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Publishable Executive Summary

The BioReCer (Biological Resources Certifications Schemes) project aims to strengthen existing certification schemes for bio-based materials by integrating tailored environmental and traceability guidelines. Deliverable 4.3 outlines the process for integrating the BioReCer environmental and traceability assessment framework into current certification schemes. To achieve this, the deliverable builds on an in-depth analysis of both current standards and voluntary sustainability certification schemes in the agriculture, forestry, fishery, and wastewater sectors. This analysis included mapping, benchmarking and gap assessments to identify improvement opportunities and inform the development of integration guidelines.

The deliverable presents a dual approach for adoption: either by using the BioReCer framework as an additional module (add-on) or by embedding it directly into the structure of existing schemes (add-in). A key outcome is the practical guidance document, designed to support certification bodies and bio-based industries in understanding and applying BioReCer requirements. To test its usability, two pilot audits were conducted in collaboration with ISCC PLUS, applying BioReCer as an add-on. Feedback from these pilots was used to refine the framework and improve the clarity of requirements. To close the loop, also the major standardization gaps and possible solutions were identified. The deliverable also includes concrete integration guidelines for certification scheme owners and outlines the process for adopting BioReCer into their systems.

This work was carried out in close coordination with other work packages. Particularly, Work Package (WP) 2 "Environmental sustainability assessment: Diagnosis and mapping of current indicators and data collection of biological resources" provided the conceptual basis for the framework, WP3 "Product Tacking and Traceability (T&T) for Circular Value Chain Integration" contributed insights on traceability, and WP5 "BIORECER ICT tool" incorporated the requirements and guidance into the Information and Communication Technology (ICT) tool. Finally, the results of this deliverable will be the starting point for WP7 and in particular the D7.3 focused on standardization. The collaborative, bidirectional exchange between these WPs ensured alignment and coherence across the project's technical components.

Structure of the deliverable

This deliverable presents the outcomes of WP4 Task 4.4 “Integration of environmental and traceability assessment framework into a current biological resource’ certification scheme”, which aimed to support the integration of the framework developed in WP2 “Environmental sustainability assessment: Diagnosis and mapping of current indicators and data collection of biological resources” into the existing bio-based certification schemes.

Chapter 1 provides background information and outlines the theoretical context, including previous work within the BioReCer project relevant to this deliverable. It also introduces the two main themes addressed: standardisation and voluntary certification schemes.

Chapter 2 focuses on the mapping of existing standards, with particular attention to CEN/TC 411 and ISO/TC 323. It presents the Standardisation Toolkit developed under this task and includes a preliminary gap analysis based on CEN/TC 411.

Chapter 3 explores current certification schemes and how the BioReCer framework can complement them. It begins with the mapping of existing schemes and includes two benchmarking exercises, followed by a gap analysis to assess alignment and identify missing requirements.

Chapter 4 builds on the findings from previous chapters and describes the development of the BioReCer practical guidance document. It gives an overview of the testing and validation of the BioReCer verification guidance and the audit checklist via pilot assessment. It also provides recommendations for certification scheme owners on how to incorporate the BioReCer framework, either by integrating its requirements directly into the main system requirements as add-in or by adopting it as an additional module to the existing requirements as add-on.

Chapter 5 provides the summary and conclusion of this report.

1. Introduction

1.1. Background and Objective

The increasing use of bio-based feedstocks across industrial sectors has raised the need for clear, reliable, and transparent mechanisms to ensure that these resources are produced and managed sustainably (Majer, et al., 2018). In response to this need, the Biological Resources Certifications Schemes (BioReCer) project aims to strengthen existing certification schemes by integrating tailored environmental and traceability guidelines. This effort seeks to improve the credibility, applicability, and acceptance of certified bio-based materials while supporting a more sustainable and circular bioeconomy.

To achieve the project objective, BioReCer developed a multidimensional assessment framework in deliverable D2.2. *Modified Assessment Methodologies* that provided a theoretical framework with the objective of providing a list of principles, criteria and requirements to evaluate sustainability and circularity that any certification system focused on bio-based products can include. The deliverable D2.3 *Circularity indicators* further provided a comprehensive set of circularity indicators, which encompass the entire life cycle of bio-based products, from raw material extraction to end-of-life (EoL) management, ensuring a holistic approach to circularity assessment. These theoretical frameworks were consolidated and streamlined in deliverable D2.5 *Guidelines for integration to bio-based certification schemes* which presented the final framework for the evaluation of sustainability and circularity of biological feedstocks and integration into certification schemes. The D2.5 therefore, acts as a blueprint for the adaptation of BioReCer framework into existing certification schemes for WP4 *Integration of the environmental and traceability assessment framework into the established certification schemes*.

The objective of WP4 is two folds. First is to establish the BioReCer Innovation Ecosystem Living Lab, a multi-agent platform and the second is to test and evaluate the integration of the assessment framework into bio-based certification schemes. This deliverable D4.3 aims to fulfil the second objective of WP4 by mapping and assessing both existing standards and certification schemes and identifying the potential gaps and improvement opportunities. The findings were considered in the development of the practical guidance for integration of the BioReCer framework as well as development of complementary tools to integrate the BioReCer environmental and traceability assessment framework into current certification schemes.

1.2. Standards and Certification Schemes

This deliverable introduces the two terms “standards” and “certification schemes”. Both play essential and interrelated roles in the context of sustainability assurance. While they support the implementation and verification of best practices across industries, they are often mistakenly seen as having the same function - which is not the case. It is, therefore, important to first distinguish between standards and certification schemes.

Standards are normative documents that define agreed-upon criteria or requirements on specific topics such as environmental performance or traceability and are established by recognized standardization organizations. Standards can be either mandatory, when recognized by the regulation, or voluntary.

In contrast, certification schemes are voluntary systems with specific standards or criteria against which products, services or organizations are assessed. Certification schemes are not legally required but include not only the standards themselves but also the procedures, governance structures, and oversight mechanisms used to assess and recognize compliance (ISEAL alliance, 2023).

While a standard can exist independently, a certification scheme can be operationalized through third-party verification and the issuing of certificates or labels. Certification schemes may also integrate multiple standards or criteria beyond formal standards, such as or industry's managerial or governance requirements. Nevertheless, standards and certification schemes are complementary to each other as standards can provide a technical foundation which, when adopted by certification schemes, can provide measurable basis for assessment.

In case of sustainability of bio-based products, it is crucial to understand the current landscape of the existing standards and certification schemes and identify existing opportunities and gaps. Thus, this deliverable highlights some insights on these aspects.

1.3. State of the art: Standardisation

1.3.1. An overview of the values underpinning standardisation

The comprehensive system of standardisation in Europe is laid down in Regulation (EU) No 1025/2012¹ on European standardisation that provides the rules and procedures necessary to ensure that standards are effective instruments in support of the Single Market and European Union policies. Particularly, Article 2 of Regulation 1025/2012 sets forth the main definitions on standardisation. It defines a standard as:

*"Technical specification, adopted by a **recognised standardisation body**, for repeated or continuous application, with which compliance is **not compulsory**, and which is one of the following:*

- (a) 'International standard' means a standard adopted by an international standardisation body;*
- (b) 'European standard' means a standard adopted by a European standardisation organisation;*
- (c) 'Harmonised standard' means a European standard adopted on the basis of a request made by the Commission for the application of Union harmonisation legislation;*
- (d) 'National standard' means a standard adopted by a national standardisation body"*

This regulatory framework provides uniform standards throughout the EU and thereby enhances standards as strategic instruments for the European Union. From the perspective set out in Regulation 1025/2012, effective and efficient standardisation can only be based

¹ <https://eur-lex.europa.eu/eli/reg/2012/1025/oj/eng>

on a flexible and transparent system for consensus-building between relevant interests, which is sustainable.

The Regulation also sets out the values underpinning the standardisation activities and which are listed in Figure 1 below.



Figure 1 Standardisation values (Source: UNI elaboration from Regulation 1025/2012)

These values ensure that the published standards are able to express the “state of the art” and represent all the interested stakeholders. An in-depth explanation of the actors delivering standards, the different types of standardisation deliverables and the benefits of standardisation for the market are included in D7.3 “Strategic standardization roadmap”.

1.3.2. Standardisation and legislation: an overview

In a report prepared by Dr Gerhard Leibrock of the Standardisation unit of Directorate G – Single market: regulatory environment, standardisation & new approach – of the Enterprise Directorate-General, European Commission², it is clearly stated that standards also play an important role in legislation, in particular in technical regulation. If a legislator includes standards in a legal act, they become a part of the requirements of a specific legislative act (e.g., Empowering Consumer Directive). “The advantages to legislators of making use of standards in legislation are manifold. Instead of being obliged to find solutions for difficult technical questions themselves, legislators can rely on the technical expertise of the technical experts and at the same time save public money. Moreover, thanks to the consensus-based, open and transparent procedure of setting standards and

² “Methods of referencing standards in legislation with an emphasis on European legislation” https://single-market-economy.ec.europa.eu/single-market/goods/european-standards/vademecum-european-standardisation_en

the subsequent broad acceptance of standards, the legislator can expect a broad acceptance of his legislation as well”.

So far, standardisation documents have been described as applied voluntarily on the free choice of the user. However, while these instruments were initially non-binding, they can become binding when incorporated into legal acts. The legislator can indeed choose to make a direct reference to standards or an indirect reference to them.

Direct references to standards: In this case, one or more specific standards are directly included in the legal text. This way, in many cases, a standard is made mandatory.

Indirect references to standards: Conversely, indirect references to standards are generally made where the legislator intends to allow or promote their voluntary use. In this case usually it is established an obligation to comply with general criteria such as "state of the art" or "essential requirements", mentioning standards merely as one possible means of fulfilling these obligations. In this scenario, the requirement is considered met, even if other arrangements are used, as long as they achieve an equivalent level of conformity with the legal requisites.

At the European level, the relationship between standards and legislation is codified in the Harmonized Standards Mechanism of the EU's New Approach. Harmonised standards refer to European standards for which references have been published in the Official Journal of the European Union (OJEU) linked to the relevant legislative act. This indicates that these standards provide a presumption of conformity with the essential requirements of that legislative act. When a manufacturer produces goods in accordance with these harmonized standards, their products benefit from a presumption of conformity with the essential requirements of the relevant Directive (for example the Regulation (EU) 2019/1009 on EU fertilising products serves as a pertinent example). Manufacturers retain the freedom to pursue alternative technical solutions; however, in such cases, they must demonstrate through other means that their products meet the essential requirements of the relevant legislative act.

1.3.3. Standardisation requests and harmonised standards

One of the most important mechanisms that European policies and legislation have used to engage in standardisation is the Standardisation Requests (SReq), i.e. the mechanism by which the European Commission (EC) and the secretariat of the European Free Trade Association (EFTA) ask the European Standardisation Organizations (ESOs), i.e. European Committee for Standardization (CEN), Comité Européen de Normalisation Électrotechnique (CENELEC), and European Telecommunications Standards Institute (ETSI) to develop and implement European standards in support of EU legislative acts.

This mechanism is described in Art.10 of the Regulation 1025/2012 which states:

*“(1) The Commission may within the limitations of the competences laid down in the Treaties, **request** one or several **European standardisation organisations to draft a European standard or European standardisation deliverable within a set deadline.** **European standards and European standardisation deliverables** shall be market-driven, take into account the public interest as well as the policy objectives clearly stated in the Commission’s request and based on consensus. The Commission shall determine the requirements as to the content to be met by the requested document and a deadline for its adoption.*

(6) Where a **harmonised standard** satisfies the requirements which it aims to cover and which are set out in the corresponding Union harmonisation legislation, the Commission shall publish a reference of such harmonised standard without delay in the **Official Journal of the European Union** or by other means in accordance with the conditions laid down in the corresponding act of Union harmonisation legislation."

The mechanism has several steps:

- The European Commission prepares and sends a draft to the relevant ESO. The draft standardisation requests are drawn up by the Commission through a consultation process involving a wide group of interested parties (e.g. social partners, consumers, SMEs, industry associations and EU Member States);
- The relevant ESO examines the draft (with the support of the relevant technical bodies) and sends comments.
- After further inquiry steps with the relevant technical bodies, the CEN and/or CENELEC Technical Board decides on whether to accept the standardisation request and informs the European Commission.
- The mandate is then formalized and the process to develop the standards begins.

Once the ESO accepts the mandate, this is included in its work programme and the relevant technical body/bodies are established or assigned the task. The national delegations, coordinated by National Standardisation Bodies (NSBs), participate in the technical bodies to represent the diversity of interests involved.

The standards developed upon a SReq are referred to as "harmonized standards". Manufacturers, other economic operators, or conformity assessment bodies can use harmonised standards to demonstrate that products, services, or processes comply with relevant EU legislation. The references of harmonised standards must be published in the Official Journal of the European Union (OJEU)³.

This procedure provides for standardisation to stay firmly connected with EU policy objectives, improve legal certainty, and open markets for products and services that are in line with the requirements.

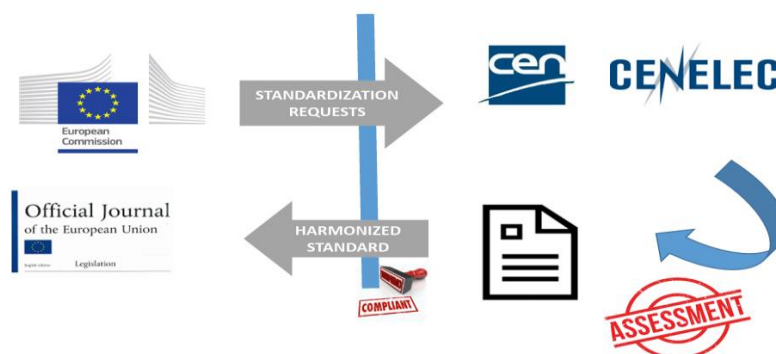


Figure 2 Standardisation requests process: a summary (Source: CEN/CENELEC)

³ https://single-market-economy.ec.europa.eu/single-market/goods/european-standards/harmonised-standards_en

1.3.4. Quality Infrastructure: conformity assessment, accreditation, metrology and standardisation

Quality infrastructure (QI) is the “quality and conformity” system that industrial societies have developed to ensure the appropriate functioning of markets and to protect the consumers and the environment. Quality infrastructure is implemented at national (NQI), European (EQIN), and international (InQI) level.

QI is based on four pillars: standardisation (which has been introduced in the previous section and deepened in D7.3), metrology (which will not be deepened in this section), accreditation, and conformity assessment (CA). In addition, public authorities take care of market surveillance, to ensure that operators comply with existing legal requirements. Thanks to the Quality Infrastructure, market surveillance can focus on the strategic activity of supervising the system and stopping irregularities.

Conformity assessment (CA) and, more particularly, certification is intimately linked to standards. CA includes everything related to confirming that product, system, service or process requirements – as defined, for example, in standards – have been fulfilled. These specifications can include e.g. efficiency, safety, performance, durability, environmental aspects (including emissions, noise) or professional skills and competences.

The third-party certification system has an important function in ensuring transparency and credibility. It also promotes the use of commonly accepted best practices, which can develop and become the “state of the art”, while delivering the objectives of sustainability and circular economy. Validation is normally by methods of examination and/or test with possible surveillance (monitoring to maintain compliance). These procedures are executed by Accredited Conformity Assessment Bodies (CABs).

Accreditation also guarantees the oversight of the CABs through an independent assessment of the CABs’ expertise, impartiality, and trustworthiness. Accreditation according to ISO/IEC 17011, provides a high degree of confidence in certificates of conformity and inspection or calibration reports, and supports the acceptance of certifications on international markets. In the EU, according to Regulation EC 765/2008, each Member State must have a national Accreditation Body which gives legal status to the act of accreditation and makes it an act of public authority. In Italy this is Accredia. The Figure 3 below visually summarizes the Quality Infrastructure.

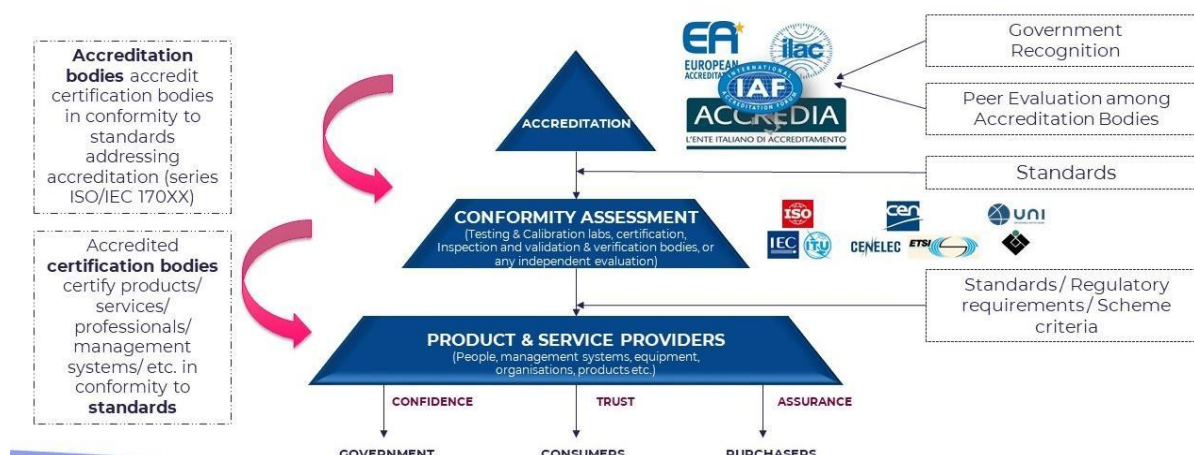


Figure 3 Standardisation, Certification and Accreditation (Source: UNI)

1.4. State of the art: Voluntary certification scheme for bio-based feedstock

Voluntary certification schemes (VCSs) have become essential tools for promoting transparency, sustainability and market credibility within value chains. They offer third-party verification of compliance with environmental, social and economic criteria and are often used to support green claims or meet buyer and regulatory expectations. A VCS usually comprises a scheme owner who develops and maintains the standard, certification bodies which are independent third parties responsible for assessing compliance, and system users such as producers or processors who apply the requirements to gain certification.

