use and final waste management.

2.2.2 Research Lines in CALIMERO Project

The state-of-the-art section in the CALIMERO project is organized into three primary research lines, reflecting the project's core objectives:

2.2.2.1 Improvement of Existing LCSA Methodologies for Bio-based Industries

The PEF/OEF is the European Union's toolbox for Life Cycle Assessment (LCA), aiming to measure the environmental impacts of both products and organizations. While the importance of considering environmental dimensions and adopting a standardized approach for life cycle environmental performance assessment is undeniable, it is noteworthy that the PEF/OEF methodologies have certain gaps, as outlined below:

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Gap 1: Sustainability Dimension

The existing Product Environmental Footprint (PEF/OEF) methodologies, recommended by the EU for LCA, exhibit gaps in incorporating social and economic dimensions. Addressing this, Valdivia et al. (2021) proposes ten principles for better-informed decision-making, yet further work is needed. The challenge lies in developing methodologies that align with the United Nations' Sustainable Development Goals, covering environmental, social, and economic aspects.

Gap 2: Assessment of Impacts on Biodiversity and Ecosystem Services

PEF struggles to assess bio-based products comprehensively, particularly in relation to impacts on biodiversity and ecosystem services. Enhancements are required to evaluate trade-offs and prevent burden shifting among impact categories.

Gap 3: Correct Accounting for Carbon Balance in Bio-based Products

Bio-based products pose challenges in terms of carbon balance assessment, overlooking the time dynamics involved. Existing assumptions, considering simultaneous occurrences of intermediate flows, need refinement to account for carbon storage potential and support climate objectives.

Gap 4: Considering Circularity Aspects and Criticality Indicators

Circularity in a bio-based context lacks clear definitions in the PEF Guide. Strategies to evaluate cascade effects and criticality indicators in a circular economy framework require further clarification.

2.2.2.2 Identification, Evaluation, and Demonstration of Solutions

Industry sustainability needs the demonstration of viable solutions to address significant environmental impacts. Best Available Technologies (BAT) and the European Commission's (EC) Best Available Techniques Reference Document (BREF) offer pathways for minimizing emissions and environmental impact. However, challenges persist in the high cost and time associated with identifying sustainable solutions, warranting the exploration of multi-objective optimization tools considering sustainability indicators.

2.2.2.3 Recommendations and Guidelines for Bio-based Sectors

Guidelines and recommendations are crucial to enhance the sustainability performance of bio-based industrial processes and align with EU objectives. Current guides recommended by the EC for assessing life cycle environmental impacts require refinement, especially concerning bio-based products. Additionally, there is a need to bridge the gap between LCA practitioners and industry/policy-makers, providing science and life cycle-based routes to enhance sustainability in bio-based sectors.

3 MARKET ANALYSIS

The market CALIMERO enters is fragmented yet fast-maturing. On one side, enterprise LCA platforms (now consolidating, e.g., One Click LCA, SimaPro) focus on EPD/PCF workflows and compliance scale-out; on the other, open and research stacks (openLCA/Brightway2, BioSTEAM, QSDsan) make it easier to wire models into code and simulators. In parallel, process-industry vendors (AspenTech, Siemens PSE/gPROMS, Honeywell, Emerson, Rockwell, Yokogawa/Insilico) dominate simulation, APC and digital twins, and pulp-and-paper leaders (Valmet, ANDRITZ, ABB, Voith) optimise mills at scale. Yet there is still no productised loop that natively couples process simulation with LCSA and multi-objective optimisation for real decision-making, being that the main core of CALIMERO targets.

Commercially, the LCA software and services market is growing at double-digit rates, and the EU27+UK are a demand front-runner thanks to CSRD reporting, the Ecodesign for Sustainable Products Regulation and the Digital Product Passport. For our target verticals (bio-chemicals, pulp & paper, wood working, construction and textiles) a pragmatic EU SAM sits in the $300–600m range over 2025–26, with adjacent spend in APC/digital-

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twin programmes signalling budget headroom. Priority buyers include scale-up and process-development leaders, mill and plant technical directors, sustainability/PCF owners, and OEM/EPC teams; consultancies and verifiers form a natural channel to embed our optimisation into existing EPD/PEF flows.

Execution risks are practical, such as foreground data access, LCI licensing, and tool fragmentation, but they are also our opportunity: CALIMERO's services-first + connectors approach (e.g., an 8–12-week "Scale-up LCSA-Optimiser" pilot) aligns with current buying patterns and price points (EPDs typically €15–50k per product; optimisation pilots €60–120k+), while paving the way to a licensable engine once connectors and workflows stabilise.

3.1 Current market situation:

The LCA tooling landscape is bifurcated. On the one hand we count on LCA platforms (e.g., One Click LCA and SimaPro) that emphasise EPD/PCF workflows and broad integrations, and on the other hand, open, developer-friendly stacks (e.g., OpenLCA/Brightway2 and BioSTEAM/QSDsan) that are easier to wire into simulators and optimisation code. Meanwhile, process-industry simulators software (AspenTech, Siemens PSE/gPROMS, Honeywell, Emerson, etc.) lead on simulation, APC and digital twins but typically stop short of productised, LCSA-aware optimisation.

Generalist enterprise LCA platforms:

- One Click LCA + SimaPro: now a combined platform (2025) spanning EPDs, PCF and enterprise integrations; strong APIs and BIM/PLM connectors.
- Sphera GaBi: enterprise LCA suite with extensive databases and sector modules.
- openLCA (GreenDelta): open platform with developer tooling (REST/gRPC, scripting) and broad database support.
- iPoint Umberto: LCA + MFA with pilots for "live" LCA from machine/energy data (dynamic dashboards).
- Earthster: cloud-native, portfolio scale LCA and DPP/PEF workflows; offers LCA Service and API connections.
- Ecochain (Mobius/Helix): product and portfolio level LCA automation for manufacturers.
- Trayak EcoImpactCOMPASS: screening/packaging LCA embedded in product development workflows.

Opensource & research grade integrators:

- Brightway2 + Activity Browser: Python framework + GUI for advanced/custom LCA, ideal as an integration layer to simulators.
- BioSTEAMLCA: opensource bioprocess simulation tightly coupled to TEA/LCA and uncertainty; well suited to early stage biorefineries.
- QSDsan: integrated system design, process simulation, TEA & LCA with uncertainty handling; Pythonnative and extensible.

Vertical/specialist LCA platforms:

- Minviro (XYCLE): LCA software + consultancy focused on mining, battery materials and critical minerals.
- CarbonCloud: climate/LCA platform for food value chains; digital twin supply chain mapping.
- Mondra: UK food system platform coupling LCA footprints with supply chain traceability and compliance (digital twin approach).

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- Higg/Worldly (MSI & PM) — apparel/textiles LCA-based material and product tools (cradle-to-gate/goods-specific).

Bridges to process simulation & optimisation:

- SuperPro Designer (Intelligen): bioprocess simulation + TEA with environmental impact/footprint calculations; often coupled to LCA tools.
- AspenTech: process simulation with sustainability application models; commonly paired with external LCA for TEA/LCA studies.
- Siemens PSE (gPROMS) — advanced optimisation and digital twins; LCA coupling typically via bespoke workflows.

3.2 Patents / FTO

There is a long tail of LCA-platform patents that claim data architectures and workflow automation rather than the ISO 14040/44 method itself. Early examples include a Duke/KM Limited patent that couples LCA with Activity-Based Costing in a relational database (conceptual precedent for LCA+LCC coupling), and an equipment-level LCA "configuration engine" for standard-compliant data ingestion and impact computation.

More recent filings focus on product footprint plumbing: e.g., normalising heterogeneous emission-factor content into a canonical model to enable audit-ready product carbon footprint calculations and downstream compliance apps; these claims typically centre on data model semantics, time validity and API handling.

Around the emerging Digital Product Passport space, several applications link material identifiers (often decentral IDs) to process-level environmental attributes and then propagate those into product passports—relevant to any "materials/bio-feedstock passport" plans.

On the optimisation side, there are long-standing, widely cited dynamic MOO families (e.g., Rockwell Automation), covering machine/process selection and control under multiple criteria (efficiency, cost, emissions). These are important when CALIMERO couples process simulation with LCSA and searches Pareto sets.

Sector-specific LCA-adjacent patents show up in bio-industry contexts. Examples include bioethanol lifecycle evaluation using straw with optimisation loops, and map-based/dynamic-network LCA systems, all signalling protection around data flows and unit-operation logic rather than impact methods.

Implication for CALIMERO. Most claims are on data models, connectors and optimisation workflows. The risk surface is (i) PCF/DPP data normalisation pipelines, (ii) how optimisation objectives are orchestrated, and (iii) passport linkages.

A patent search in several databases (Table 2), including the European Patent Office (Esp@cenet) and World Intellectual Property Organisation (WIPO), was performed, which did not show any competing results for CALIMERO implementation and exploitation of results, therefore allowing "freedom to operate".

Table 2: List of active LCA/MOO patents

Publication Number	Title	Category
WO2023225920A1	Automatic calculation method for emission amount (BOM → LCA software mapping)	Automation / BOM-to-LCA
US20060286518A1	Product environmental information system	Consumer-facing environmental info
US8321183B2	Multi-variable control-based optimization to achieve target	Control/optimisation

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	performance	
WO2023117969A1	Environmental attributes for materials (material passport)	Digital Passport / attributes
CN118134096B	Map-based life cycle assessment system based on dynamic network collaborative model	Dynamic LCA system
US6490569B1	System for combining Life Cycle Assessment with Activity-Based Costing	LCA + LCC (ABC)
EP1205863A1	Multi-objective optimization using evolutionary algorithms	MOO (general method)
US8914300B2	Dynamic multi-objective optimization of machine selection, integration and utilization	MOO / optimisation
US10581974B2	Dynamic multi-objective optimization of machine selection, integration and utilization (continuation)	MOO / optimisation
CN101807265A	System and method for dynamic multi-objective optimization	MOO / optimisation
US12217269B2	Method for determining the carbon footprint of a product in production processes	PCF in production
US12229785B2	Method and apparatus for determining a carbon footprint of a product	PCF in production
US12223513B2	Computer-implemented method for calculating the carbon footprint of a product	PCF in production
EP4437435A4	System and method for determining and reporting product carbon footprint (PCF)	PCF platform
WO2020223282A1	Polymeric compositions comprising PLA with low CO2 emission	Process patent citing LCA tools

3.3 Market size and opportunities

The market for LCA and related optimisation tools is expanding rapidly, driven by global growth and strong regulatory demand within the European Union and the United Kingdom.

Summarized in Table 3, can be seen that globally, the LCA software market is valued at around €214 million in 2024 and projected to reach approximately €647 million by 2032, with a Compound Annual Growth Rate (CAGR) of ~15%. When combining software and services, the global LCA market is estimated at €712 million in 2024, rising to €1.57 billion by 2030 (CAGR ~14%, Grand View Research). The LCA services segment alone is forecast to grow from €1.12 billion in 2024 to €2.33 billion by 2033 (CAGR ~9%, Verified Market Reports; higher estimates cited by Dataintelo). Adjacent optimisation markets, which act as useful proxies for multi-objective optimisation demand, are also expanding strongly. The Advanced Process Control (APC) market currently stands between €1.95–3.26 billion (2024/25), expected to grow at 8–12% CAGR to 2030–2034 (GVR, FMI, Precedence, Allied). Meanwhile, the Industrial Digital Twin market is projected to rise from €13.5–23.3 billion in 2024 to approximately €140–145 billion by 2030, reflecting an impressive 30–35% CAGR (MarketsandMarkets; Grand View Research).

Table 3: Compound Annual Growth Rate of LCSA/MOO services

GAGR	Market Size	Forecast period	Source
15.0%	€211.7m (2024) → €639.7m (2032)	2024–2032	Fortune Business Insights — LCA software (global)
14.4%	€704.0m (2024) → €1.55bn (2030)	2024–2030	Grand View Research — LCA market (software + services,

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			global)
9.1%	€1.10bn (2024) → €2.30bn (2033)	2024–2033	Verified Market Reports — LCA services (global)
13.3% (alt view)	€1.38bn (2023) → €4.42bn (2032)	2023–2032	Dataintelo — LCA services (global)
10.6%	€2.00bn (2023) → €4.18bn (2030)	2023–2030	Grand View Research — Advanced Process Control market (global)
47.9%	€19.45bn (2025) → €137.83bn (2030)	2025–2030	MarketsandMarkets — Industrial Digital Twin market (global)

The European market is a clear front-runner in adopting LCA, Life Cycle Costing (LCC), and sustainability-driven decision-making tools. Demand is both regulation-led and customer-driven, fuelled by the Corporate Sustainability Reporting Directive (CSRD), the Ecodesign for Sustainable Products Regulation (ESPR), and the emerging Digital Product Passport (DPP) framework. These measures position the EU as a global leader in product-level environmental data, creating direct market pull for LCA and decision-support solutions.

A Serviceable Available Market for the EU bio-industries scope of the project, represents a material share of the global LCA and optimisation spend. A reasonable planning range is €280–560 million (2025–2026) across software and services within these verticals, which can be refined through bottom-up analysis of pipelines and sector splits.

4 KEY EXPLOITABLE RESULTS

4.1 Methodology

To give a thorough image of CALIMERO results and update the KERs, CTA used a series of tools dedicated to discover the potential of the project and its results. As exploitation is a work that requires all partners' involvement, during the project timing, CTA updated the Exploitation Questionnaires to meet expectations at the end of the project.

In order to collect the most appropriate information for each type of result, two types of questionnaires have been developed: a commercial and a non-commercial one (both included in Annex 1).

In this way, the partners have provided their contributions according to whether their KERs had potential for exploitation in the market or whether their exploitation strategy is oriented towards further research, publications, open-source dissemination, etc.

Moreover, these actions will be complemented by Exploitation Workshops during the General Assemblies or in online meetings if necessary. The Exploitation and IPR Workshop developed in the last General Assembly in September 2023 aimed at training partners in the exploitation activities and ensure fluent interaction with all the relevant parties.

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Figure 2: Exploitation Workshop Presentation

With the use of the Exploitation Questionnaire and Exploitation Workshop, the results collected from the partners are included in a meta-table encompassing the project entire results as well as individual tables in order to keep the information as concise as possible and allowing the partners to use as a tool for their personal endeavours. Example models of such tables are included below.

Table 4: Meta-table for project KERs

Results	Owner	Partners	Description	Type	Innovation	State-of-the-art	Competition	Strategy	Time to market	Stakeholders

Table 5: Table template used for individual KERs

Key Exploitable Results n°1	
Description	
Lead partner	
Participating partners and their involvement	
Work package	
Exploitation potential	
Relevance and problem solution	
State-of-the-art	
Competitors	
Different applications	
Target users	
Value proposition	
Time to market (if applicable)	

In addition, partners have been asked about the advantages and possible disadvantages of their strategic results. The idea is to identify what added value and advantages the solutions they develop have with respect to those already existing in the market or science. Also, partners should describe the possible disadvantages or inconveniences that the solution could present regarding development, implementation, go to market or social acceptance. From the pros and cons from each KER, a SWOT analysis was carried out to identify opportunities or barriers in the market.

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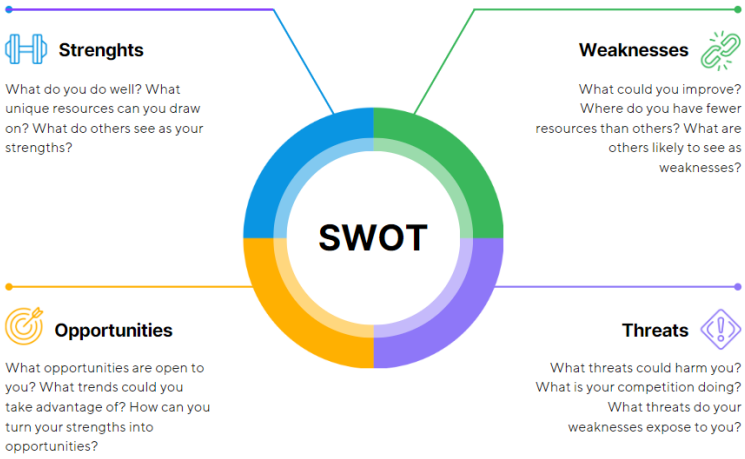

