SUST CERT 4 BIOBASED
SUSTAINABILITY CERTIFICATION FOR BIOBASED SYSTEMS

D6.9

Concise Glossy Final Report

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ABBREVIATIONS

AHP	Analytical Hierarchy Process
BMT	BIOBASECERT Monitoring Tool
CBA	Cost-benefit analysis
CSA	Coordination and Support Action
CSL	Certification schemes and label
EC	European Commission
EU	European Union
EUBCE	European Biomass Conference & Exhibition
HS/CN	Harmonised System/Combined Nomenclature
NACE	Nomenclature of Economic Activities
NoI	Network of Interest
PRODCOM	"PRODuction COMmunautaire" - Community Production
SDG	Sustainable Development Goal

1. Introduction

1.1 SUSTCERT4BIOBASED Project

A successful transition from linear fossil-based systems to circular biobased systems should secure environmental, social and economic sustainability. To this end, a plethora of sustainability certification schemes and labels (CSLs) have been developed to allow business-to-business traceability and transparency of sustainability impacts along biobased value chains and trades, within the EU and globally, for responsible production and consumption. It is essential that there are ways to evaluate the performance of these tools. This is where SUSTCERT4BIOBASED comes into play!

SUSTCERT4BIOBASED (Sustainability Certification for Biobased Systems) is a 3-year Horizon Europe project which started in June 2022 and ends in May 2025. SUSTCERT4BIOBASED aims to promote the adoption of effective and robust sustainability certification schemes and labels for industrial biobased systems. These ambitions are addressed by a strong consortium covering different disciplines and expertise consisting of:

- Wageningen Research, the coordinator with expertise on sustainability of biobased products;
- CIRCE, a research organisation specialised in sustainable development solutions;
- ECOS, a non-governmental organisation active in standards and policies in environmental topics including the bioeconomy;
- Control Union, a certification body experienced in sustainability certification schemes and their audits on-site; and
- White Research, a consulting agency managing dissemination, communication and exploitation activities.

1.2 BIOBASEDCERT cluster

In order to maximize the project's impact, SUSTCERT4BIOBASED has joined forces with two other projects funded under the same call (HORIZON-CL6-2021-ZEROPOLLUTION-01): STAR4BBS (Sustainability Transition Assessment Rules for Bio-Based Systems) and HARMONITOR (Harmonisation and monitoring platform for certification schemes and labels to advance the sustainability of bio-based systems). Together, these three projects have formed a project cluster named BIOBASEDCERT.

The objectives of the cluster are to:

- Gain a precise picture of existing sustainability CSLs for industrial biobased systems;
- Gather data on global trade flows of biological resources and bio-based materials and products, differentiating between certified and uncertified flows;
- Develop and test a monitoring system to assess the robustness, comprehensiveness and effectiveness of existing sustainability CSLs;
- Assess costs and benefits from the adoption of CSLs in industrial biobased value chains and perform a feasibility study on selected CSLs;
- Develop and disseminate findings and recommendations to promote the adoption of comprehensive, effective and robust sustainability CSLs to different categories of stakeholders.

The cluster works together in the implementation of different joint activities, including the development and implementation of the BIOBASEDCERT Monitoring Tool (BMT).

2. SUSTCERT4BIOBASED Approach

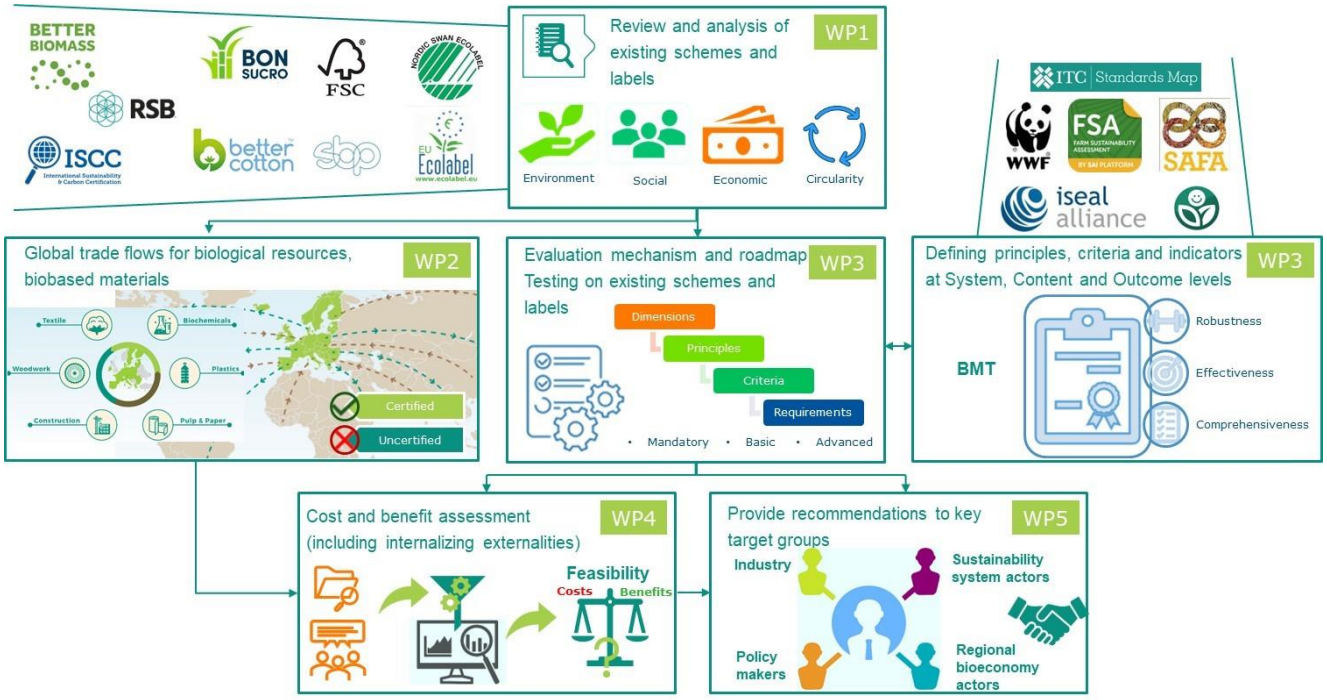

Figure 1: SUSTCERT4BIOBASED approach

The approach of SUSTCERT4BIOBASED is shown in Figure 1, aligned with the objectives of the project and the BIOBASEDCERT cluster (specified above). WP1 aims to classify biological resources and biobased products and perform the identification, review, and analysis of relevant sustainability CSLs. This concerns the certification of biological resources intended for industrial biobased value chains and biobased materials and products, excluding food/feed, biofuels and bioenergy. Hereby, all six industrial sectors pinpointed as prominent sectors in the EC's Bioeconomy Strategy – chemicals, plastics, textiles, pulp and paper, construction, and woodworking – are considered in the project (Figure 2).