Most VCSs are developed by non-state actors, including industry associations, non-governmental organisations (NGOs), and multi-stakeholder platforms. Their credibility is reinforced through clear standards, robust auditing procedures and adherence to conformity assessment principles, which are often overseen by accreditation bodies. International organisations such as International Social and Environmental Accreditation and Labelling Alliance (ISEAL) promote good practices and principles for assurance systems to further support credibility (ISEAL alliance, 2023).

Over the past two decades, the role of voluntary certification in bio-based sectors has expanded in response to growing market demand for verified sustainability claims and evolving EU and international policy frameworks. Early schemes often targeted single commodities, but market and regulatory pressures have driven a shift towards multi-criteria approaches that address environmental, social, and economic dimensions simultaneously (Marx, van der Loo, & van den Broeck, 2024). This evolution reflects the increasing importance of aligning certification systems with broader sustainability agendas such as the EU Green Deal and the Circular Economy Action Plan (European Commission, 2020).

The coexistence of multiple certification schemes can place a significant burden on companies, particularly small and medium-sized enterprises, due to the need to navigate divergent and sometimes conflicting requirements (Jellema, Werner, Rasche, & Cornelissen, 2022). Interoperability between schemes through shared definitions, harmonised indicators, and mutual recognition agreements is becoming increasingly relevant to reduce administrative burdens and improve market acceptance (ISEAL Alliance, 2018).

VCSs are playing an increasing role in supporting sustainability and market trust for bio-based products. However, their focus and scope can vary significantly across sectors such as agriculture, forestry, fisheries, and wastewater. In addition to these sectoral differences, there are also gaps related to the completeness of existing criteria sets, the practical implementation of these criteria in certification processes and the alignment with evolving legislative frameworks (Götz, 2018). These factors can limit the consistency and comparability of sustainability claims across bio-based value chains.

The BioReCer framework is designed to act as a complementary add-on or add-in, enabling existing certification schemes to incorporate harmonised criteria and indicators that support a more consistent, cross-sectoral approach to sustainability and circularity in bio-based value chains.

1.5. Synergies between different work packages (WPs)

Overall, deliverable D4.3 outlines how the BioReCer framework can be adapted and integrated into existing certification schemes by combining benchmarking results with practical verification methods. The deliverable draws on contributions from and contributes to several WPs within the BioReCer project, particularly WP2 WP3, WP5, WP6 and WP7.

WP2 developed the conceptual basis of the BioReCer integrated framework, defining its pillars, principles, criteria, and requirements for assessing sustainability and circularity in bio-based value chains. This framework was refined through ongoing feedback with WP4, especially informed by benchmarking and gap analysis of existing certification schemes. WP4 then translated the framework into practical guidance and verification tools to support its implementation within existing certification processes.

WP4 also contributed to the design of the traceability system developed in WP3 by providing input from the traceability benchmark. This helped ensure consistency with existing standards. WP5 incorporated the framework's requirements and guidance into a digital format via the ICT tool, where the verification guidance contributed to the design of self-evaluation tool i.e. Decision Support System (DSS) and audit functionalities.

The pilot assessment carried out for the testing of the BioReCer framework and verification guidance also contributes to WP6 for demonstration and validation of the developed methodologies on the case studies.

Finally, the results of this deliverable will be the starting point for WP7 and in particular the D7.3 *Strategic standardization roadmap* focused on standardization. Also, the practical guidance document, which is a key result of WP4 will contribute to the exploitable plan produced by WP7.

2. Standards

This section presents the results of a mapping of the main standards and technical committees relevant to the BioReCer project. To facilitate understanding of the terminology and content of this mapping, key concepts related to the field of standardisation are briefly described first. The ultimate aim of this research activity is to provide an overview of ongoing developments and to identify gaps in the standardisation landscape, with the objective of improving circularity in the bio-based sector.

2.1. Standards mapping: Methodology

Previous experience in research and innovation projects and extensive knowledge of the world of standardisation have clearly highlighted the difficulty many market operators have in finding the standardisation document that suits their needs (e.g. Life Cycle Cost methodology; standards for bioproducts, circular economy references etc.).

This is understandable, as most aspects of economic and social activities can be covered by standards. However, even if what you are looking for is likely to be available in a standardisation deliverable, finding the right one is not always an easy task. This is due to the complexity of technical documents, the large number of standards available, and the fact that online semantic searches are not sufficiently effective. Standards are indeed protected by copyright and the semantic search only attains to titles and scopes.

In this context, the BioReCer project mapped the most relevant national, European, and international standards considered potentially applicable to its activities. This mapping provides project partners and stakeholders with a one-stop reference for identifying existing standards across the selected areas. Figure 4 below summarises the steps followed to carry out the mapping.



Figure 4 Standard mapping methodology

To ensure efficiency and avoid duplication of effort, the process began with the existing baseline. The baseline was defined by the Grant Agreement, with a focus on the objectives to be achieved in relation to the activities of the BioReCer consortium. The second step extended the mapping to cross-cutting topics. In particular, the UNI and ISO databases were analysed to include circular economy strategies and environmental management standards. UNI also verified the standards identified for the Horizon 2020 CircThread (GA 958448) and Horizon Europe Star4bbs (GA 101060588) projects, considered as twin initiatives.

After consolidating the baseline and incorporating relevant results from sister projects, standards already identified as pertinent within other BioReCer activities (notably WP2) were also included. A series of additional activities were then carried out under Task 4.4.1 (Mapping of standards and gap analysis), which involved identifying standards relevant to the project's technical research activities. Partner input was requested during this stage, and the preliminary list of standards was presented for review. A similar approach was applied to the certification schemes identified.

The outcome of this process is a list of 166 standardisation deliverables and 17 certification schemes (55 documents). For each of these, the following data were compiled: reference code, retrieval link, title, year of publication, scope (summary of the content), and, in the case of standards, the responsible International/European/National Technical Committee, together with its status (current or work in progress).

All the standards were reclassified by "AREA", according to the ones described in Table 1 below. Also, to each document several keywords were assigned based on the content of the document as emerging from the scope and the title. Areas and keywords have been conceived as a user-friendly tool to support the stakeholders to narrow down the search for documents.

Table 1 Standards and certification schemes mapping areas

Area	Definition
Product use	Activity that the user may perform with or on the product during its whole life cycle. Use covers the intended use and the reasonably foreseeable misuse in normal and reasonably foreseeable conditions of use. [Source: ISO 10209:2022(en), 3.14.45]
Recycling	Any recovery operation by which waste materials are reprocessed into products, materials, or substances whether for the original or other purposes [Source: ISO/TS 21929-2:2015(en), 3.33]
Traceability systems	Ability to trace the origin, processing history, application, distribution or place of materials or products under consideration [Source: ISO 23664:2021(en), 3.22]
Circular Economy strategy	Circular Economy (CE) = economy that is restorative and regenerative by design, and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles [Source: Adapted from Ellen MacArthur Foundation [24] - ISO 20400:2017(en), 3.1] CE strategy = organisation's approach to achieve circular economy goals
Data Exchange Format	Template/format which presents standardised and trustworthy information on the circularity aspects of a product [Source: ISO/TS 13399-70:2016(en), 2.8]

Integrated environmental and traceability assessment framework into certification schemes

Area	Definition
Environmental management	Environmental management (system) = part of the management system (3.1.1) used to manage environmental aspects (3.2.2), fulfil compliance obligations (3.2.9), and address risks and opportunities (3.2.11) [Source: ISO 14001:2015(en), 3.1.2]
Security, privacy and ethics	Security = any of a variety of procedures used to ensure that information exchange is guarded to prevent disclosure to unauthorised individuals. Security measures are intended to prevent disclosure of sensitive information even to those who have valid access to the communication network. Privacy = right of individuals to control or influence what information related to them may be collected and stored and by whom that information may be disclosed [Source: ISO/IEC TR 26927:2011, 3.34] Ethics = code of ethics standard: standard that describes the characteristics of a set of moral principles dealing with accepted standards of conduct by, within, and among professionals [Source: ISO/IEC/IEEE 24765:2017(en), 3.619]
Decision support framework	Includes tools and standards that help the different actors in making decisions (including communication).
Bioeconomy	The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources, i.e. agriculture, forestry, fisheries and aquaculture; and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services. It cuts across these sectors and systems, interlinking them and creating synergies. [Source: European Commission] Biodegradability = susceptibility of an organic substance to biodegradation [Source: ISO 6107:2021(en), 3.68]
Design	Design (and development) = process (3.5.5) that transforms requirements (3.5.7) into a solution (3.2.1) Note 1 to entry: Design and development usually follow a series of steps, i.e. starting with an initial idea, transforming the idea into a formal specification, through to the creation of a solution, its potential redesign and consideration of end of life (3.5.30, 3.5.31). Note 2 to entry: Design and development can include taking a solution idea from planning to provision and review of the solution. It can include considerations on business strategies, marketing, research methods and design aspects that are used. It includes improvements or modifications of existing solutions. [Source: ISO 14006:2020, 3.2.1, modified — “solution” replaced all occurrences of

Area	Definition
	"product" in the Notes to entry]
Manufacturing	Process of production from the acquisition of all materials through all processing stages, including final packaging. [Source: ISO/TS 16791:2020(en), 3.1.17]
Food Safety	Concept that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use. [Source: ISO 22000:2005, 3.1]

2.2. Standardisation mapping results in numbers

As mentioned, all these steps resulted in 166 standardisation deliverables that were mapped across the 12 AREAS, of which 95% are currently in place. Figure 5 briefly shows an overview of the mapped standards, while the full list is available through the Standardisation Toolkit.

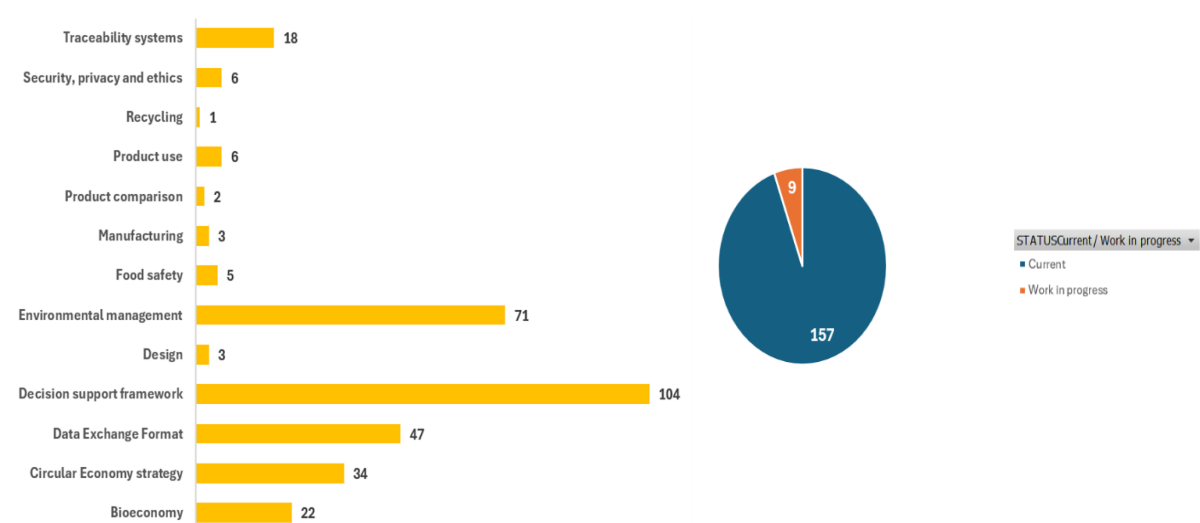


Figure 5 Standardisation deliverables mapped across 12 Areas

2.3. Technical Committees: a mapping

Via the standards mapping, several European and International Technical Committee (TC) developing the standards relevant for the project were also identified as listed in Table 2. This is an important information in order to spot relevant standardisation stakeholders and technical experts to network with and facilitate the transfer of BioReCer results to future standardisation activities.

Table 2 European and International technical Committees: most relevant results from the standardisation mapping

Technical Committee (TC)	Level
CEN/TC 411 Bio-based products	European
CEN/TC 249 – Plastics	European
CEN/CLC/JTC 10 Energy-related products - Material Efficiency Aspects for Ecodesign	European
CEN/CLC/JTC 1 Criteria for conformity assessment bodies	European
CEN/SS C01 Food Products	European
CEN/SS S26 Environmental management	European
CEN/SS S29 Social responsibility	European
CEN/TC 230 Water analysis	European
CEN/TC 248 Textiles and textile products	European
CEN/TC 261 Packaging	European
CEN/TC 320 Transport - Logistics and services	European
ETSI ISG CIM ⁴	European
ETSI TC DATA ⁵	European
ISO/TC 323 Circular economy	International
ISO/CASCO Committee on conformity assessment	International

⁴ Developing the relevant documents ETSI GS CIM 009 - NGSI-LD API and the ETSI GS CIM 006 - NGSI-LD Information Model.

⁵ Founded in 2025, it will take over all ETSI ISG CIM activities and will produce NGSI-LD TS (Technical Specifications) from now on.

Technical Committee (TC)	Level
ISO/IEC JTC 1 Information technology	International
ISO/TC 147 Water quality	International
ISO/TC 176 Quality management and quality assurance	International
ISO/TC 207 Environmental management	International
ISO/TC 282 Water reuse	International
ISO/TC 34/SC 17 Management systems for food safety	International
ISO/TC 61 Plastics	International

The following sub-sections will focus on two technical committees among the mapped ones that are most relevant for the BioReCer project: CEN/TC 411 “Bio-based products” and ISO/TC 323 “Circular economy”. The ETSI Committees ISG CIM and TC Data are not discussed further in that report as they are extensively presented in BIORECER WP5 deliverable where the BIORECER IT Tool (BIT) develops NGSI-LD data model for products processing and KPI information exchange in the BIT platform.

2.3.1. Focus (A) CEN/TC 411 - Bio-based products

CEN/TC 411 is the CEN Technical Committee on Bio-based products that was set up by NEN, the Dutch National Standards Body, in May 2011.

The main scope of TC 411 is to develop standards for bio-based products covering horizontal aspects. This includes consistent terminology, sampling, certification tools, bio-based content, application of and correlation towards life cycle analysis, sustainability criteria for biomass used and for final products, and aspects where further harmonisation is needed on a horizontal level. At the beginning of its activity, the TC also developed standards for bio-solvents, covering product functionality, biodegradability and other product specific aspects.

In September 2024, the Swedish Standardisation Body (SIS) took over the secretariat of the TC and its Working Groups. The committee is composed of a wide and experienced international representative coming from every European country and from various European associations and institutions ensuring that the standards address diverse stakeholder needs.

CEN/TC 411 carries out its activities through four dedicated working groups, each focusing on specific aspects as shown in Table 3.

Table 3 CEN/TC 411 structure

Working Group (WG)	Focus area
WG 1	Terminology
WG 3	Bio-based content
WG 4	Sustainability criteria, life cycle analysis and related issues
WG 5	Certification and declaration tools

These groups develop standards and technical reports that provide guidance, methodologies, and best practices ensuring comprehensive coverage of bio-based products in key dimensions.

Recent developments and ongoing work

The TC current business plan is dated back in 2018, and, due to recent technical developments and market strategies to reach European climate objectives, it needs to be updated and prioritised. For the time being there is only one ongoing project, under WG 3, for determining the bio-based carbon content (prEN 16640 Bio-based products - Bio-based carbon content - Determination of the bio-based carbon content using the radiocarbon method) but it is foreseen a well-structured work program after the revision of the TC business plan.

Table 4 CEN/TC 411 standards

Deliverable	Scope	WG	Publication
EN 16575	Bio-based products - Vocabulary	WG 1	2014
EN 16766	Bio-based solvents - Requirements and test methods	WG 2	2017
CEN/TR 16721	Bio-based products - Overview of methods to determine the bio-based content	WG 3	2014
EN 16785-1	Bio-based products - Bio-based content - Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis	WG 3	2015
EN 16640	Bio-based products - Bio-based carbon content - Determination of the bio-based carbon content using the	WG 3	2017

Deliverable	Scope	WG	Publication
	radiocarbon method		
EN 16785-2	Bio-based products - Bio-based content - Part 2: Determination of the bio-based content using the material balance method	WG 3	2018
EN 17351	Bio-based products - Determination of the oxygen content using an elemental analyzer	WG 3	2020
EN 16751	Bio-based products - Sustainability criteria	WG 4	2016
EN 16760	Bio-based products - Life Cycle Assessment	WG 4	2015
CEN/TR 16957	Bio-based products - Guidelines for Life Cycle Inventory (LCI) for the End-of-life phase	WG 4	2016
CEN/TR 17341	Bio-based products - Examples of reporting on sustainability criteria	WG 4	2019
EN 18027	Bio-based products - Life cycle assessment - Additional requirements and guidelines for comparing the life cycles of bio-based products with their fossil-based equivalents	WG 4	2025
EN 16848	Bio-based products - Requirements for Business-to-Business communication of characteristics using a Data Sheet	WG 5	2016
EN 16935	Bio-based products - Requirements for Business-to-Consumer communication and claims	WG 5	2017
CEN/TR 17674	Bio-based products - Use of stable isotope ratios of Carbon, Hydrogen, Oxygen and Nitrogen as tools for verification of the origin of bio-based feedstock and characteristics of production processes - Overview of relevant existing applications	TC	2021

2.3.2. Focus (B) ISO/TC 323 – Circular Economy

ISO/TC 323 is the ISO technical committee on Circular Economy that was set up by Association Française de Normalisation (AFNOR), the French NSB member to ISO, in September 2018. Its aim is to contribute to international standards that support transformation towards a circular economy and enable sustainability, resource efficiency and economic development in the long run. Develop common frameworks, definitions and methodologies, to permit companies in all business sectors and countries to implement circularity effectively, promoting global alignment and co-operation.