Figure 3: SWOT Analysis. Source: CTA

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4.2 KER Table

Partner	Result	Owner	Partners	Description	Type	Innovation	State-of-the-art	Competition	Strategy	Time to market	Stakeholders
CTA	Knowledge acquired in an improved, more complete and more suitable methodology to assess the environmental impacts of bio-based products	CTA	No	Simulation of bio-industrial processes and development of MOO frameworks and LCSA methodologies. The knowledge acquired could be used in order to provide commercial services based on the application of Life Cycle Sustainability Assessment procedures to potential customers (i.e., bio-based industries)	Data Services Skills and knowledge Collaboration platforms	Availability of the most advanced life cycle based analytical methodology so far in terms of modelling and specification for the 5 bio-industrial sectors of the CALIMERO project (i) construction, (ii) pulp and paper, (iii) textiles, (iv) biochemicals and (v) woodworking.	The majority of similar services are based on life cycle thinking and internationally standardized regulations. However, they are usually limited to studies related to environmental indicators using databases of general modelled processes. The potential of this service is to carry out studies that follow a more holistic perspective of sustainability, integrating the social and economic dimensions.	Current LCA software providers including MOO aspects (Brightway2, OpenLCA). Entities participating in projects to improve their current software tools	Use for further research Develop and sell new service	CTA is working to develop a service that could be offered in 1-2 years	Individual clients or other commercial entities concerned about climate change or that want to improve their processes to reduce costs and comply with regulation
	Sustainable multi-objective optimization framework	CTA	No	Algorithm to obtain optimal solutions to improve several sustainability objectives. It is composed by 4 modules: i) simulation of industrial process, ii) sustainability assessment models, iii) multi-objective optimization algorithm and iv) interpretation.	Software Services Skills and knowledge Collaboration platforms	A versatile product that is able to extract information from different sources, offering LCA/LCC optimization studies and scale-up solutions in Industrial Processes using a Multi Objective Optimization Algorithm.	All the tools that are currently known are from LCA focused on sustainability. We are not aware of a software or tool similar to the one developed in CALIMERO that brings together the three types of analysis: simulation - LCA - optimization	LCA software providers including multi objective optimization. Ipoint Umberto Software, openlca, GaBi, Solidforest Air.e	Use for further research Develop and sell new service	The service will be ready at the end of the project to reach the market	Companies specializing in BioProcess at R&D Stage planning to scale their process. (more in CTA table below)
	Job Creation Potential Tool (JCP)	CTA	LIST	Analytical software designed to estimate how many jobs a project, investment, or policy could create, both directly and indirectly (foreground and background jobs) through input-output models	Software Services Skills and knowledge	An innovative tool that enables to calculate the jobs created by an activity, as a way to perform S-LCA in bio-based sectors	Similar services are based on regional and local data. The tool enables to perform the analysis at an European level	Advanced frameworks such as ILO, World Bank, OECD, RIMS II or LEAP, now include job quality, sustainability, and skills alignment, not just job counts.	Use for further research Develop and sell new service	The tool continues to be developed in order to market a service.	Individual clients or other commercial entities, policy makers
	Life Cycle Costing (LCC) Tool	CTA	LIST	The tool helps identify cost drivers, compare alternative design and support sustainable investment decisions by balancing economic efficiency with environmental and performance goals.	Software Services Skills and knowledge	This innovative LCC tool provides a comprehensive sustainability and economic assessment by combining traditional Life Cycle Costing (LCC) with environmental externalities and advanced financial indicators such as Total Cost of Ownership	Innovative platforms such as One Click LCA, GaBi Envision, and SimaPro with LCC modules enable integrated environmental–economic assessments and scenario comparisons. Current research trends emphasize digitalization, AI-assisted data collection, uncertainty analysis,	Current LCC and TEA tools have been developed in European-funded projects	Use for further research Develop and sell new service	The tool continues to be developed in order to market a service.	Individual clients or other commercial entities

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						(TCO), Net Present Value (NPV), and Payback Period	and dynamic LCC, where costs and impacts evolve over time.				
CESEFOR	New knowledge applied to the wood-based panel manufacturing related to: (1) the most impactful processes, (2) the solutions to reduce the environmental impact, (3) monitoring strategies to assess the environmental impact	CESEFOR	CTA, DTU, LIST, Neovili, IVL, Weelop	Providing data for two LSL manufacturing case studies (pressing and biomass energy production). The goal is to identify optimal solutions that balance environmental, economic, and social aspects, along with developing monitoring strategies.	Skills and knowledge Educational Material	New knowledge on the impacts of the manufacturing processes of LSL is relevant since this is, among the wood-based panels/products, a niche product from which there is no generalized knowledge. The assessment of the impact on the whole product value chain are topics that manufacturers are still starting to take into account, so new information will be beneficial for partners and clients in the sector.	LSL is a niche product so there is not a lot of research on it. In CESEFOR specific table (4.3.2) there are some references found on the assessment of the impact of the manufacturing of LSL.	Not known.	Use for further research We will share the results with the wood-based panels sector	Immediate after project completion	LSL manufacturers
WeLOOP	Novel methodology for inventory and impact assessment of circularity and criticality indicators of bio-based products	WeLOOP	IVL, LIST, CTA, NEOVILI	The criticality approach for bio-based materials, coupled with circularity considerations in life cycle inventories (e.g., carbon content and storage), including credit allocation for recycling or cascading materials, will generate revenue through advisory services. These services target businesses, decision-makers, and institutions, helping assess, improve, and communicate sustainability performance in products, processes, services, and organizations.	Policy recommendations Services Data Educational material Skills and knowledge	Advancements in the modelling of circularity and criticality represent a potential advantage when prospecting for public and private funding on various R&D or LCA-related projects. Circularity may be used in training or expert consulting service in helping other people to set up their LCA model. The developments on criticality may be integrated in criticality data of bio-based materials in our IRTC tool (currently non-commercial, possibly commercial at a later stage).	There is scarce work done on criticality and circularity specific to bio-based materials. The work developed in CALIMERO is original in the sense that it addresses problematics considering specificities for bio-based sectors (e.g., the cascading of Wood products, Pulp & paper) as well as the criticality of bio-materials, which may present specific parameters that are different from classical criticality assessments for metals and minerals (e.g., renewability of materials, choice of crops)	ORIENTING Project where circularity aspects in LCSA are developed (however not specific to bio-based materials), as well as the sisters Project of CALIMERO, i.e. the ALIGNED Project.	Use for further research Develop and sell the new service	The results may be directly marketable as part of improved methods for LCA or LCSA. Further developments may be needed depending on how far developments are achieved in CALIMERO.	Industries as main users, but potentially also other regional actors
	Monitoring procedures of target bio-based industries	WeLOOP	CTA	The EU Bioeconomy Monitoring System will be used as starting point for the identification of the most suitable monitoring indicators for the aforementioned bio-sectors. The limitations and challenges to apply the monitoring procedures will be considered to provide a simple and effective procedure to monitor the sustainability	Skills and knowledge	Monitoring procedures are providing interconnections between the businesses, sectors and supply chains at regional level, monitoring indicators targeted to the relevant industrial actors.	We are not aware of similar exiting skills and knowledge for the bioeconomy actors.	The AWARE project ("sister" project of Calimero)	Use for further research Standardization activities (new standards or support ongoing procedures)	N/A	Industries as main users, but also other regional actors

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				performance of the bio-sectors assessed.							
NEOVILI	Knowledge acquired in an improved, more complete and more suitable methodology to assess the environmental impacts for the textile sector	NEOVILI	DTU, IVL, LIST, WeLOOP, TECHTERA, Ereks	Calimero's advanced methodology excels in environmental impact assessment for the textile sector, offering precision and systemic vision. Calimero's approach details process optimization's ecological footprint, meeting industry benchmarks and establishing new biodiversity protection standards in bio-based industries. Brands can reduce and neutralize their impact by identifying environmental areas through expert consultancy, policy recommendations, and customized training facilitated by Calimero's methodology.	Policy recommendations Processes Services (Collaboration) platforms Reports Codes of conduct Educational material Skills and knowledge	Calimero's suite of services (KER from Neovili) offers a comprehensive solution to the textile industry, addressing critical needs for sustainability and process enhancement. This suite extends into building the capacity of brands through the development of skills and knowledge that are pivotal for navigating the complexities of environmental compliance. It includes the crafting of industry-specific codes of conduct and actionable policy recommendations, fostering a culture of continuous improvement and viability of processes. Moreover, the value added by Calimero's suite lies in its commitment to knowledge transfer and collaboration. This suite of services distinguishes itself by identifying areas for improvement and equipping users with the means to achieve and sustain those improvements.	The application of environmental impact evaluation methods and standard nomenclature is allowing textile operators to consider environmental impact in their process and chemical purchasing decisions. One of the key trends in this domain is the use of LCA to evaluate the environmental impact associated with the development of new strategies for the textile industry. Another emerging trend is the use of O-LCA, a decision-making process that helps textile and clothing companies integrate environmental objectives into corporate management control and decision systems. In terms of products, there is a growing focus on the development of eco-friendly materials and technologies due to customer and regulatory pressure.	Environmental Consultancy Firms, Sustainability Software Providers, Industry Associations, Academic and Research Institutions, Corporate Social Responsibility (CSR) Advisors, Non-Governmental Organizations, Independent Sustainability Experts, Business Schools, Technology Innovators	Use for further research Develop and sell the new product/service Spin off activity Standardization activities (new standards or support ongoing procedures)	2 to 3-year timeline provides sufficient latitude to ensure that the service suite is not only market- ready but also poised to offer a competitive edge in the evolving textile industry sustainability and compliance landscape.	Brands, retailers, e-tailers, textile associations, business schools

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TECHTERA	New knowledges applied to textile sector	TECHTERA	IVL, DTU, WeLOOP, CTA, Neovili	New knowledges applied to the textile sector related to: (1) the most impactful processes, (2) the solutions to reduce the environmental impact, (3) monitoring strategies to assess the environmental impact.	Research Roadmaps Data Reports Educational material Skills and knowledge	Textile sector faces sustainability challenges related to raw materials, processes and energy. The EC has introduced regulations like the Green Deal and Digital Product Passport and brands must innovate to comply. However, the sector lacks sufficient research coverage compared to other bio-based sectors. Focus is on developing sector-specific knowledge to provide guidelines and methodologies for eco-design in textiles, particularly for SMEs.	Most publications are produced by technology providers and this raises the question of neutrality. Scientific papers on the topic of sustainable textile and LCA for textile remain hard to translate in "commercial" language and answer direct market/industrial questions. Our approach is to provide agnostic methodologies to compare solutions using qualitied/tangible impacts. Our approach aims to democratize LCA methodologies and engage textile brands.	Circular & Biobased Textiles Innovation Hub (STFI (DE), RISE (SE), Centexbel (BE), Centrocot (IT), and CETI (FR), the Textile ETP has launched the Circular & Biobased Textiles Innovation Hub ECOSYSTEX ADEME	Use for further research Transfer knowledge to the textile industry actors.	N/A	Early adopters: European companies producing bio-based materials for textile industry. Also, French and European textiles already involved in LCA process and interested to switch to bio-based raw materials.
ESSITY	Case studies definition and assessment for pulp and paper and forestry. Applicability of current and novel methodologies for biodiversity and ecosystem services.	IVL	Essity, LIST	Input of site-specific data for tissue product life cycle and of generic data for forestry case study. Essity was active in the pulp and paper pilot in the Product Environmental Footprint methodology (PEF) development and continues to evaluate PEF methodologies in parallel to the company's ordinary LCA way of working. Specific focus is put on land use modelling such as LANCA from PEF and novel biodiversity and eco system service indicators.	Processes Data Reports Skills and knowledge. Applicability of current and novel methodologies.	Correctly describe and evaluate our products and value chain, and secure communication credibility. Improved and tested methodologies for assessment of biodiversity and ecosystem services.	Pulp and paper industry has been bio-based for many years and uses significant amounts of recycled fibres, The sector has been regulated with permits from authorities and is now transitioning to greener technology. Essity current sustainability priorities is hygiene and health, NetZero climate impact (has a Science Based Target and a commitment for NetZero 2050), respecting biodiversity and contribution to a circular society and work within the Calimero project is well in line.	Not known, the technology and methodologies should rather be commonly used in the whole industry sector for a general benefit.	Use for further research Develop and sell the new product/service	The results themselves are not marketable, but the results will hopefully end in development of more sustainable products, which will have a better market potential than current products.	Our supply chain stakeholder, business partners and end customers. Within our own industry sector
LIST	NON-COMMERCIAL: Updated temporal DyPLCA database	LIST	N/A	This temporal DyPLCA database is a collection of temporal data (duration, emission profile over time etc.) of industrial processes of the existing ecoinvent database. The current version of DyPLCA is outdated and contains temporal data for the old 3.2 version of ecoinvent. First, the new DyPLCA database was updated with temporal data corresponding with the updated	Data Services Skills and knowledge Collaboration platforms	This is the only temporal database for a full life cycle database, to the best of our knowledge. In other words, it is the only one permitting the analysis of a fully dynamic LCA spreading all emissions over time, as well as impacts, and considering the time-related influence on the latter. Yet, this KER does not concern the new development of it but	No other databases like this at the scale of a full life cycle	There are no direct competitors, since no other database like this exist at the scale of a full life cycle database, but there might be some that foresee to develop such a database.	Use for further research Develop and sell the new product/service Sell IP-rights or IP-based business License IP rights	2-5 year	Application by scientists/consultants/policy makers, but will mainly be LCA specialists

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				processes of ecoinvent 3.10. Second, it is foreseen to update in particular the temporal data for forest-related processes with information from literature or other tools. It relies on the old version of the DyPLCA database, which is owned by LIST and INSA* *INSA, is a partner in LCA4BIO, and the valorization of this KER may also belong to that project		rather its update and improvement. It would lead to better informed decision making.					
	NON-COMMERCIAL: Method to character ecosystem services change through land use	LIST	CTA, CESEFOR, WELOOP, EREKS, NEOVILI, TECHTERA	New methods to characterize the impact on particulate matter removal through land use of product life cycles, resulting as well in a set of characterization factors for a respective life cycle impact assessment method. Method is based on the LANCA model; new set of characterization factors (CF) that represent the impact of toxic compounds emitted by product life cycle, which are of primary concern for biobased sector; Framework for alternative approaches to integrate multi-objective optimization (MOO) in the context of process modelling with optimization regarding life cycle sustainablity assessment (LCSA) indicators	Skills and knowledge Data Reports Software Processes Services	improved CFs for particulate matter removal for all elementary flows of a database, in particular based on advanced modelling (LANCA), new set of CFs for biobased sectors, framework to integrate MOO in process modelling	Compared to current state of art, there are no CF for particulate matter removal by land use; our CF are comletely novel	Various methods as discussed in the text left	Use for further research Sell IP-rights or IP-based business License IP rights	N/A	Scientists & in particular LCA experts
BIMKEMI	New knowledge applied to the biochemical sector to reduce environmental impact, identify the most impactful processes and monitor strategies to assess the environmental impact	IVL	BIMKEMI	New knowledge is applied to the biochemical sector, focusing on impactful processes, solutions for reducing environmental impact, and monitoring strategies for environmental assessment. We support sustainability in pulp and paper industry by helping maintain and develop natural resources. Specifically, BIM Kemi collaborates with the industry, developing specialty chemical	Processes Skills and knowledge Research roadmaps (Collaboration) platforms	Gain knowledge about LCA for selected product concepts and gain knowledge about how to improve their sustainable profile. The knowledge will be used internally at BIM, but hopefully result in improved sustainable profile of our concepts, which will be used for marketing purposes as well	It is getting more and more important for our customers that we can provide LCA data of our products and concepts. At the moment we do not have any full LCAs done for our products or concepts.	We are not into the LCA community so we do not know if anyone else is performing this kind of analysis of similar materials or processes. However, our customers are demanding simple versions of LCAs more and more.	Use for further research	The results themselves are not marketable, but the results will hopefully end in development of more sustainable products, which will have a better market potential than	We will use the results internally at BIM Kemi for R&D purposes.

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				concepts to address specific challenges, enhance efficiency, and impart desired properties to end products. The key objectives include implementing CALIMERO solutions to enhance environmental performance within the company and obtaining LCA data for selected product concepts.						current products.	
DTU	Simulation models	DTU	CESEFOR, TECHTERA, MELIORA	Simulation models aim to represent and simulate both the existing process and proposed enhancements. The purpose is specific to the defined case study associated with a particular bio-based industrial sector. Customized modelling and simulation strategies are tailored for each case study based on available information. This diversity in objectives extends to varying input variables (e.g., temperature, concentration, time, mass flow rate)	Data Reports Policy recommendations (Collaboration) platforms Educational material	Different bio-based industrial sectors can benefit from the simulation models and simulation strategies developed in CALIMERO. For instance, the simulation models can be re-used by a particular industry facing the same problems identified in CALIMERO, or adapted to their specific needs. As for simulation strategies, these can be adapted to their simulation needs, or applied when enough information is not available or when there is the necessity to manage "complexity" during the model development step.	Commercial process simulators are not often customized to specific simulation tasks linked to the bio-based sectors in CALIMERO. For instance, specific compounds involved in particle board manufacturing process and their physicochemical properties as well as thermodynamic model parameters linked to the different phase equilibrium (VLE, LLE, SLE, etc.) that these compounds undergo during the process, model for specific processing steps to perform a desired reaction/separation task are missing in the databases of these commercial simulators. Thus, the models developed in CALIMERO intend to overcome these limitations.	Woodworking sector - Wood Composite Simulations As for water and energy savings in industrial processes - Simulis Pinch	Use for further research	N/A	The partners from the bio-based industrial sectors in CALIMERO 1. Woodworking sector 2. Bio-based chemical sector 3. Textile sector

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EREKS	EREKS BLUE MATTERS	EREKS	IVL, WeLOOP, NEOVILI, ECIA, CESEFOR, TECHTERA, ESSITY, BIM Kemi, LIST	We systematically gather data and waste water analysis from our washing department, wastewater facility, encompassing energy, water, and chemical consumption. Subsequently, we conduct thorough analyses, following which we promptly disseminate the findings to our work package leader. This process is further fortified through our regular, scheduled meetings.	Research Roadmaps Policy recommendations (Collaboration) platforms Data Reports Educational material Prototypes Skills and knowledge	As a case study company, we firmly believe that enhancing Life Cycle Sustainability Assessment (LCSA) methodologies within the textile sector will yield substantial benefits for our industry peers. Given the intricacies of the textile sector, we are committed to a meticulous, step-by-step data clarification process. Our goal is to transparently share this refined information with our stakeholders in a manner that is both comprehensive and impactful. Additionally, this research will show us the differences between conventional and sustainable production.	We are of the firm belief that recent regulatory developments within the textile sector have paved the way for an unprecedented level of transparency in the production processes. These new regulations, which encompass CSRD, the CSDDD, the Green Deal initiative, the Eco Product Passport, and others, impose stringent controls across the entire supply chain. As a result, they mandate heightened transparency standards and accountability, which promise to reshape the industry landscape significantly, ushering in a new era of responsible and sustainable textile production.	Unknown	Use for further research Develop and sell the new product/service Cooperation agreement/Joint venture Standardization activities (new standards or support ongoing procedures)	N/A	Our supply chain stakeholders and business partners, also universities and research centres and last consumer.
IVL	ProScale and ProScale E method	IVL	No	ProScale: The current ProScale version (1.5) focuses on direct exposure-related human toxicity potential. Recognizing the need to assess eco-toxicity potential similarly, the **ProScale-E method** is proposed. It's reach-based, user-friendly, requires minimal substance data, and provides meaningful results. Built on REACH elements, it will offer characterization factors and default process assessments for chemicals in LCA.	Data Reports Services Skills and knowledge Educational material	Several policies under development in the EU request for chemicals to be assessed. But the available methods aren't fulfilling needs of industry. The ProScale method in its current version (1.5) was established in a project in 2016-17. Prerequisites for the method were to: (i) assess the relevant direct exposure potential along the whole life cycle; (ii) use existing data (iii) allow comparison in relation to technical performance; and (iv) be relevant for B2B and B2C. Currently there is a need to have a method to be able to assess the eco-toxicity potential in a similarly practical way as the current ProScale offers for human toxicity potential.	IVL is currently developing the ProScale method family (ProScale and ProScale-E) and related databases in collaboration with several industries and within several research projects, including CALIMERO (Horizon Europe), PARC (Horizon Europe), Mistra SafeChem (Foundation Mistra, Sweden) and Detoxolys (FORMAS, Sweden). Specifically, it is under evaluation to be used in the context of the policy area Safe and Sustainable by Design	There are other methods currently considered (e.g. USEtox) as competitors. Within SSbD, there are several tools under development covering different parts of the overall methodology. But it is a bit nuclear which (if any) methods that specifically will compete with ProScale in this context	Use for further research Standardization activities (new standards or support ongoing procedures) Provide non-profit services based on the method	N/A	Chemicals developing industry