Figure 2: Industrial sectors covered by SUSTCERT4BIOBASED

WP2 is dedicated to mapping and evaluating the most representative biobased value chains. It provides collection of data to portray the current situation in terms of global trade flows of selected representative biobased value chains using available international statistical sources. Thereby WP2 provides an understanding of the imports into and exports from the EU and their level of certification.

WP3 is focused on the development of a monitoring system by reviewing and building on existing monitoring/benchmarking tools and guidelines. The developed monitoring system is then tested on selected CSLs, whereby opportunities for improvement for each CSL are identified. As described above, the monitoring system was developed jointly with the sister projects and is called BIOBASEDCERT Monitoring Tool (BMT). The BMT has been developed to assess the robustness, comprehensiveness and effectiveness of CSLs applicable to industrial biobased systems. structured into three levels: system, content, and outcome (see Figure 3). SUSTCERT4BIOBASED led the development of the content level focused on the sustainability requirements of the CSLs.

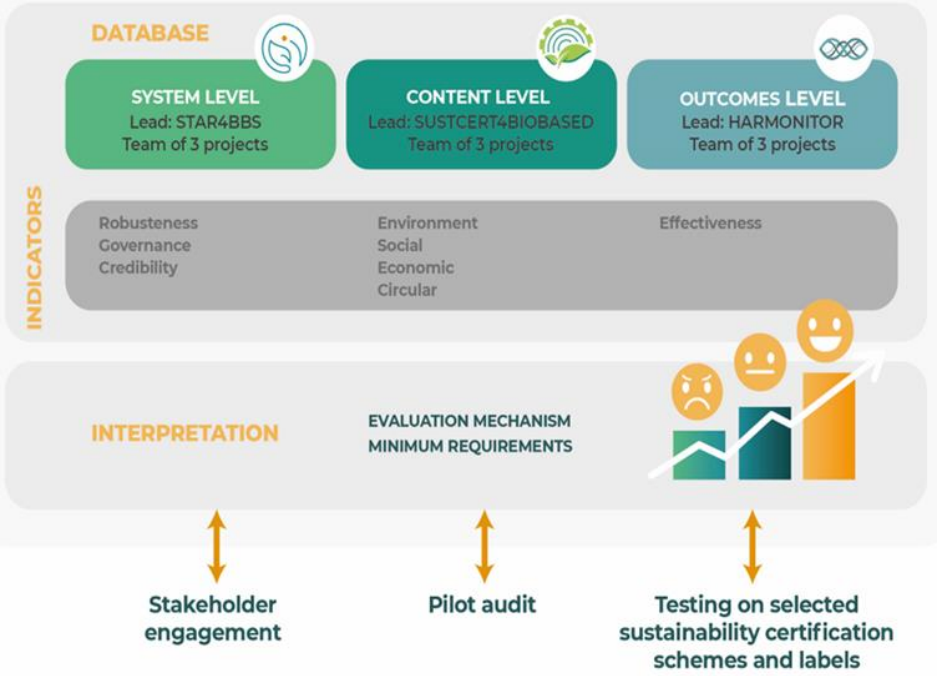

Figure 3. BIOBASEDCERT Monitoring Tool (BMT)

WP4 is focused on the cost and benefit analysis (CBA) of sustainability certification for biobased systems, and includes internalizing of externalities (environmental and social costs and benefits). The developed method is then used in assessing the feasibility of adopting sustainability CSLs in three selected biobased value chains (i.e., sugarcane, cotton, wood).

Subsequently, the results of the project as well as the insights gained along the way are used in deriving recommendations in WP5 for four key target groups: policy makers, sustainability system actors, industrial biobased value chain actors, and regional bioeconomy actors.

3. SUSTCERT4BIOBASED Main Results

The main results of the SUSTCERT4BIOBASED project are listed below:

- Classification of biological resources and biobased products (D1.1)
- Catalogue of sustainability certification schemes and labels for industrial biobased systems (D1.2)
- Identification of the most representative biobased value chains in the EU (D2.1)
- Quantification of global trade flows of selected biobased value chains (D2.2)
- BIOBASEDCERT Monitoring Tool - BMT (D3.3) and testing of the BMT on selected CSLs (D3.2)
- Cost benefit analysis - CBA (including internalizing of externalities) for sustainability certification (D4.1-D4.4)
- Recommendations to targeted stakeholders (D5.1-D5.5)

The main findings for each of these topics is described in the following sections. For more detailed information, readers are encouraged to refer to the associated deliverables (in brackets) that are available online through our Project website: https://sustcert4biobased.eu/resources/deliverables/ and our Zenodo community: https://zenodo.org/communities/sustcert4biobasedproject/records.

3.1 Classification of biological resources and biobased products

To begin with, a classification was made of biological resources intended for EU industrial biobased systems and biobased products (D1.1). This classification served to provide a better understanding of which sustainability CSLs are relevant to these resources and products (see section 3.2).

Regarding classification of biological resources, four main categories were identified (see Table 1):

1. Primary dedicated: Biomass purposively grown as such or which constitutes the primary result of production.
2. Primary residues: Biomass generated as an element of production and/or management but not the main product, e.g., parts of biomass left on the field or in the forest after harvesting.
3. Secondary residues: All forms of biomass that arise from the industrial processing of biomass.
4. Tertiary residues and waste: Sources that have already had a use (post-consumer) and that consist partly or fully of biological material (e.g., organic fraction of municipal solid waste, demolition wood).

Furthermore, the project has identified and classified biobased products according to the six industrial sectors of primary interest to the EU bioeconomy (see Figure 2). The classification includes products that are wholly or partially biobased. To maximise the possibilities of linking with available statistical data, the Statistical classification of economic activities in the European Community, abbreviated as NACE codes were used. Furthermore, the range of biological resources that can be utilised for each product category was analysed. This resulted in 345 product categories, classified according to applicable industrial sector (presented in Annex B of D1.1).

