WP 1 – Shared modelling framework and learnings

D1.3 – Intermediate version of the Policy Brief

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This document is the ALIGNED project (grant no. 101059430) deliverable. It contains an intermediate version of the Policy Brief on optimization of environmental and socio-economic performance of five bio-based sectors: construction, woodworking, textile, pulp and paper, and bio-chemicals.

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EUROPEAN

POLICYBRIEF

Aligning Life Cycle Assessment methods and bio-based sectors for improved environmental performance

This intermediate version of a policy brief summarizes insights and learnings on modelling framework to assess and optimise the environmental and socio-economic performance of five bio-based sectors: construction, woodworking, textile, pulp and paper, and bio-chemicals for policy-makers.

31st March 2024

INTRODUCTION

Circular biobased systems hold the promise of **increasing the environmental performance and sustainability of processes, mitigate climate change, restore biodiversity and protect air, water and soil quality along industrial value chains.** This is in line with the aims of the European Green Deal and its Zero Pollution ambition and the EU 2030 Climate Target Plan.

In the **ALIGNED** project, the Environmental Sustainability of **five industrial biobased sectors – construction, woodworking, biochemicals, pulp and paper and textiles** – is to be improved. Specifically, the methods to assess such Environmental Sustainability are to be improved and aligned to each other.

In the stakeholder consultations carried out by ALIGNED in all five sectors it became clear that:

- Improving environmental performance is costly and time consuming,
- There is no level playing field compared to fossil products,
- Many different standards and certifications are used,
- Assessment methods are not aligned,
- There is a lack of acceptance of the sustainability assessment results by customers and general public.

The ALIGNED project intends to facilitate the assessment of biobased products via methodological harmonization, selecting the best assessment models, and making them available and operational to those who need them. The focus of ALIGNED is on harmonizing different methods within the Life Cycle Assessment (LCA) domain into a common framework so that it is possible to:

- Improve scenario modeling – how biobased systems will behave in the future, i.e. when more renewable energy will be available and feedstock resources more scarce;
- Model the competition for biomass in all industrial biobased sectors in a similar way;

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- Perform dynamic and time-specific accounting of carbon flows (both in Life Cycle Inventory and Impact Assessment);
- Model accurately the impact on climate and biodiversity;
- Perform sound sensitivity and uncertainty analysis in the LCA of biobased products;
- Couple LCAs with socio-economic assessment.

ALIGNED has in the first half of the project selected the best available methodologies for these purposes, and these will be tested during the second half of the project in specific case studies at least one for each sector.

Policy implications are that:

- Work aiming to improve the environmental sustainability needs to be **recognized and supported**
- Alignment efforts, alongside and beyond the Product Environmental Footprint (PEF), **need recognition and support**
- **Continuous monitoring** emphasizes the importance of ongoing evaluation and adaptation to ensure the effectiveness and accuracy of environmental assessments.
- The **interconnection** between various biobased sectors needs to be **acknowledged**

EVIDENCE AND ANALYSIS

Gathering feedback on the environmental sustainability of industrial biobased sectors and improvement application

ALIGNED efforts included compiling five sector overviews that describe the environmental sustainability aspects of all five industrial biobased sectors in Europe. For each industrial biobased sector, a consultation and a stakeholder workshop were organised in the first half of 2023. For all five sectors this meant five consultations and five workshops. Goals were to gather feedback on the sector overview, get input on the environmental sustainability of each sector, and the ways in which this is normally measured and proven. Below the process of gathering feedback – in this case on the biobased construction sector – is graphically depicted in Figure 1.