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	Simulation models in chemicals and pulp/paper industry:	IVL	Essity, BIM Kemi	IVL develops a digital twin of a kraft pulping plant, to be enhanced within Calimero with a refined tall-oil production module, in collaboration with an external company (SCA). This expansion aims to improve the digital twin model and will be accessible to kraft pulping operators, including Essity plant in Mannheim, Germany. Tall-oil is a raw material for BIM Kemi, used in their production for synthesis of functional chemicals The synthesis process will also be but into a digital process model and subject to optimization	Knowledge Data Models	With digital models, various optimization scenarios can be modelled	IVL has developed a digital model for the chemicals recycling part of kraft pulp making in previous projects (MISTRA digital forest). Further refinement is planned in Calimero, in particular to facilitate the optimization modelling of Tall Oil production, a co-product in the pulping plant.	Big engineering companies (VALMET, Andritz) have parts of similar models. Also a few other research institutions have digital models of Pulping plants	Exploitation strategy is to offer the model and services to other pulp makers. But also, to receive funding from other funding sources for the current model to make it more accurate	2-3 years	Essity and BIM Kemi internally. Other companies with similar processes, i.e. pulp makers.
	Novel methodology for inventory and impact assessment of biodiversity	IVL	Essity, LIST	A new/improved and useful method to include biodiversity impacts in LCA results	Knowledge Models Data	Method beyond state of the art	Many approaches are suggested, but harmonization and acceptance is lacking	Other research projects	Collaborate with other research projects and groups	2 years	LCA community
	Knowledge about biobased industries sustainability performance and assessment of biobased value chains	IVL	No	Systematic gathering of information and data regarding bio-based industries, and feedback communication to stakeholders to foster improvement of performance.	Knowledge	Communication formats and data exchange modes	Sustainability information is currently transferred in value chains on an ad-hoc basis	CSR consultants	Explore the approach fit-for -purpose and implement it	4-5 years	Companies active in the biobased sector value chains
ECIA	New knowledge in 3 fields: Boric acid, Biochar & Cardboard	WeLOOP	ECIA	The original goal was to reduce fire retardants in cellulose insulation products. Discussions with WeLOOP revealed ways to minimize environmental impact, focusing on 3 pillars: **Chemical R&D:** research aims to reduce the impact of **boric acid** in cellulose insulation. Boric acid has been decreased from 15% to less than 5%, and further reduction is being pursued.	Processes Data Prototypes Products Reports Skills and knowledge Policy recommendations Educational material	**To point 1: Boric acid** Lower impact on the environment if boric acid can be reduced. This will add a value to society in terms of the availability of an ecological product in the insulation buildings sector. **To point 2: Biochar** Multiple problems solved if cellulose insulation could be converted at the end-of-life to	**To point 1: Boric acid** Under the current REACH legislation there is no restriction on articles. Industry aims for a fire-retardant solution with lower environmental impact. **To point 2: Biochar** The process of producing coal is secured. It needs more research and minor improvements. But it can be executed. The next challenge lies in the legal policy	Carbon Balance Indicator (CBI) - The Credit Method implementation and the Book and Claim Model shall not be used as they allow claims for outputs with specified inherent properties which do not reflect the physical flows.	Use for further research Develop and sell the new product/service Spin off activity Standardization activities (new standards or support ongoing procedures)	N/A	Our industry and the fertiliser industry.

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				Biochar Production: Use of biochar containing boric acid (a fertilizer) from recycled cellulose insulation material. Legal aspects need consideration. **Usage of Cardboard**: As a future resource, cardboard is considered for cellulose insulation, replacing traditional products.		a fertiliser (deeply explained in point 4.3.12) **To point 3: Cardboard** The usage of more cardboard extents the possibilities for the green industry on the market. Broader understanding of the capacity of sustainable insulation and building physics.	of using the sort of waste within a new product. **To point 3: Cardboard** Tests made by ECIA showed that it is possible to add cardboard to the product. There are no negative impacts on the characteristics of cellulose insulation using cardboard.	Mass balance is for the time being not compliant with the Construction Products Regulation.			

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4.3 Parner's individual results

In this section, CALIMERO's KERs will be analysed individually using a SWOT framework (Strengths, Weaknesses, Opportunities, and Threats) to assess their exploitation potential and strategic relevance. Each KER will be classified as either commercial or non-commercial, depending on its maturity level, market potential, and intended use pathway. For commercial KERs, a Profit and Loss Statement is developed.

This analysis aims to provide a clear understanding of how each result can contribute to the project's exploitation strategy, supporting both market-oriented outcomes (e.g., services, or tools) and non-commercial impacts (e.g., policy contributions, capacity building, or scientific advancement). The structured assessment ensures alignment with CALIMERO's overall objectives and maximises the long-term uptake and sustainability of results beyond the project duration.

4.3.1 Non-commercial KERs

4.3.1.1 CTA

4.3.1.1.1 KER 1 description

KER Name	Job Creation Potential Tool (JCP)
Description	Analytical software designed to estimate how many jobs a project, investment, or policy could create, both directly and indirectly (foreground and background jobs) through input-output models
Lead Partner	CTA + LIST
Participating Partners and their involvement	Involvement and ownership: CTA (75%) and LIST (25%)
Work Package	WP4
Exploitation potential	Non-commercial
TRL	Initial: 3 End of project: 5
Relevance and problem solution	An innovative tool that enables to calculate the jobs created by an activity, as a way to perform S-LCA in bio-based sectors
State-of-the-art	Similar services are based on regional and local data. The tool enables to perform the analysis at an European level
Different applications	JCP tool can be used as a service for bio-based industries to calculate the number of jobs created by their activity, to foreseen the direct jobs. Also it can be used by policy makers to analyse the foreground and background jobs created by an activity that can help decision-making.
Target users	Bio-based industries and policy makers
Value proposition	The Job Creation Potential Tool offers a unified, data-driven framework to quantify and compare employment impacts of investments, projects, and policies across EU Member States. By integrating sectoral employment multipliers, regional labour data,

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	and EU policy priorities, it enables evidence-based decision-making that supports inclusive growth, green transition, and industrial competitiveness.

4.3.1.1.2 KER1 SWOT Analysis

Strengths

- Captures direct and indirect job creation across sectors and regions.
- Supports key EU objectives
- Versatility across different industrial sectors.
- Scientific and social value: detailed documentation and decision support.

Weaknesses

- May not fully capture dynamic market shifts or technological change.
- Limited integration with social or job quality indicators such as skills.

Opportunities

- Direct competitors are focused on LCA/LCC only.
- Allows S-LCA to be integrated in LCSA
- Contribute to a unified EU framework for measuring job impacts of investments
- Exploitation potential through software licensing or service provision.

Threats

- New developments of S-LCA methodologies.
- Adoption barriers in industries reluctant to invest in new digital tools.
- S-LCA is still not an obligation in Europe, which would limit the interest of potential customers in investing in this analysis.

4.3.1.1.3 KER 2 description

KER Name	Life Cycle Costing (LCC) Tool
Description	The tool helps identify cost drivers, compare alternative design and support sustainable investment decisions by balancing economic efficiency with environmental and performance goals.
Lead Partner	CTA + LIST
Participating Partners and their involvement	Involvement and ownership: CTA (90%) and LIST (10%)
Work Package	WP4
Exploitation potential	Non-commercial
TRL	Initial: 3 End of project: 6
Relevance and problem solution	This innovative LCC tool provides a comprehensive sustainability and economic assessment by combining traditional Life Cycle Costing (LCC) with environmental externalities and advanced financial indicators such as Total Cost of Ownership (TCO), Net Present Value (NPV), and Payback Period
State-of-the-art	Innovative platforms such as One Click LCA, GaBi Envision, and SimaPro with LCC modules enable integrated environmental–economic assessments and scenario comparisons. Current research trends emphasize digitalization, AI-assisted data

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	collection, uncertainty analysis, and dynamic LCC, where costs and impacts evolve over time.
Different applications	CALIMERO´s LCC tool has a wide range of applications across bio-based sectors, supporting both economic and sustainability goals, analysing indicators such as TCO, NPV and PP.
Target users	Bio-based industries and policy makers
Value proposition	CAMILERO´s LCC tool offers an integrated approach to evaluating the total economic and environmental performance of products, systems, or projects throughout their entire life cycle. By combining Life Cycle Costing (LCC) with Life Cycle Assessment (LCA) and the monetization of environmental externalities, the tool enables decision-makers to identify solutions that are not only cost-efficient but also environmentally sustainable and socially responsible.

4.3.1.1.4 KER 2 SWOT Analysis

Strengths

- Integrates economic and environmental dimensions, providing a holistic view of project or product sustainability
- Supports key EU objectives
- Versatility across different industrial sectors.
- Enables evidence-based choices in design, procurement, and investment by combining LCC, LCA, and TCO/NPV analysis.

Weaknesses

- Requires high-quality environmental and economic data, often difficult to obtain or harmonize.
- Demands expertise in both cost accounting and environmental assessment.

Opportunities

- Allows LCC to be integrated in LCSA
- Helps companies demonstrate sustainable value creation and attract green investment.
- Exploitation potential through software licensing or service provision.

Threats

- New developments of LCC methodologies.
- Adoption barriers in industries reluctant to invest in new digital tools.
- Traditional cost-focused decision-makers may be reluctant to adopt integrated models.

4.3.1.2 CESEFOR

4.3.1.2.1 KER description

KER Name	**New knowledge applied to the wood-based panel manufacturing related to: (1) the most impactful processes, (2) the solutions to reduce the environmental impact, (3) monitoring strategies to assess the environmental impact**
Description	After providing data for two case studies on the laminated strand lumber (LSL) manufacturing process (pressing and energy production from biomass), CESEFOR will gain knowledge on the environmental impact of these two processes as well as the optimal solutions to fix them balancing environmental, economic and social aspects as well as strategies for the monitoring.

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Lead Partner	CESEFOR
Participating Partners and their involvement	CTA, DTU, LIST, Neovili, IVL, WeLOOP
Work Package	WP5
Exploitation potential	Non-commercial
Relevance and problem solution	This new knowledge on the impacts of the manufacturing processes of laminated strand lumber (LSL) is very relevant since this is, among the wood-based panels/products, a niche product from which there is no generalized knowledge. In addition to this, the assessment of the impact on the whole product value chain, especially the biomass sourcing phase, as well as the carbon footprint of products, are topics that manufacturers are still starting to take into account, so new information on this matter will be beneficial for us to transfer partners and clients in the sector in our sphere of action.
State-of-the-art	As mentioned, LSL is a niche product so there is not a lot of research on it. The only references found on the assessment of the impact of the manufacturing of LSL are: • Poonam Khatri, Kamalakanta Sahoo, Richard Bergman, Maureen Puettmann. 2021. Life Cycle Assessment of North American Laminated Strand Lumber (LSL) Production • Sahoo, Kamalakanta; Bergman, Richard; Puettmann, Maureen. 2021. Cradle-to-gate life-cycle assessment of North American laminated strand lumber production. Research Paper. FPL-RP-710. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 33 p. However, LSL belongs to the category of wood-based panels made out of woodchips, such as particleboard and oriented strand lumber (OSB), which have a very similar manufacturing process and are widely marketed. Reference research institutions in these field are: Ecole Superieure de Bois de Nantes (France), Institute for Materials and Wood Technology of the Bern University of Applied Sciences (Switzerland)
Different applications	Optimization routes for the LSL manufacturing process provided by Calimero results can be applied by LSL manufacturers. Knowledge on the environmental impacts of the process can help decision-making.
Target users	LSL manufacturers
Value proposition	Through the dissemination of the results of the Project with our partners/clients on the wood-based panels manufacturers, we expect to make them to get a wider notion of the environmental impacts of their processes as well as to make them aware of the carbon-storage capacity of wood based-products. Moreover, we expect to make them familiar in general with the tools for life-cycle assessment and environmental footprint and specifically, with the tool generated in CALIMERO.

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4.3.1.2.2 SWOT Analysis:

Strengths

New knowledge relevant to the whole sector of wood-based panels.
Including detailed perspective of the pre-manufacturing operations (raw materials sourcing).

Opportunities

Dissemination of the results of the Project with partners/clients on the wood-based panels manufacturers to give a wider notion of the environmental impacts and to make them aware of the carbon storage capacity of wood-based product.
Clients can be familiar with tools for life-cycle assessment and environmental footprint, and specifically with the tool generated in CALIMERO.
Knowledge on sustainability and optimization routes can be applied by LSL manufacturers, supporting the decision-making process.

Weaknesses

Non-commercial exploitation potential.
LSL is a niche product.

Threats

LSL belongs to the category of wood-based panels made out of woodchips, such as particleboard and oriented strand lumber (OSB), which have a very similar manufacturing process and are widely marketed.

4.3.1.3 BIMKEMI

4.3.1.3.1 KER description

KER Name	New knowledge applied to the biochemical sector to reduce environmental impact, identify the most impactful processes and monitor strategies to assess the environmental impact
Description	New knowledges applied to the biochemical sector related to: (1) the most impactful processes, (2) the solutions to reduce the environmental impact, (3) monitoring strategies to assess the environmental impact. Through innovation and an entrepreneurial spirit, BIM Kemi is helping customers in the pulp and paper industry to sustainably maintain and develop their natural resources and raw materials. More concretely, BIM Kemi is developing specialty chemicals concepts in close collaboration with the pulp and paper industry in order to solve specific problems, increase the efficiency or apply specific properties to the end products for our customers. The main objectives of the result are: • Application of suggested CALIMERO solutions in the company for improving its environmental performance. • Acquire LCA-data on selected product concepts.
Lead Partner	IVL

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	Analysis of current technology, concepts and processes. Pin-point areas of environmental improvement. Suggest changes in order to improve our product's environmental profiles.
Participating Partners	BIM Kemi Data collection of current chemical concepts and production processes
TRL	Initial: 3 End of the project: 5
Work Package	WP 1, 2, 3, 5, 6, 7
Exploitation potential	Non-Commercial
Relevance and problem solution	Gain knowledge about LCA for selected product concepts and gain knowledge about how to improve their sustainable profile. The knowledge will be used internally at BIM, but hopefully result in improved sustainable profile of our concepts, which will be used for marketing purposes as well.
State-of-the-art	It is getting more and more important for our customers that we can provide LCA data of our products and concepts. At the moment we do not have any full LCAs done for our products or concepts.
Competitors	We are not into the LCA community so we do not know if anyone else is performing this kind of analysis of similar materials or processes. But our customers are demanding simple versions of LCAs more and more.
Different applications	The results of the project could be used to: - Improve the sustainable profile of our product concepts.
Target users	We will use the results internally at BIM Kemi for R&D purposes.
Value proposition	Thanks to the new results activities, BIM Kemi aims to reinforce his knowledge, skills and network to better align with our customer's and the societie's expectations and demands for the sustainable transition.
Time to market	The results themselves are not marketable, but the results will hopefully result in development of more sustainable products, which will have a better market potential than current products.

4.3.1.3.2 SWOT analysis

Strengths

- Provide new knowledge and more accurate data on environmental impact of the products, gaining knowledge on how to improve sustainability.

Opportunities

- Results can be used for marketing purposes

Weaknesses

- At this moment, the company does not have a full LCA of the products or concepts.

Threats

- Implementing the new knowledge may increase costs by requiring additional time

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and R&D.
- Customers are demanding more information about LCA of the products they consume.

and/or resources.

4.3.1.4 WELOOP

4.3.1.4.1 KER 1 description

KER Name	Monitoring procedures of target bio-based industries
Description	The EU Bioeconomy Monitoring System will be used as starting point for the identification of the most suitable monitoring indicators for the aforementioned bio-sectors. The limitations and challenges to apply the monitoring procedures will be considered to provide a simple and effective procedure to monitor the sustainability performance of the bio-sectors assessed.
Lead Partner	WeLOOP → based on the hotspot analysis performed in WP1 (by WeLOOP)
Participating Partners	All partners
Work Package	WP5
Exploitation potential	Non-commercial
Relevance, problem solution and added value	Monitoring procedures are providing interconnections between the businesses, sectors and supply chains at regional level, monitoring indicators targeted to the relevant industrial actors.
State-of-the-art	We are not aware of similar exiting skills and knowledge for the bioeconomy actors.
Competitors	We don't know any. Maybe the sister project of CALIMERO (Aware) aims for something similar
Different applications	Support industries to target relevant monitoring indicators to improve their sustainability.
Target users	Industries as main users, but also other regional actors.
Value proposition	Societal value

4.3.1.4.2 KER 1 SWOT analysis

Strengths

Transfer the state of the art into a usable check list format for SMEs, to provide a simple and effective procedure.
Bring the knowledge developed in CALIMERO to practice.

Weaknesses

The transformation to an applicable tool is not planned during the project and will require additional steps involving SMEs.

Opportunities

Threats

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Interconnections at regional level across businesses, sectors and supply chains.

There are similar tools and methods available. It's important not to generate duplicates in market.