From the analysis, it was derived that different biological resource categories can be used for in different biobased products, spanning different sectors.

Table 1: Classification of biological resources

CATEGORY	TYPE	FEEDSTOCK SUB-CATEGORY	SOURCE	SUB-TYPE FEEDSTOCK	EXAMPLES
Primary dedicated	Plant	Aquatic biomass	Marine	Aquatic plants and macroalgae	Seaweed, duckweed
				Microalgae and cyanobacteria	Spirulina, chlorella
		Lignocellulosic from croplands and grassland	Agriculture	Short rotation coppice (SRC)	Willow, poplar
				Agricultural fibres	Cotton, Flax, Hemp, Jute, Sisal, Coir
				Herbaceous perennials and grasses	Miscanthus, Giant reed, Reed canary grass, Switchgrass
		Lignocellulosic wood/forestry	Forest	Softwood	Pine, Spruce, Fir
				Hardwood	Oak, Birch, Beech
				Cork	Cork (cork oak)
		Oil crops and plants	Agriculture	Oil crops	Soybean, Rapeseed, Sunflower, Canola, Castor beans, Linseed
				Oil plants (fruit, nut)	Coconut, Olive, Jatropha curcas
		Starch crops	Agriculture	Edible grains	Wheat, corn, barley, rye, oat, rice
				Tubers	Potato, Cassava
		Sugar crops	Agriculture	Sugar crops	Sugar cane, sugar beet
		Other primary biomass	Agriculture/ Forest/ Marine	Natural resins	Natural latex (rubber tree), natural dyes, amber
	Animal	Livestock-based biomass	Agriculture	Fibres of animal origin	Wool, silk
		Marine animals	Marine	Fish	Cod, tuna, shark
				Marine arthropods	Crab, shrimp, lobster
	Microbial	Microbial biomass	Industry	Enzymes	Xylanases, amylases, proteases, cellulases
				Bacteria	Nocardioides nitrophenolicus, Rhodococcus opacus
				Protist	Heterotrophic protist
				Fungi	Fungal biomass
Primary residues	Plant	Residues from agriculture	Agriculture	Agricultural field residues	Straw (wheat, rice), Leaves (sugar beet), Stover (corn), Sugarcane trash, Oil palm fronds
		Residues from forestry	Forest	Forest field residues	Logging residues, branches, stumps, foliage, roots
		Residues from nature and landscape management	Urban	Biomass from nature and landscape management	Green biomass (grass clippings), Tree pruning, felling
		Residues from aquatic biomass cultivation	Marine	Residues from aquatic biomass cultivation	Residues from aquatic biomass cultivation
	Animal	Animal-based residues	Agriculture	Animal manure	Dry manure (poultry, sheep & goat, cattle), Wet manure (pig, cattle)
Secondary residues	Plant	Residues from agro-food industry	Industry	Sugar crop processing residues	Sugar beet pulp, Sugarcane bagasse
				Starch crop processing residues	Potato peels, Rice husks, Corn cobs
				Oil crop and plant processing residues	Empty fruit bunch, Mesocarp fibre, Palm kernel shell & meal, Soy hulls, Nut shells, Olive stones
				Other industry resides using agricultural products	Cotton acorn, coffee silverskin
				Residues from fermentation	Distiller`s dried grains with solubles (DDGS)
		Residues from forest-based industry (woodworking, pulp & paper)	Industry	Secondary forestry residues	Sawdust, bark, brown and black liquor, fibre sludge, lignin and tall oil, cutter shavings
	Animal	Residues from fish and arthropods processing	Industry	Secondary marine residues	Arthropods shells, fish scales and bones, muscles and oils
		Residues from meat processing industry	Industry	Animal by-products from slaughterhouses	Bones, skin, animal fat
Tertiary residues and wastes	Mix	Post-consumer wastes / tertiary residues	Urban + Industry	Organic fraction municipal solid waste (MSW)	Food waste, garden waste and other fermentable materials
				Biowaste (separately collected)	Food and kitchen waste from households, restaurants, retail
				Recyclable materials	Textiles and clothing, Paper and cardboard & Plastics
				Used cooking oil	Used cooking oil (from restaurants, households and others)
		Post-consumer and industrial waste wood	Urban	Post-consumer wood	Used furniture
			Industry	Industrial waste wood	Demolition wood, bulk transport packaging
		Sewage and wastewater sludge	Industry	Sewage and wastewater sludge from industry	Industrial wastewater and sludge
			Urban	Sewage and wastewater sludge from municipalities	Sewage sludge and wastewater from municipalities

3.2 Catalogue of sustainability certification schemes and labels for industrial biobased systems

In D1.2, firstly, a collation of sustainability principles and criteria applicable to biological resources and biobased materials and products was made by reviewing relevant EU legislation, certification schemes, and studies in the field of sustainable bioeconomy. Principles and criteria were defined with equal consideration for the three pillars of sustainability: environment, social and economic. Additionally, in order to ensure the contribution of biobased products to a circular economy, circularity was included as a fourth dimension with its own principles and criteria.

Then the project identified CSLs relevant to biological resources and biobased products, producing a long list. This longlist was narrowed down to eleven most relevant CSLs by the application of several selection criteria. Such as exclusion of schemes that focus on one stage of the life cycle

(e.g., end of life), schemes that focus only on one sustainability topic (e.g., climate impact) and schemes that are more specifically developed for food, feed, biofuel or bioenergy applications. The eleven selected CSLs consist of 4 for biobased products and materials (ISCC PLUS, RSB Advanced Products, Better Biomass and Textile Exchange GRS), 4 for biological feedstock (FSC (wood), RSPO (palm), Bonsucro (sugarcane), Better Cotton (cotton)) and 3 ecolabels (EU Ecolabel, Blue Angel, Nordic Swan).

Factsheets were prepared on these eleven shortlisted CSLs for industrial biobased systems. In addition to general information and scope, the factsheets contain information on the governance of the schemes and their sustainability criteria categorized into environmental, circularity, social, and economic dimensions (see Figure 4 for an example section of produced factsheets from D1.2).

D1.2 Catalogue of sustainability certifications schemes and labels, 30/04/2023

6.2 Factsheet RSB Advanced Products

This factsheet aims to provide accessible and factual information on the RSB Global Advanced Products certification scheme. This factsheet presents the actual status of the scheme in March 2023. For more detailed information on the system, the reader may visit the website of the certification scheme or contact the scheme owner.