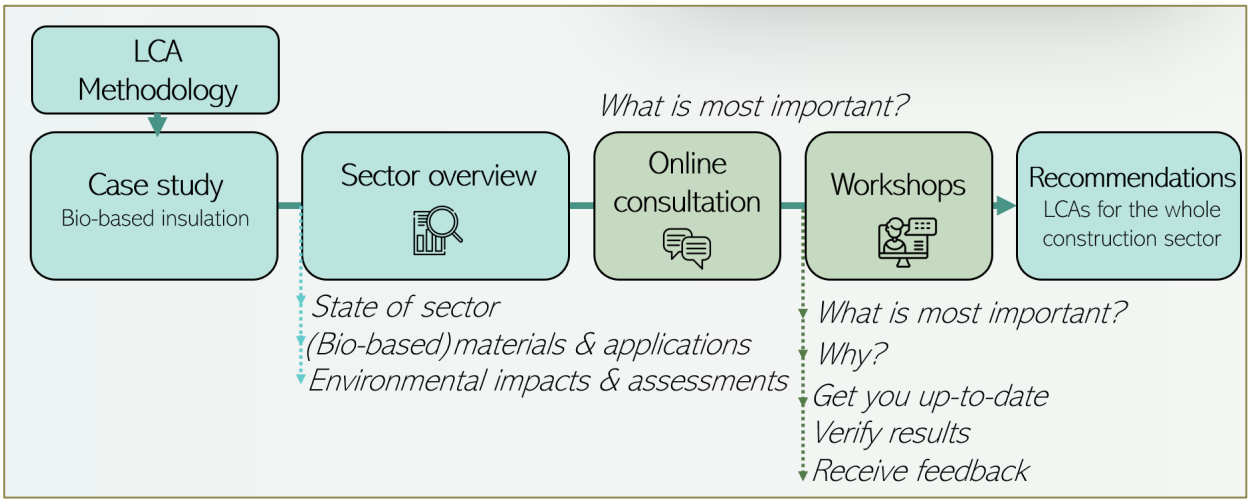

Figure 1: ALIGNED stakeholder involvement - construction sector

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Main findings on stakeholder online consultation:

- It was clear from the sector overview, online consultations and the stakeholder meetings that all five industrial sectors have significant environmental impacts. Among these the contributions to climate change, waste generation, energy use, toxicity, and loss of biodiversity were rated as the most important, though there were differences between sectors; e.g. in the textile sector toxicity of process chemicals was considered more of an issue than compared to other sectors such as construction and woodworking.
- Among many environmental assessment methods currently in use, Life Cycle Assessment (LCA) and LCA-like methods used in Environmental Product Declarations (EPD) were for all sectors considered to be the most important.
- Life Cycle Assessments were judged to be integral, comprehensive, facts-based, and systematic.
- Despite that, many issues with the use of LCA were mentioned:
    - Lack of harmonisation across sectors
    - Inconsistency and lack of background data, data reliability
    - Costly and time consuming
    - Complicated to understand both for professionals and the public
    - Difficult to compare across sectors due to lack of harmonisation
    - Inability to confirm claims by outsiders
    - Unclarity regarding biogenic carbon accounting
    - Too many systems and standards
    - Lack of incentives and or commercial advantage
- According to the stakeholders the potential improvements would be:
    - Harmonisation of the methodology
    - More understandable and comparable LCA results
    - Consistent determination methods and uniform allocation principles
    - Better inventory data
    - Clarity about biogenic carbon sequestration
    - Best practices in assessing biodiversity footprints
    - New generic database models
    - Recommendations on end-of-life models
    - Guidelines and training

<u>From these findings it can be derived that:</u>

- Industrial biobased sectors have significant environmental impacts
- LCA is very important, but there are non-negligible issues with applicability, consistency, methodologies, and costs.
- There is a clearly articulated and widely shared need to improve environmental performance in the sectors and methodological harmonisation of LCA.

Improving methodological harmonisation

In the first half of the project period, the scientific partners in ALIGNED have worked to review, select, improve, and tailor the best available scientific methods within the LCA domain to tackle the challenges listed above regarding the need for better and more aligned assessment, and performed an effort of harmonization of these methods into a common scientific framework.

Main findings from methodological harmonisation

Biobased products are often in early stages of development and the LCAs need to be **projected in the future.** Prospective databases are needed but not easily available and when available only for a limited set of

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modelling choices. Consequential versions of these databases are needed too to serve all users. Tutorials for using prospective databases and customize them have been therefore developed.

Competition for biomass is not considered in current LCAs. Existing consequential methods are fit for this purpose but not specifically tailored to the case of biobased products, and it is unclear how to implement them in practice. Therefore, guides and tools to identify constraints to biomass supply availability have been developed in the project.