4.3.1.4.3 KER 2 description

KER Name	Novel methodology for inventory and impact assessment of circularity and criticality indicators of bio-based products
Description	The criticality approach developed for bio-based materials and the approach to account for circularity in life cycle inventories, with special considerations for bio-based materials, e.g. carbon content and storage during the lifetime of products, and also the allocation of credits among successive products in the case of recycling or cascading materials, will be used to generate revenues from advice services addressed to businesses, decision makers and institutions, to assess, improve and communicate their product, process, services and organization sustainability performance. It may also support further collaborative research.
Lead Partner	WeLOOP
Participating Partners and their involvement	IVL, LIST, CTA, NEOVILI Methodological developments for the consideration of criticality and circularity of bio-based materials
Work Package	WP3
Exploitation potential	Non-Commercial
TRL	Initial: 3 End of project: 7
Relevance, problem solution and added value	Advancements in the modelling of circularity and criticality represent a potential advantage when prospecting for public and private funding on various R&D or LCA-related projects. Circularity may be used in training or expert consulting service in helping other people to set up their LCA model. The developments on criticality may be integrated in criticality data of bio-based materials in our IRTC tool (currently non-commercial, possibly commercial at a later stage).
State-of-the-art	There is scarce work done on criticality and circularity specific to bio-based materials. The work developed in CALIMERO is original in the sense that it addresses these problematics considering specificities for bio-based sectors (e.g., the cascading of Wood products, Pulp & paper, etc.) as well as the criticality of bio-materials, which may present specific parameters that are different from classical criticality assessments for metals and minerals (e.g., renewability of materials, choice of crops, etc.)
Competitors	Competition may arise from the ORIENTING Project where circularity aspects in LCSA are developed (however not specific to bio-based materials), as well as the sister Project of CALIMERO, i.e. the ALIGNED Project.

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Different applications	Implement a more solid method to model circularity in LCA models for different industrial partners, and propose a methodology to assess the criticality of bio-based materials through the IRTC tool and as a LCSA indicator.
Target users	Industries as main users, but potentially also other regional actors
Value proposition	Societal value through educational materials, guidelines, scientific value through one or more scientific publication (criticality may be integrated in a scientific paper on the economic sustainability framework), the IRTC tool and R&D projects, and economic purposes in the case of consulting activities, funded R&D projects, and, eventually, the IRTC tool (although the IRTC tool is currently non-commercial, it could be possibly commercial at a later stage)

4.3.1.4.4 KER 2 SWOT Analysis

Strengths

- Advanced methodological development for inventory and impact assessment of circularity and criticality indicators of bio-based products.

Weaknesses

- The development might involve time-consuming additional modeling for LC(S)A studies.
- IRTC tool: currently non-commercial (possibly commercial at a later stage).

Opportunities

- Commercial exploitation potential via advice services addressed to businesses, decision makers and institutions to assess, improve and communicate sustainability performance.

Threats

- CALIMERO will face competitors in LCSA (not specific of bio-based materials).

4.3.1.5 TECHTERA

4.3.1.5.1 KER description

KER Name	New knowledges applied to textile sector
Description	New knowledges applied to the textile sector related to: (1) the most impactful processes, (2) the solutions to reduce the environmental impact, (3) monitoring strategies to assess the environmental impact. Through publications and events, TECHTERA will popularise the results of the project regarding the textile sector. More concretely, Techtera will organise and lead webinars, workshops or publish articles and participate to conferences, with the aim to: - Share the potential and limitation of carrying Life Cycling Analysis on textile products and processes - Share the potential of new Life Cycle Analysis methodologies (with the newly developed methodologies of CALIMERO) for the textile sector

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	- Share the benefits of carrying a process modelization and Multi-Objectif Optimisation - Share the potential of environmental impact reduction of several scenario: guideline for process improvement
Lead Partner	TECHTERA
Participating Partners	IVL, DTU, WeLOOP, Contactica, Neovili
Work Package	WP2, WP5, WP6
Exploitation potential	Non-commercial
Relevance and problem solution	The textile sector is facing several challenges in terms of its sustainability: linked to the raw material, linked to the processes and the energy spent in process. European commission is putting in place several regulations (Green Deal, Digital Product Passport) to push sustainable production and usage of textile goods. European brands and industrial actors have to innovate quickly in order to comply to those new regulations while remaining competitive with international players. Concretely, brands and industrials need to work with qualified data and quantified scenario comparison in order to guide their strategy. The textile sector is very fragmented as composed of a broad combination of raw material and process steps, which do not have a good research coverage, as it could be the case for other bio-based sectors. The stake here is to develop a sector-specific, quantified knowledge on sustainability improvement: guidelines and methodologies for improving (eco-design) products and processes for textile actor, mostly SMEs.
State-of-the-art	Most publications addressing brands and industrials are produced by technology providers (biobased materials, energy recovery technologies). This raises the question of neutrality. On the other hands, scientific papers on the topic of sustainable textile and Life Cycle Analysis for textile remain hard to translate in “commercial” language and answer direct market/industrial questions. Our approach is to provide agnostic information and methodologies to compare solutions with each other, using qualitied/tangible impacts. Our approach aims to democratize Life Cycle Analysis mythologies and engage textile brands and SMEs to use them.
Competitors	Circular & Biobased Textiles Innovation Hub (STFI (DE), RISE (SE), Centexbel (BE), Centrocot (IT), and CETI (FR), the Textile ETP has launched the Circular & Biobased Textiles Innovation Hub to help textile companies, research organisations, brands and retailers to learn, network and collaborate on the hot topics of circular and biobased textiles. ECOSYSTEX ADEME
Different applications	The results of the project could be used to: - Assess more realistic impact effect of bio-based material use in textile industry

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	- Offer more powerful LCSA solution with multicriteria analysis to identify action leverage on textile industry value chain. Action leverage should support key strategic impact: Lower environmental footprint Keep or increase profitability of the production Improve social impact Respect the biodiversity
Target users	The new results of Calimero project will be addressed to the French and European textile industry value chain. Early adopter will be European companies producing bio-based material for textile industry as well as the fashion and sport Brand with high environmental acumen. French and European textiles company already involve in LCA process, using or interested to switch to bio-based raw material will follow.
Value proposition	Thanks to the new results activities, TECHTERA aims to reinforce his knowledge, skills and network to better support his ecosystem of textiles industry players. Specific objectives: - Create a bridge between policy makers and textile SMEs - Collaboration with LCSA expert to support TECHTERA animation activities as textile industry cluster. - Initiate innovative collaborative project for TECHTERA members - Dissemination and communication to inform Techera network of new results in the field of LCSA and bio-based material

4.3.1.5.2 SWOT analysis

Strengths

- Qualified approach based on multicriteria tools that allows to prioritize the desired effects (focus on cost efficiency or PEF).
- Results adapted to European scale activities (in oppositions to many studies based on big scale factories).
- Provide a more realistic vision on biobased material use impact in the textile industry.

Weaknesses

- Limited perimeter (process defined and modelised for the project but not applicable directly to many processes).

Opportunities

- European regulations such as EU Green Deal and Digital Product Passport push sustainable production/usage of textiles.
- Potential to create a bridge between policymakers and SMEs, collaborate with LCSA experts, and spark innovative collaborative projects for TECHTERA members.

Threats

- In textile industry the value chain is wide. There is a lot of different and custom processes even among one factory. It may require new modelisation for each.
- Market pressure: European brands/industrials must remain competitive with international players while adapting to regulations.

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4.3.1.6 ESSITY

4.3.1.6.1 KER description

KER Name	Case studies definition and assessment for pulp and paper and forestry. Applicability of current and novel methodologies for biodiversity and ecosystem services.
Description	Input of site-specific data for tissue product life cycle and of generic data for forestry case study. Essity was active in the pulp and paper pilot in the Product Environmental Footprint methodology (PEF) development and continues to evaluate PEF methodologies in parallel to the company's ordinary LCA way of working. Specific focus is put on land use modelling such as LANCA from PEF and novel biodiversity and eco system service indicators.
Lead Partner	IVL
Participating Partners	Essity. All partners
Work Package	WP2
Exploitation potential	Non-commercial
TRL	Initial: TRL 1 Current: TRL 2 Expected at the end: TRL 5
Relevance, problem solution and added value	Correctly describe and evaluate our products and value chain, and secure communication credibility. Improved and tested methodologies for assessment of biodiversity and ecosystem services (partly related to WP3).
State-of-the-art	Pulp and paper industry has been bio-based for many years and uses significant amounts of recycled fibres, The sector has been regulated with permits from authorities and is now transitioning to greener technology. Essity current sustainability priorities is hygiene and health, NetZero climate impact (has a Science Based Target and a commitment for NetZero 2050), respecting biodiversity and contribution to a circular society and work within the Calimero project is well in line.
Competitors	Not known, the technology should rather be commonly used in the whole industry sector for a general benefit.
Different applications	Applicable for all products containing fibre-based materials
Target users	Within our own industry sector
Value proposition	Scientific and economic value
Time to market	The results themselves are not marketable, but the results will hopefully end in development of more sustainable products, which will have a better market potential than current products.

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4.3.1.6.2 SWOT Analysis

Strengths

- Improved life cycle assessment for pulp and paper products.
- Improved methodologies for assessment of land use related impact.

Opportunities

- Alignment with Essity current sustainability priorities: hygiene and health, NetZero climate impact (Science Based Target and commitment for NetZero 2050), respecting biodiversity and contribution to a circular society.
- Even though the results are not marketable, they may end in development of more sustainable products, in a sector that is transitioning to greener technologies.

Weaknesses

- The process may increase costs, and time-consuming work or need more resources.

Threats

- Pulp and paper industry context with regulation and permits from authorities may influence methodology application and communication.

4.3.1.7 LIST

4.3.1.7.1 KER 1 Description

KER Name	Updated temporal DyPLCA database
Description	This temporal DyPLCA database is a collection of temporal data (duration, emission profile over time etc.) of industrial processes of the existing ecoinvent database. The current version of DyPLCA is outdated and contains temporal data for the old 3.2 version of ecoinvent. First, the new DyPLCA database has been updated with temporal data corresponding with the updated processes of ecoinvent 3.10. Second, it is foreseen to update in particular the temporal data for forest-related processes with information from literature or other tools. In the meantime, LIST has full ownership over this database (it used to be partily owned by INSA*, but all ownership has been transferred to LIST, although INSA staff are still official authors) *INSA, is a partner in LCA4BIO, and the valorization of this KER may also belong to that project
Lead Partner	LIST
Participating Partners	N/A
TRL	Initial: DyPLCA 9 End of project: DyPLCA 9
Work Package	WP3
Exploitation potential	NON - COMMERCIAL

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Relevance and problem solution	This is the only temporal database for a full life cycle database, to the best of our knowledge. In other words, it is the only one permitting the analysis of a fully dynamic LCA spreading all emissions over time, as well as impacts, and considering the time-related influence on the latter. Yet, this KER does not concern the new development of it but rather its update and improvement. It would lead to better informed decision making.
State-of-the-art	No other databases like this at the scale of a full life cycle
Competitors	there are no direct competitors, since no other database like this exist at the scale of a full life cycle database, but there might be some that foresee to develop such a database.
Different applications	Application by scientists/consultants/policy makers, but wil mainly be LCA specialists
Target users	Users: Scientists & LCA practitioners Effect: society
Value proposition	Economic value Scientific and societal value Dissemination Knowledge increase Honing and developing new skills Reputation increase This all will also facilitate collaboration
Time to market	2-5 years
Existing protextion	It relies on the old version of the DyPLCA database, which is owned by LIST and INSA* *INSA, is a partner in LCA4BIO, and the valorization of this KER may also belong to that project

4.3.1.7.2 KER 1 SWOT Analysis

Strengths

- Uniqueness: there is no other temporal database, that allows a temporal differentiation of environmental impact, considering effects of related aspects such as carbon storage.
- The updated version will specifically be better tailored for biobased systems.

Opportunities

- Enrich the database by updating temporal data for forest-related or different processes, using literature and complementary tools, strengthening coverage and accuracy for dynamic LCA.

Weaknesses

- Complex to consider and apply (using DyPLCA), possibly even for mainstream LCA specialists.

Threats

- Time differentiation is not obliged in prominent international standards, making it of less business interest.

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4.3.1.7.3 KER 2 Description

KER Name	Method to character particulate matter removal and framework for alternative approaches to integrate MOO in process modelling
Description	Method/data 1: New method to characterize the impact on particulate matter removal through land use of product life cycles, resulting as well in a set of characterization factors for a respective life cycle impact asessment method. Method is based on the LANCA model. Code/algorithm 1: related with method/data 1, code For particulate matter removal modelling base don GIS-maps Method/data 2: New set of characterization factors (CF) that represent the impact of toxic compounds emitted by product life cycle, which are of primary concern for biobased sector. CF have been derived from the USEtox methodology for life cycle impact assessment, Code/algorithm 2: related with method/data 2, code with machine Learning to derive toxicity CF Method/data 3: Framework for alternative approaches to integrate for multi-objective optimization (MOO) in the context of process modelling with optimization regarding life cycle sustainablity assessment (LCSA) indicators (this outome will contribute to/be shared with LCA4Bio HE project).
Lead Partner	LIST
Participating Partners	CTA, CESEFOR, WELOOP, EREKS, NEOVILI, TECHTERA
Work Package	WP3
Exploitation potential	NON-COMMERCIAL
Relevance and problem solution	Method/data 1: improved characterization factors for ecosystem services impact for all elementary flows of a database, in particular based on advanced modelling (LANCA) Method/data 2: new toxicity characterization (factors) for certain toxic compounds for which these were lacking Method/data 3: Framework and guidance multi-objective optimization in the specific context of process improvement considering LCSA indicators
State-of-the-art	Method/data 1: There are no CF for particulate matter removal by land use; our CF are completely novel Method/data 2: Characterization factors in EF3.0 are not available for the specific compounds of concern Method/data 3: A framework for MOO but then tailored for LCSA at a systematic level. There are few articles that have done that, and it was not a systematic approach that could be duplicated

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Different applications	This is mainly in the field of LCA research, Application and its policy implementation, as the KER is tailored to that.
Target users	Users: Scientists & in particular LCA experts Effect: society
Value proposition	• Scientific and societal value • Dissemination • Knowledge increase • Honing and developing new skills • Reputation increase • This all will also facilitate collaboration
Related Publications	Publication 1: Fully Dynamic carbon footprint on circular biological systems – an update of the temporal DyPLCA database*, tailored and applied to forest-based systems, with case study (to be completed after project). Publication 2: A method to characterize loss or gain in particulate matter removal (ecosystem service) due to land use in LCA built on the LANCA model – to be completed after project Publication 3: Multi-objective optimization approach in the context of LCSA – Application to energy optimization in the case of textile washing – to be completed after project. Publication 4: Difference between databases for working hours and job creation potential - a case study on jeans washing (to be completed after Project) Publication 5: "Characterizing Chemical Toxicity for Life Cycle Assessment Using Machine Learning Models Based on Environmental Footprint – Illustrated importance through a textile case study " (preprint available open access: https://chemrxiv.org/engage/chemrxiv/article-details/6821b3d850018ac7c5a221be)

4.3.1.7.4 KER 2 SWOT Analysis

Strengths

- It will build further on the LANCA approach, already considered in the PEF method, improving characterization factors for particulate matter removal for all elementary flows of a database.
- It will cover a higher-quality assessment of related with product systems

Opportunities

- Future applications in the field of LCA research.

Weaknesses

- They have not yet explicitly been taken up in the PEF method.

Threats

- Many methods exist (e.g., MIMES, current LANCA characterization factors) with different applicability, which may influence method selection and uptake.

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4.3.1.8 DTU

4.3.1.8.1 KER description

KER Name	Simulation models
Description	Simulation models of the case studies developed in WP2 intend to model and simulate the current process and the proposed improvements. Depending on the definition of the case study associated with a particular bio-based industrial sector, -each simulation model will have a specific purpose. Likewise, depending on the information available, a specific modelling/simulation strategy is customized for each case study. This is due to some sectors aim for a reduction in energy and/or water consumption while others for a reduction of specific emissions generated by their manufacturing process. Thereby implying that also the input variables (e.g. temperature, concentration, time, mass flowrate, etc.) are different for the different models.
Lead Partner	DTU
Participating Partners	CESEFOR, TECHTERA, MELIORA Definition of the case study, input data for simulation, data for model validation
Work Package	WP2
Exploitation potential	Non-commercial
Relevance and problem solution	Different bio-based industrial sectors can benefit from the simulation models and simulation strategies developed in CALIMERO. For instance, the simulation models can be re-used by a particular industry facing the same problems idenfied in CALIMERO, or adapted to their specific needs. As for simulation strategies, these can be adapted to their simulation needs or applied when enough information is not available or when there is the necessity to manage “complexity” during the model development step.
State-of-the-art	Commercial process simulators are not often customized to specific simulation tasks linked to the bio-based sectors in CALIMERO. For instance, specific compounds involved in particle board manufacturing process and their physicochemical properties as well as thermodynamic model parameters linked to the different phase equilibrium (VLE, LLE, SLE, etc.) that these compounds undergo during the process, model for specific processing steps to perform a desired reaction/separation task are missing in the databases of these commercial simulators. Thus, the models developed in CALIMERO intend to overcome these limitations.
Competitors	Wood-working sector - Wood Composite Simulations (https://wood-composites.com/) As for water and energy savings in industrial processes - Simulis Pinch (https://www.prosim.net/en/)
Different applications	Different bio-based industrial sectors can benefit from the simulation models and simulation strategies developed in CALIMERO. For instance, industries from the woodworking and construction sector can use these models for process optimization linked to reduction in energy consumption or investigate a new type of adhesive or

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	binder with less environmental footprint. Likewise, reduction in utility consumption, water consumption in the textile sector can be other application. As for the biochemical sector and particularly for the production of biobased chemicals (e.g. bioetanol, bioethylene) the models developed in CALIMERO can be used to investigate new technologies (new separation techniques) in the process performance, uncertainties in raw materials that can affect product quality, etc.
Target users	The partners from the bio-based industrial sectors in CALIMERO 1. Woodworking sector 2. Bio-based chemical sector 3. Textile sector
Value proposition	Scientific value through disseminating the results in conferences and peer-reviewed journals, as well as collaboration with academia and other relevant stakeholders that can benefit from the results.