Disclaimer: The information contained in this factsheet is for informational purpose only and cannot be used in replacement of the official RSB standards and procedures

Table 10 Factsheet RSB Advanced Products

Scheme Feature	Description
General	
Name of scheme	RSB Global Advanced Products Certification
Scheme owner	The Roundtable on Sustainable Biomaterials (RSB) is a global, multi-stakeholder independent organisation. Originally established to ensure the sustainability of biofuels, RSB expanded in 2013 to cover biomaterials and now offers the most comprehensive system for certifying bio-based feedstock. The RSB has members from a worldwide movement of businesses, NGOs, academics, government and UN organisations. For fuel producers, RSB offers RSB Global and RSB EU RED. For biomaterials producers, RSB offers the RSB Advanced Product Standard. For groups of smallholders, RSB offers a Smallholder Standard. RSB's low Indirect Land Use Change (ILUC) Standard is a voluntary addition.
Website	https://www.rsb.org/
Label provided	RSB CERTIFIED 000000/000000/000000 · RSB CERTIFIED 000000/000000/000000 · RSB CERTIFIED
Operational since	2013
Number of active certificates	21 (https://rsb.org/certification/rsb-certificates/, 24 March 2023)
Standard ownership	Private
General objective	Driving the development of the bio economy for a better world through certification, sustainability solutions, innovation and partnerships.
Scope	
Biomass feedstock coverage	Any biobased feedstock. Besides biobased feedstock, scheme also includes as feedstock recycled fossil feedstock and end of life products.
Sector/Product group coverage	Any industrial application. RSB Global Advanced Products Certification enables the certification of non-energy products like plastics, textiles, pharmaceuticals, packaging, tableware, cosmetics, nutritional supplements, food, feed, pulp, paper and many others. RSB Certified Advanced Products are split into 3 distinct categories: Category I: Products that are biobased they need to have a share of bio-based content not less than 25% present in the product; Category II: Products produced with recycled content (non-biogenic end-of-life products or production residues) and Category III: Production systems that process bio-based feedstock or non-bio-based end-of-life products or production residues in combination with virgin fossil feedstocks (either biobased or non-biobased).
Supply chain coverage	Applicable to all elements of the supply chains. Biomass production, feedstock processing, intermediary and final product production
Geographic focus of the standard	Global
Governance, Standard Development and Certification Requirements	
Scheme governance	The RSB members are organised into five Chambers that elect the governing body of the organisation – the Assembly of Delegates. Membership Chambers represent different sectors of business, civil society, trade unions, government, academia and multi-lateral organisations. The five chambers are: 1. Growers & producers, 2. End users, blenders & investors, 3. Social, 4. Environmental, 5. UN, Governments & Research. Each

Figure 4. Excerpt from factsheet prepared for RSB Advanced Products

3.3 Identification of the most representative biobased value chains in the EU

For each of the six industrial sectors of primary interest to the EU bioeconomy (textile, woodworking, plastic, pulp and paper, construction and chemical), three biobased value chains were selected. These eighteen biobased value chains were ranked using a multicriteria decision making methodology based on the analytical hierarchy process (AHP) in D2.1. The value chains were ranked based on environmental, socioeconomic and technical criteria. The environmental criteria utilised included the potential bio-based share of the final product, the estimated percentage share of bio-based products in the market, environmental concerns, and relevance to EU policy priorities. The socioeconomic criteria included market size, market growth, and social concerns. The technical criteria were determined as the innovative character of the value chain, feedstock availability in the

EU, bio-based final product produced in the EU, and the valorisation of residues and waste. Inputs from experts were collected for the valuation of the criteria and sub-criteria. It is important to note that the final ranking depends on the weight of each criterion and sub-criterion, which may vary depending on the goals and priorities of different stakeholders. For each of the sub-criteria, a scale from 1 to 9 was drawn up with a description of what each value means, and through desk research a score has been given to each value chain for each sub-criteria.

Table 2. Top three biobased value chains from the final ranking

Biobased value chain	Subsector	Sector	Final score (0 to 100)
Mulch film - PHA from organic waste	Agriculture	Plastics	89.09
Prefabricated buildings - OSB from wheat straw	Building envelope	Construction	76.75
Adhesives from tall oil	Adhesives	Chemical	76.55

The AHP method has been applied to all the data collected and the final ranking of the chains has been obtained. The 3 biobased value chains that scored the highest are provided in Table 2. The value chains that utilized biomass residues and waste (e.g., organic waste, straw and tall oil) were found to receive a higher ranking. Also, the products that allow for a replacement of current fossil based product were seen to score higher. The textile value chains that relied on conventional production and utilized primary resources were found to score lower (e.g., belting from wool, t-shirts from cotton). This sector can benefit from transition to alternative sources (such as recycled wool, hemp) and new production technologies such as man-made cellulosic fibres (e.g., Lyocell). This ranking can help stakeholders, policymakers, and investors identify promising biobased value chains and make informed decisions regarding investments, policies, and research and development initiatives.

3.4 Quantification of global trade flows of selected biobased value chains

The objective of this empirical analysis was to explore which share of EU imported products within the selected biobased value chains can be labelled as ‘certified’. This type of indicator is considered to be relevant for monitoring the progress of sustainably produced and traded biobased products at a global level. The analysis was conducted for ten biobased value chains. The results with the trade flow data of certified products in these selected value chains is provided in an Excel file which is accompanied by a reading guide (D2.2).

It was possible to approximate the percentage of certified EU imports of raw primary biological resources used in the biobased value chains analysed (dots in Figure 5) via the ITC Standards Map, which covers data on certified land use of a specific raw crop (e.g., sugar cane or cotton) in a specific region. However, when it came to the use of resources from biological residues and waste (like the use of greasy wool or organic waste) evidence on the certified share of these feedstock was hard to get.

Data gaps were observed especially downstream in the biobased value chain concerning certification rates of intermediate and final biobased products produced in the EU or traded between the EU and non-EU regions. There is no annual monitoring of certified production and trade volumes for intermediate and final biobased production at a regional market level and/or sector level, which

hinders the monitoring of the indicator. Certification providers generally only publish lists of companies that have valid, withdrawn or fake certificates without giving insights into the production sizes of the companies or dynamics of the companies that have valid certificates the one year but not the other.