The committee is composed to obtain a wide international representation and experience.



Figure 6 ISO/TC 323 Participants (Source:ISO)

The ISO/TC 323 counts:⁶

- 79 Countries Participating members
- 24 Countries Observing Members
- 20 liaison bodies, such as industry associations, NGOs and international institutions (e.g. United Nations Economic Commission for Europe (UNECE)) that contribute to the discussions and ensure that the standards address diverse stakeholder needs.

National experts from the participating countries, are nominated by their NSBs. These experts represent diverse sectors, and are grouped in the ISO stakeholder categories i.e. industry, government, consumers, academia, etc.



Figure 7 ISO/TC 323 liaison members

⁶ Data as of July 4th, 2025

ISO/TC 323 carries out its activities through dedicated working groups (Table 5), each focusing on specific aspects of the circular economy:

Table 5 ISO/TC 323 structure

Working Group	Focus area
ISO/TC 323/AG	Communication
ISO/TC 323/AHG 1	Survey
ISO/TC 323/CAG	Chair's Advisory Group
ISO/TC 323/STTF	Spanish Translation Task Force
ISO/TC 323/WG 2	Practical approaches to develop and implement Circular Economy
ISO/TC 207/SC 5/JWG 14	Joint ISO/TC 207/SC 5 - ISO/TC 323 WG: Secondary materials

These groups develop standards and technical reports that provide guidance, methodologies, and best practices, ensuring comprehensive coverage of the circular economy's key dimensions.

In 2024, the work of ISO/TC 323 took an important step forward in the development of international standards on which to base the circular economy. Table 6 shows the standards published.

Table 6 ISO/TC 323 standards

Standard Reference	Title	Planned date
ISO 59004:2024	Circular economy — Vocabulary, principles and guidance for implementation	May 2024
ISO 59010:2024	Circular economy — Guidance on the transition of business models and value networks	May 2024
ISO 59020:2024	Circular economy — Measuring and assessing circularity performance	May 2024
ISO/TR 59032:2024	Circular economy — Review of existing value networks	May 2024
ISO 59040:2025	Circular economy — Product circularity data sheet	May 2024

2.2. Standardisation Toolkit

The BioReCer Standardisation Toolkit, developed with PowerBI, is an extensive open online research tool developed within the project for professionals in the bio-based industry. As an interactive dashboard, it enables easy access to key information on standards and certification schemes, which are essential to sustainability, circular economy strategies and traceability of bio-based data.

The toolkit comprises two dashboards, both serving their own purpose, but together providing a coherent picture of the standardisation and certification schemes landscape in relation to bio-based products and processes.

The toolkit is freely available on the project website: <https://biorecer.eu/standardisation-toolkit/>

2.2.1. Standards Dashboard

The first dashboard of the toolkit is the Standards Dashboard that consists of a selection of 166 standards at the national (UNI), European (EN) and international (ISO) levels. These standards address a variety of subjects of importance to the bio-based industry, such as:

- Biodegradable plastics
- Bioeconomy frameworks
- Environmental management systems
- Circular economy approaches
- Data exchange formats
- Traceability systems

Most of the standards that have been mapped are current, so offer considerable grounding in best practice in areas like recycling, environmental protection and sustainable product design. This map provides an understandable and accessible lay of the land of the standards landscape that is necessary for the bioeconomy and environmental governance.

2.2.2. Certification Schemes Dashboard

The second dashboard of the toolkit is the Certification Schemes Dashboard, featuring information on the 17 certification schemes mapped and analysed in WP2 and WP4. These certification schemes address critical areas such as:

- Environmental management
- Waste
- Bioeconomy
- Chain of Custody
- Sectors- forest, agriculture, fisheries and aquaculture, sewage sludge

For each document, the toolkit presents its scope and link to retrieve the relevant document (as of 10 June 2025), to facilitate a deeper analysis. This approach helps professionals easily identify the most pertinent certifications, thus saving time.

2.2.3. Validation efforts

The preliminary standards mapping underpinning the Standardisation Toolkit has been published on Zenodo ([10.5281/zenodo.11618893](https://zenodo.org/record/11618893)) in June 2024 in order to disseminate the mapping and gather possible comments. Since then, 73 views have been registered and 17 downloads.

Before the official release, the Toolkit has also been shown to technical experts and BioReCer stakeholder community in several situations, to gather their feedback. To mention the main events and meetings:

- BioReCer online Annual Stakeholder Event, on November 27th, 2024
- Workshop Sustainable places 2024
- Strengthening of institutional as well as human capacities of Georgian National Agency for Standards and Metrology (GEOSTM) according to the international/EU best practices meeting UNI / GEOSTM (Georgia Standards Body), on July 11th, 2024
- CEN/TC 289 "Leather" Plenary meeting, October 10th, 2024.

After its release, the toolkit has been presented during the CEN/TC 411 "Bio-based products" plenary meeting held in Stockholm on March 19th, 2025. Important feedback (on existing relevant standards) has been received and incorporated in the current version of the toolkit.

Finally, to ensure a constant contact point for the users, in the dashboard it has been included an email address and a few minutes anonymous [satisfaction survey](#).

For any comment, please email sviluppo.progetti@uni.com

Your opinion matters!

<https://www.surveymonkey.com/r/BIORECERStdToolkit>



**Funded by
the European Union**

Figure 7 Standardisation toolkit: contacts and survey.

In particular, the survey asks users to rate their experience according to how easy it is in swiping through the toolkit web pages; ease of navigation to find data; ease of familiarisation with the toolkit as a first-time user; understanding of the information once found.

The BioReCer Standardisation Toolkit offers a range of advanced features:

- **Wide range of content:** standards and certification schemes relevant to circular economy strategies, bio-products, environmental management, recycling, product use, product comparison, and traceability systems.

- **Immediate access to catalogues:** integrated hyperlinks to allow users to easily search and consult in-depth documentation, so that professionals can access them easily.
- **Keywords:** each standard and certification scheme is mapped to specific keywords, which facilitates searching and allows users to easily find relevant references.
- **Intuitive interaction:** the toolkit's simple layout allows users to navigate easily and focus on the standards and certification schemes most relevant to their processes.

By providing a centralised webpage to explore both standards and certification schemes, the toolkit serves as a critical enabler for adopting best practices and enhancing sustainability performance in bio-based projects. It empowers organisations to find the right reference for their needs, thus fostering innovation, improving market acceptance, and contributing to a resilient circular economy.

2.3. Gap assessment: a preliminary analysis

The bio-based sector is pivotal in transitioning towards a sustainable and circular economy. In 2011, the European Commission acknowledged that “regarding bio-based products standards are seen as essential elements in aggregating initial demand, in particular for new bio-based products”.⁷ Standardisation and certification are indeed essential tools to ensure sustainability, traceability, and quality of bio-based products; and, not less importantly, reliability of data and consequently of the communication both at B2C and B2B level.

As identified in the standards mapping, the relevant European technical committee developing horizontal standards for the bio-based products is the CEN/TC 411 “Bio-based products”. Back in 2011 indeed (through the mandate M/492 EN), the European Commission invited CEN to establish this technical committee.

The mandate foresaw the development of a standard to have a consistent terminology for bio-based products (EN 16575:2014). And, as reported in the mandate M/492 EN, the development of a single standard with several parts for bio-based products covering horizontal aspects like sampling, bio-based content, application of and correlation towards Life Cycle Assessment, sustainability of biomass used and a certification scheme for bio-based products, identifying which characteristics can/should be assessed and how they should be reported. These requests have been “transformed” in the standardisation deliverables mentioned in Section 2.1 (focus A).

In the same mandate, the European Commission stressed the importance of taking into account the pre-normative research carried out by regional and European projects: BioReCer results can perfectly fit this scope.

Starting from year 2025, indeed the CEN/TC 411 has decided to revise its Business Plan, which dates back to October 2011.

⁷ M/492 EN - Mandate addressed to CEN, CENELEC and ETSI for the development of horizontal European standards and other standardisation deliverables for bio-based products.

**Integrated environmental and traceability assessment framework
into certification schemes**

The CEN/TC 411 current Business Plan outlines the strategic framework for developing horizontal standards for bio-based products in Europe, emphasising the urgency and value of standardised approaches to support innovation, market uptake, and sustainability. The plan aligns with the EU's Lead Market Initiative, aiming to foster a European bioeconomy by enhancing competitiveness, environmental performance, and consumer trust.

Key priorities include:

- establishing a consistent terminology (which has been done, but needs to be revised);
- developing methods for determining bio-based content (for example the CEN/TR 16721:2014 and EN 16640:2017 have been published, but should be integrated through the standard currently under development prEN 16640 rev "Bio-based products - Bio-based carbon content - Determination of the bio-based carbon content using the radiocarbon method");
- developing sustainability criteria (EN 16751:2016, EN 16760:2015; and the most recent EN 18027:2025 have been delivered);
- and creating certification schemes identifying which characteristics can/should be assessed and how they should be reported.

Related to the last key priority, the CEN/TC 411 has established a dedicated Working Group, the WG 5 "Certification and declaration tools" which has published the standards EN 16848:2016 "Bio-based products - Requirements for Business to Business communication of characteristics using a Data Sheet" and the EN 16935:2017 "Bio-based products - Requirements for Business-to-Consumer communication and claims". These documents offer important requirements to the industries and market operators to appropriately communicate towards consumers and businesses.

Nonetheless, lots still need to be done to standardise fully the certification schemes. The CEN/TC 411, in its business plan, has indeed highlighted both the importance of cooperating with other stakeholders and the challenges to fully reach the initial objectives of the business plan. In particular, it was mentioned that challenges that might impact the plan implementation include:

- expert resources are not sufficiently available (for certain projects), because the prime attention should be horizontal methods, where the majority of the experts might have a product-focus.
- Specific expertise for a project is lacking, which could affect the project's development as well as the credibility of the resulting standard in the business community.
- Validation of a test method is dependent upon funding being available.

The first two challenges confirm the importance of facilitating the exchange between the TC and the research projects' results. And BioReCer results (and in particular this deliverable) can be a valuable support in reaching the objective of creating certification schemes standards.

2.3.1. Existing gaps in standards for certification schemes

Although standards and certification schemes complement one another, they operate in different ways and there are some gaps that persists which need to be addressed.

Limited scope of existing certification schemes and lack of a standard providing common guideline

The majority of available certification schemes on the market focus on specific sectors, such as energy, food, leaving the other areas underrepresented. There are only few that certify bio-circular raw material and products for instance ISCC. Besides this, there are several certification schemes on the market, each with varying scopes and criteria, and this leads to fragmentation in the bio-based sector. So, there is no common harmonised approach for certification schemes. Nevertheless, one common aspect among them is that most certification schemes refer to ISO standards as a key requirement and operationalise it.

The main gap is that standards are often high-level and open to interpretations so certification schemes and certification bodies may apply or interpret them differently. Also, there is no specific standards that guides the certification schemes to harmonise the process specifically for bio-based products. Considering this fragmentation and the lack of a common guideline, the CEN/TC411/WG5 should define a common sound approach to certification, inspired by the standardisation underpinning values and the quality infrastructure. This is becoming particularly relevant considering the recent legislative developments related to greenwashing.⁸

Lack of systematic integration of social and economic criteria

Many existing certification schemes primarily address environmental aspects than social and economic dimensions of sustainability. There is also no dedicated standard for social and economic aspects specifically that reflect the broader impacts of bio-based products. A holistic approach that includes social equity, economic viability, and environmental protection is necessary to fully assess the sustainability of bio-based products.

Inadequate traceability and data collection

Reliable data collection and traceability are crucial for certifying the sustainability of bio-based products. However, challenges persist in tracking the origin and processing of biological resources, especially when dealing with organic waste and by-products. There are very few certification schemes that has strong traceability aspects like ISCC. However, lack of unified tracking systems hampers the ability to verify compliance with sustainability criteria. The introduction of the Digital Product Passport through the Ecodesign for Sustainable Products Regulation (ESPR) goes in the direction of tackling this problem, but still a lot needs to be done (also because not all product categories are covered by the ESPR).

2.3.2. Call to action

The following approach can be adopted to address the gaps between standards and certification schemes

⁸ Directive (EU) 2024/825 of the European Parliament and of the Council of 28 February 2024 - Empowering consumers for the green transition through better protection against unfair practices and through better information

- **Harmonised approach:** The main priority emerged from several discussions is the harmonisation of existing certification schemes to reduce fragmentation on the market. Developing unified criteria that encompass environmental, social, and economic aspects will facilitate a more coherent and comprehensive assessment of bio-based products and support the entire value chain in discovering the full potential of bio-based products. To reach this goal, CEN/TC411/WG5 should play a central role to engage all relevant stakeholders' developing, certifying and applying certification schemes. A close cooperation between the European Commission and the CEN/TC 411 will also ensure this harmonisation process does not remain a "simple" intellectual activity.
- **Broaden scope:** Certification schemes should broaden their scope to include underrepresented areas. Incorporating criteria for these sectors will ensure a more inclusive approach to sustainability certification in the bio-based industry. The collaboration with pre-normative research projects and sectorial technical committees is key.
- **Holistic approach:** A lot has been done by different actors working on standardisation to include all the dimensions (economic, environmental and social) of sustainability, but still a systematic approach is lacking. Certification schemes must integrate social and economic indicators alongside environmental ones to provide a holistic assessment of sustainability. This integration will address the multifaceted impacts of bio-based products and support informed decision-making by stakeholders.
- **Enhancement of Traceability Systems:** Strengthening existing traceability systems, supported by digital tools, will improve data collection and verification processes. These systems should enable tracking of biological resources from origin to final product, ensuring transparency and accountability. Sound data is key to taking grounded decisions. Existing good practices can be used as example for improving the traceability system.

2.3.3. BioReCer project support to close these gaps

The BioReCer project has developed a comprehensive framework to analyse biological raw materials and their supply chains. This framework aims to complement existing standards and certification schemes by incorporating new criteria for sustainability, origin, and traceability. The framework is detailed in D2.2 "*Modified Assessment Methodologies*", below it has been extracted a section to summarise the content of the framework.

The BioReCer framework has been structured into pillars, principles, criteria, requirements and indicators as shown below. The number provided in the figure indicates the diverse items involved for each of the fields mentioned. The theoretical BioReCer framework has been also subdivided into two, depending on if the goal of the requirements was to satisfy sustainability or circularity aspects.

Integrated environmental and traceability assessment framework into certification schemes

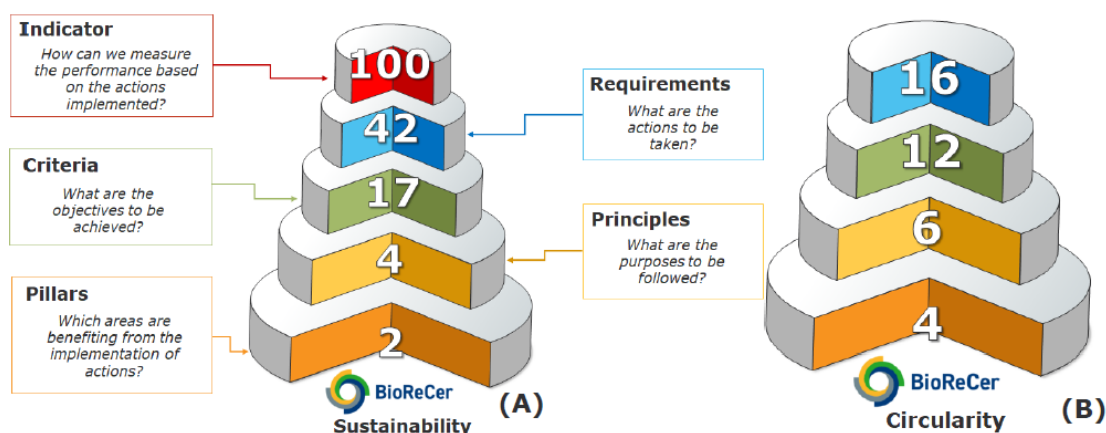


Figure 8 Structure of the (A) sustainability and (B) circularity framework of the BioReCer project. (Source: BioReCer deliverable D2.2)

BioReCer ICT Tool (BIT)

The BioReCer Information Communication Technology tool (BIT) enhances traceability, environmental performance, and social acceptance of bio-based products. This self-assessment tool allows stakeholders to evaluate feedstock sustainability, track CO₂ emissions, and check compliance with certification requirements, thereby addressing the data collection and traceability gaps in the sector.

Standardisation Toolkit

As described in Chapter 2.2, BioReCer has introduced a Standardisation Toolkit comprising two interactive dashboards: the standards dashboard and the certification schemes dashboard. This tool supports the market operator in disentangling between the enormous number of standardisation references and certification schemes.

In nutshell, addressing the standardisation gaps in certification schemes is vital for the advancement of the bio-based sector. The BioReCer project contributes significantly⁹ by developing tools and frameworks that complement existing certification schemes, promoting a more comprehensive and integrated approach to sustainability assessment. By implementing the recommended actions, stakeholders can enhance the credibility, transparency, and effectiveness of certification schemes, fostering the growth of a sustainable bio-based economy.