4.3.1.8.2 SWOT Analysis

Strengths

- The simulation models are customized for particular sectors linked to a specific problem to be solved (e.g., reduction in emissions, reduction in energy and water consumption, energy integration, etc.).
- Ability to target reductions in energy and/or water consumption or reductions of specific emissions, with tailored input variables (e.g., temperature, concentration, time, mass flowrate).

Weaknesses

- Depending on the information available, the modelling/simulation strategy must be customized for each case study.
- Input variables are different for the different models (e.g., temperature, concentration, time, mass flowrate).

Opportunities

- The simulation models can be reused or adapted to different bio-based industrial sectors.
- Commercial simulators are not often customized.
- Other models are implemented in commercial simulators (e.g. AVEVA) so the potential user must have this process simulator to use it.

Threats

- The results could induce in increased costs, time-consuming analysis or need for more resources.

4.3.1.9 EREKS

4.3.1.9.1 KER description

KER Name	EREKS BLUE MATTERS
Description	We systematically gather data and waste water analysis from our washing department, wastewater facility, encompassing energy, water, and chemical consumption. Subsequently, we conduct thorough analyses, following which we promptly

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	disseminate the findings to our work package leader. This process is further fortified through our regular, scheduled meetings.
Lead Partners	EREKS, IVL, WeLOOP, NEOVILI NEOVILI: We have convened meetings with various partners within our work package group during the data collection phase. Once we have gathered the data and relevant information, we promptly transmit it to Neovili.
Participating Partners	ECIA, CESEFOR, TECHTERA, ESSITY, BIM Kemi, LIST. LIST: Following the transmission of data to Neovili, we establish an ongoing feedback loop with the List team. This collaborative effort is designed to continually enhance our data collection methods and identify any gaps or areas for improvement in our methodology.
Work Package	WP1
Exploitation potential	Non-commercial
Relevance and problem solution	As a case study company, we firmly believe that enhancing Life Cycle Sustainability Assessment (LCSA) methodologies within the textile sector will yield substantial benefits for our industry peers. Given the intricacies of the textile sector, we are committed to a meticulous, step-by-step data clarification process. Our goal is to transparently share this refined information with our stakeholders in a manner that is both comprehensive and impactful. Additionally, this research will show us the differences between conventional and sustainable production.
State-of-the-art	We are of the firm belief that recent regulatory developments within the textile sector have paved the way for an unprecedented level of transparency in the production processes. These new regulations, which encompass CSRD, the CSDDD, the Green Deal initiative, the Eco Product Passport, and others, impose stringent controls across the entire supply chain. As a result, they mandate heightened transparency standards and accountability, which promise to reshape the industry landscape significantly, ushering in a new era of responsible and sustainable textile production.
Competitors	Unknown
Different applications	Our sustainable versus conventional comparison provides us with guidance on how to incorporate these findings into our overall production. It also highlights the benefits of taking the necessary steps to become a leading company in waste management, specifically sludge.
Target users	Our supply chain stakeholders and business partners, also universities and research centres and last consumer.
Value proposition	By conducting a comprehensive comparison of our sustainable and conventional jeans production processes, we can generate robust scientific evidence that will not only validate our sustainable practices but also reveal the true environmental and economic impact of each approach. This in-depth data will empower us to gain a broader understanding of the factors influencing our environmental footprint and operational costs.

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4.3.1.9.2 SWOT Analysis

Strengths

- Systematic data analysis will enhance energy efficiency, low water consumption and reduced Stone Waste (Sludge) and chemical usage in Sustainable Washing.
- Comparison of sustainable vs. conventional production to reveal environmental and economic impact.

Opportunities

- Regulatory developments in the textile sector (CSRD, CSDDD, Green Deal, Eco Product Passport, and others) mandate heightened transparency and accountability across the supply chain.
- The sustainable vs. conventional comparison provides guidance for incorporating findings into overall production and highlights benefits to become a leading company in waste management (specifically sludge).
- Enhancing LCSA methodologies within the textile sector aims to benefit industry peers.

Weaknesses

- The effect we achieve from washing with stones and stoneless leads to differences.
- The process relies on data collection and coordination across partners (data transmission, scheduled meetings).

Threats

- The sector is moving into a new era of responsible, sustainable textile production driven by stricter regulations, which may reshape industry practices.

4.3.1.10 IVL

4.3.1.10.1 KER 1 Description

KER Name	ProScale and ProScale E method
Description	The ProScale method in its current version (1.5) was established in a collaborative project in 2016-17 with participation from Life cycle assessment and Risk assessment experts. Currently ProScale covers the direct exposure related human toxicity potential. However, there is a need to have a method in place to also be able to assess the eco-toxicity potential in a similarly practical way as the current ProScale method offers for human toxicity potential. This approach to a method for ecotoxicity potential assessment, ProScale-E, has similar characteristics as currently ProScale, *i.e.* reach-based, straightforward to use, easy to understand, require little to moderate substance data and still provide meaningful results. The method builds on elements from the chemical's legislation REACH. The results will consist of a repository of characterization factors for chemicals and corresponding ready-made default process assessments to be used in Life cycle assessment.
Lead Partner	IVL
Participating Partners	N/A
Work Package	WP3

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Exploitation potential	Non-commercial
Relevance and problem solution	Several policies under development in the EU request for chemicals to be appropriately assessed within the policy context. But the currently available methods are not fulfilling the needs of industry at large. The ProScale method in its current version (1.5) was established in a collaborative project in 2016-17 with participation from Life cycle assessment and Risk assessment experts from six chemical industries (BASF, Covestro, Deutsche Bauchemie, DSM, Kingspan, Solvay), IVL Swedish Environmental Research Institute and supported by UetlibergPartners. The method was developed to be science-based, transparent, pragmatic and generally applicable methodology for toxicological potential assessment of products, along the entire lifecycle. Prerequisites for the method were to: (i) assess the relevant direct exposure potential along the whole life cycle; (ii) use existing data, e.g. REACH based; (iii) allow comparison in relation to technical performance; and (iv) be relevant for business-to-business and business-to-customer communication. Currently ProScale covers the direct exposure related human toxicity potential. However, there is a need to have a method in place to also be able to assess the eco-toxicity potential in a similarly practical way as the current ProScale method offers for human toxicity potential.
State-of-the-art	IVL is currently developing the ProScale method family (ProScale and ProScale-E) and related databases in collaboration with several industries and within several research projects, including CALIMERO (Horizon Europe), PARC (Horizon Europe), Mistra SafeChem (Foundation Mistra, Sweden) and Detoxolys (FORMAS, Sweden). Specifically, it is under evaluation to be used in the context of the policy area Safe and Sustainable by Design
Competitors	ProScale has been designed partly for the reason that it could serve as the recommended methods to include toxicity aspects in PEF. Therefore, it is obvious that other methods currently considered (e.g. USEtox) is a competitor. Within SSbD, there are several tools under development covering different parts of the overall methodology. There are partial overlaps between several of these methods including overlap towards the scope of ProScale. But it is a bit nuclear which (if any) tools/methods that specifically will compete with ProScale in this context
Different applications	Basically any application where there can be an interest to use aggregate indicators for multiple chemical use and exposures/ emissions, i .e. chemical footprints.
Target users	Chemicals developing industry
Value proposition	Recognition, scientific papers
Publications	PREVIOUS: Lexén J, Belleza E, Loh Lindholm C, Rydberg T, Amann N, Ashford P, Bednarz A, Coërs P, Dornan P, Downes R, Enrici MH, Glöckner M, Gura E, de Hults Q, Karafilidis C, van Miert E, Saling P, Tiemersma T, Wathelet A, Weinbeck X, ProScale – A life cycle oriented method to assess toxicological potentials of product systems, Guidance document, version 1.5, on behalf of the ProScale consortium, UetlibergPartners, Oetlikon, Switzerland, and IVL Swedish Environmental Research Institute, Stockholm Sweden, IVL report B2433, ISBN 978-91-7883-335-1, 2017. *This is the fundament of ProScale, the guideline that presents and documents the scientific foundation, and provides detailed instructions how to apply the method,*

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together with a few examples, for individual processes as well as for cradle-to-gate systems.

Saling P, van Gelder R, Krüger C, ProScale: Human toxicity assessment in LCA, LCM 2019, Poznan, Poland, DOI: 10.13140/RG.2.2.24492.62089

LCA models for toxicity impacts are focussing on the indirect impact of chemicals emitted into the environment. As a performance-based indicator for the application in LCA; ProScale assesses hazard and direct exposure potentials from chemicals along their life cycle. This conference paper presents the ProScale assessment of a EPS insulation board cradle-to-gate.

Rydberg T, Gottfridsson M, Gunnarsson J, Johannesson C, Johansson K, Lindskog N, (2020) Integration of ProScale toxicity potential assessment in LCA applied to Utility Poles, Extended Abstract and Poster Spotlight to SETAC 30th Annual Meeting, Dublin 4-7 May, 2020. Full report as Gunnarsson J, Lindskog N, Gottfridsson M, Rydberg T, Tegstedt F, ProScale assessment within life cycle assessment on utility poles, IVL Report B2392, September 2020. https://www.ivl.se/english/ivl/publications/publications/proscale-assessment-within-lca-on-utility-poles.html

This study uses the Proscale method to assess the direct human toxicity potential resulting from the cradle-to-gate production of a variety of utility poles, and to highlight the added value from filling a method gap by using ProScale alongside other LCA results.

Rydberg T, Gunnarsson J, Gottfridsson M, Global Human Toxicity Potential assessed with the ProScale method for use in Normalisation in LCA, *Toxicology Letters*, Volume 350, Supplement, 2021, Page S242, ISSN 0378-4274, https://doi.org/10.1016/S0378-4274(21)00800-6.

The study presents the results of the first calculation of two such global Normalisation scores for ProScale, inhalation and dermal. Assessment of about 60 processes in the petrochemical and plastics value chains have been combined with annual production, or in some cases production capacity. The results facilitate using ProScale alongside other LCIA methods when normalization is included in the assessment.

Dahllöf L, Rydberg T, Cotgreave IA, Nilsson C, Holmquist H and Bignami F, The application of a tiered life cycle assessment (LCA) approach to safe and sustainable chemistry in the development of smart solutions for water and air purification: The Mistra TerraClean case. IVL Report number C 591, ISBN 978-91-7883-275-0. https://www.ivl.se/english/ivl/publications/publications/the-application-of-a-tiered-life-cycle-assessment-lca-approach-to-safe-and-sustainable-chemistry-in-the-development-of-smart-solutions-for-water-and-air-purification-the-mistra-terraclean-case.html

A tiered approach for life cycle based environmental and human health assessment early in process development was introduced in the Swedish research programme Mistra TerraClean. In the project smart filters for water and air purification are under development. Innovative materials and devices are applied and evaluated with a systems perspective. In our tiered approach life cycle assessment (LCA), chemical

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	safety assessment and applied eco and human toxicity assessments are combined, with a particular focus on the inclusion of toxicity potential impacts in LCA. To this end, the model USEtox has been applied, complemented with the method ProScale. *ProScale applied in SSbD Case study - Plasticizers in Food contact materials, Commissioned by European Commission, JRC-D.3 Therese Kärnman, Amanda Lundberg and Tomas Rydberg, delivered 2023-01-23.*

4.3.1.10.2 KER 1 SWOT Analysis

Strengths

- ProScale is aligned with exisiting Information in REACH.
- Easier to understand and use than other "competing" methods.
- Requires little to moderate substance data yet provides meaningful results.

Opportunities

- EU policies under development request chemicals to be appropriately assessed within the policy context.
- Recognition and scientific papers (published and planned) strengthen visibility.

Weaknesses

- The simplicity of the process can lead to inaccurate results.
- Currently ProScale covers human toxicity only; need a method to also assess eco-toxicity potential in a similarly practical way.

Threats

- Competing methods (e.g., USEtox) are also being considered for PEF.
- Multiple SSbD tools are under development with overlapping scope.
- It's uncertain which tools will ultimately compete directly with ProScale.

4.3.1.10.3 KER 2 description

KER Name	Simulation models in chemicals and pulp/paper industry
Description	IVL develops a digital twin of a kraft pulping plant, to be enhanced within Calimero with a refined tall-oil production module, in collaboration with an external company (SCA). This expansion aims to improve the digital twin model and will be accessible to kraft pulping operators, including ESSIty plant in Mannheim, Germany. Tall-oil is a raw material for BIM Kemi, used in their production for synthesis of functional chmicals. The synthesis process will also be but into a digital process model and subject to optimization
Lead Partner	IVL
Participating Partners	Essity, BIMKEMI
Work Package	WP2, WP5
Exploitation potential	Exploitation strategy is to offer the model and services to other pulp makers. But also, to receive funding from other funding sources for the current model to make it more accurate

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Relevance and problem solution	With digital models, various optimization scenarios can be modelled
State-of-the-art	IVL has developed a digital model for the chemicals recycling part of kraft pulpmaking in previous projects (MISTRA digital forest). Further refinement is planned in Calimero, in particular to facilitate the optimization modelling of Tall Oil production, a co-product in the pulping plant.
Competitors	Big engineering companies (VALMET, Andritz) have parts of similar models. Also a few other research institutions have digital models of Pulping plants
Target users	Other companies with similar processe, i.e. pulp makers.
Value proposition	Services, training, science paper

4.3.1.10.4 KER 2 SWOT Analysis

Strengths

- Process variations and disruptions can easily be studied and used for energy and environmental optimization.
- Inside the Calimero project, a digital twin of a kraft pulping plan will be improved with a refined tall-oil production module and accessible to kraft pulping operators

Weaknesses

- To obtain appropriate accuracy, a lot of detailed analysis is needed.

Opportunities

- Offer the model and services to other pulp makers (or other companies with similar processes).
- Funding from other sources to improve model accuracy.

Threats

- Big engineering companies (VALMET, Andritz) or research institutions have parts of similar models.

4.3.1.10.5 KER 3 Description

KER Name	Novel methodology for inventory and impact assessment of biodiversity
Description	There is a current lack of an acknowledged method for assessment of Biodiversity, that is suitable in an LCA context. The purpose of the work here is to come up with an approach that
Lead Partner	IVL
Participating Partners	Essity, LIST
Work Package	WP3
Exploitation potential	Non-commercial
Relevance and problem solution	Assessment of Biodiversity suitable in an LCA context is asked for from many stakeholders, including the European Commission, in the context of PEF.

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State-of-the-art	There are several approaches for assessing biodiversity, but currently no method is widely accepted.
Competitors	Science based targets initiative, among others
Different applications	An emerging application area is within company management where “Science based targets for nature” is gaining importance
Target users	LCA practitioners
Value proposition	Recognition, scientific papers
Publications	Scientific publication on inventory and impact assessment of biodiversity for biobased sectors

4.3.1.10.6 KER 3 SWOT Analysis

Strengths

- Approach that assesses biodiversity impact and is suitable with the LCA.

Opportunities

- Large demand for a more appropriate method among LCA practitioners. There are several approaches to assess biodiversity but none of them is widely accepted.

Weaknesses

- The method is under development and adoption uncertainty exists.

Threats

- With many approaches and no common standard, biodiversity assessment can become fragmented.

4.3.1.10.7 KER 4 Description

KER Name	Knowledge about biobased industries sustainability performance and assessment of biobased value chains
Description	Systematic gathering of information and data regarding bio-based industries, and feedback communication to stakeholders to foster improvement of performance.
Lead Partner	IVL
Participating Partners	All
Work Package	WP2, WP5
Exploitation potential	Non-commercial
Relevance and problem solution	Scientifically based information, knowledge and communication to stakeholders about biobased systems sustainability performance is currently in-sufficient
State-of-the-art	Often, there is a prejudice that
Competitors	Environmental and LC(S)A consultants
Different applications	All biobased sectors
Target users	Paper and pulp industries, chemical industries using biobased materials

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Value proposition	Training, LC(S)A services

4.3.1.10.8 KER 4 SWOT Analysis

Strengths

- Calimero partners will be leading competences in biobased systems sustainability performance knowledge.

Opportunities

- Provide scientifically based information and knowledge to stakeholders to improve performance across bio-based value chains.
- Apply to all bio-based sectors, reaching paper and pulp and chemical industries using bio-based materials through training and LC(S)A services.

Weaknesses

- Scientifically based information, knowledge and communication about bio-based systems' sustainability performance is currently insufficient.

Threats

- Uncertainty on how to maintain the knowledge base beyond Calimero project.