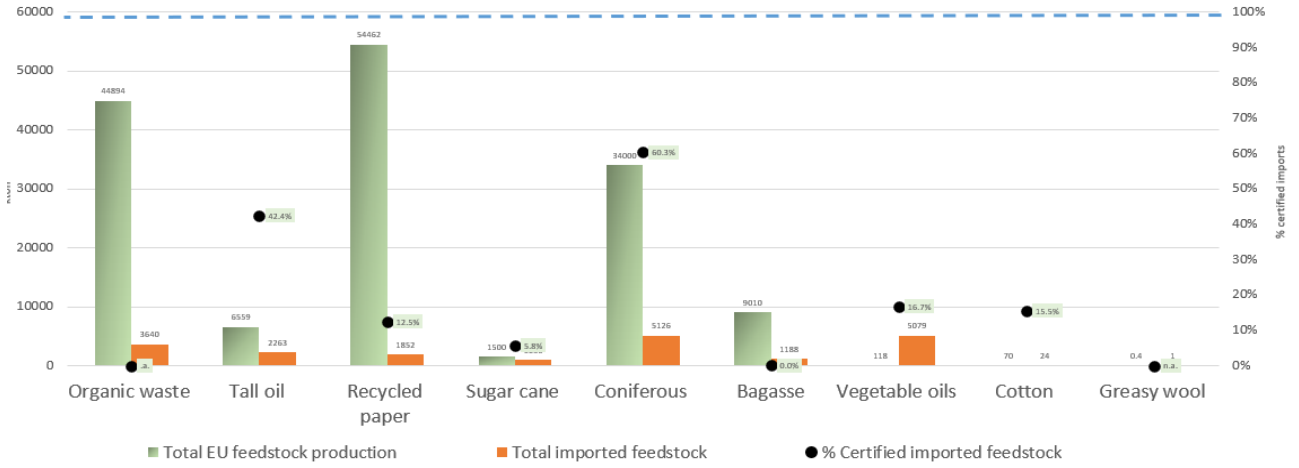

Figure 5: Percentage certified EU imports of biological feedstock in the analysed biobased value chains, 2020

To improve the monitoring of certified trade, it is recommended to make data disclosure mandatory, for example on (certified) biobased intermediate and end products and on (certified) raw material use. To ensure the tracing of new biobased products, it is recommended to assign their own HS/CN product codes. The use of digital tools (e.g., blockchain) could help to enable traceability of production and trade volumes and prices. Consistent reporting by companies and sectors could be encouraged by linking the classification and statistical system to EU policies (e.g., the Green Claims Directive). Also, standardisation of trade and shipping documentation on biobased content and certification status will be an important action. Finally, the collected data is advised to be annually integrated into Eurostat and Comext statistics to build long-term datasets. The cooperation of policy makers with customs and statistical authorities can stimulate the establishment of a robust central EU monitoring system for biomass flows.

3.5 BIOBASEDCERT Monitoring Tool

3.5.1. Development of the BMT

Central to the BIOBASEDCERT cluster's efforts is the development of a monitoring system to assess the robustness, comprehensiveness and effectiveness of existing CSLs for biobased systems. This joint system, called the BIOBASEDCERT Monitoring Tool (BMT), is structured into three levels ((see Figure 3). The system level focuses on CSL system characteristics, such as governance, traceability, and assurance. This level provides an assessment of the robustness of schemes. The content level focuses on the sustainability requirements CSLs set for operators seeking certification. This level provides an assessment of the comprehensiveness of the CSL standards. The outcome level focuses on evidence of the performance and impact generated by the implementation of CSL requirements. This level provides an assessment of CSLs' effectiveness. It is an Excel tool provided as D3.3 together with a report describing the BMT and guidance notes on how to use it.

SUSTCERT4BIOBASED has led the development of the content level while collaborating in the development of the system and outcome levels. The content level is categorized into four dimensions: environmental, circularity, social and economic. Under each dimension, a set of principles (building on the outcome of D1.2, see section 3.2), criteria and requirements are defined.

There is also a high-level requirement demanding CSLs to require operators to comply with laws and regulations. Figure 6 provides an overview of sustainability principles of the content level.

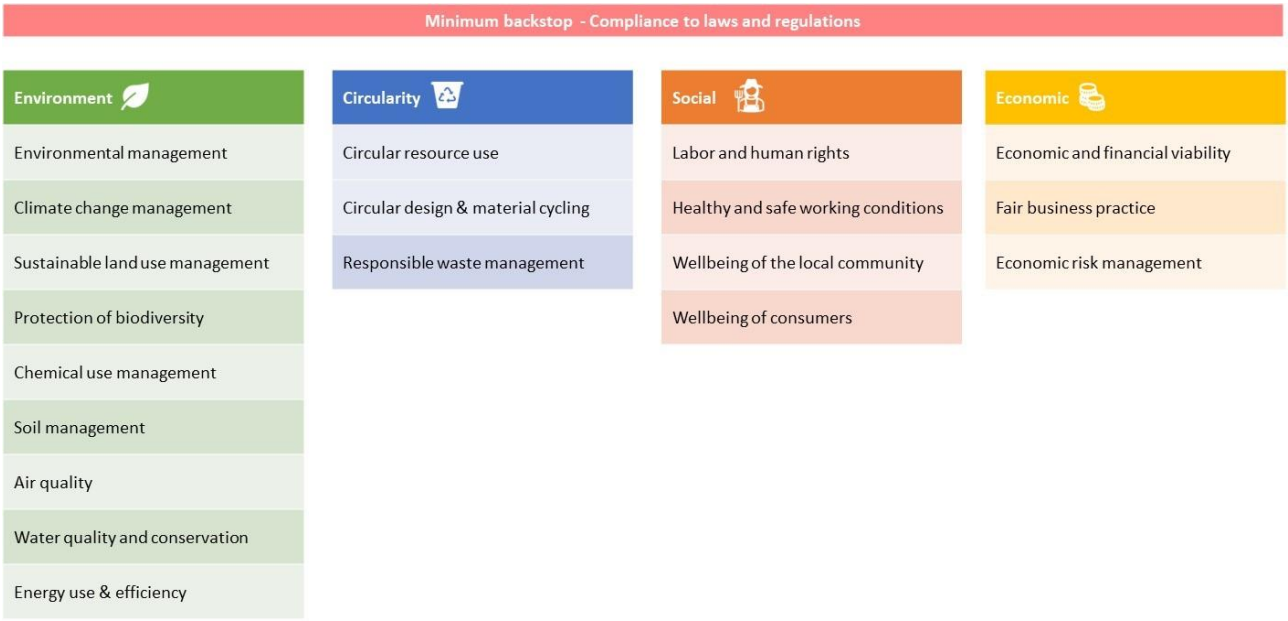

Figure 6: Overview of the content level BMT sustainability principles

Each requirement is assigned one of three levels: mandatory, basic, or advanced. Mandatory requirements are linked to legislation, sustainability protocols and conventions. These are expected to be currently covered by schemes. Basic requirements provide more prescriptive details, and advanced requirements are aspirational requirements that were defined to drive continuous improvement. The results of the assessment are displayed as tables, showing the fraction of applicable requirements covered by the assessed CSL for each level and each principle.