⁹ Several relevant scientific publications are also available on the [project Zenodo page](#).

3. Certification schemes

This chapter describes the process followed to integrate the BioReCer framework into existing certification schemes. This process led to the development of a practical guidance document aimed at supporting certification schemes and certification bodies in interpreting and applying the BioReCer requirements. It also resulted in recommendations for how current schemes could adopt these criteria, either by incorporating them directly or by using BioReCer as an add-on module, as tested with ISCC in the pilot assessment.

Figure 9 summarises the methodology applied in Task 4.4.2, illustrating the main steps, intermediate results, and key synergies with other Work Packages, both as inputs and outputs.

As outlined in the figure, the mapping of existing certification schemes served as the starting point for the benchmarking exercise, which was then used to conduct a gap analysis. This analysis identified alignment areas and additionalities introduced by the BioReCer framework. The insights gained from this exercise informed recommendations for integration, based on opportunities to enhance existing schemes, and laid the groundwork for the next chapter. These outcomes also contributed to other work packages, as further detailed in the following figure.

Deliverable D4.3

Integrated environmental and traceability assessment framework into certification schemes

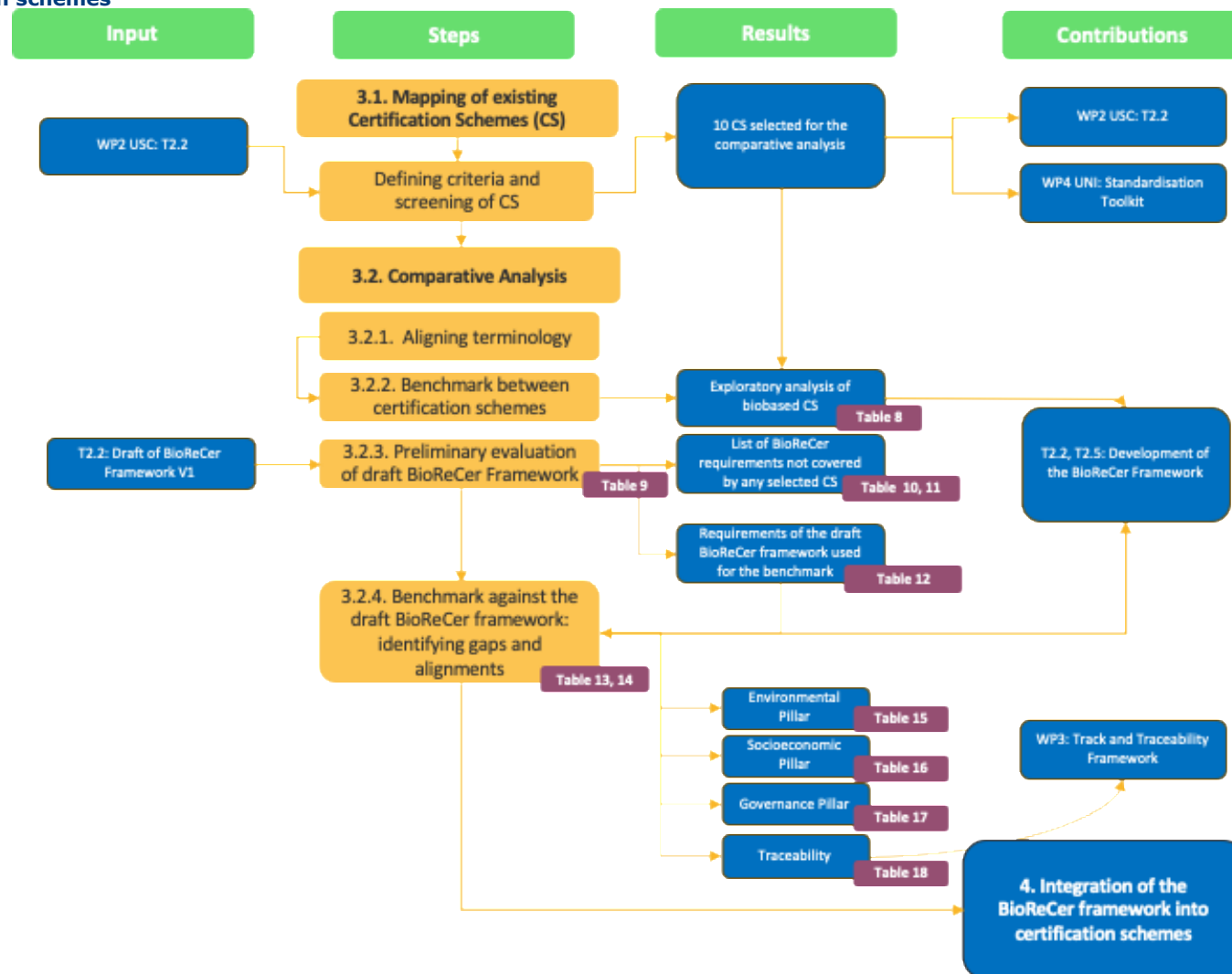


Figure 9 Steps followed, results and synergies between WPs in Chapter 3

3.1. Mapping of existing certification schemes

The objective of *T4.2.2 Comparative analysis* is to provide an overview of the main gaps between the environmental and traceability assessment framework (WP2 & WP3) and existing bio-based certification schemes, in where ISCC PLUS was used as a key reference. However, as ISCC PLUS and ISCC EU share the same sustainability requirements for forest and agricultural biomass, ISCC EU documents 202-1, 202-2, 202-3, and 202-4 were considered to conduct the benchmark. To fulfil the objective of the task, a mapping of existing certification in agriculture, forestry, fishery and wastewater sectors was conducted in coordination with T2.2 *Identification of Environmental and Circularity Criteria*. As a first step, a set of selection criteria for identifying existing certification schemes, as listed below, was jointly defined with T2.2 partner.

- The certification scheme covers the following sectors: forestry, agriculture, Wastewater treatment and fisheries
- The certification scheme complies with European regulations
- The certification scheme must be credible, incorporate a robust third-party verification approach, and ensure multistakeholder engagement
- The certification scheme has governmental and/or market recognition
- Certification schemes specific for food/feed and biofuel/bioenergy sectors must be excluded

Based on these criteria, certification schemes were mapped. The deliverable *D2.2 Modified Assessment Methodologies* presents preliminary mapping of about 341 certification schemes from Standard Maps¹⁰ out of which 18 schemes were filtered to be relevant to the sectors considered in the BioReCer project (detailed methodology explained in D2.2). Taking this as a basis, T4.2.2. carried out the detailed analysis of the existing requirements of certification schemes. To do so, it is crucial to have access to the system documents of the schemes. Therefore, only the schemes that had publicly available and transparent guidelines, were considered further for the comparative analysis.

As a result, ten certification schemes were selected for an in-depth comparative analysis (Table 7). A total of six certification schemes were selected for the forestry sector: International Sustainability and Carbon Certification (ISCC- Forest biomass), Sustainable Biomass Program (SBP), Forest Stewardship Council (FSC), Roundtable on Sustainable Biomaterials (RSB), Programme for the Endorsement of Forest Certification (PEFC), and Sustainable Resources Voluntary Scheme (SURE) for forest biomass. For the agriculture sector, the selected schemes were ISCC Agriculture, Better Biomass, and SURE (agriculture biomass). For the fishery sector, three schemes were selected: Global G.A.P. Aquaculture, Marine Stewardship Council (MSC), and Aquaculture Stewardship Council (ASC). There is no specific certification scheme focused exclusively on wastewater treatment plants or sewage sludge. However, schemes such as ISCC PLUS and RSB covers this sector. Therefore, the principle, criteria and requirement of those schemes also apply to the wastewater sector.

¹⁰ <https://standardsmap.org/en/home>

Table 7 Selected certification schemes used for the comparative analysis

Certification Scheme	Sector	Description
ISCC (International Sustainability & Carbon Certification)	Agriculture & Forestry	A globally recognised sustainability certification system covering all feedstocks, including agricultural and forestry biomass. It ensures traceability, no-deforestation, and compliance with environmental and social criteria. ISCC uses specific documents for agricultural biomass (ISCC EU 202-1 & 202-2) and forest biomass (ISCC EU 202-3 & 202-4). ¹¹
SURE (Sustainable Resources Verification Scheme)	Agriculture & Forestry	A voluntary certification scheme for demonstrating compliance with the EU Renewable Energy Directive (RED II/III) sustainability and GHG criteria for biomass used in energy production, including agricultural and forestry feedstocks. ¹²
SBP (Sustainable Biomass Program)	Forestry	Certification for woody biomass (pellets, chips, biochar) ensuring legal and sustainable sourcing, regulatory compliance, and supply chain traceability. ¹³
FSC (Forest Stewardship Council)	Forestry	Global certification system for responsible forest management and chain of custody, based on FSC Principles & Criteria to ensure environmental, social, and economic benefits. ¹⁴
RSB (Roundtable on Sustainable Biomaterials)	Forestry	Multi-stakeholder certification for sustainable biomaterials, fuels, and products, applying robust environmental and social sustainability principles and GHG accounting. ¹⁵
PEFC (Programme for the Endorsement of Forest Certification)	Forestry	International alliance promoting sustainable forest management through independent third-party certification; the world's largest forest certification system. ¹⁶
Better Biomass (NTA 8080)	Agriculture	International certification system for solid, liquid, and gaseous biomass to demonstrate sustainability across supply chains, based on NTA 8080 standards. ¹⁷
GLOBALG.A.P. Aquaculture	Fishery	Global standard for responsible aquaculture production, covering food safety, environmental protection, animal

¹¹ <https://www.iscc-system.org/>¹² <https://www.sure-system.org/>¹³ <https://sbp-cert.org/>¹⁴ <https://fsc.org/>¹⁵ <https://rsb.org/>¹⁶ <https://pefc.org/>¹⁷ <https://betterbiomass.com/>

Certification Scheme	Sector	Description
		welfare, worker welfare, and traceability. ¹⁸
MSC (Marine Stewardship Council)	Fishery	Certification for wild capture fisheries ensuring sustainable fish stocks, minimal ecosystem impact, and effective management, with independent third-party audits. ¹⁹
ASC (Aquaculture Stewardship Council)	Fishery	Certification and labeling program for responsibly farmed seafood, based on robust environmental and social standards and independent third-party audits. ²⁰

3.2. Comparative analysis of voluntary certification schemes (T4.4.2)

The comparative analysis was conducted to compare environmental, socio-economic and traceability requirements (i) between the selected certification schemes: providing an overview of the existing requirements of certification schemes and identifying similarities as well as gaps between them, and (ii) between the selected certification schemes and the draft BioReCer framework developed under WP2: to evaluate how the certification schemes align with the framework. The analysis was conducted using benchmarking exercise which involved systematic comparison various schemes against a uniform set of criteria. A detailed methodology and results from the comparative analysis is described below.

3.2.1. Aligning terminologies

Before commencing the comparative analysis, it was integral to align the relevant terminologies used by each certification scheme. This is because certification schemes are independent and can have different process and structure. The diversity of certification procedures makes it difficult to systematically select requirements and criteria. For example, ISCC categorises its standard into “principles, criteria, and requirements” while SBP categorises as “principles, criteria, and indicators”. In this context, the terms “requirement” and “indicator” were used interchangeably, referring to the detailed measures that companies should take, and auditors should check for the audit. Additionally, given the continuous feedback exchange between WP4 and WP2, it was necessary to ensure consistency with the project’s methodology, use of key terms and support the subsequent comparative analysis. Thus, the following terminologies, as defined also in the deliverable *D2.2 Modified Assessment Methodologies*, were adopted to conduct the comparative analysis:

- **Pillar:** Aspect or area in which the principles are supported (i.e., environmental, social or economic).
- **Principle:** Fundamental truth or law that provides a rationale for action (i.e., protection of ecosystems or working conditions).

¹⁸ <https://www.globalgap.org/>

¹⁹ <https://www.msc.org/>

²⁰ <https://www.asc-aqua.org/>

- **Criterion:** Objective that assesses the aspirational goal or principle that governs decisions and behaviour.
- **Requirement:** Necessary condition that must be met in order to apply for accreditation, comply with legislation or be judged by a third party.
- **Indicator:** Quantitative, qualitative, or binary variable that can be measured or described for the evaluation of a defined aspect (in agreement with the definition of UNE-EN 16751:2016).
- **Threshold:** Quantitative, qualitative, or binary variable that indicates the level of compliance with the requirement or indicator.

Following this definition, all the standard document of the certification schemes selected were collected and screened for collection of information.

3.2.2. Benchmark between certification schemes: identifying similarities and differences

After the mapping of the existing certification schemes, the first benchmark was carried out among the certification schemes to carry out the comparative analysis. And provide an exploratory overview of how selected bio-based certification schemes address sustainability. In line with the Grant Agreement, ISCC PLUS was taken as the key reference certification scheme for integration of the framework therefore, the requirements of selected certification schemes were benchmarked against ISCC standard. To note that, as ISCC PLUS and ISCC EU share the same sustainability requirements for forest and agricultural biomass, thus, ISCC EU documents 202-1, 202-2, 202-3, and 202-4 were considered to conduct the benchmark.

The benchmarking was conducted mainly for forestry and agriculture sectors. Certification schemes for the fishery and wastewater sectors were not benchmarked against ISCC, as it does not include specific requirements for these sectors. However, the requirements applicable for agriculture is also applicable for aquaculture and traceability requirements are applicable to all bio-circular products which also includes sewage sludge and wastewater²¹. Therefore, five certification schemes in the forestry sector (SBP, FSC, RSB, PEFC, and SURE (Forest Biomass)) were benchmarked against ISCC forest biomass (Principles 1 to 6). For the agriculture sector, SURE (agriculture biomass) was benchmarked against ISCC agriculture biomass. The topics of environmental and socio-economic sustainability were compared in detail across the certification schemes, as these are the main contents that the current schemes cover. The circularity aspects were not addressed separately; rather, they were considered as embedded in the sustainability requirements. Table 8 presents an example of the results of the benchmarking of ISCC Forestry Biomass requirements against the SBP scheme. The detail benchmark is presented in Annex A.

²¹ The list of material eligible for ISCC PLUS certification includes, algae, sludge from wastewater treatment. https://www.iscc-system.org/wp-content/uploads/2025/06/ISCC_PLUS_material_list_09062025.pdf

Table 8 Example of benchmarking: SBP against ISCC Forestry Biomass requirements

ISCC Forestry Biomass (202-3 and Doc 202-4)			SBP (SBP Standard 1: Feedstock Compliance)		
Principles	Criteria	Requirements	Principles	Criteria	Indicators/minimum requirement
Principle 2 – Environmental Responsible Production to Protect Soil, Water and Air	2.1 Land management and management system	2.1.1 Protection of land with high conservation value forests The objective of ISCC is to protect high conservation value forest which are biodiverse and serve the protection of threatened or vulnerable species, or which have other ecological or cultural importance. The following land categories and their respective protection are of relevance for forest biomass production: 1. Primary forest 2. Species diversity forest 3. Indigenous tree species 4. Areas designated by law or by the relevant competent authority for nature protection purposes	Principle 2: Feedstock sourcing does not harm the environment	2.1 Biodiversity is maintained or enhanced	2.1.1 Key species, habitats, ecosystems, and areas of high conservation value (HCV) pertaining to biodiversity in the Supply Base shall be identified. 2.1.2 Threats to and impacts on the identified key species, habitats, ecosystems, and areas of high conservation value (HCV) pertaining to biodiversity in the Supply Base shall be identified and evaluated. 2.1.3. Key species, habitats, ecosystems, and areas of high conservation value (HCV) pertaining to biodiversity in the Supply Base shall be maintained or enhanced.

The result of this provided an overview of the existing requirements of ISCC and other certification schemes. As the drafting of the BioReCer framework in WP2 was ongoing in parallel to the benchmark, and that the WP2 and WP4 are interlinked, the detailed benchmark was shared with WP2. This was essential for providing feedback to task T2.2 to develop the first draft of the principle, criteria, and requirements of the BioReCer framework (methodology described in detail in D2.2). WP4 provided comments and reviewed the draft framework under T2.2. based on the outcomes of this benchmark exercise. Additionally, this analysis provided overview of the similarities and gaps between the different schemes.

3.2.3. Preliminary evaluation of the draft BioReCer Framework

The first draft of the BioReCer framework developed under T2.2, was shared with WP4 and a preliminary evaluation was conducted. The principles, criteria, and requirements of the ten certification schemes mapped were screened against the draft BioReCer framework. For the forestry sector, ISCC Forest Biomass, SBP, FSC, RSB, PEFC, SURE; for agriculture, ISCC Agriculture Biomass and Better Biomass; and, for fisheries, Global GAP Aquaculture, ASC (Salmon) and MSC were assessed.

As the schemes may have different documents and audit checklist applicable for various scope of the supply chain, all relevant documents were reviewed and analysed. For example, schemes applicable to the forestry sector include checklists for the forestry production stage, as well as for other parts of the supply chain, such as points of origin for wastes and residues, first gathering points, central offices, collecting points for waste and residues, processing units, and traders and storage facilities. All those documents were reviewed. The list of documents reviewed are also available in Certification Scheme dashboard in the Standardisation tool²².

Table 9 provides an example of the preliminary evaluation of requirements of mapped certification schemes against requirements of one of the principles of the BioReCer framework, "Business models and value creation". The detailed evaluation is presented in Annex A. The column "full supply chain coverage" indicates whether the draft BioReCer requirement is fully addressed by at least one certification scheme across all relevant certified elements of the supply chain. An "X" denotes that the requirement is covered (partially or completely) throughout the supply chain elements, while "-" indicates that the requirement is not covered along the supply chain elements. Text highlighted in red identifies the principles, criteria, and requirements that are not currently addressed by any of the mapped certification schemes.