4.3.1.11 ECIA

4.3.1.11.1 KER description

KER Name	New knowledge in 3 fields (three-part strategy for mitigation of cellulose insulation's environmental impacts - mainly GWP)
Description	The original aim was to reduce fire retardants within the product of cellulose insulation. During internal discussions with WeLOOP it was discovered that there are different ways to reduce the impact on the environment. The pillars that have to be mentioned are: 1. Chemical R&D: There is no possibility at the moment to substitute boric acid in the product. Boric acid has a major impact, about ¼ on the LCA (Life Cycle Assessment) of cellulose insulation. Boric acid was reduced from around 15 to less than 5%. Research is ongoing to lower it even more. For example, a mixed product with natural fibres, which have already intrinsic fire protection characteristics in it, can be added to the product, then that could lead to a further reduction of boric acid. 2. Biochar containing boric acid which is a fertiliser (storage in a form of coal for CO2) could be produced out of recycled cellulose insulation material. Research has been conducted by members of the ECIA regarding this topic. With this approach the product which already consists of a recycled material could be reused in another end-of-life scenario. Some legal aspects have to be considered. For example, at the moment it is not secured how boric acid which is listed as a SVHC (Substance of Very High Concern) can be reused in terms of "waste" as a fertiliser (even though fertilisers have much higher contents of boric acid). 3. Usage of cardboard: In the past, cellulose insulation was mainly based on the recycling of recovered newspaper. With the intention to reduce global environmental impact of insulation, the market will substitute usual products with cellulose based

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	products. The resource of newspaper is too small to cover this. Manufacturers already include different recovered paper sorts, but in the future, cardboard will be a broadly available resource. A major advantage to natural fibres is that one does not need to adjust the production and the quality can be adjusted in the production to a consistent product. Conclusion: There are 3 different ways to diminish the environmental impact in the industry of cellulose insulation. Each point comes with different tasks and specific challenges. Tests have to be executed for point 1 and 3. Point 2 is rather a political and administrative topic. Loose fill cellulose insulation represents the highest market share within the sector of natural fibres, but only has about 2-3% total insulation market share.
Lead Partner	WeLOOP Meetings on replacing boric acid. There is no specific ownership of anything since it is a development all members of the ECIA participate and should in the end benefit from.
Participating Partners	ECIA Lab tests as well as factory tests, desktop research, scientific work with external experts.
Work Package	WP1
Exploitation potential	Non-commercial
Relevance and problem solution	to point 1: - Lower impact on the environment if boric acid can be reduced in the product. Therefore, it can be said that this will add a value to society in terms of the availability of an even more ecological friendly product within the insulation sector of buildings. The community will have more possibilities to restore or build sustainable buildings. The stakeholder will benefit then from an increasing demand. to point 2: - There will be multiple values, problems solved if cellulose insulation could be converted at the end-of-life to a fertiliser. It will have a major impact on the LCA. The former boric acid, considered a debated ingredient in the insulation, could be recycled. In the future more cellulose insulation will be retrieved. So the society and the community will have an alternative for a fertiliser with a cascade utilisation. Further possible applications of biochar have to be scrutinised for the future. The stakeholders have worked together to produce co-application of biochar and fertiliser. to point 3: - The usage of more cardboard extents the possibilities for the green industry on the market. That could lead to a broader understanding of the capacity of sustainable insulation. Also, it will lead to a deeper understanding of building physics, since experts have to occupy themselves with the properties of

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	renewable fibres. So, the society and the community can benefit from this alike. In support of the EU Circular Economy Action Plan, we are investigating possibilities of extending the service life of natural fibers used in single use cardboard by upcycling the resource into a long-lasting product.
State-of-the-art	To point 1: - Boric acid Boric acid is currently commonly used fire retarding additive in cellulose insulation. Boric acid has been identified as a "hot spot" of environmental impacts in the analysis conducted by our partner WeLoop. We're working on finding an alternative with lower net impacts, therefor aiming to lowering the CO2 emissions of the final product. Under the current REACH legislation there is no restriction on articles. General trend: industry is aiming for a fire-retardant solution with lower environmental impact. to point 2: - Biochar The process of producing the coal is secured. Perhaps it needs some more investigations and minor improvements. But it can be executed. The next challenge lies in the legal policy of using the sort of waste within a new product. Also, it could be that different member states in Europe have different regulations when it comes to this topic. Due to the long-lasting life-time of cellulose insulation there is not a lot of material retaken at the moment. The manufacturers will have to work together in this field of improvement for the environment. to point 3: - Cardboard ECIA has identified increasing supply of cardboard, mainly from growth of e-commerce shipments, as an alternative raw material for producing long-lived insulation products Within the Calimero project tests were made from ECIA – members, which showed that it is possible to add cardboard to the product. The dosage has to be adjusted according to the machines in the production. A VOC (Volatile Organic Component) test at Natureplus in Germany was executed by one of the members of the ECIA to see some possible results there. There are no negative impacts on the characteristics of cellulose insulation using cardboard. In the past years the low primary energy advantages of cellulose have not been recognised and many quality labels excluding cellulose form a “green” level because of the boric acid content.
Competitors	Carbon Balance Indicator (CBI) The Credit Method implementation of the Mass Balance Method, and the Book and Claim Model shall not be used as they allow claims for outputs with specified inherent properties which do not reflect the physical flows. Mass balance is for the time being not compliant with the Construction Products Regulation.
Different applications	The goal is to reduce CO2 in the product and to have an even more environmentally friendly product at the end. The potential is there but it is not fully deployed in terms

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	of market share. So, all of the three procedures will gain knowledge and therefore can improve the performance of the product. The most important performance of an insulation, the thermal performance won´t be deteriorated. We think that with the three procedures we have a practical approach that will lead to more knowledge in the field of fire retardancy, production of different raw materials, standardisation work, legal information, definition of insulation and thus having the opportunity of reducing environmental impacts.
Target users	Our industry and the fertiliser industry.
Value proposition	to point 1: - Gain knowledge with executing tests. Trying to find a compound raw materials and fire additives that will end in a product that is even more natural and has a smaller impact on the environment plus a contribution to the "Green Deal". to point 2: - Research has to be done with external experts on how to position the new co-application of biochar and fertiliser on the market. This might even extent the value to the whole biobased material insulation industry to support the European Circular Economy goals. to point 3: - With cardboard we strive to maintain and expand our possibilities on the European market, thus reducing the CO2- emissions of conventional insulation materials.
Publications	- 01_A new EPD made by WeLOOP. It is not completely ready, so we annexed the version just before the final verification from us and the official verifier. - 02_A position paper on Biochar that was made after one of the meetings this year. - 03_XAMK: Fire retardants - 04_XAMK: REPORT PYROLYSIS OF CELLULOSE WOOL MATERIAL

4.3.1.11.2 SWOT Analysis

Strengths

- Three-part mitigation strategy for cellulose insulation's environmental impacts, that can be considered together or separated.

Opportunities

- Point 2: The advantage of Biochar is an additional end-of-life scenario for an already recycled product. This approach is not completely new, but if possible in the future, it will have a positive impact on the environment because of recirculation.
- Point 3: the possible usage of the same

Weaknesses

- No substitute for boric acid currently available; boric acid is ~¼ of the LCA impact of cellulose insulation.

Threats

- ECIA does not have a direct link to and the field will be also highly political.
- Quality labels have previously excluded cellulose from "green" level because of boric acid content; low primary energy advantages not always recognised.
- Limited take-back volume in the near term due to the long service life of cellulose

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production lines and availability of the raw material in the future and the increase of the market share thus reducing the amount of CO2 emissions caused by conventional insulation materials. Maintaining or even enlarging competitiveness will result in a better understanding and broader application of cellulose insulation and circular economy.

insulation.

4.3.2 Commercial KERs

4.3.2.1 CTA

4.3.2.1.1 KER 1 description

KER Name	Sustainable multi-objective optimization framework
Description	Multi-objective optimization of industrial processes using life cycle scientific and economic environmental objectives. The tool combines simulation of industrial processes, life cycle analysis (LCA), life cycle cost (LCC) and multi-objective optimization (MOO) to apply the improved life cycle sustainability assessment (LCSA) methodology developed in CALIMERO. The result is an algorithm to obtain optimal solutions to improve several sustainability objectives. It is composed by 4 modules: i) simulation of industrial process, ii) sustainability assessment models, iii) multi-objective optimization algorithm and iv) interpretation. The algorithm guides a search of the best values for a set of selected target variables (which are reflected in real-life conditions that can be controlled in the production process and are replicated in the simulation module), aiming to minimize a set of objective functions, which are some selected sustainability indicators whose values depend on the results of the simulation. At least one combination of values for the target variables are identified by the algorithm to best balance the minimization of the desired objectives, and then the interpretation module is used to identify which one of those should be considered as most fitting.
Lead Partner	CTA
Participating Partners and their involvement	DTU: simulation module development
Work Package	WP4
Exploitation potential	Commercial
TRL	Initial: 3 End of project: 5

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Relevance, problem solution and added value	Added value: A versatile product that is able to extract information from different sources, offering LCA/LCC optimization studies and scale-up solutions in Industrial Processes using a Multi Objective Optimization Algorithm. Problems solved: • R&D professionals are facing several difficulties to measure environmental impact within their industrial designs. • Lack of methodology for sustainability of novel techs. • The scaling step for R&D projects lacks both prospective life cycle assessment and life cycle cost studies, causing environmental and economic impacts • European 2030 framework is pushing for a more sustainable design for any kind of industry so companies need to perform environmental studies from laboratory design to the final production plant.
State-of-the-art	Only used in Research & Development. All the tools that are currently known in the market and the Academy are from LCA focused on sustainability. We are not aware of a software or tool similar to the one developed in CALIMERO that brings together the three types of analysis: simulation - LCA - optimization.
Competitors	Current LCA software providers that may include multi objective optimization aspects (implementing Brightway2, using OpenLCA, etc.) Other examples of similar tools: Ipoint Umberto Software, openlca, GaBi, Solidforest Air.e LCA
Different applications	The result could be used to offer a service to different industries and also for further research activities. It's applicable in Food, Pharma, Energy or Petrochemical Industries (Companies using a software simulator). As background in R&D projects. In order to optimize factories' installations and operations.
Target users	Ideal Customer: Public/Private company specializing in BioProcess at R&D Stage, mainly in Europe, planning to scale their process, with a constant source of revenues to get a long-term agreement. Other customers: • Technology licensors developing and designing new patents. E.g: Axens, Chevron. • Engineering companies looking to cover LCA and LCC requirements for their projects. • Industrial companies designing and building their own plants. • Factories trying to optimize their installations. E.g: Hutchinson. • Renewable energy companies showing their net zero impact. E.g: Iberdrola, Endesa, Naturgy. • Everyone trying to get any sustainability certificate. E.g: General companies without industrial processes but engaged by our product.

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	• Construction companies.
Value proposition	Scientific value and economic purposes. It helps us to obtain very detailed documentation and analysis for clients and internally. We would obtain the economic value by licensing the software or by using the tool to provide a service to the industries mentioned before.
Time to market	The tool continues to be developed with the aim of trying to have a service to offer to potential clients. The estimated timing is 4 years

4.3.2.1.2 KER 1 SWOT Analysis

Strengths

- Unique integration of process simulation, LCA, LCC and MOO in one algorithm.
- The MOO framework used in CALIMERO enables the simultaneous simulation of inputs/outputs even in multiregional scales.
- Versatility across different industrial sectors (Food, Pharma, Energy, Petrochemical).
- Scientific and economic value: detailed documentation and decision support.

Weaknesses

- Tool still under development, with an estimated 4 years to market.
- It relies on the quality of the simulation, which is often limited to data availability.
- The process cannot be automated and therefore needs specific program adaptation for each context.
- Dependence on specialized users with expertise in process simulation and sustainability.

Opportunities

- Direct competitors are focused on LCA/LCC only.
- Increasing demand due to the European 2030 framework for sustainable industrial design.
- Lack of methodologies for sustainability assessment in the scale-up stage of R&D.
- Potential market in engineering companies, bioprocess firms, renewable energy, and construction.
- Exploitation potential through software licensing or service provision.

Threats

- Competition from existing LCA software providers may include MOO aspects.
- Risk that competitors integrate simulation and optimization capabilities.
- Adoption barriers in industries reluctant to invest in new digital tools.
- LCA is still not an obligation in Europe, which would limit the interest of potential customers in investing in this analysis.

4.3.2.1.3 KER 1 Profit and Loss Statement

The financial planning for the service provided by CTA is structured into CAPEX (Capital Expenditures) and OPEX (Operational Expenditures). CAPEX includes one-time investments such as IT infrastructure, proprietary tools and software. OPEX covers recurring costs like salaries and office expenses, ensuring smooth day-to-day operations. During first year, one service of 18.000€ is foreseen, increasing to 3 services per year from year 2.

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Table 6: CTA KER 1 Profit and Loss Statement

	Years			
	1	2	3	4
CAPEX	-26,700.00 €			
Depreciation rate	-6,675.00 €	-6,675.00 €	-6,675.00 €	-6,675.00 €
OPEX	-17,200.00 €	-17,733.20 €	-18,282.93 €	-18,849.70 €
Mantainance	0.00 €	0.00 €	0.00 €	0.00 €
Sales	18,000.00 €	54,000.00 €	55,674.00 €	57,399.89 €
EBITDA	800.00 €	36,266.80 €	37,391.07 €	38,550.19 €
EBIT	-5,875.00 €	29,591.80 €	30,716.07 €	31,875.19 €
Taxes	0.00 €	-7,397.95 €	-7,679.02 €	-7,968.80 €
EAT	-5,875.00 €	22,193.85 €	23,037.05 €	23,906.40 €
Cash flow	800.00 €	28,868.85 €	29,712.05 €	30,581.40 €
Accum. cash flow	800.00 €	29,668.85 €	59,380.90 €	89,962.30 €
Discounted cash flow	761.90 €	26,184.90 €	25,666.39 €	25,159.39 €
NPV	761.90 €	26,946.80 €	52,613.19 €	77,772.58 €
COGS	23,875.00 €	31,806.15 €	32,636.95 €	33,493.50 €
% Profit Margin	**-33%**	**41%**	**41%**	**42%**

4.3.2.1.4 KER 2 description

KER Name	**Knowledge acquired in an improved, more complete and more suitable methodology to assess the environmental impacts of bio-based products**
Description	Simulation of bio-industrial processes and development of Multi Objective Optimization frameworks and Life Cycle Sustainability Assessments methodologies. The knowledge acquired during the development of the CALIMERO project could be used in order to provide commercial services based on the application of Life Cycle Sustainability Assessment procedures to potential customers (i.e., bio-based industries)
Lead Partner	CTA
Participating Partners and their involvement	N/A
Work Package	WP5
Exploitation potential	Commercial
TRL	Initial: 3 End of project: 5
Relevance, problem solution and added value	The potential commercial service developed in the CALIMERO project could be time and resource savings to optimize processes with technical and sustainability considerations The main attraction of the potential commercial service would be the availability of the most advanced life cycle based analytical methodology so far in terms of modelling and specification for the 5 bio-industrial sectors of the CALIMERO project (i) construction, (ii) pulp and paper, (iii) textiles, (iv) biochemicals and (v) woodworking. This would allow solving all the problems related to the lack of precision for specific industrial processes and, therefore, to the uncertainty of the results obtained.

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	Therefore, the added value of such a commercial service would be to provide more accurate and customized results depending on the type of bio-industry (i.e., potential customer).
State-of-the-art	Currently, the development of the implementation of sustainability services that can be offered to clients in terms of evaluation and communication of results has seen an upward trend in recent decades. The vast majority of these services are based on life cycle thinking and internationally standardized regulations. However, they are usually limited to studies related to environmental indicators using databases of general modelled processes. Therefore, the potential of the service that could be offered by the methodology carried out in the CALIMERO project is to carry out studies that follow a more holistic perspective of sustainability, integrating the social and economic dimensions, together with other aspects, e.g., criticality or circularity. All of this is modelled on real industrial processes for greater accuracy of the results obtained.
Competitors	Current Life Cycle Assessment software providers who may include multi objective optimization aspects (Brightway2, OpenLCA, etc.). Those companies that already offer LCA-based software licences, in addition to training courses and workshops for training to attract clients who want to train in the subject and stop depending on third-party services (e.g., Pré Sustainability). In addition, there are other related companies participating in projects to improve their current software tools and procedures in line with the objectives of the CALIMERO project.
Different applications	The different applications of the service would be the assessment of the different impacts related to the client's production processes, advice on sustainability and improvement of their environmental or socio-economic profile. The service could be offered to all those integrated in the bio-based sector. In addition, it could be adapted to each client, as specific modelling is done for the production processes that integrate different industrial sectors.
Target users	The main application of this service would be to advise individual clients or other commercial entities on sustainability issues. These should be related to the bio-economic sectors addressed in the CALIMERO project. The interested company profile would be those concern about climate change or other sustainability issues and/or those that want to obtain an indirect benefit in terms of economic savings in the production process after the application of the Multi Objective Optimization framework.
Value proposition	Scientific and economic value. Increased quality of sustainability optimizations at industrial level by using high quality simulations. The value could be gained by offering and providing the service to potential customers. Also, a scientific value because CTA aims to use the knowledge acquired for other research projects to continue improving methodologies, internal skills. This would be useful to give better support to the clients.
Time to market	CTA is working to develop a service that could be offered in 3-4 years

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4.3.2.1.5 KER 2 SWOT Analysis

Strengths

- Quality of simulation and modeling of specific industrial processes
- Holistic sustainable services, considering socio-economic indicators, together with the evaluation of other important aspects such as biodiversity, ecosystem services, the criticality of the supply of raw materials or circularity.
- Time and resource savings to optimize processes with technical and sustainability considerations.

Weaknesses

- Both Multi Objective Optimization framework and the novel methods for estimating new indicators beyond the environmental dimension of sustainability are methodologies not standardized or recognized by external organizations.

Opportunities

- CTA will use the knowledge for other research projects, improving methodologies and internal skills.
- Commercial exploitation potential: provide services based on the application of Life Cycle Sustainability Assessment procedures to bio-based industries.

Threats

- Contracting these additional services to those typically found in the marketplace can involve both time- and economic-demanding activities, so that clients may not want to undertake.
- Current Life Cycle Assessment software providers may include Multi Objective Optimization aspects.

4.3.2.1.6 KER 2 Profit and Loss Statement

The financial planning for the service provided by CTA is structured into CAPEX (Capital Expenditures) and OPEX (Operational Expenditures). CAPEX includes one-time investments such as IT infrastructure, proprietary tools and software. OPEX covers recurring costs like salaries and office expenses, ensuring smooth day-to-day operations. During first year, one service of 12.000€ is foreseen, increasing to 3 services per year from year 2.