The BMT has been optimised using the feedback from testing on selected CSLs, review by certification body experts, and additional stakeholder engagement. The testing of the BMT on selected CSLs in close collaboration with the CSL owners resulted in collection of feedback on the BMT to finetune the requirements and evaluation mechanism. Consulting experts from a certification body aimed at ensuring a balance between practicality and comprehensiveness of the requirements. Furthermore, by engaging with a range of targeted stakeholders through workshops, bilateral meetings, and a survey, the applicability and acceptance of the BMT is improved.

The BMT aims to provide the EC with a framework to evaluate the potential of CSLs and accompanying standards to contribute to the objectives and sustainability goals prioritised in relevant EU policies and SDGs. Additionally, the BMT supports and incentivizes CSL owners to improve their systems by identifying potential areas for improvement.

3.5.2. Testing of the BMT on selected CSLs

The BMT was tested on selected CSLs for two main purposes: firstly, to gain a better understanding of the coverage of (mandatory) requirements of each assessed CSL and formulate targeted recommendations for improvement, and secondly, to generate feedback for refining the BMT itself.

An iterative approach to testing was used, whereby two testing phases were conducted, each followed by a revision of the BMT based on the generated feedback. In total nine CSLs were assessed against the BMT requirements as listed in Table 3. This selection largely overlaps with the shortlisted CSLs in D1.2. The relevant scheme/label standards were collected and the coverage of the defined BMT requirements were analysed. Draft assessment results were reviewed by the scheme/label owner. The obtained feedback was integrated into the assessment results, resulting

in the final version of the assessment results. The results were analysed and individual recommendations were devised for each CSL based on the BMT requirements identified as not being covered. These are reported in D3.2.

Table 3: Overview of selected CSLs for testing with BMT

Category	Selected scheme/label
1: Sustainability certification schemes for biobased products and materials	ISCC PLUS
	RSB Advanced products
	Better Biomass
2: Sustainability certification schemes specific for biological feedstocks for industrial biobased systems	FSC (wood)
	SBP (wood)
	Bonsucro (sugarcane)
	Better Cotton (cotton)
3: Type 1 Ecolabels	EU Ecolabel
	Nordic Swan Ecolabel

The selected sustainability CSLs have a wide variety of scopes in terms of applicable feedstocks (e.g., forests, crops) and value chain actors (e.g., biomass producer, industrial processor, final product manufacturer). The analysis showed that each CSL has potential room for improvement on varying degrees, which can be explained by differences in scope. The majority of mandatory requirements were covered by most tested CSLs. The coverage of basic requirements varied significantly between the different CSLs, while most advanced requirements were found to be scarcely covered as expected.

Generally, a relatively high coverage of requirements in the social and environmental dimensions was found, and less of a focus on the economic and circularity dimensions. Opportunities for improvement identified include, for the Environmental dimension, the inclusion of more explicit requirements on GHG emission reporting, monitoring air quality, and energy use efficiency and use of renewable energy. Regarding the Social dimension, the CSLs were suggested to consider including explicit requirements on e.g., fair contract practices, the provision of social security benefits, and maternity leave. Concerning the Circularity dimension, it is recommended to consider integrating requirements beyond waste management, such as on the reuse or recycling of residual flows and resource efficiency. Furthermore, for CSLs applicable to biobased products, it is encouraged to also consider including requirements related to the design for high quality recyclability and product-life extension strategies. Finally, related to the Economic dimension, the schemes could potentially benefit from including more specific requirements on business plans, record keeping of fraudulent practices and economic risk management.

3.6 Cost Benefit Analysis (CBA)

SUSTCERT4BIOBASED fills the gap in CBA research by incorporating environmental and social externalities into the CBA methodology to provide an understanding of the true economic feasibility of adopting sustainability certification. This proposed new CBA methodology (see Figure 7) was used in assessing the feasibility of sustainability certification schemes in three biobased value chains (i.e., sugarcane, cotton, wood). Internal and external costs and benefits of certification are considered. Internal costs include costs for compliance, such as training and audit fees, while internal benefits include price premiums and an improved market position. Externalities (environmental and social costs/benefits), which are positive or negative impacts not reflected in transaction prices, are valued using True Cost Accounting. The findings suggest that internal benefits generally outweigh internal costs; however, data limitations have hindered a complete evaluation of externalities. The lack of

data is not only due to the perceived sensitivity of the data thus organisations' reluctance to share it but the fact that measuring these externalities is often not required and therefore not measured. Addressing these data limitations is critical to enhance the accuracy of CBAs for biobased value chains. Further research is needed to better understand the costs and benefits of certification, which calls for standardised reporting requirements on key environmental and social externalities across certification schemes.