Table 9 Example: Preliminary evaluation of requirements of certification schemes against the draft BioReCer framework

Principle	Criteria	Requirement	Full supply chain coverage
Business models and value creation	The company has records on the consumption of raw materials and the manufacture of products and their quality	The company has established of measures to improve product traceability	X
		The company has established measures to track the disposal of by-products and waste	X
		The company promotes the use of biodegradable materials for the packaging of its products	-
		The company promotes the use of materials with bio-based origin	-
	The company makes good use of its assets	The company keeps records on the purchase cost of biomass	X

²² <https://biorecer.eu/standardization-toolkit/>

Principle	Criteria	Requirement	Full supply chain coverage
		The company keeps records on the costs of relevant process equipment	-
		The company keeps records on the costs of waste treatment	-
		The company keeps records on the operational costs	-
		The company obtains revenues from environmental services	-
		The company has economic balances and result sheet available for the public	-
		Investments and expenditures in the sector related to research, development and training of employees	X
		The company has a good management of the unsold finished goods, prevention of generation of waste	-
	The company respects private property and promotes transparency	The company is a legally defined entity with a clear and documented legal record	X
		The company has fully documented property rights	X
		The company has fully documented intellectual rights	X
		The company strategies and claims are validated by a third-party	X

This exercise helped to identify the requirements that are already covered by the existing biobased certification schemes as well as those that are new or additional from the BioReCer framework. The sustainability and circularity requirements from BioReCer framework which were identified as additional to most of the current certification schemes are listed in Table 10 and Table 11 respectively.

Table 10 Additional BioReCer requirements on sustainability

SN	BioReCer sustainability requirements
1	The company promotes the use of biodegradable materials for the packaging of its products
2	The company promotes the use of materials with bio-based origin
3	The company keeps records on the costs of relevant process equipment

SN	BioReCer sustainability requirements
4	The company keeps records on the costs of waste treatment
5	The company obtains revenues from environmental services
6	The company has identified actions to protect seafloor and stocks
7	The company has defined the location and number of sampling points for water quality monitoring
8	The company measures the odour to ensure a level high of respect for its neighbours
9	The company considers the use of treated biowaste as fertiliser
10	The company identifies the interactions between the wildlife and farmed species
11	The company identifies the significant energy uses inside the facility
12	The company determines the origin of the energy used (i.e., from the grid or onsite)
13	The company has a plan for the efficient energy consumption
14	The company is able to produce energy products and co-products from any source of biomass
15	The company has records on the precipitations of each area

Table 11 Additional BioReCer requirements on circularity

SN	BioReCer circularity requirements
1	The company has identified carbon footprint avoided emissions as a consequence of the implementation of circular economy strategies (reduction, recycling, recovering...)
2	The company keeps records on the waste generation though time in order to ensure that savings are achieved
3	The company promotes the substitution of virgin materials by secondary raw materials
4	The company keeps records on the consumption of raw materials in order to ensure that its demand is continuously reducing

SN	BioReCer circularity requirements
5	The company promotes the use of recycled materials on the final products
6	The company is able to demonstrate that the company is resource efficient or has an increased productivity
7	The company is able to demonstrate that the company is energy efficient or has an increased productivity
8	The company has records on the durability, upgrading and reusability of products
9	The company has plans, initiatives or practices to ensure the increase of resource durability
10	The company has documentation on actions to transform and rethink resources that can be seen as waste into valuable inputs
11	The company has plans, initiatives or practices to ensure the increase of resource productivity
12	The company has defined strategies to follow promote a system thinking of processes and the analysis of material loops
13	The company has plans, initiatives or practices for the recovery of waste
14	The company develops tools, applications and services that enable circular economy strategies
15	The company has designed new products using public investment in aspect related to circularity
16	The company receives funding for the innovation of products and/or strategies that can be considered circular
17	The company is able to demonstrate that the implementation of plans, initiatives and practices on circular economy has resulted in economic benefits
18	The company has collaborations with other companies aiming at the good use of resources
19	The company is willing to share information publicly about its activities related to the circular economy
20	The company has participated in awareness campaigns to promote the benefits of the circular economy
21	The company has programmed training activities for workers in order to tackle the specifics of circular technologies and/or strategies

SN	BioReCer circularity requirements
22	The company has created new jobs positions in line with the needs of the circular economy strategies implemented

The requirements that are covered, by the existing schemes, partially or completely, listed in Table 12 was then used as the for the detailed benchmark (Chapter 3.2.4). The results were shared with T2.2 to align the work.

Table 12 Requirements of the draft BioReCer framework used for the benchmark.

Pillar	Principle	Criteria	Requirements
Environmental	Protection of ecosystems	The company ensures the preservation of ecosystem diversity	The company limits the sourcing of feedstock from land area with high biodiversity and high carbon stock
			The company protects the high conservation value forests
		The production system does not affect the biological diversity of species	The company protects the biodiversity within the area in terms of species distribution, population dynamics, community structure, functioning of the ecosystem among others
			The company protects native threatened species and prevents its overexploitation
			The company restricts the use of genetically modified and invasive species.
		The company manages waste under an environmentally sound approach.	The company selects the most appropriate treatment for waste management
		The company takes measures to manage the environmental impact of the operation	The company shall have documentation guaranteeing that has performed an Environmental Impact Assessment (EIA) of the area before starting its operations
			The company has risk management and emergency procedure in place to minimise environmental risks
			The company has soil management measures that include soil quality and soil erosion.
			The company has management system

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Pillar	Principle	Criteria	Requirements
	Sustainable use of resources		on water quality and quantity
			The company has air quality management measures
		The company promotes the sustainable management of natural resources	The company takes measures to maintain the forest production capacity
			The company shall indicate whether it adopts ecosystem regeneration and rehabilitation measures
Socio-economic	Working conditions	The company prevents and minimises the pollution from the operation	The company identify and minimises or restricts the use and impact of fertilisers, pesticides, and organic compounds
		The company ensures occupational health and safety	The company promotes the participation of its employees on certified training activities and competencies
			The company identifies potential hazards, record incidents, and has emergency procedure in place
			The company has equipment available for accidents and requires workers to use suitable personal protective equipment (PPE)
			The company has insurance for accident coverage and adequate compensation in the workplace
		The company respects workers' rights	The company allows work and personal life combination with the limitation of the worked hours
			There is no forced labour in the operation
			There is no child labour in the operation
			There is no discrimination in the operation
			The company respects freedom of association and collective bargaining
			The company is able to provide records and documentation proving the existence of fair and transparent contracts
	Community impact	The company does no harm to the local community	The company protects and respects the land and land use rights of the local community

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Pillar	Principle	Criteria	Requirements
Governance			The company has mechanisms to resolve grievances and provide fair compensation to local communities and individuals related to impacts of management activities
		The company contributes to job creation and helps to meet community needs	The company contributes to enhance the employment rate in the sector and activates the economy of its surroundings
			The company ensures the payment of wages that meet or exceed industry minimum standards
	Business planning and management	Business commitment to improve sustainability is in place	The company considers strategic plans, actions and procedures to improve its sustainability
		The company establish and implement management plan to ensure long-term economic viability	The company keeps records of purchasing cost, revenues, and yield of the operation and make management plan to ensure long term economic viability
	Traceability	The company facilitates the traceability of the value/process chain	The company has established of measures to improve product traceability
		The company assesses and manages GHG emission	The company conducts GHG calculation and takes GHG emission reduction measures
	Legal compliance	The company ensures compliance with legal requirements	The company ensures compliance with legal requirements

3.2.4. Benchmark against the draft BioReCer framework: identifying gaps and alignments

The second benchmark was conducted using the same group of 10 selected certification schemes in the forestry, agriculture, and fishery sectors. The main objective here is to identify the existing gaps and alignments between the draft BioReCer framework and the existing biobased certification schemes. Table 11 above served as the foundation for this detailed benchmark. For each of these schemes, publicly available guidance documents were thoroughly reviewed to determine the extent to which each BioReCer requirement is addressed by the respective certification schemes. An example of the results of this benchmark is shown in Table 13, where one of the BioReCer requirement is covered by different certification scheme. The detailed benchmark is presented in Annex A.

Table 13 Example of the benchmark of certification schemes conducted against the draft BioReCer requirement

BioReCer Requirement	SURE	ISCC	Better Biomass
The company has established of measures to improve product traceability	4.3. ...The SURE-EU system requires all economic operators to have a document management system that can be checked as part of an audit. Proper documentation is mandatory for all economic operators to ensure compliance with the legal provisions. All of the documents in the document management system must be kept for at least 5 years regardless of any other legal requirements relating to retention period...	6.2.1 Establishment of a recording system for each unit of production A recording system should be established for each unit of production. These records must be kept systematically and up-to-date and should be available for at least five years. Current records must provide a history of biomass production of all production areas.	4.1.2 The organisation shall establish and implement one or more of the chain of custody models for all materials or products with specified characteristics and shall be transparent about the model chosen 5.1.1 The organisation shall implement and maintain a chain of custody system adequate to the organisation's type and complexity to ensure the continuous conformity to all applicable chain of custody requirements

Building on the benchmark against the draft BioReCer framework results, a sector-specific gap analysis was conducted to evaluate how well existing certification schemes address the BioReCer requirements. The schemes were grouped by sector—Fisheries, Agriculture, and Forestry. This gap analysis helped identify common requirements and procedures and reveal gaps across the schemes. Table 14 provides an illustrative example. Together with the gap analysis result, benchmarking exercise also enabled providing feedback and comments to WP2 for further revision of the BioReCer requirements. The results were further used as reference for the development of the BioReCer verification guidance and audit checklist which is further explained in Chapter 4.

Table 14 Example of gap analysis for one of the BioReCer requirement

BioReCer Requirement	Sector	Gap analysis
The company ensures the payment of wages that meet or exceed industry minimum standards	Agriculture	- ISCC requires a living wage that meets or exceeds legal/industry minimums and covers basic needs plus some discretionary income. Pay slips must show compliance. - Better Biomass requires salaries that cover basic necessities (based on an 8-hour day) and are customary for the region. Employers must prove compliance and ensure no compulsory deductions. - SURE agriculture does not have a related requirement
	Forestry	- All schemes except SURE have requirement on payment of wages to be above minimum wage. - ISCC and FSC have higher standard of requirement for the wages by requiring wages to be higher than the forestry industry wages standard or living wages.

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	Fishery	- ASC requires the company to pay workers at least basic wage that is above the minimum wage. Also, the employer should demonstrate efforts toward the payment of basic needs wage. - Not addressed by MSC or Global GAP
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To illustrate the degree of coverage of BioReCer requirements across certification schemes, quantitative approach was applied. Thus, below mentioned scoring system was developed:

- 1: The BioReCer requirement is fully addressed by the certification scheme.
- 0.5: The BioReCer requirement is partially addressed.
- 0: The BioReCer requirement is not addressed.

These scores were applied to each requirement assessed across all schemes. To ensure comparability, scores were normalised by dividing the score obtained by the maximum possible score for that topic or pillar i.e environmental, governance, socio-economic, producing percentage values that reflect the relative coverage. The normalised scores were then used to graphically illustrate the degree of coverage of BioReCer requirements across certification schemes (Figure 10).

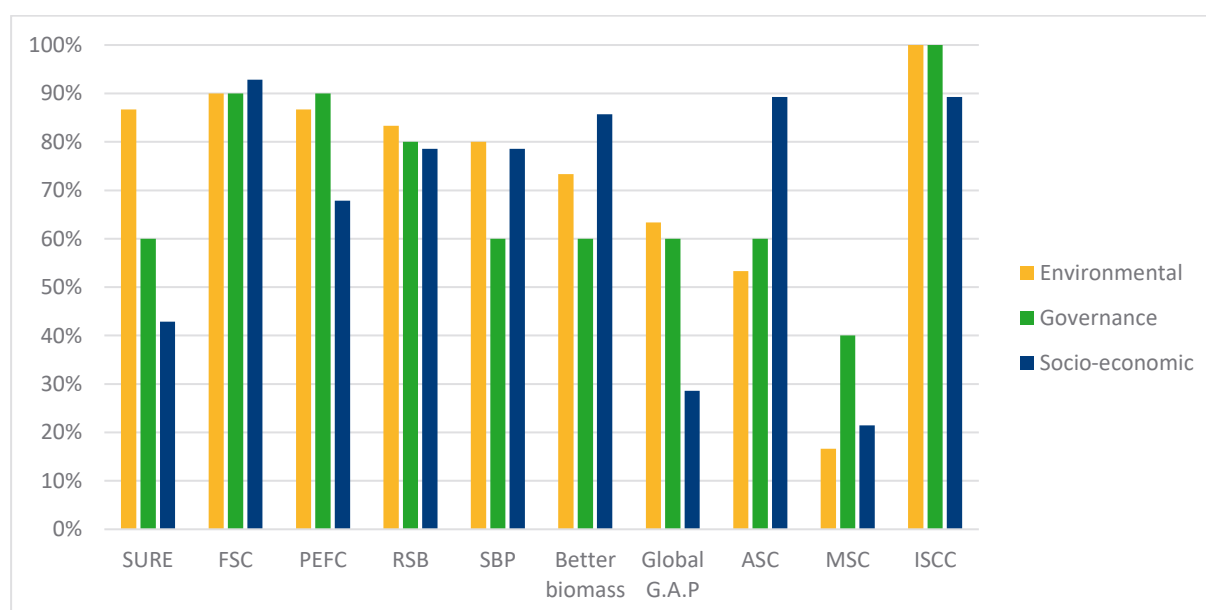


Figure 10 Degree of coverage of BioReCer requirements across certification schemes.

The benchmark and gap analysis focused exclusively on BioReCer requirements that are addressed, at least partially, by one or more of the selected certification schemes. Requirements that were not covered at all by any of the schemes are listed separately in Table 9 and Table 10.

Among the compared schemes, ISCC demonstrated the highest overall similarity with the BioReCer framework. This is partly due to its broader scope and the fact that ISCC was used as a key reference during the early stages of BioReCer's development. In contrast, MSC showed the lowest level of similarity, largely due to its strong focus on wild fisheries, where requirements are structured more around the sustainable use of natural fish stocks than on broader bio-based value chains. GLOBALG.A.P. also scored lower, particularly

within the socioeconomic pillar, where its coverage of BioReCer-related topics is more limited.

To provide a clear and quantitative overview of the gap analysis results, the following subsection presents graphical representations and summary tables for each of the pillars of the BioReCer framework. While the benchmarking was conducted at the requirement level, through a primarily qualitative assessment of how each BioReCer requirement is addressed within the selected certification schemes, the next subsection consolidates those findings to illustrate the degree of similarity at both the pillar and requirement levels. The graphs and tables help to visualise key areas of alignment and divergence, highlighting where significant gaps remain across existing certification schemes.

- Environmental pillar

The environmental pillar of the BioReCer framework consists of 15 requirements, grouped into 6 criteria and derived from 2 overarching principles. Figure 11 illustrates the level of similarity between environmental principles “Protection of ecosystems” and “Sustainable use of resources” and the ten selected certification schemes in this pillar.

For the principle on “Protection of ecosystems”, higher levels of similarity are observed among forestry-focused schemes. FSC, PEFC, RSB, SURE, and SBP cover between 70% and 90% of the related requirements, indicating stronger alignment with BioReCer's ecosystem protection criteria in the forestry sector.

Regarding the principle on “Sustainable use of resources”, ISCC, SURE, FSC, and PEFC demonstrate full coverage of the related requirements. SBP and Better Biomass follow closely, each achieving over 80% similarity. In contrast, RSB, GLOBALG.A.P., ASC, and MSC show lower levels of coverage, with similarity scores falling below 40%.

Overall, the fishery and aquaculture sector schemes show the lowest alignment with BioReCer's environmental requirements.

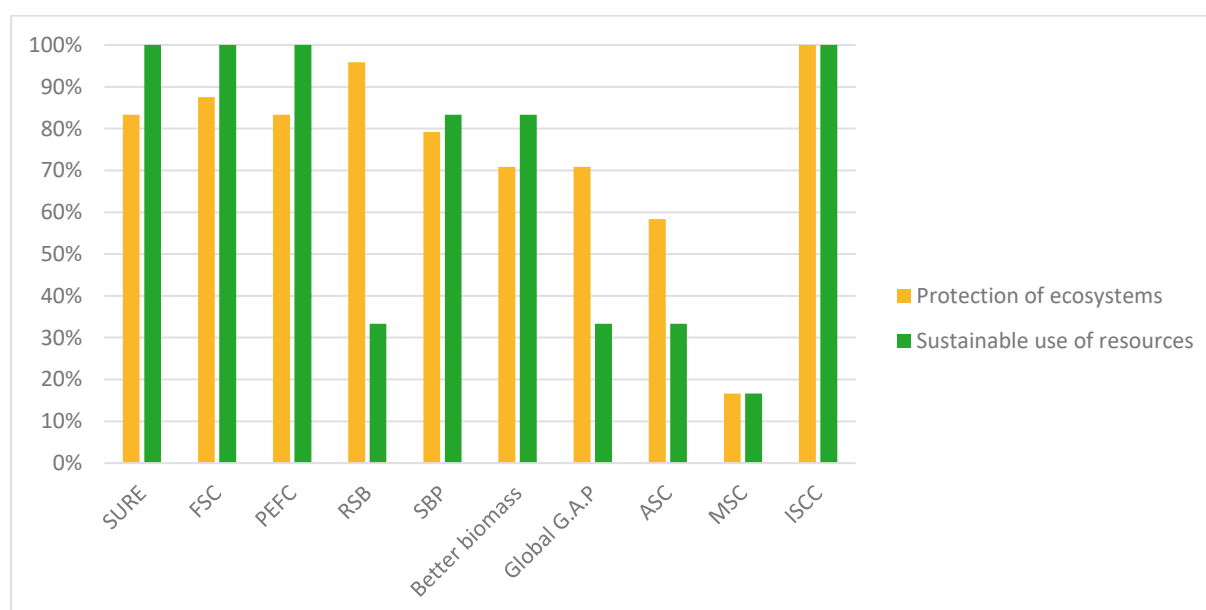


Figure 11 Similarity percentage between the environmental pillar of the BioReCer draft framework against selected certification schemes.