Carbon accounting in biobased products is static and does not reflect the dynamic effects of carbon uptake and release over time. Methods for this exist but are not operational or limited to few species. Therefore, a dynamic model for carbon fluxes accounted has been extended to multiple species and validated to be applied in a variety of cases.

Accounting of **climate impacts** also is done in a static way so that time dynamics of carbon uptake, storage, and release are not accounted for. There is inconsistency in how to account for biogenic and fossil carbon that can lead to misleading results. New methods for assessing **biodiversity impacts** are available at experimental level only. Tools for calculating dynamic characterisation factors and guides for accounting biogenic carbon have been provided. Characterisation factors for estimating biodiversity impacts have been made operational for LCA practitioners.

LCAs are models and their results have high **uncertainty and sensitivity** to assumptions. Theoretical approaches for uncertainty and sensitivity analysis are well established but methods for the case of LCA and biobased products are not operational. Therefore, a guide on how to perform these analyses and related tutorials and tools have been developed.

Besides environmental impacts, **economic and social** dimensions need to be accounted to assess the sustainability of biobased products. The science on how to integrate these three dimensions in LCA is not conclusive and several approaches exist. Therefore, the project developed guides and tools to make techno-economic analysis and perform multi-criteria decision analysis on multiple indicators (environmental, social, economic).

It was clear during the project that there is a trade-off between model complexity and accuracy on one hand, and applicability and operability on the other. Therefore, all methods were followed by **"tiered" recommendations** for use by different target audiences. A basic use of the method is guaranteed, that requires limited resources but has however lower accuracy than an advanced use requiring more resources.

It was also clear that **extensive testing** of tools and methods on case studies is needed, which is what the project will focus on in the second half of period by applying all tools **in five industrial case** studies and collecting feedback on the experience.

Overall conclusion is that:

- A vast knowledge base exists in LCA but the bottle neck is applicability of these methods
- Harmonisation and selection of the most scientifically sound methods is a necessary first step
- Methods covering all ISO phases (from goal and scope to interpretation) have been harmonized ensuring that full LCAs of biobased products can be performed in the soundest way
- A tiered approach is useful to ensure applicability for different user types
- Extensive testing on real world case studies improved the relevance of the harmonized methods.

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Policy Implications and Recommendations

The evidence and analysis presented in the previous section underscore critical policy implications and offer actionable recommendations to address the challenges and harness the opportunities identified in the optimization of environmental and socio-economic performance within the bio-based sectors.

Policy implications are:

Recognition and support for efforts of improving environmental performance:
Emphasizes the importance of recognizing and supporting efforts aimed at improving environmental performance within the bio-based sectors. This highlights the need for policy support and investment in initiatives like the ALIGNED project.

Support for alignment efforts:
Advocates for the recognition and support of alignment efforts, alongside and beyond the Product Environmental Footprint (PEF). This highlights the significance of harmonizing methodologies and standards across sectors to promote consistency and comparability in environmental assessments.

Importance of continuous monitoring:
Highlights the importance of continuous monitoring as a means of ensuring the ongoing evaluation and adaptation of environmental assessments. This emphasizes the need for proactive measures to maintain the effectiveness and accuracy of assessment processes over time.

Acknowledgment of interconnection between sectors:
Recognizes the interconnection between various bio-based sectors and emphasizes the importance of acknowledging these interdependencies. This underscores the need for integrated approaches and collaborative efforts to address environmental and socio-economic challenges across sectors.

Policy recommendations will be assessed and improved at a later stage, when the results of the methodology, implementation and the industrial cases will be finalised. Findings from the case studies and further recommendations will be included in the final policy brief.

Research Parameters

This section provides a succinct overview of the ALIGNED project's objectives and methodology, highlighting the key elements that have contributed to the insights and recommendations presented in this policy brief.

Objectives:
The ALIGNED project is driven by three primary objectives:

Improve, Harmonize, and Align LCA Methodology:
Enhance the Life Cycle Assessment (LCA) methodology for the assessment of bio-based industries.
Achieve consistency and alignment across diverse bio-based sectors to ensure comprehensive and comparable results.