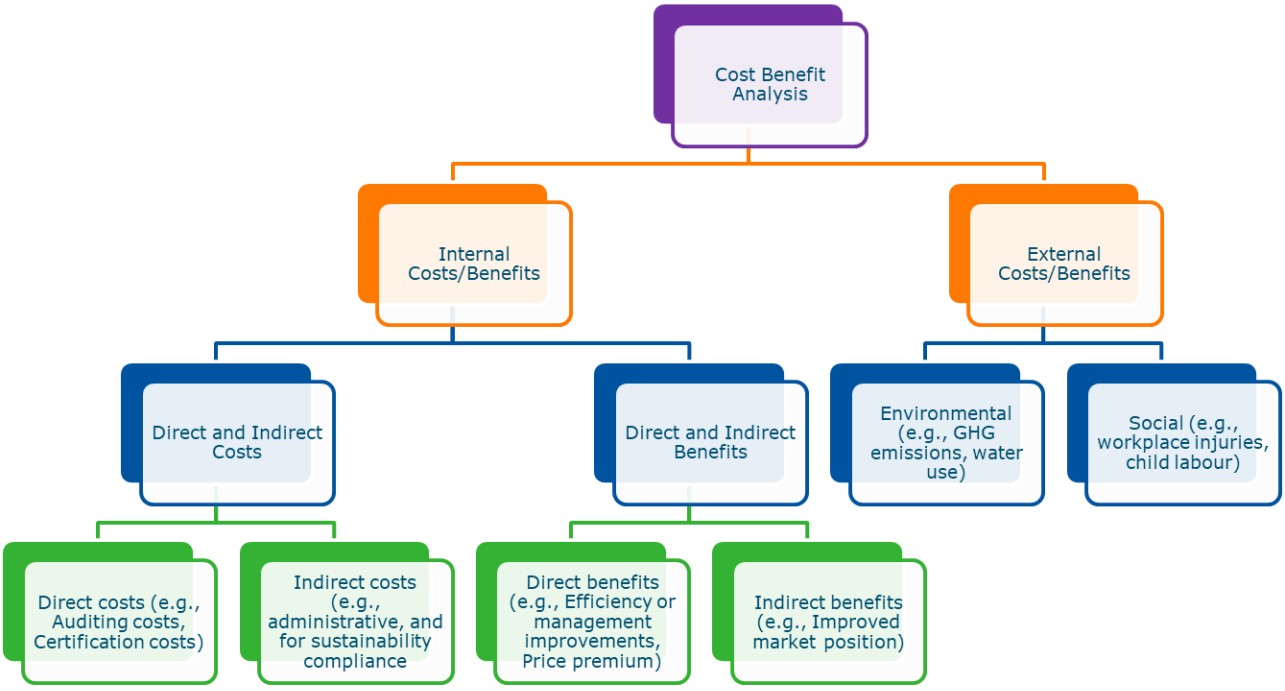

Figure 7: SUSTCERT4BIOBASED Cost benefit analysis approach

3.7 Recommendations to targeted stakeholders

The results of the project were used in deriving recommendations which were reported in thematic briefs and conveyed to the four key target groups (see Figure 8) using a tailored dissemination and communication strategy:

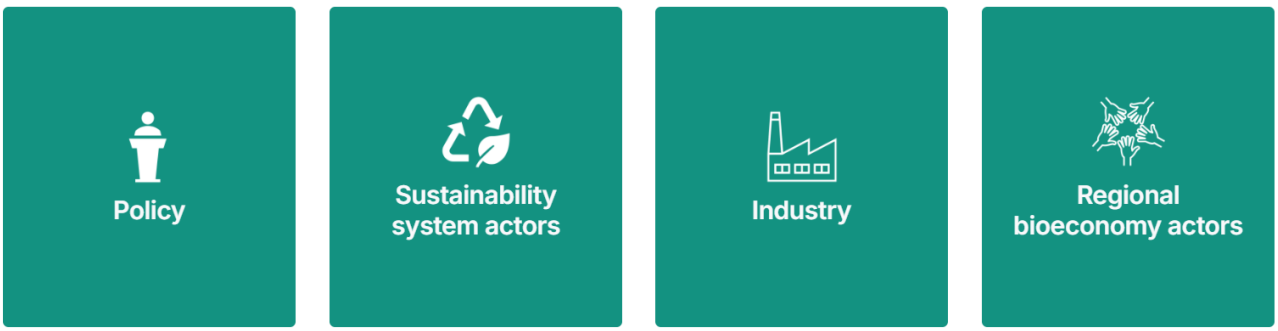

Figure 8. Four key targeted stakeholder groups of the SUSTCERT4BIOBASED project

Policy makers

Through project results policymakers get informed about the current landscape of biobased value chains and level of certification. They can benefit from a monitoring system that can be integrated into policy process to drive the harmonisation of schemes. Two policy briefs (D5.2 and D5.3) were prepared as a cluster summarizing main messages.

Sustainability system actors

Standardization bodies can use the sustainability criteria compiled in content level BMT in incorporating other areas (such as circularity requirements) in future revision of relevant standards (e.g., EN 16751: 2016 Biobased product – Sustainability criteria). Scheme owners can enhance the performance of their schemes/labels by addressing identified opportunities for improvement. The recommendations compiled for these actors are provided in thematic brief as part of D5.4.

Industrial biobased value chain actors

Through project findings, industrial actors, receive clear information about the range sustainability certification schemes and labels available for biobased system and understand the costs and benefits of their adoption. The project also identified technical, administrative, and market-related barriers impeding adoption of certification and derived recommendations to address them. These were described in a dedicated thematic brief, D5.5. By addressing these challenges, EU bio-based industries can not only improve their sustainability credentials and supply chain transparency but also gain competitive advantage.

Regional bioeconomy actors

Regional actors, get insights into more sustainable practices and value of certification which they can adopt into their regional bioeconomy strategies. Embedding robust, credible, and efficient sustainability assurance mechanisms can enhance market access, regulatory alignment, and stakeholder trust. The project analysed the national bioeconomy strategies from five different European counties and defined country specific as well as cross-cutting recommendations in the thematic briefs as part of D5.6.

4. Stakeholder Engagement

A key pillar of SUSTCERT4BIOBASED, under Horizon Europe classified as a Coordination and Support Action (CSA) project, was stakeholder engagement. Our engagement activities mainly focused on raising awareness, fostering collaboration, and disseminating insights across Europe's sustainability certification landscape. A distinction can be made between two main lines of activities, being the SUSTCERT4BIOBASED-specific Network of Interest (NoI), and the organization of strategic engagement events and workshops by the BIOBASEDCERT cluster.

4.1 SUSTCERT4BIOBASED Network of Interest (NoI)

The SUSTCERT4BIOBASED NoI is a vibrant and inclusive community that brings together stakeholders from across industrial biobased value chains and the broader sustainability system community. Its goal is to foster international networking, facilitate dialogue, and promote knowledge exchange among individuals and organizations interested in sustainability certification for biobased systems.

Through bi-annual thematic meetings (see Figure 9), interviews, and invitations to project events, NoI members enriched the project by actively shaping discussions and sharing their expertise. As such, the NoI served as a flexible knowledge pool, contributing to project needs on an ad-hoc basis.