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At the requirement level, Table 15 presents the average similarity between the environmental pillar requirements of the draft BioReCer framework and those of the reviewed certification schemes. Requirements highlighted in red indicate a similarity level of 60% or below, suggesting areas where the BioReCer framework may offer added value compared to the selected schemes.

Table 15 Average similarities between the environmental pillar of the BioReCer draft requirements and selected certification schemes.

BioReCer requirement	Average similarity all certification schemes
The company has air quality management measures	35%
The company has management system on water quality and quantity	80%
The company has risk management and emergency procedure in place to minimise environmental risks	70%
The company has soil management measures that include on soil quality and soil erosion.	65%
The company identify and minimises or restricts the use of fertilisers, pesticides, and organic compounds	80%
The company limits the sourcing of feedstock from land area with high biodiversity and high carbon stock	80%
The company protects native threatened species and prevents its overexploitation	95%
The company protects the biodiversity within the area in terms of species distribution, population dynamics, community structure, functioning of the ecosystem among others	75%
The company protects the high conservation value forests	80%
The company restricts the use of invasive species.	60%
The company restricts the use of GMO species	85%
The company selects the most appropriate treatment for waste management	85%
The company shall have documentation guaranteeing that has performed an Environmental Impact Assessment (EIA) of the area before starting its operations	85%
The company shall indicate whether it adopts ecosystem regeneration and rehabilitation measures	70%
The company takes measures to maintain the forest production capacity	55%

- Socioeconomic pillar

The socioeconomic pillar of the BioReCer framework includes 14 requirements, organised into 4 criteria across 2 overarching principles. Figure 12 presents the degree of similarity

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between the principles “Community impact” and “Working conditions” and the selected certification schemes in this pillar.

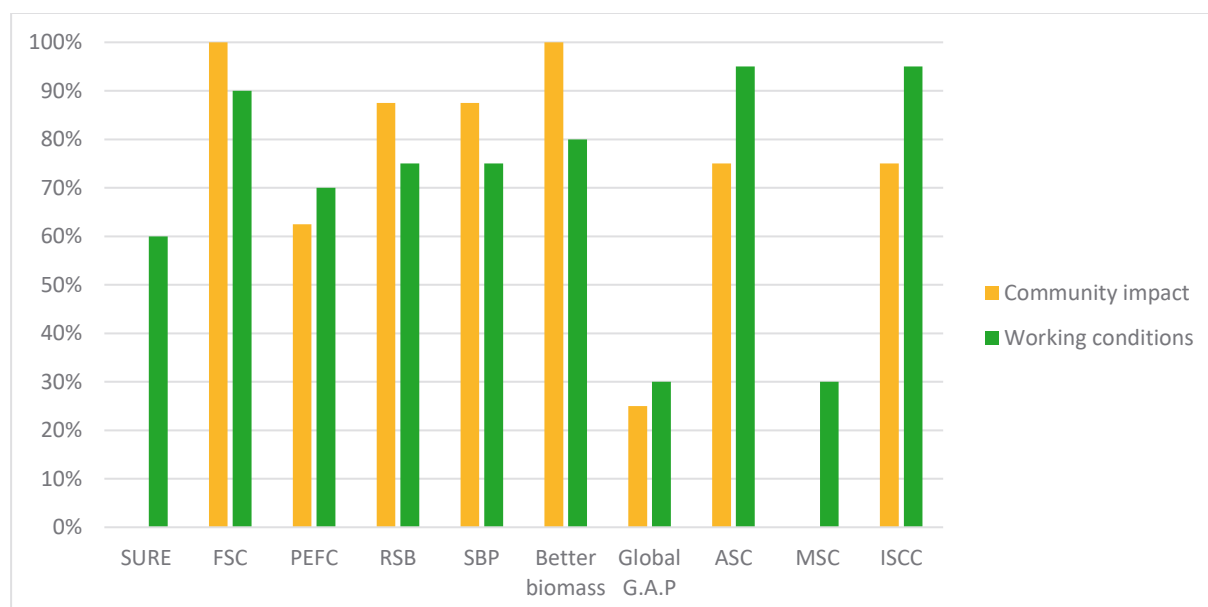


Figure 12 Similarity percentage between the socioeconomic pillar of the BioReCer draft framework against selected certification schemes.

Regarding the Principle “Community impact”, FSC and Better Biomass show the highest overall alignment, covering nearly all BioReCer’s socioeconomic requirements. They are followed by RSB, SBP, ASC, and ISCC, which display similarity levels between 70% and 90%. In contrast, MSC and SURE do not address community impact requirements as stated in the BioReCer framework, and GLOBAL G.A.P. also shows limited alignment.

When focusing specifically on “Working conditions”, ISCC, ASC, and FSC demonstrate the highest similarity, each covering 90% or more of the related BioReCer requirements. These are followed by Better Biomass, SBP, RSB, and PEFC, while SURE, MSC, and GLOBALG.A.P. has 60% coverage in this criterion.

Similar to the analysis of the environmental pillar, Table 16 presents the average level of similarity between the socioeconomic requirements of the draft BioReCer framework and those of the reviewed certification schemes. Requirements marked in red indicate a similarity score of 60% or below, highlighting potential areas where the BioReCer framework offers added value beyond the current requirements of the existing schemes.

Table 16 Average similarities between the socioeconomic pillar of the draft BioReCer requirements and selected CS

Draft BioReCer requirements	Average similarity between all certification schemes
The company allows work and personal life combination with the limitation of the worked hours	45%
The company contributes to enhance the employment rate in the	40%

Draft BioReCer requirements	Average similarity between all certification schemes
sector and activates the economy of its surroundings	
The company ensures the payment of wages that meet or exceed industry minimum standards	55%
The company has equipment available for accidents and requires workers to use suitable personal protective equipment (PPE)	80%
The company has insurance for accident coverage and adequate compensation in the workplace	35%
The company has mechanisms to resolve grievances and provide fair compensation to local communities and individuals related to impacts of management activities	80%
The company identifies potential hazards, record incidents, and has emergency procedure in place	75%
The company is able to provide records and documentation proving the existence of fair and transparent contracts	40%
The company promotes the participation of its employees on certified training activities and competencies	90%
The company respects freedom of association and collective bargaining	80%
The company protects and respects the land and land use rights of the local community	70%
There is no child labour in the operation	85%
There is no discrimination in the operation	80%
There is no forced labour in the operation	90%

- **Governance pillar**

This pillar includes five requirements, each belonging to a different criterion, and structured under three overarching principles "Business planning and management", "legal compliance", and "traceability". Figure 13 illustrates the level of similarity between governance principles and the ten selected certification schemes in this pillar.

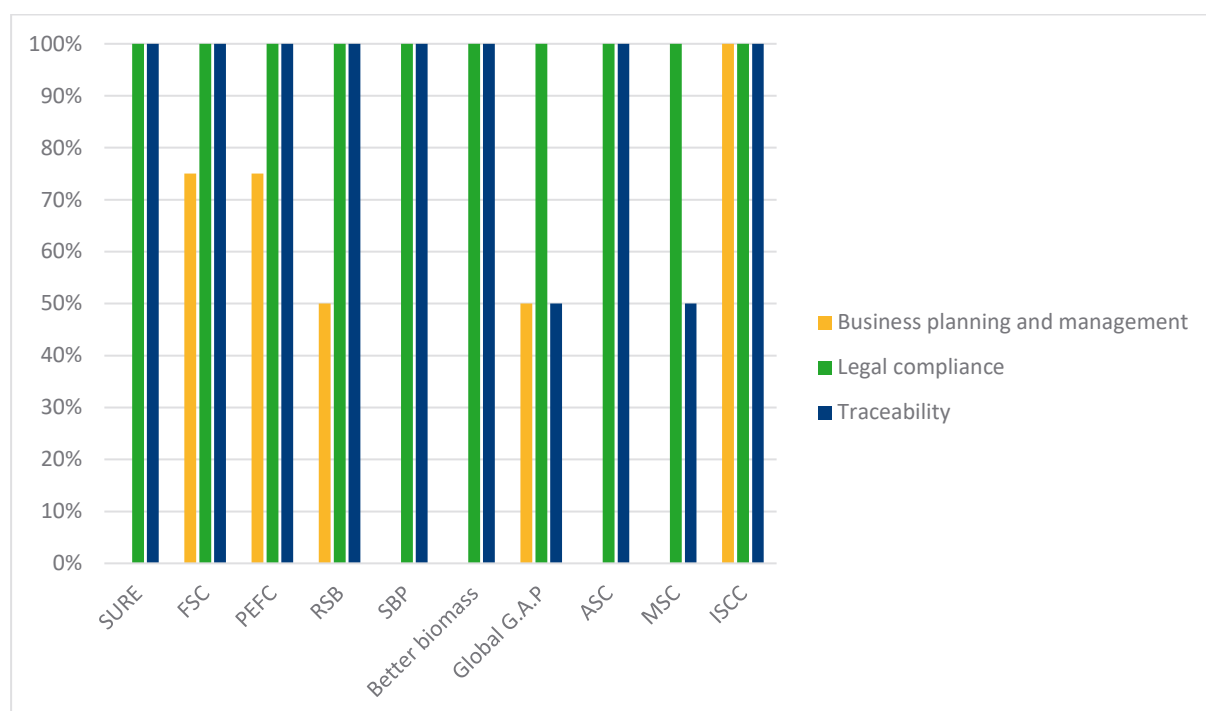
**Integrated environmental and traceability assessment framework
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Figure 13 Similarity percentage between the governance pillar of the draft BioReCer framework against 10 selected certification schemes.

Figure 13 illustrates that most of the selected certification schemes align well with BioReCer's requirements on "legal compliance" and "traceability". However, greater variation appears in the criterion related to "business planning and management". Only ISCC achieves full alignment (100%) with BioReCer in this area, followed by FSC and PEFC, each covering 75% of the relevant requirements. The remaining schemes show less than 60% similarity or no alignment at all, highlighting a common gap in this aspect of internal governance.

Following the same methodology applied to the previous pillars, Table 17 displays the average similarity scores between the governance-related requirements of the BioReCer draft framework and those found in the reviewed certification schemes. Requirements with a similarity score of 60% or lower are highlighted in red, as they may represent areas where the BioReCer framework introduces additional governance considerations not commonly addressed by other schemes.

Table 17 Average similarities between the governance pillar of the draft BioReCer requirements and selected certification schemes.

BioReCer Requirement	Average similarity all certification schemes
The company conducts GHG calculation and take GHG emission reduction measures	80%
The company considers strategic plans, actions and procedures to improve its sustainability	50%

BioReCer Requirement	Average similarity all certification schemes
The company ensures compliance with legal requirements	100%
The company has established of measures to improve product traceability	100%
The company keeps records of purchasing cost, revenues, and yield of the operation and make management plan to ensure long term economic viability	20%

- Traceability

Although the traceability principle is addressed within the governance pillar, the project has a specific focus on traceability aspects of the bioproducts special under WP3 and WP5. To complement and align with those work packages BioReCer framework, the topic demanded further examination. Therefore, a dedicated analysis was conducted. This included a review of traceability-related documents from the assessed certification schemes. Due to the variation in how schemes approach traceability, a summary table (Table 18) was created to compile the elements commonly included in these documents. The results were shared with WP3 and WP5 partners and feedback was provided to the deliverables respectively.

Table 18 Common content on traceability documents of the reviewed certification schemes

Criteria	Sub-criteria
Certification criteria	Sample definition
	Scope definition
Management system requirement	General requirement
	Written procedures for chain of custody
	Procedure for traceability system
	Stakeholder engagement
	Written Commitment
	Training of employees
	Documentation and Reporting system
	Periodic reporting system

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Criteria	Sub-criteria
	Data protection system
Chain of custody management	CoC method
	Requirement for physical segregation
	Requirement for mass balance
Due Diligence system	Due diligence system
	Risk assessment
	Risk Management
Proof of sustainability	Feedstock source identification
	Mass balance requirement
	Content of sustainability declaration
	Information on CoC element
Record keeping	Up to date Proof of sustainability
	Bookkeeping of applicable COC method
	Delivery requirements
	Record history
	Documentation requirements for used biomass
	Supply base report
	Records of incoming and outgoing materials
Verification process	Verification of claims
	Verification of due diligence system

Criteria	Sub-criteria
	Multistakeholder engagement
	Document verification

Following the review of traceability documents across the certification schemes, it can be concluded that there is a traceability system in place under certification schemes. Having a specific documentations and records relating to mass balance, sustainability declarations and identification of the source of the feedstock is a basic requirement. Recordkeeping requirements typically cover all incoming and outgoing materials, as well as bookkeeping relevant to the applied Chain of Custody method. However, there are some gaps (as mentioned in chapter 3.3) which need to be addressed for enhancing traceability.

3.3. Results: Key gaps and insights from the comparative analysis

The main objective of the mapping of the certification schemes as well as the benchmark exercises was to provide an overview of the main gaps between the framework developed under WP2 and WP3 and existing bio-based certification systems. During the comparative analysis, the BioReCer framework was also parallelly under development in WP2. This allowed for continuous bi-directional feedback between WP2 and WP4. Thus, the below mentioned key gaps were identified and the value addition of BioReCer were communicated to WP2, which helped in the development of the final BioReCer framework (D2.5).

- There is a limited presence of certain environmental requirements or indicators at the operational level in the reviewed certification schemes. The schemes generally do not include specific requirements for companies to track or manage aspects such as the use of biodegradable or bio-based packaging, details on the monitoring of environmental parameters (e.g., odour, water quality), or the valorisation of environmental services and biowaste, as their focus is primarily on broader, high-level principles. The BioReCer framework addresses this gap by proposing specific requirements that encourages companies to monitor and improve their resource use, environmental performance, and contributions to ecosystem services.
- Another relevant gap identified through the benchmark relates to the limited integration of circular economy practices at the company level within existing certification schemes. While most reviewed schemes acknowledge resource efficiency in general terms, they do not include operational requirements such as promoting the substitution of virgin materials by bio-based materials or evaluating the economic benefits and avoided emissions resulting from circular strategies. Likewise, there is little emphasis on collaboration, innovation, workforce development, or tools that enable circularity in practice. The BioReCer framework can complement existing certification schemes by embedding these aspects into its structure; encouraging companies to not only improve resource productivity and efficiency, but also to systematically adopt circular thinking, document its outcomes, and foster innovation across the value chain.
- Regarding the environmental sustainability, common requirements were identified in forest and agriculture sector, which also aligned with the requirements of BioReCer framework. However, in case of fishery sector, requirements varied and sometimes are not applicable for entire value chain. More specifically, requirements such as *"The company has air quality management measures"*, *"The company*

restricts the use of invasive species,” and *“The company takes measures to maintain forest production capacity”* are the least commonly addressed among the reviewed schemes. The latter may need to be reviewed to assess whether it is appropriate to retain in the final framework, as it focuses solely on forest production capacity. Although air quality and invasive species management are not consistently covered by all the reviewed schemes, they should still be addressed in certified value chains expected to apply the BioReCer framework.

- The requirement on the socioeconomic sustainability varies widely. Some schemes include stricter requirements regarding working conditions, while others, particularly in the fishery sector, take a lighter approach. The requirements related to community impact also differ significantly, with some certification schemes not addressing any of the draft framework’s requirement under this principle. Notably, key gaps identified in the reviewed schemes include the absence or partial coverage of requirements related to provision of contracts, accident insurance and compensation, payment of prevailing wages, enhancement of local employment rates, and the limitation of working hours to support work-life balance. Social criteria were mostly not applicable along the supply chain.
- For the governance pillar, a higher level of alignment was observed in requirements related to legal compliance and traceability, but gap exist in covering the aspect of business planning and management. However, BioReCer could help fill gaps in existing schemes through requirements that promote the development of strategic plans, procedures to improve sustainability performance, economic record-keeping, and the implementation of a management plan to ensure long-term economic viability.
- The reviewed certification schemes include comprehensive requirements to ensure traceability along the value chain. However, there are several gaps to be addressed. The sample definition and traceability system scope must be clearly established. A system for the management of traceability is also a requisite, this generally comprise written procedures and policies that demonstrate management’s commitment, as well as mechanisms for the development of employee capacity and ongoing review through a reporting system. The method used to ensure traceability, whether physical segregation, mass balance or another chain of custody approach, must be clearly defined, with the corresponding requirements specified. In addition, a due diligence system should be in place to enable continuous risk assessment and management. Finally, the verification process must ensure the effectiveness of the traceability system by engaging with multiple stakeholders and verifying supporting documentation, sustainability claims and the due diligence system itself. Given the variation in traceability requirements across schemes, BioReCer could follow the traceability requirements established by the main certification scheme, whenever the scheme has a sufficiently robust structure to meet BioReCer’s traceability needs. Additionally, to address gaps in circularity and other socio-environmental aspects not fully covered by the main certification schemes, BioReCer-specific indicators and requirements can be integrated into existing traceability systems. WP2 (via Deliverable 2.3) developed a set of tailored indicators for each value chain actor, including primary, intermediate, and final producers, as well as waste managers, to enhance the traceability of bio-based products. These indicators have also been incorporated into the digital traceability solutions developed in WP3 and WP5.