Table 7: CTA KER 2 Profit and Loss Statement

	Years			
	1	2	3	4
CAPEX	-7,700.00 €			
Depreciation rate	-1,925.00 €	-1,925.00 €	-1,925.00 €	-1,925.00 €
OPEX	-10,948.84 €	-11,288.25 €	-11,638.19 €	-11,998.97 €
Mantainance	0.00 €	0.00 €	0.00 €	0.00 €
Sales	12,000.00 €	36,000.00 €	37,116.00 €	38,266.60 €
EBITDA	1,051.16 €	24,711.75 €	25,477.81 €	26,267.63 €
EBIT	-873.84 €	22,786.75 €	23,552.81 €	24,342.63 €
Taxes	0.00 €	-5,696.69 €	-5,888.20 €	-6,085.66 €
EAT	-873.84 €	17,090.06 €	17,664.61 €	18,256.97 €
Cash flow	1,051.16 €	19,015.06 €	19,589.61 €	20,181.97 €
Accum. cash flow	1,051.16 €	20,066.22 €	39,655.83 €	59,837.80 €
Discounted cash flow	1,001.11 €	17,247.22 €	16,922.24 €	16,603.76 €
NPV	1,001.11 €	18,248.33 €	35,170.57 €	51,774.33 €
COGS	12,873.84 €	18,909.94 €	19,451.39 €	20,009.63 €
% Profit Margin	**-7%**	**47%**	**48%**	**48%**

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4.3.2.2 NEOVILI

4.3.2.2.1 KER description

KER Name	Knowledge acquired in an improved, more complete and more suitable methodology to assess the environmental, social and economic impacts for the textile sector
Description	Calimero's refined methodology delivers environmental impact assessment for the textile sector through ecological footprint optimization using multidimensional assessment criteria. This systemic approach meets existing industry benchmarks while pioneering new standards for biodiversity protection and sustainability within bio-based industries. The methodology integrates Life Cycle Costing analysis to evaluate profitability, operating expenses, and investment returns alongside environmental metrics, ensuring Product Environmental Footprint compliance through multiple performance indicators including carbon emissions, water use, toxicity factors, and biodiversity impacts. Through accurate identification of environmental impact areas, process optimization opportunities, and job creation potential, the textile industry gains capabilities to reduce and neutralize environmental footprints while building economic value. The social dimension quantifies employment generation across circular bio-based business models, measuring direct job creation and indirect employment throughout the value chain. Life Cycle Costing demonstrates the economic viability of these models by analyzing total ownership costs, revenue stream diversification, and long-term profitability scenarios. Neovili facilitates this transformation through a comprehensive service suite comprising: • **Expert consultancy services** incorporating LCC modeling and job creation forecasting to demonstrate circular model return on investement and profitability • **Policy and governance support** including code of conduct development that balances economic, social, and environmental objectives for PEF compliance • **Capacity building programs** delivering bespoke training and materials covering integrated sustainability assessment methodologies These services embed Calimero's process optimization practices into business operations while ensuring alignment with EU regulatory frameworks through multidimensional PEF criteria including resource efficiency, circularity indicators, and social value metrics. For textile companies, this represents an opportunity to achieve comprehensive PEF compliance while creating additional value through reinforced profitability, local employment generation, and sustainability performance that meets evolving stakeholder expectations. The integrated approach transforms the transition outcomes into strategic business advantages.
Lead Partner	Neovili

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Participating Partners and their involvement	DTU, IVL, LIST, WeLOOP, TECHTERA, Ereks - Calimero's academic partners (RTOs) contribute to providing cutting-edge research and insight significantly enriching the body of knowledge on process optimization and environmental sustainability within the bio-based industry. - Our technological partner, DTU, will infuse the Calimero project knowledge creation with advanced data modelling insights, driving the process optimization knowledge within the bio-based industry.
Work Package	WP1 and WP2
Exploitation potential	Commercial
TRL	Initial: 3 End of project: 5
Relevance, problem solution and added value	Neovili's suite of services addresses the textile industry's critical problems. First, it transforms sustainability from a cost center into a value driver by demonstrating concrete ROI through LCC analysis and calculating the economic value of job creation and social benefits. Second, it supports PEF compliance through integrated multidimensional assessments that simultaneously address carbon, water, toxicity, and biodiversity requirements, providing reinforced monitoring aligned with EU regulatory frameworks. Neovili's approach embeds capabilities directly into client organizations through collaborative working groups, actionable deep-dives workshops that extract transferable insights while protecting competitive information, and bootcamp programs that translate technical sustainability metrics into business language. The Bio-Based Theory of Change framework provides concrete pathways for transformation, offering step-by-step implementation roadmaps tailored to the industrial context. This comprehensive approach transforms the bio-based transition into a strategic opportunity for market differentiation, operational efficiency, and business development.
State-of-the-art	The textile industry is currently undergoing a significant transformation towards sustainability and efficiency, driven by advancements in technology and a growing awareness of environmental issues. The application of environmental impact evaluation methods and standard nomenclature is now allowing textile mill operators to consider environmental impact in their process development and chemical purchasing decisions, a shift from the previous focus on cost and mill performance alone (Moore and Ausley, 2004). One of the key trends in this domain is the use of life cycle assessment (LCA) to evaluate the environmental impact associated with the development of new strategies for the textile industry. This approach has shown that significant benefits can be achieved through innovative protocols that reduce energy, water, and raw material consumption (Parisi, 2015). Another emerging trend is the use of Organisational- Life Cycle Assessment (O-LCA), a decision-making process that helps textile and clothing

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	companies integrate environmental objectives into corporate management control and decision systems. This approach enables companies to identify hotspots that need to be managed to reduce their environmental footprint, leading to cost savings and the development of a business case for sustainability (Resta, 2016) In terms of products, there is a growing focus on the development of eco-friendly materials and technologies due to customer and regulatory pressure. Our service will fit within this current state-of-the- art by offering a comprehensive consulting approach that combines process optimization and environmental impact assessment. (Moore, 2004) We will leverage advanced data analytics and AI algorithms to identify areas of improvement in our client's manufacturing processes, leading to increased efficiency and reduced resource consumption. Additionally, we will provide a thorough assessment of the environmental impact of their operations, helping them meet regulatory requirements while aligning with sustainability goals.
Competitors	Potential competitors for this suite of services in the environmental impact and process optimization for the textile industry could include: 1. Environmental Consultancy Firms: Established firms (BSR, GRI) that specialize in environmental impact assessments and sustainability consulting. 2. Sustainability Software Providers: Companies offering software solutions (LCAs) for sustainability management, supply chain analysis, and carbon footprint calculations (Sphera, Pré, Makersite). 3. Industry Associations: might provide similar services as part of membership benefits, including best practices, codes of conduct, and industry reports. 4. Academic and Research Institutions: Universities and research centres that could offer in-depth knowledge, training, and cutting-edge research findings. 5. Certification Bodies: these entities might also offer consultancy and training services to help businesses comply with certification standards. 6. Corporate Social Responsibility (CSR) Advisors: Advisors or agencies specializing in CSR strategies, which may include environmental performance as a key component. 7. Non-Governmental Organizations (NGOs): focused on environmental advocacy that also offer consultancy and reporting services to industries. 8. Independent Sustainability Experts: Freelancers or independent consultants with expertise in textile sustainability and process optimization. 9. Business Schools: Educational institutions that offer corporate training programs in sustainability and may provide consulting services. 10. Technology Innovators: Start-ups and tech companies innovating in the space of environmental data analytics, process automation, and resource optimization.
Different applications	The suite of consulting services for process optimization and environmental impact assessment has far-reaching applications across the textile industry. One of the primary uses is to help textile manufacturers refine their production processes to reduce waste, conserve energy, and minimize their ecological footprint. For instance, a manufacturer could leverage these services to assess the environmental impact of their dyeing processes, identify inefficiencies, and implement more sustainable practices without sacrificing product quality. Another practical application is in supply chain management. Brands can utilize the services to evaluate and improve the sustainability of their entire supply chain—from raw material sourcing to

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	manufacturing and distribution. The reports and policy recommendations could help companies set and meet ambitious sustainability targets, such as reducing water usage. Additionally, companies looking to adhere to or exceed industry standards, such as the Global Organic Textile Standard (GOTS), can benefit from our detailed codes of conduct and tailored advice. Beyond direct industry application, our services have educational value. Business schools could incorporate our suite into their curricula, teaching the next generation of business leaders how to integrate sustainable practices into their operations from the inception. Moreover, our collaboration platforms serve as a hub for industry players to share insights, discuss challenges, and develop collective strategies for sustainability, fostering a community of practice committed to environmental stewardship.
Target users	Brands, retailers, e-tailers, textile associations, business schools.
Value proposition	The service we offer in consulting process optimization and environmental impact assessment for the textile industry is designed to deliver multifaceted value: scientific, societal, and economic. Scientifically, we aim to advance the understanding of sustainable practices in the textile industry. The methodology underpinning our services is grounded in applied research and offers a nuanced perspective on environmental impact using additional characterization factors, for example. Our objective is to contribute to the body of knowledge in this field, providing data and insights that can inform further scientific inquiry and innovation. To achieve this, we plan to collaborate with academic institutions and publish findings in peer-reviewed journals, ensuring the evidence-based and credibility of this KER. Societally, our service is positioned to effect real-world change by supporting textile companies in reducing their environmental footprint, thus benefiting communities and ecosystems. The suite of services offers practical tools for brands to implement sustainable practices, thereby fostering a culture of corporate responsibility. Through policy recommendations and codes of conduct, we aim to influence industry standards and practices, contributing to the broader societal goal of sustainable development. Engaging with industry bodies, non-profits, and governmental agencies will be crucial in disseminating best practices and advocating for systemic change. Economically, the service is designed to provide economic benefits to the ecosystem. By optimizing processes and reducing environmental impact, we help brands enhance their efficiency, potentially lower costs, and improve their market position. The educational aspect of the service also aims to upskill employees, increasing their value within the company and the industry at large. To extract economic value, we plan to measure the efficiency gains achieved by our clients, using these metrics to refine our service offering and demonstrate return on investment to potential users. Our strategy to realize these values includes forming strategic partnerships, leveraging digital platforms for knowledge sharing, and maintaining a robust feedback loop with our clients to continuously improve and adapt our services to the evolving needs of the textile industry.
Time to market	The timeline for bringing Neovili's service suite to market is strategically aligned with the immediate industry needs. Given the mature state of CALIMERO's methodologies and tools, Neovili envisions a rapid market entry within 6 to 12 months after project completion.

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	Immediate Phase (Months 1-3): Neovili will launch pilot engagements responding to active market demands. The existing Theory of Change framework and PEF compliance tools enable immediate deployment while refinement continues. Scaling Phase (Months 4-9): Building on pilot successes, Neovili will expand service delivery through structured implementation programs. This includes rolling out the complete suite integrating LCC modeling, job creation forecasting, and multidimensional PEF assessments. Strategic partnerships with organizations like the Fédération de la Mode Circulaire and the ETP platform could accelerate market penetration and credibility. Market Consolidation (Months 10-12): The final phase focuses on establishing Neovili as the reference provider for bio-based and circular business model optimization in textiles. This involves packaging learnings from initial engagements into standardized service offerings and developing subscription-based monitoring services for ongoing compliance support. The collaborative approach ensures continuous improvement through client feedback integration. This accelerated timeline leverages CALIMERO's completed research outputs to meet urgent market demands for compliance and business support.

4.3.2.2.2 SWOT analysis

Strengths

- Methodology tailored specifically for the textile industry; unlike generic assessment tools, this methodology provides a nuanced approach that considers the unique processes and challenges inherent to the sector.
- It delivers a systemic vision that not only considers immediate production stages but also the extended supply chain and lifecycle of textile products.
- This depth of analysis allows for a level of precision in identifying and mitigating environmental impacts that are currently unmatched.
- The service includes policy recommendations and educational materials, empowering clients with knowledge and the means to implement sustainable changes.

Weaknesses

- The level of detail and customization we provide may come at a higher cost compared to off-the-shelf solutions.
- The implementation of our comprehensive recommendations may require substantial changes to existing processes, which could encounter resistance within organizations.
- There may also be a learning curve associated with utilizing our methodology and platforms, necessitating a period of adjustment.
- The trade secret nature of CALIMERO's methodology adds value but limits widespread adoption.

Opportunities

- Growing EU regulatory requirements for PEF compliance and sustainability reporting create urgent demand for integrated assessment methodologies and compliance support services.

Threats

- Regulatory compliance and market readiness dependencies could affect the timeline for market introduction.
- Coexistence with existing industry benchmarks and conventional methodological

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- Textile sector's accelerating shift toward sustainability driven by customer expectations, investor scrutiny, and environmental advocacy creates demand for proven transformation frameworks.
- Brands seeking market advantage through verified sustainability credentials need comprehensive solutions that demonstrate both environmental performance and economic viability.
- Increasing adoption of circular bio-based business models across the textile value chain requires specialized expertise in multi-dimensional assessment (environmental, economic, and social metrics).
- Industry's limited internal capacity to conduct simultaneous LCC analysis, job creation forecasting, and multidimensional PEF assessments creates opportunity for specialized consulting services.
- Growing focus on eco-friendly materials and technologies due to regulatory and customer pressure increases demand for process optimization and environmental impact validation.
- Universities and business schools seeking practical sustainability frameworks for curricula development represent additional market channels and knowledge-sharing opportunities.

approaches.

- Growing number of sustainability software solutions and independent consultants entering the market could drive price competition and reduce perceived differentiation.
- Textile companies' limited internal capabilities, budget constraints, or organizational resistance to sustainability transition.
- Lack of universal industry standards for integrated assessment (LCC + PEF + social metrics).
- Financial pressures on textile companies during economic uncertainty may deprioritize sustainability investments viewed as non-essential, despite long-term ROI.
- Emerging AI-driven automated assessment tools from tech innovators and start-ups could challenge traditional consulting service models with faster, lower-cost alternatives.

4.3.2.2.3 KER Profit and Loss Statement

The financial planning for Neovili's consulting services is structured into CAPEX (Capital Expenditures) and OPEX (Operational Expenditures). CAPEX includes frugal investments such as website maintenance, marketing materials, and essential software subscriptions, as the service leverages existing CALIMERO methodologies without requiring proprietary infrastructure. OPEX covers recurring costs like consultant salaries, office expenses, travel, and marketing. COGS (Cost of Goods Sold) represents direct project delivery costs including travel, external expertise, and partner fees, estimated at 20% of revenue.

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Table 8: NEOVILI KER Profit and Loss Statement

Years	1	2	3	4
CAPEX	-2 000,00 €	-2 000,00 €	-2 000,00 €	-2 000,00 €
Depreciation rate	-500,00 €	-500,00 €	-500,00 €	-500,00 €
OPEX	-55 000,00 €	-95 000,00 €	-160 000,00 €	-220 000,00 €
Maintenance	0,00 €	0,00 €	0,00 €	0,00 €
Sales	30 000,00 €	120 000,00 €	270 000,00 €	400 000,00 €
EBITDA	-19 000,00 €	49 000,00 €	164 000,00 €	268 000,00 €
EBIT	-19 500,00 €	48 500,00 €	163 500,00 €	267 500,00 €
Taxes	0,00 €	-12 125,00 €	-40 875,00 €	-66 875,00 €
EAT	-19 500,00 €	36 375,00 €	122 625,00 €	200 625,00 €
Cash flow	-17 000,00 €	38 875,00 €	125 125,00 €	203 125,00 €
Accum. cash flow	-17 000,00 €	21 875,00 €	147 000,00 €	350 125,00 €
Discounted cash flow	-15 740,74 €	33 329,05 €	99 328,26 €	149 302,94 €
NPV	-15 740,74 €	17 588,31 €	116 916,57 €	266 219,50 €
COGS	6 000,00 €	24 000,00 €	54 000,00 €	88 000,00 €
% Profit Margin	-65%	30%	45%	50%

ASSUMPTIONS

REVENUE PROJECTIONS:

- Year 1 (Pilot Phase, 6-9 months): 2-3 clients with sales at €12,000 average = €30,000
- Year 2 (Initial Scaling): 8 clients with sales at €15,000 average = €120,000
- Year 3 (Market Penetration): 15 clients with sales at €18,000 average = €270,000
- Year 4 (Consolidation): 20 clients with sales at €20,000 average = €040,000

CAPEX (Minimal - €2,000/year):

- Basic website/landing page updates
- Marketing materials (digital brochures, case studies)
- Essential software subscriptions (CRM, project management)
- No proprietary infrastructure or tool development
- Depreciation: €500/year over 4 years

OPEX (Scaled with Growth):

- Year 1: 1 FTE consultant + overhead = €55,000
- Year 2: 1.5 FTE + increased marketing = €95,000
- Year 3: 2.5 FTE + expanded operations = €160,000
- Year 4: 3.5 FTE + full operations = €220,000
- Includes: salaries, office costs, travel, subscriptions, insurance, marketing

COGS (20% of Sales):

- Direct project delivery costs: travel, external expertise, partner fees, materials
- Scales proportionally with revenue

OTHER ASSUMPTIONS:

- Tax rate: 25% on positive earnings

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- Discount rate: 8% for NPV calculation
- Service mix: LCC modeling, PEF assessments, capacity building, policy support
- Leverage existing CALIMERO methodologies and partner networks

5 IPR MANAGEMENT

CTA supports the partners in developing individual strategies as well as a joint strategy in order to ensure to follow the principles of the Horizon Europe projects regarding Open Access as well as ensuring all information and data are thoroughly protected when necessary to protect the partners' interest and added value.

5.1 Methodology

Before the project started, partners signed the Consortium Agreement (CA) for the management of the knowledge produced, which was developed around the following major points:

- The partners identified their pre-existing know-how, to which they grant access rights to the consortium in the Annex 1 to the Consortium Agreement. Partners were able to define the scope of already existing IPR ("background") to which access rights will be granted to the entire consortium.
- The contractors agreed that the access rights on the knowledge needed for carrying out the project shall be granted on a royalty-free basis.
- All project results (foreground) will be available for use to all partners.
- IP arising from the work carried out collectively will be the joint property of the partners. In this case, the partners will jointly apply to obtain and/or maintain the relevant rights and shall strive to set up amongst themselves appropriate agreements in order to do so. Decision-making procedures are well-defined in the CA. Knowledge/IP generated within the life of the project by individual partners will be owned by the partner generating it.

5.2 Background IP

According to the Grant Agreement (Article 16.1) Background is defined as "data, know-how or information (…) that is (…) needed to implement the Action or exploit the results". Because of this need, Access Rights have to be granted in principle, but Parties must identify and agree amongst them on the Background for the Project.

For this reason, all the partners identified the Background IP in the Attachment 1 of the Consortium Agreement. The general claim for the partners is that: No data, know-how or information of any partner shall be needed by another party for implementation of the project or exploitation of that other party's results.

As to DTU, it is agreed between the Parties that, to the best of their knowledge, the following Background is hereby identified and agreed upon for the Project.