Figure 9: Impression of the Network of Interest (NoI) meeting agendas

4.2 Strategic events and workshops of BIOBASEDCERT cluster

As described earlier, SUSTCERT4BIOBASED joined forces with STAR4BBS and HARMONITOR to form the BIOBASEDCERT cluster. One of the reasons underlying this strategic collaboration is to avoid stakeholder fatigue that may arise from the organization of separate engagements. By collectively giving shape to events and workshops, the cluster managed to maximize its outreach while ensuring efficient coordination.

In total, three engagement events were organized throughout the project's duration: two side events at the EUBCE (in 2023 in Bologna and 2024 in Marseille), and a final event at the premises of the EC in Brussels (2025) (see Figure 10). During these stakeholder engagements, project results were presented and interactions took place in different formats through e.g., panel discussions and involvement of the audience.

Figure 10: Compilation of impressions from the BIOBASEDCERT events

In addition to these annual engagement events, a range of purpose-driven workshops were organized (see Figure 11). These workshops typically focussed on targeted stakeholder groups (as specified in section 3.7), and besides dissemination also aimed at feedback collection and verification of results gathered in WP1-WP5. For example, several multi-stakeholder co-creation workshops were set up throughout the project to support the development and refinement of the BMT, ensuring its relevance to real-world certification needs. In addition, separate national workshops were organized to disseminate and validate the recommendations gathered by the cluster. Additionally, BIOBASEDCERT Roundtable Meetings were held regularly with CSL owners discussing among other things BMT, future perspectives and relevant legislation.

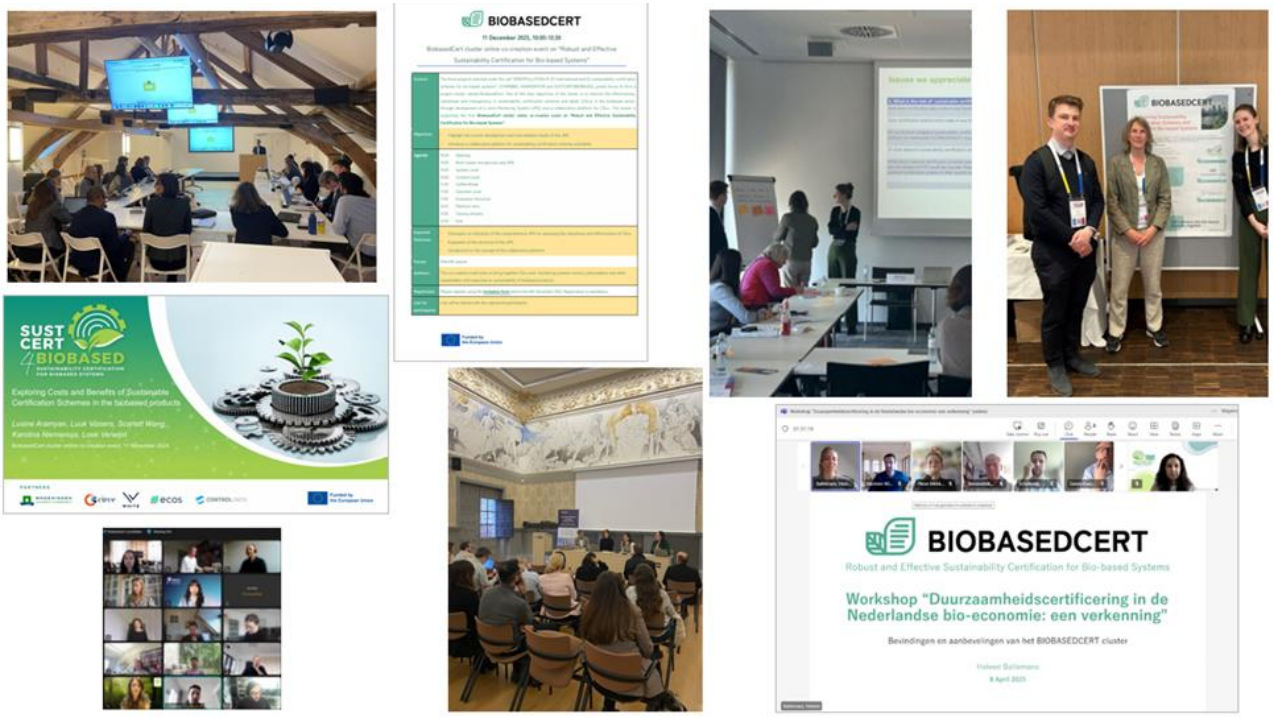

Figure 11: Compilation of impressions from the BIOBASEDCERT workshops and roundtable meetings

5. Impact and Outlook

SUSTCERT4BIOBASED's consortium has successfully raised awareness among the targeted stakeholders through various channels involving physical events, online co-creation workshops, bi-annual network of interest meetings, information provided on project website and social media posts.

SUSTCERT4BIOBASED has generated significant achievements and plethora of data, information, methods and tools that can drive further enhancement of sustainability certification of biobased systems. Moreover, the use and recognition of the BMT by the EC would be a significant step to facilitate the potential harmonisation of existing CSLs. This would pave the way for using CSLs in EU co-regulation frameworks to boost the market of sustainability-certified biobased products

As the transition toward a circular, bio-based economy progresses, the establishment of sustainability criteria for biobased products, that can be defined using the findings of SUSTCERT4BIOBASED, will become increasingly vital. The sustainability and circularity of industrial bio-based systems is instrumental to guarantee that they are developed in a way they can contribute to the just green transition of the EU economy away from a linear fossil-based system.

About SUSTCERT4BIOBASED

SUSTCERT4BIOBASED is an EU funded (Horizon Europe) project aiming at defining and promoting the adoption of effective and robust sustainability certification schemes and business-to-business labels for industrial biobased systems to support tracing the sustainability (environmental, social, economic) of biobased products along the value chains and trades within the EU and globally for responsible production and consumption. This objective is realised by the development of a monitoring system, mapping of the current situation in global trade flows of biological resources and biobased products, and feasibility assessment from the adoption of certification schemes and labels considering actual economic as well as internalized environmental and social costs and benefits. The results of the project are leveraged to provide recommendations to four key target groups: policy makers, sustainability system community, industrial biobased value chain actors, and regional bioeconomy stakeholders. These ambitions are addressed by a strong, well-balanced and multi-disciplinary consortium comprised of 5 complementary partners. SUSTCERT4BIOBASED thereby supports the development of harmonized system requirements, continuous improvement of sustainability certification schemes and labels and contributes towards establishing a circular, climate-neutral and sustainable biobased industry.

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