By addressing the abovementioned overlooked aspects and enhancing coverage of environmental, socioeconomic, circularity, traceability, and governance requirements, the BioReCer framework complements existing certification schemes.

4. Integration of the BioReCer framework into certification schemes

Chapter 4 outlines the methodology used to integrate the BioReCer framework into existing certification schemes. It includes the following,

- Chapter 4.1 describes the methodology for the development of the verification guidance and audit checklist to support certification schemes and certification bodies in assessing, interpreting and verifying the BioReCer requirements.
- Chapter 4.2 provides guideline for certification schemes on how the BioReCer framework can be adopted—either by using BioReCer as an additional module (add-on) or by fully integrating them into current schemes (add-in).
- Chapter 4.3 describes the development of a standalone document “The insights gained from this exercise informed recommendations for integration, based on opportunities to enhance existing schemes, and laid the groundwork for the next chapter. These outcomes also contributed to other work packages, as further detailed in the following figure.” which serves other certification schemes interested in integrating the environmental and traceability criteria into their system.
- Chapter 4.4 presents the results of the integration of BioReCer framework into ISCC PLUS. Two key activities are presented. First, the results of the pilot assessments carried out together with certification bodies and pilot partners. These assessments were instrumental in validating the auditability and applicability of the BioReCer framework in real-world settings. The insights gained from the pilots were also used to refine the practical guidance document and the audit tools developed. Second, the chapter also sheds light on the contribution of BioReCer project in developing the social criteria for ISCC PLUS.

Figure 14 summarises the overall methodology applied in developing the integration approach. The activities carried out was achieved by input from different tasks and work packages.

The insights gained from this exercise informed recommendations for integration, based on opportunities to enhance existing schemes, and laid the groundwork for the next chapter. These outcomes also contributed to other work packages, as further detailed in the following figure.

Deliverable D4.3



Integrated environmental and traceability assessment framework into certification schemes

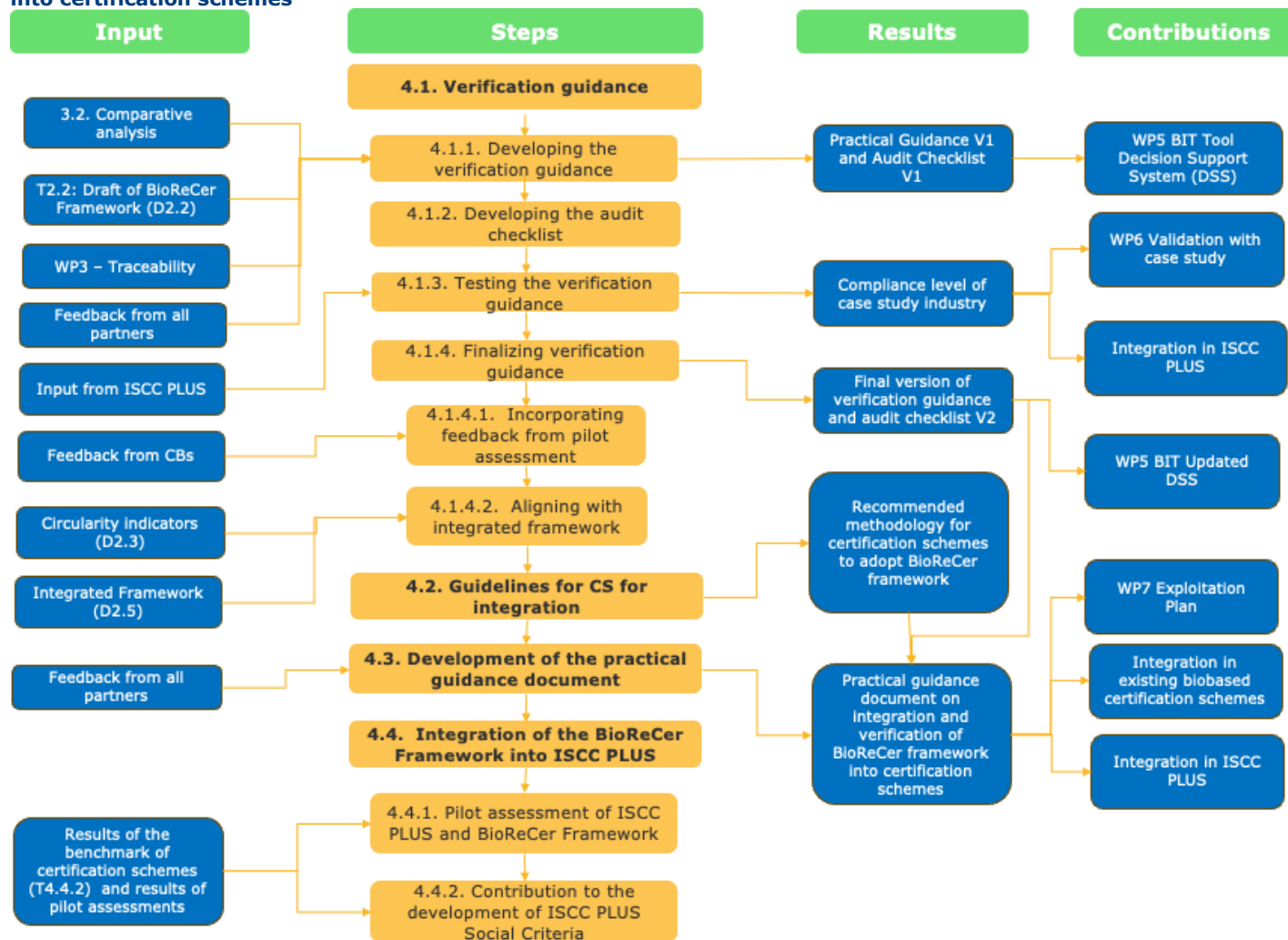


Figure 14 Steps followed, results and synergies between WPs in Chapter 4

4.1. Verification guidance

Certification schemes have structured systems that verify the compliance with its standards and the requirements. The verification guidance is a foundational operational tool for certification schemes to ensure the requirements are applied effectively. Certification schemes collaborate with networks of auditors and certification bodies to conduct audits and verify compliance with the standard. Therefore, certification bodies need to understand the essence of the requirements. It provides a systematic approach to evaluate compliance by the stakeholder involved in the assurance process, mainly certification bodies. The some of the key importance of this document are as below

- **Defined verification procedures:** The document outlines acceptable types of evidence and documentations needed to assess the compliance with the respective requirements. It also guides on what data collection and interpretation techniques.
- **Standardised auditor's practices:** The document lays uniform process of verification for all certification bodies and auditors. This helps in reducing the subjectivity and inconsistency and enhance fairness across sectors and regions
- **Simplifies requirements and standards into auditable criteria:** Certification schemes and standards can often contain high-level principles. Verification guidance document helps to simplify it and serves as bridge between theory and field implementation
- **Resource for training certification bodies and auditors:** The simplified presentation of the requirements helps to train the auditors and ensure all users have common understanding.
- **Ensures scheme's credibility:** The uniform and reliable verification procedures help to gain stakeholder's trust and market acceptance of certified products

The verification guidance document ensures that the BioReCer framework is not only theoretically sound but also operationally effective. It provides a reference for helping auditors to verify BioReCer requirements with reliable evidence and documentation. Thus, developing a verification guidance is an essential first step for integration of the BioReCer framework into the certification scheme and also one of the major outcomes of the project.

4.1.1. Developing the verification guidance

The tasks *T2.2 Identification of Environmental and Circularity Criteria*, *T2.3 Environmental Impact Assessment Methodology* and *T2.4 Circularity indicators for biobased products* under WP2 were the tasks dedicated to developing a theoretical qualitative framework. The development of the verification guidance is dependent on the outcome of these tasks however the deliverables of these tasks were due on month M24 and M30. In order not to delay the process for drafting the verification guidance, the initial draft of the sustainability requirements was taken as reference. The circularity indicators were not drafted at that stage so was not included in the first version of the verification guidance document.

The drafting of the verification guidance started with analysing the results of a comprehensive gap analysis (Chapter 3.2.5). This gap analysis revealed that some certification schemes had robust environmental requirements, while others placed greater emphasis on social criteria, showcasing a lack of uniformity. Furthermore, it made it possible to pinpoint similarities and differences in the requirements of various certification schemes as well as how the existing schemes guides its user (companies and certification bodies) understand the requirements better. Therefore, references from the existing

schemes were used to explain the BioReCer requirements in a way that harmonizes these differences. The development process also incorporated relevant ISO standards and insights from the policy and regulatory review conducted under WP2, ensuring that the guidance aligns with international best practices and regulatory expectations.

The BioReCer verification guidance includes following fields,

- Principle, criteria, and requirements
- Explanation of the requirements
- Level of compliance of the requirements (basic or advance)
- List of evidence and documentations

The first draft of the verification guidance was then shared with the project consortium to gather feedback on 1 October 2024. After incorporating input from all partners, the practicality of the verification guidance version 1 was tested during pilot assessments. Chapter 4.1.3. explains the process of testing and Chapter 4.4.1 presents the results of pilot assessments.

4.1.2. Developing an audit checklist

In addition to the verification guidance, an audit checklist was developed. The audit checklist helps auditors to systematically assess all relevant requirements and provide a concise and structured approach to verify and report compliance with standards. It is a practical tool that operationalises the verification guidance. The BioReCer audit checklist (Figure 15) contains the following fields.

- A list of criteria and requirements from the framework.
- A list of evidence and documents to assess conformity of the requirement.
- "Findings" as a field for observations, evidence collected, and auditor comments.
- "Conformity" as field to record compliance status (e.g., compliant, non-compliant, not applicable).

The fields "findings" and "conformity" as shown in Figure 15 below are to be filled by the auditors during the audit. The complete audit checklist is presented in Annex C. This can be used by certification schemes adopting BioReCer framework and the certification bodies verifying the BioReCer requirements.

Integrated environmental and traceability assessment framework into certification schemes

 BioReCer Biological Resources Certifications Schemes Type of Action (Horizon-IA) Call Identifier: HORIZON-CL5-2021-ZERO-POLLUTION-01							
Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.							
Note: Please refer to the "Practical Guidance Document on Integration of BioReCer Framework" for detailed description of the requirements and Annex 1 for Circularity Indicators. Please do not leave any cell in Column G, H and I empty							
Principle	Criteria	Req.No.	Requirements	BioReCer Decision	Evidence/documentation	Findings Please do not leave this Column blank	Conformity Yes/No/ NA
1. Protection of ecosystem	1.1 The company has functions to conserve and manage the environment	1.1.1	The company has data available about the type of sources of water use for the production process, including water reclamation	Basic	- Reports or inventory records for the water consumption, specifying the water source type and the quantity used. - Water use plan or water management plan elaborating on the water use - Permission of authority on the water use, if applicable - Documentations on formal or customary water rights in the area of operation (if applicable)		
1. Protection of ecosystem	1.1 The company has functions to conserve and manage the environment	1.1.2	The company identifies the water sources affected by runoffs and discharges	Basic	- EIA including impact of operation's run off and discharge - Map of water protection area affected by the operation - Records of the quality assessment of discharges - Water management plan including appropriate measures taken or planned to manage operation's run off and discharge impact		

Figure 15 BioReCer audit checklist.

4.1.3. Testing the verification guidance and audit checklist

Testing the practicality of the verification guidance and audit checklist is a critical step within the BioReCer project in order to ensure the real-world applicability, effectiveness, and usability of the BioReCer framework. Onsite pilot assessments helped to identify unforeseen challenges or barriers, such as unclear instructions, difficulties with data collection, and any inconsistencies hindering certification bodies or auditors from verifying BioReCer requirements. Thus, the feedback and learnings from the pilot assessment provided valuable insights that enabled the iterative refinement of both the BioReCer framework and the verification guidance document. As ISCC PLUS is a key reference to the project, the testing and validation was done by carrying out pilot assessment following ISCC PLUS audit procedure.

The objectives of these pilot assessments were to

- test the practicality of the BioReCer framework
- identify existing gaps in the bio-based sector in complying with BioReCer requirements
- provide guidance to bio-based industries in achieving compliance with the ISCC PLUS certification system for their biological feedstock
- provide feedback to WP2 for refinement of the BioReCer framework

The steps shown in Figure 16 were taken to conduct the pilot assessments and each step is explained in the section below:

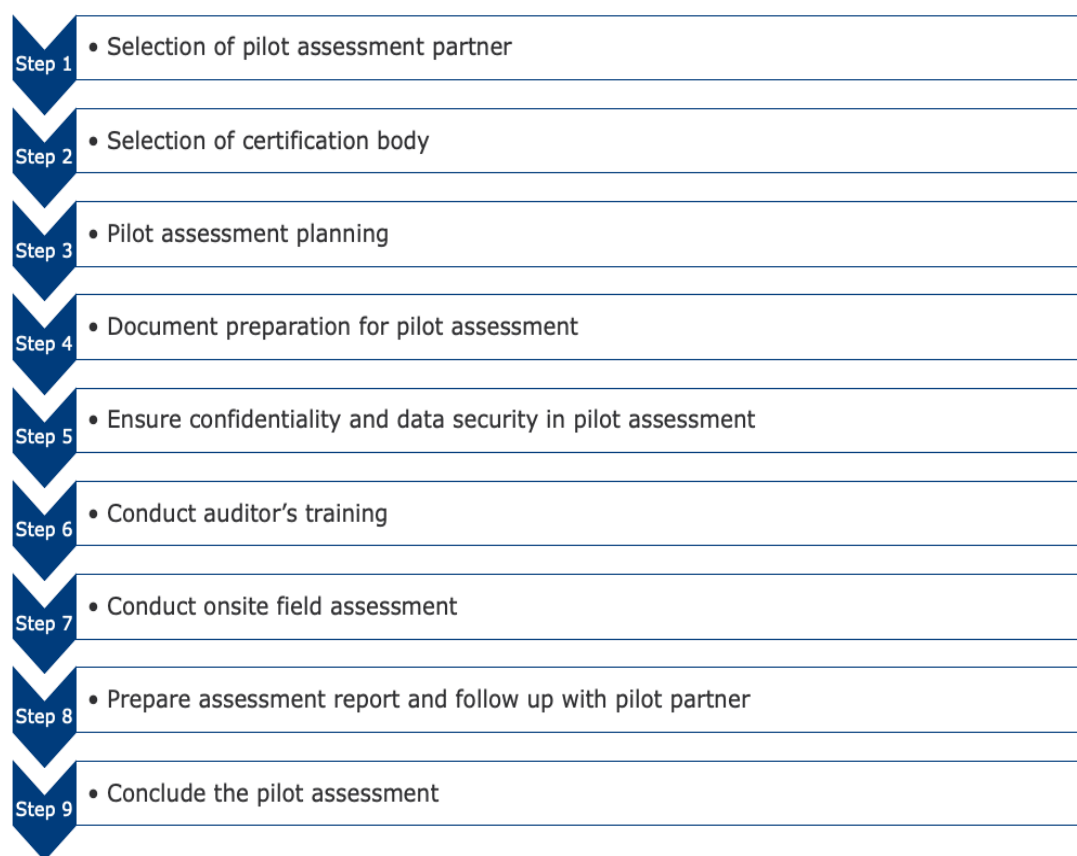
**Integrated environmental and traceability assessment framework
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Figure 16 Methodology for conducting pilot assessment.

Step 1: Selection of pilot assessment partner

The basic criteria for the selection of pilot assessment were that it should represent the case studies included in the project. Thus, case study leads, namely, CERTH, ANFACO, UNIVPM and RISE were contacted to explore their networks. Companies were reached out by explaining the objective of BioReCer framework and two pilot assessment were carried out in the case study regions in Italy and Greece. Both pilot assessments represented different sector and scopes of assessment as shown in Table 19. The process to select the pilot partners started in month 18 (M18) and were executed on the months M26 and M27 respectively.

Table 19 Information on pilot assessments

Country	Raw material	Output material	Scope
Italy	Municipal wastewater	Sewage sludge	Point of origin
Greece	Straw, organic waste	Fertiliser	Processing unit

Step 2: Selection of certification body

The prerequisites to select the certification bodies were that these must be recognised by the ISCC PLUS system and must operate in the pilot assessment area. ISCC PLUS recognised certification bodies must undergo trainings which ensure that they have appropriate skills and knowledge of ISCC PLUS sustainability requirements.²³ In addition, recognised certification bodies must ensure integrity of the certification process. By selecting an ISCC PLUS recognised certification body the credibility of BioReCer pilot assessments was ensured.

Step 3: Pilot assessment planning

A kick-off meeting was held involving MCS, the pilot partners, certification bodies, the respective case study leads, and ISCC PLUS. The primary objective of this meeting was to gain a comprehensive understanding of the pilot partners' value chains and to define the raw materials and scope of the audit (as detailed in Table 12). This collaborative discussion ensured that all stakeholders were aligned and shared a common understanding of the assessment process and expectations.

Step 4: Document preparation for pilot assessment

All the relevant documents for the pilot assessment i.e. the first draft of BioReCer verification guidance document, and the BioReCer and ISCC PLUS audit checklists, relevant to the scope of assessment, were shared with pilot partners and certification bodies in advance to allow them time to prepare. This helped the pilot partners to prepare the evidence and documentation accordingly. Any questions on the clarity of the documents were addressed by MCS. It is important to note that, during the time these pilots were conducted, the circularity indicators (D2.4) and the final BioReCer framework (D2.5) were under development (both due on M30). In order not to delay the activities of the project and also to provide feedback on the finalisation of the BioReCer framework, only the sustainability requirements were assessed during the pilot assessments.