Table 9 DTU's Background from the Grant Agreement

Partner	Describe Background	Specific restrictions and/or conditions for implementation	Specific restrictions and/or conditions for Exploitation

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DTU	Bio-refinery process models and simulations for producing bioethanol as biochemical	Access Rights to Background is only granted to the extent that is Needed for the implementation of the Project.	Access Rights to Background may only be granted to the extent that is Needed for the Exploitation of a Party's own Results, to complete requirements and aims foreseen for the CALIMERO Project under Fair and Reasonable Conditions to be negotiated with DTU. The Background cannot be shared or used outside of this without prior permission by DTU. Further, Access Rights to Background for Exploitation is only granted to the extent that said Background is not subject to terms and conditions in other agreements that may prohibit the desired Access Right.

5.3 Foreground IP

During the development of the final exploitation plan, all partners have updated the list of IP protection to fit the advancement of their results. Now the table is updated as we reach the end of the project, and it is shown in Table 9:

Table 10: Updated IPR table for all KERs

Partner	Result	Type	Foreground Protection	Background IP
CTA	Knowledge acquired in an improved, more complete and more suitable methodology to assess the environmental impacts of bio-based products	Data Services Skills and knowledge Collaboration platforms	Trade secret Copyright	CTA does not have a protected background.
	Sustainable multi-objective optimization framework	Software Services Skills and knowledge Collaboration platforms	Trade secret Copyright Trade mark	CTA does not have a protected background. The algorithm depends on other licenses (Aspen, Ecoinvent). Other simulation software could be used. Ecoinvent is one of the largest sources of LCA data.
CTA (75%) + LIST (25%) ownership	Job Creation Potential Tool	Software Services Skills and	Trade secret Copyright	CTA and LIST do not have a protected background.

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		knowledge		
CTA (90%) +LIST (10%) ownership	Life Cycle Costing Tool	Software Services Skills and knowledge	Trade secret Copyright	CTA and LIST do not have a protected background.
CESEFOR	New knowledge applied to the wood-based panel manufacturing related to: (1) the most impactful processes, (2) the solutions to reduce the environmental impact, (3) monitoring strategies to assess the environmental impact	Skills and knowledge Educational Material	No protection is foreseen	The background corresponds to knowledge and expertise. There is no prior intellectual protection.
WeLOOP	Novel methodology for inventory and impact assessment of circularity and criticality indicators of bio-based products	Policy recommendations Services Data Educational material Skills and knowledge	Trade secret Part of the knowledge Will be for public use (e.g. guidelines). To be defined at a later stage.	The current IPs of WeLOOP and other partners of Calimero on sustainability assessment methods and tools, including environmental, social and economic assessment methods and metrics.
	Monitoring procedures of target bio-based industries	Skills and knowledge	None, For public use.	The current IPs of WeLOOP and other partners of Calimero on sustainability assessment methods and tools, including environmental, social and economic assessment methods and metrics.
NEOVILI	Knowledge acquired in an improved, more complete and more suitable methodology to assess the environmental impacts for the textile sector	Policy recommendations Processes Services (Collaboration) platforms Reports Codes of conduct Educational material Skills and knowledge	Trade secret	Our participation in the project involves contributing knowledge, solutions, and technologies that are not under intellectual property protection. In our domain, our focus has been on sharing openly available and non-protected insights and innovations.

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TECHTERA	New knowledges applied to textile sector	Research Roadmaps Data Reports Educational material Skills and knowledge	No protection foreseen, we did not develop any IP ourselves, and we plan to use non protected results.	TECHTERA doesn't have a protected background
ESSITY	Case studies definition and assessment for pulp and paper and forestry. Applicability of current and novel methodologies for biodiversity and ecosystem services.	Processes Data Reports Skills and knowledge	No protection foreseen, Pulp and papermaking in principle always common knowledge in the broad perspective.	Essity does not have a protected background
LIST	Updated temporal DyPLCA database	Software Data	Copyright	Yes, it relies on the old version of the DyPLCA database, which is owned by LIST and INSA* *INSA, is a partner in LCA4BIO, and the valorization of this KER may also belong to that project
	Method to character particulate matter removal	Data Reports Skills and knowledge Policy recommendations Educational material	Copyright	No protected background. It relies on existing scientific knowledge, which are copyright protected and should be cited
BIM Kemi	New knowledge applied to the biochemical sector to reduce environmental impact, identify the most impactful processes and monitor strategies to assess the environmental impact	Processes Skills and knowledge Research roadmaps (Collaboration) platforms	Trade secret	BIM Kemi doen't have any intellectually protected background that is relevant for the project. We have brought knowledge, solutions and technologies that are not protected.
DTU	Simulation models	Data Reports Policy recommendations (Collaboration) platforms Educational material	Copyright	Look at DTU's Background from the Grant Agreement

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EREKS	EREKS BLUE MATTERS	Research Roadmaps Policy recommendations (Collaboration) platforms Data Reports Educational material Prototypes Skills and knowledge	Copyright	We don't have any updates regarding background. There is not protected IP.
IVL	ProScale and ProScaleE methods	Data Reports Services Skills and knowledge Educational material	Trademark Method to be published scientifically. Data and ready-made assessed processes to be managed by IVL on a self-sustaining but non-profit manner	ProScale is a registered trademark currently managed by IVL. Data base for ProScale assessments for LCA background processes
	Simulation models in chemicals and pulp/paper industry	Data Reports Policy recommendations (Collaboration) platforms Educational material	Trade secret Copyright Models for esterification process in chemical industry and specific parts of the chemical recycling process in pulpmaking	Specified in Grant Agreement Annex 1, notably chemical recycling in pulpmaking (treatment process train of crude black liquor)
	Novel methodology for inventory and impact assessment of biodiversity	Skills and knowledge Educational Material	Copyright	No background to be protected
	Knowledge and data about biobased industries value chains	Skills and knowledge Educational Material	Trade secret	No
ECIA	New knowledge in 3 fields	Processes Data Protoypes Products Reports Skills and knowledge Policy recommendations Educational material	Trade secret Copy right Trademark Utility model	No IP protection. The knowledge is generated within the association.

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6 BUSINESS MODEL

The Business Model Canvas is a strategic management template used for developing new business models developed by Alexander Osterwalder and Yves Pigneur in 2010. (Alexander Osterwalder, Yves Pigneur, 2010).

This tool is used to be able to present a complete a defined Business Plan of all the commercial results of the project. Here the business models to apply in CALIMERO will be developed and the potential clients, revenue, costs, partners, etc. expected at the end of the project will be defined.

These business plans will be the basis for partners to continue planning their commercial strategies and obtain benefits from the results developed in the project.

Table 11: CALIMERO Business model canvas

Business Model Canvas		
Key Partners	**Key Activities**	**Value Proposition**
• Research and technology organisations (RTOs) • Universities and scientific partners • Industrial bio-based companies (chemicals, pulp & paper, wood, textiles, construction) • Digital technology providers (data analytics, simulation, AI) • LCA software developers • Standardisation bodies (PEF, ISO, CEN) • EU and national policy stakeholders	• Development of advanced LCSA methodologies integrating environmental, economic, and social dimensions • Design of multi-objective optimisation algorithms for process and product sustainability • Validation through pilot studies in bio-based industries • Integration of LCSA and optimisation tools into digital platforms • Training and knowledge transfer to industrial users	• Novel, integrated LCSA methodologies tailored for bio-based value chains • Decision-support tools combining environmental and techno-economic performance • Evidence-based optimisation for process design and scale-up • Compliance-ready methods supporting CSRD, ESPR, and PEF/DPP reporting • Enhanced competitiveness and sustainability in EU bio-industries
Customer Relationships	**Customer Segments**	**Key Resources**
• Co-creation with industry partners • Technical support and capacity building • Long-term collaboration via joint R&D and licensing agreements • Engagement through workshops, demonstrators, and open-access tools	**Commercial users:** • Bio-based industry (bio-chemicals, pulp & paper, wood, textiles, construction) • Equipment OEMs and EPCs **Non-commercial users:** • Research and policy institutions • Standardisation and certification bodies • Academic and scientific communities	• Interdisciplinary R&D expertise (LCA, LCC, optimisation, sustainability assessment) • Access to pilot and demonstration facilities • Data sets from industrial case studies • Digital infrastructure and computational resources • IPR and methodological frameworks developed in the project
Channels	**Cost Structure**	**Revenue Streams / Exploitation Pathways**
• Direct collaboration with industrial partners • Scientific publications and	• Research and development costs • Personnel and data management • Software development and	**Commercial exploitation:** • Licensing of software modules and algorithms

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policy briefs • Training programmes, webinars, and capacity-building workshops • Online platforms, digital tools, and repositories • Industry fairs, conferences, and EU networks (e.g., BIC, CBE JU)	integration • Validation and demonstration activities • Dissemination, training, and communication	• Consulting and customised assessments • Service models for optimisation platforms **Non-commercial exploitation:** • Open-access methodologies and guidelines • Policy recommendations and standardisation input • Training materials and scientific publications

7 Conclusion

The main objective of CALIMERO is to build on primary data from industrial case studies from construction, woodworking, textile, pulp & paper and biochemicals, to:

- improve current Life Cycle Sustainability Assessment (LCSA) methodologies of bio-based products,
- identify and proposed sectorial and cross-sectorial solutions to tackle sustainability hotspots to bio-based industries
- develop guidelines and recommendations to assess, monitor and improve their sustainability performance.

The CALIMERO project has developed a comprehensive exploitation strategy that ensures the accessibility and impact of its findings beyond the project's completion. By identifying Key Exploitable Results (KERs) and integrating both commercial and non-commercial exploitation pathways, the project strengthens its contribution to scientific advancements, policymaking, and industry applications.

A critical aspect of CALIMERO's approach is its emphasis on open-access data, fostering transparency and collaboration within the scientific community while enabling policymakers to make evidence-based decisions. Furthermore, the project's focus on intellectual property management and risk assessment ensures that potential challenges in levelling the technological readiness aspect, commercialization, market adoption, and regulatory compliance are proactively addressed.

The CALIMERO project has strong scientific outputs, but many results are still at low TRLs (4-6), delaying their path to market. A focused TRL advancement strategy is needed to bridge the gap from research to commercial application. The outlined steps should guide the transition from lab-scale findings to real-world impact.

The deliverable D6.2 Final Exploitation Plan also highlights the potential for continued research, and policy development. Through strategic dissemination and collaboration with relevant stakeholders, CALIMERO maximizes its long-term impact in tackling plastic pollution and advancing sustainable environmental solutions.

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9 ANNEX I: EXPLOITATION QUESTIONNAIRE

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SECTION 1: KEY EXPLOITABLE RESULTS (KER)

1. **Please fill in the following information**

KER Name	New knowledge applied to the biochemical sector to reduce environmental impact, indentify the most impactful processes and monitor strategies to assess the environmental impact
Lead Partner	BIM Kemi
Participating Partners	IVL
TRL	Initial: 3 Current: 4 Expected at the end: 5
Work Package	WP ?

TRL 1 – basic principles observed
TRL 2 – technology concept formulated
TRL 3 – experimental proof of concept
TRL 4 – technology validated in lab
TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
TRL 7 – system prototype demonstration in operational environment
TRL 8 – system complete and qualified
TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

(Commission, 2023)

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2. KER description (Please include principal characteristics/functions/how it works, etc)

Describe in a few lines your result and/or solution (i.e., product, service, process, standard, course, policy recommendation, publication, etc.). Use simple wording, avoid acronyms, make sure you explain how your UVP is delivered.

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New knowledges applied to the biochemical sector related to: (1) the most impactful processes, (2) the solutions to reduce the environmental impact, (3) monitoring strategies to assess the environmental impact.

Through ... BIM Kemi is ...

More concretely, BIM Kemi is working on... and developing ... in order to...

The main objectives of the result are:

- Application of suggested CALIMERO solutions in the company for improving its environmental performance
- ...

(here you should describe your expected results. What are you doing and why is it useful for the project and will be impactful for BIM Kemi internal work, processes and objectives?

3. If this technology is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners.

If this result/research activity is developed by more than one partner, please indicate the contribution of each partner and how the ownership will be distributed among the partners. Please make a brief description of each partner's contribution; the ownership distribution; value added by each partner; if applicable, mention how partners will coordinate their efforts and how communication and decision-making related to the shared result will take place.

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Partner	Contribution
BIM Kemi	(What are you developing)
IVL	(Here you should say what are other partners doing related to this result. IVL and others)

4. The new technology/product could be used in the form of (Choose all the options that apply to your result):

☐Software	☐Products	☐Research Roadmaps	☐Policy recommendations
☒Processes	☒Services	☐Pre-standards	☒(Collaboration) platforms
☐Data	☐Reports	☐Codes of conduct	☐Educational material
☐Prototypes	☒Skills and knowledge		

5. What makes this new technology/product (KER) attractive to the potential markets/users? Key benefits or problems solved by this new technology/product? What is its added value compared to existing technologies?

Please mention the key benefits or advantages that this technology offers and why is better to the existing ones; describe the challenges or problems that this technology aims to solve focusing in a simple way on how the result could benefit or add value to the market/society/community/stakeholders.

This exploitable result offers a comprehensive assessment of … addressing a crucial need for businesses looking for impoving their environmental impact and also…

It provides a holistic view of …, helping users understand and mitigate environmental issues associated with …

In addition, … this knowledge/ improved process, empowers businesses to make informed and data-driven decisions regarding …

Regarding regulatory compliance, it helps entities and users in adhering to …

Added value: (maybe you could say what is the value this result/research/knowledge adds to an entity's products or processes)

6. What is the current state-of-the-art in the domain of this new technology/product (KER)?

Provide information about most recent developments in the field of the technology or product, key technological advancements, relevant research or innovations that have recently emerged, emerging trends and areas of focus in the industry or community related to your KER, any references to leading products, solutions, or companies in this domain. Also explain how the technology fits within or contributes to the current state-of-the-art.

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(Here I'm adding a State of the Art of the result : LCA assessment, from another project that is not related to your KER but may be useful for you to understand what we are expecting here. You can also add publications or relevant papers related to the topic)

Example:
Existing LCAs are assessing a range of environmental impact categories, including carbon footprint (climate change), energy consumption, water usage, and land use. These categories allow holistic evaluation of products.

Several software tools, like SimaPro, are available to model and analyse product systems and perform LCAs efficiently; different industries are increasingly integrating LCA into their sustainability strategies to make informed decisions about products design, material selection and supply chain optimization.

Environmental Product Declarations (EPDs) based on LCA data, are becoming more common in various industries.

7. **What technology/product or company/research centers do you think will be the major competitors for this KER?**

Mention any existing technologies/products/research outcomes that are similar or related to the result; Name some companies or organizations that are currently active in the same field

Current RTOs with knowledge in biochemical sector such as …

Environmental Research Centres such as …

Environmental consultancies and companies with expertise in … such as …

(if you have, you could give examples)

8. **How do you plan on exploiting the project results after the end of the project? (You can choose one or more options)**

☐Use for further research

☐Develop and sell the new product/service

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☐Spin off activity

☐Cooperation agreement/Joint venture

☐Sell IP rights or IP-based business

☐License IP rights

☐Transfer ownership of IP rights to another partner from the consortium

☐Standardization activities (new standards or support ongoing procedures)

☐Other methods. Please indicate: Click or tap here to enter text.

9. **Will this new result/research activity (KER) be marketable?** Yes☐ No ☐ **- If so, what is the time to market after the end of the project (in years)?**

Provide an estimate of the time it will take to bring this result to the market after the project's completion. When estimating the time to market, consider factors such as product development, testing, regulatory approvals (if applicable), market research, and any other relevant steps in the commercialization process.

(Is it markeatable ?
Maybe not the result alone but could be exploitable by the implementation in your existing products.
If you think that it's not markeatable, you just put : No.)

SECTION 2: TECHNOLOGY WATCH

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1. What are the different applications for this technology (KER)?

Potential applications for the new result. Think broadly about how this technology or research finding could be applied in different contexts. Examples of how the result could be used in practical applications (These examples should illustrate the versatility and adaptability of the technology).

The results of the project could be use to :

- offer solutions...
- Assess more realistic impact effect of ... in the biochemical sector
- ...

2. Who will be the target customers or users of the new technology?

Enumerate the specific user groups or stakeholders who are expected to benefit from, interact with or by affected by the new result; Identify early adopters

(here the target audiente, interested sector. Please try to be specific. Not just the biochemical sector but maybe some industries within this sector)

3. What is the value that you would like to get from this KER? (e.g., for scientific, societal, or economic purposes, etc.) And how do you plan to get the value?

Define the types of value you seek to derive from the result; Describe specific objectives related to the value. Outline strategies or approaches you plan to use to get it.

Thanks to the new results activities, BIM Kemi aims to reinforce his knowledge, skills and network to better support ...

Other BIM Kemi objectives:

...

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4. What is the advantage and disadvantage of this new result/research activity (KER) comparing to existing ones?

Advantages: Identify the unique features or value of the new result that set it apart from existing ones and describe how it performs better than existing solutions; if applicable, explain how the new technology is more cost-efficient.

Disadvantages: limitations or drawbacks of the new result. Explain if there are barriers to initial adoption or implementation that potential users may face.

Advantages :

What are the advantages that the result provides. It can be related to the improvement it provides to processes, mentioning what type of advantages, whether they are economic, social impact, etc.

Disadvantages:

may involve increased costs, time-consuming analysis, need for more resources, etc. (This is just an example)

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SECTION 3: IPR STRATEGY AND PROTECTION

I. FOREGROUND IP (INTELLECTUAL PROTECTION OF THE KER)

1. How do you plan to protect this technology, service, product, asset?

☐Trade secret

☐Copy right

☐Trade mark

☐Patent

☐Utility model

☐Industrial design

☐Other methods. Please indicate: Click or tap here to enter text.

☐No protection is foreseen. Please explain why: Click or tap here to enter text.

II. BACKGROUND IP (EXISTING IP, PREVIOUS TO PROJECT START):

2. Does this KER rely on any existing IP/background IP? What is it? Who owns it? Is the background IP protected? If so, how?

Remember that the background information cannot be modified with respect to what you have said in the proposal stage. However, we ask for a broader description of the knowledge, models, methods, patents, etc. that you have brought to the project to have more context about your expertise and value contribution.

What knowledge have they brought to the project? Are they protectable?

Thank you very much for your contribution!

contactica innovation

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