Demonstrate Methodology's Power:
Showcase the efficacy of the enhanced methodology in improving the environmental and socio-economic performance of five specific bio-based technologies.

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Provide tangible evidence through real-world case studies in construction, woodworking, textile, pulp and paper, and bio-chemicals.

Inform, Involve, and Empower Stakeholders:
Establish efficient communication channels to inform stakeholders about project advancements.
Foster collaboration with stakeholders, ensuring their active involvement and empowerment in the methodological uptake.

Methodology:
The ALIGNED project employs a robust methodology to achieve its objectives:

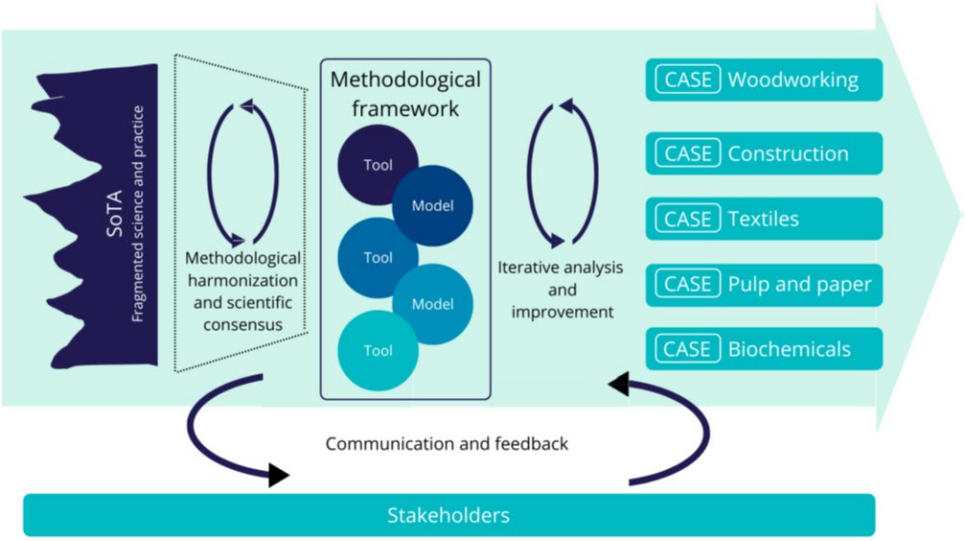

Figure 2 Structure of ALIGNED methodological framework

Based on a review of the State of the Art and selection of most scientifically sound approaches, models, and tools to solve a specific problem in the assessment of bio-based products, the project harmonizes these methods under the same scientific framework, ensuring that they can be used together consistently. Then, the project applies the selected methods to different real-world industrial case studies in five bio-based sectors. This allows to improve the methods, to understand the right balance between complexity and accuracy that ensures optimal decision support, to test operability across sectors, and to obtain shared learnings across sectors on improving the environmental performance of bio-based products. Alongside the process, stakeholders are actively involved in providing feedback to the methodological development as well to the case analysis.

In summary, the ALIGNED project adopts a comprehensive approach, integrating modelling framework development, iterative application in the case studies, stakeholder engagement, and cross-sectoral analyses to achieve its objectives. This methodology forms the foundation for the evidence and analysis presented in this policy brief, providing valuable insights for policymakers seeking to address the challenges and opportunities within the bio-based sectors.

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PROJECT IDENTITY

PROJECT NAME

ALIGNING LIFE CYCLE ASSESSMENT METHODS AND BIO-BASED SECTORS FOR IMPROVED ENVIRONMENTAL PERFORMANCE (ALIGNED)

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October 2022 – September 2025 (36 months)

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WEBSITE

https://alignedproject.eu/

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FOR MORE INFORMATION

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FURTHER READING

1. *The environmental impacts of the lignin-first biorefineries: A consequential life cycle assessment approach:* *https://www.sciencedirect.com/science/article/pii/S0921344924000600?dgcid=author*

2. Can LCA be FAIR? Assessing the status quo and opportunities for FAIR data sharing https://doi.org/10.1007/s11367-024-02280-3

3.

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