Step 5: Ensure confidentiality and data security

During the assessment process, companies may be required to share confidential or sensitive information with auditors to enable verification of compliance with relevant requirements. ISCC PLUS certification is a third-party verification system so the disclosure of all information is not mandatory. It is, therefore, the responsibility of the certification body to ensure that any data or information shared by the company is adequately protected. To this end, data protection agreements were established between the respective certification bodies and the pilot partners. These agreements stipulate that only the final results of the assessments will be shared with the BioReCer project, thereby safeguarding proprietary and sensitive data.

Step 6: Conduct auditor's training

Dedicated training sessions were conducted with the respective auditors to ensure a thorough understanding of the BioReCer framework. These sessions aimed to familiarise auditors with the framework's structure, as well as the verification methods to be applied during the assessment. The training included open discussions to clarify the doubts on the

²³ ISCC EU 103 – Requirements for Certification Bodies and Auditors (https://www.iscc-system.org/wp-content/uploads/2025/04/ISCC_EU_103_Requirements_for_CBs_and_Auditors_v4.2.pdf)

requirements or type of evidence to be collected and address any questions or uncertainties, ensuring auditors were fully prepared to carry out assessments in line with BioReCer's objectives.

Step 7: Conduct on-site field assessment

The on-site field assessment is a critical component of the certification process, serving to verify that a company producing, processing, or handling bio-based materials is in compliance with requirements defined by both ISCC PLUS and the BioReCer framework.

In collaboration with the pilot partner and the certification body, an on-site audit was conducted. The assessment approach involved the use of both the ISCC PLUS and BioReCer audit checklists. During the visit, the auditor reviewed all relevant documentation required under both ISCC PLUS and BioReCer and, where necessary, conducted interviews with key personnel from the pilot partner to clarify procedures and gather further evidence.

In addition to the document review and interviews, the auditor performed a physical inspection of the company's production, storage, and processing facilities. This was done to verify that actual practices aligned with documented procedures, ensuring consistency, traceability, and compliance with the defined sustainability criteria.

Step 8: Prepare assessment report and follow up with pilot partner

Following the completion of the on-site assessment, the auditor compiled an assessment report detailing the identified conformities and non-conformities with respect to the requirements of both the certification scheme and the BioReCer framework. Where uncertainties or ambiguities arose, the auditor engaged in direct communication with the pilot partner to obtain necessary clarifications and ensure the accuracy of the findings.

Upon finalisation, the completed assessment report was submitted to MCS for review and documentation purposes, contributing to the overall evaluation of the pilot implementation.

Step 9: Conclude the pilot assessment

A final meeting was held between MCS and the auditor to review and clarify the findings of the pilot assessment. The objective of this meeting was twofold: to ensure a common understanding of the outcomes of the assessment, and to collect feedback on the practical implementation of the BioReCer framework. Any discrepancies identified in the assessment results were addressed and final reports were subsequently submitted to MCS. These results are presented in chapter 4.4.1. The insights and observations collected during the meeting contributed to the refinement of the verification guidance (Table 20 and 21), ensuring its relevance, clarity, and applicability for future certification processes.

4.1.4. Finalising the verification guidance and audit checklist

The verification guidance document and the audit checklist were finalised by incorporating feedback received from the certification bodies based on their experience during the pilot assessments. In addition, at Month 30 (M30) of the project, Deliverables D2.3 and D2.5 were completed. The relevant outcomes from these deliverables were integrated into the verification guidance to ensure consistency and alignment across work packages. Following this, the updated version of the guidance document was shared with consortium partners for review and validation, as part of the finalisation process.

4.1.4.1. Incorporation of feedback from certification bodies

The practical experience in applying the BioReCer verification guidance and audit checklist during the pilot assessments provided valuable insights into the clarity, applicability, and usability of the guidance materials. Table 20 below presents specific examples of how individual comments were addressed and incorporated into specific requirements. This process contributed to the development of Version 2 of the verification guidance document. Table 21 below presents examples of how comments were incorporated into revise requirements.

Table 20 Feedback from auditors to revise the BioReCer verification guidance

Auditor Feedback	Comments from MCS
Point of Origin has no suppliers; questions for suppliers should be deleted	The checklist specifies which part of the value chain each requirement applies to. Some supplier-related requirements may still be relevant at the point of origin, as primary producers might source seeds, fertilisers, or other inputs from external suppliers. The requirement description was revised accordingly.
Apply only one checklist by integrating requirements into a single document	Not feasible, as BioReCer could be add-on or add-in to the main certification schemes. It depends how a scheme wants to integrate BioReCer. However, requirements already covered by the main scheme (as identified in a benchmark) may be omitted during the BioReCer audit, avoiding duplication. This suggestion was incorporated while defining the guidelines for schemes to adopt the framework.
Clarify if the certification is site-specific, similar to ISCC PLUS	BioReCer does not define a scope on its own but follows the scope of the main certification scheme. This means that if the main scheme is site-specific, BioReCer will apply to that site.
Create a list of materials that can be certified	BioReCer is applicable to a wide range of materials, if the main feedstock is a biologically derived waste. The list of eligible materials should align with that of the main certification scheme being used. This was included in the practical guidance document.
Some requirements are too general (e.g.: 1.1.2, 2.1.1, 2.1.2, 2.2.2, 3.1.1, 3.1.3, 3.2.1, 3.3.1, 3.3.4.)	The requirements flagged as too general were reviewed, and additional explanations were included in the practical guidance to support interpretation, while keeping them broadly applicable across the intended BioReCer sectors.

Table 21 Example of the incorporation of auditor's feedback

Requirement	Auditor's feedback	Revised requirement
1.2.1. The company measures its Greenhouse Gases (GHGs) and has established a reduction plan	The requirement should be improved specifying that: the subject of quantification (organisation, product ...), the reporting boundary (scope 1, scope 2 and also scope 3 or only scope 1 and scope 2), the references to standards/ programs recognised	The company should specify: - Quantification level (products or processes) - Reporting boundaries (scope 1,2 or 3) - The recognised methodology followed for the calculation
2.1.2 The company establishes and monitors key performance indicators to ensure a responsible use of resources and avoid the degradation of ecosystems	The requirement should improve since it is too generic	Included measurable indicators for water use, chemical/material input, and product circularity, making the requirement more concrete
3.2.2. The company has a robust procedure to handle waste from the unsold finished goods	The requirement should improve since it is applicable only in organisations that produce final products	It is clarified in VG to explicitly include intermediate and final products. This should be applicable for all companies.

4.1.4.2. Aligning with the final integrated BioReCer framework (D2.5)

The deliverable 2.5 "Guideline for integration to bio-based certification schemes" provides a set of 52 requirements categorised into "basic" (mandatory) and "advanced" (non-mandatory, self-improving). Of the 52 requirements, 29 have been classified as basic and 23 have been classified as advanced requirements. To determine the compliance level with the BioReCer framework, a two-stage process is needed. The first stage is exclusionary and related to the compliance with basic requirements, and the second stage is evaluative and related to the compliance with advance requirements. All basic requirements must be met in order to fully comply with the BioReCer framework, if a company fails to comply with any of these requirements, it will not be considered eligible as they establish the minimum threshold (see Figure 17).

In addition to the requirements, Deliverable 2.5 establishes direct links between the framework and the circularity indicators introduced in Deliverable 2.3. It includes detailed guidance on how these indicators are to be calculated and applied in audit contexts. Based on this integration, the relevant sections of the verification guidance document were revised and updated to ensure consistency with the BioReCer framework and its associated deliverables.

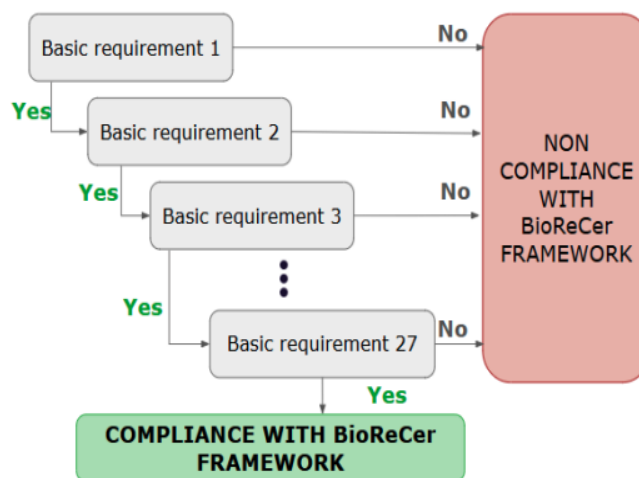


Figure 17 Decision tree to establish compliance with BioReCer framework (Source: D2.5)

Thus, based on these inputs the verification guidance document was finalised and is presented in Annex B of this deliverable. In addition to the revision of the verification guidance document, the BioReCer audit checklist was also revised, presented in Annex C. Both verification guidance document and the audit checklist act as tools to bridge the gap between theory and practice, ensuring that existing certification schemes as well as industries can successfully adopt and implement the framework.

4.2. Guidelines for the existing certification schemes for integration of the BioReCer framework

The BioReCer framework is a complementary framework to the existing certification schemes, meaning, it does not function as a standalone certification scheme. The framework will therefore have to be integrated into the existing certification schemes. In this section, the processes for integrating the BioReCer framework into certification schemes is outlined. However, as each certification scheme is independent and has different approaches to adopt new frameworks, it is important to note that the processes and requirements described here is a suggested method for integration. These details can be adapted based on the specific focus and requests of the certification schemes.

As integration of the BioReCer framework into a current certification scheme is one of the main objectives of the project, this section elaborates on the criteria and process of integration into the existing certification schemes.

4.2.1. Eligibility criteria for certification schemes for integration of BioReCer framework

It is essential to assess whether the mission, scope, and target audience of a certification scheme are aligned with those of the BioReCer framework. To ensure effective integration, any certification scheme incorporating the BioReCer framework must meet the following minimum criteria:

- **Independent third-party system:** The scheme must operate independently, with a clear separation between the standard owner, certification bodies, and certified companies. Audits, assessments, or inspections must be conducted by an impartial

third-party organisation to ensure unbiased verification of compliance with established standards.

- **Clear and transparent standards:** The scheme must be based on well-defined, measurable, and specific criteria. All requirements and processes for achieving certification must be publicly accessible, ensuring transparency for companies, stakeholders, and the wider public.
- **Multistakeholder governance:** The scheme must be developed and managed through a participatory process that includes a diverse group of stakeholders. This should involve representatives from industry, civil society, consumer groups, governmental bodies, and other relevant entities, promoting legitimacy and balanced input in standard-setting and implementation.
- **Ongoing monitoring and compliance:** The certification scheme must include a robust monitoring system to ensure that certified entities continue to comply with the standards post-certification. Periodic reviews and audits are essential to maintain credibility and trust.
- **Integrity and sanction mechanisms:** The scheme must have a clearly defined integrity program to prevent fraud, conflicts of interest, or any practices that could compromise the scheme's credibility. In case of non-compliance, an established system of sanctions—such as suspension or revocation of certification—must be in place and consistently applied.

These criteria served as the foundation for selecting certification schemes included in the comparative analysis under Task 4.4.2. Thus, they represent a reliable basis for ensuring that selected schemes are capable of effectively integrating the BioReCer framework and upholding its principles.

4.2.2. Process of integration

A structured integration process is essential to enable certification schemes to effectively adopt and implement the principles, criteria, and requirements of the BioReCer framework. Thus, the three-step integration process as shown in Figure 18 is designed to evaluate compatibility, address gaps, and align the operational procedures of the BioReCer framework with those of existing certification systems. By following these structured steps, certification schemes can ensure that the BioReCer framework is not only conceptually integrated but also effectively implemented and auditable within their systems. This contributes to greater consistency, traceability, and sustainability assurance across the bio-based value chain. These steps are explained in detail below.

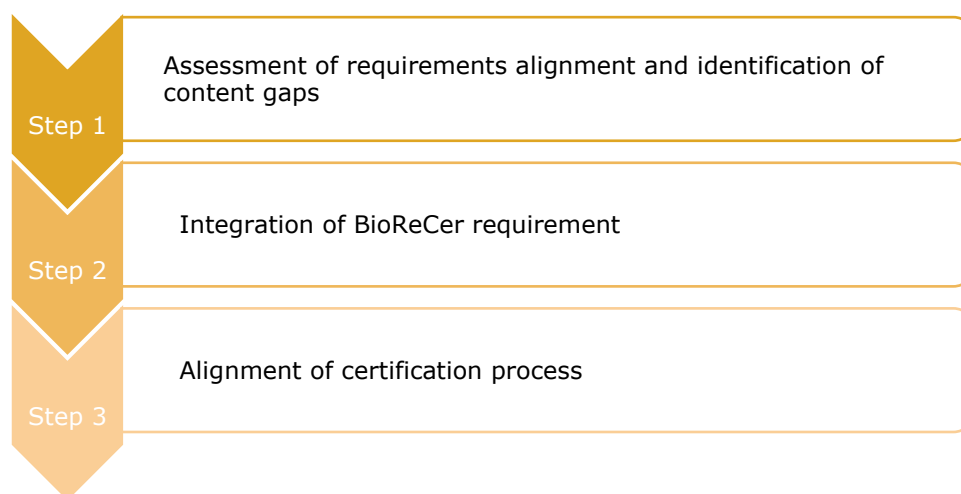


Figure 18 Process for integration of BioReCer framework into current certification scheme

Step 1: Assessment of requirements alignment and identification of content gaps

This step involves a comprehensive benchmarking exercise to evaluate the alignment between the BioReCer framework and the main certification scheme. This step is essential to determine the extent to which the principles, criteria, requirements, and indicators defined in the BioReCer checklist are already addressed by the existing certification scheme, and to identify any gaps or inconsistencies.

Each requirement of the main certification scheme should be systematically reviewed against the corresponding element in the BioReCer framework. Table 22 presents the alignment category applied for the benchmarking process and actions required:

Table 22 Alignment category for the benchmarking process and actions required

Alignment category	Description	Action
Fully aligned	The requirements of the main certification scheme meet all relevant BioReCer framework requirements.	No further action for integration is required. The current practice must be maintained.
Partially aligned	The requirement of the main certification scheme aligns with the key area of the BioReCer requirements, but gaps persist in meeting the full scope of the requirement	Identify gaps and complement scheme requirements, procedures, or supporting documentation to ensure full alignment.
Not aligned	The requirements of the main certification scheme do not meet BioReCer framework requirements.	Complement scheme requirements, procedures, or supporting documentation to meet full alignment
Not applicable	The BioReCer framework requirements are not relevant for the scheme's scope	No further action for integration is required. Document justification for non-applicability

Each assessment must be accompanied by a clear justification, outlining the reasoning behind the assigned alignment status. In case of "Full alignment" and "Not applicable", no actions are required. However, wherever the certification scheme is "Partially aligned" or "not aligned", appropriate integration measures must be taken in subsequent steps of the process.

Additionally, BioReCer requirements are categorised into two level of compliance

- **Basic requirements:** Core elements essential for minimum compliance with the BioReCer framework
- **Advanced requirement:** Criteria that go beyond the minimum threshold and reflect higher levels of performance.

Out of the total 52 BioReCer requirements, 29 are classified as basic requirements and 23 as advanced. When conducting the benchmarking exercise, special attention must be given to the basic requirements. If any of these 29 core elements are missing or only partially addressed in the main certification scheme, this must be recorded as a case of partial alignment, therefore requiring action for integration. Table 23 shows an example of the template that can be used for the benchmarking method. This structured assessment ensures a transparent and evidence-based foundation for subsequent integration steps, enabling certification schemes to make informed decisions on adapting their standards and procedures to meet BioReCer requirements. Meo Carbon Solutions can provide service for conducting the benchmark of the certification scheme against the BioReCer framework.

Table 23 Example template for conducting benchmarking.

BioReCer Framework Requirement	Compliance level	Certification scheme Requirement	Compliance level	Level of Alignment	Justification
Requirement 1					
Requirement 2					

Step 2: Integration of BioReCer requirements

When a new framework is introduced, a certification schemes need to adapt their systems accordingly. This involves updating standards, audit procedures, and reporting templates to ensure consistency and compliance. The BioReCer framework allows certification schemes to select an integration approach. In general, there are two integration approaches to integration, which are described as below:

- i. **BioReCer add-on:** This approach involves integrating the BioReCer framework as supplementary module to the existing certification scheme without altering the core structure of the original standard. Meaning, instead of revising the core standard, it is added as a supplementary module that complements the existing core certification standard. In this case, a dual certification system applies, i.e. the auditor uses two checklists during the audit: first, the main checklist from the existing certification standard and, second, the BioReCer audit checklist, developed as part of the BioReCer add-on module (Annex C). The audit report must clearly document the outcomes of both assessments. This ensures transparency and maintains the integrity of the original certification scheme while accommodating the new framework.
- ii. **BioReCer add-in:** This approach involves directly incorporating the BioReCer framework requirements directly into the core structure of the certification standard. Rather than treating them not as supplementary elements, they are

considered integral components of the main system. This integration is achieved through a combined checklist, which merges requirements from both the existing scheme and the BioReCer framework are merged into a single checklist. This unified system ensures that framework requirements are embedded within the core audit procedures, evaluation criteria, and reporting mechanisms.

In both approaches, it is essential that certification bodies and auditors receive adequate training on how to interpret and evaluate the BioReCer-related requirements and how to correctly apply the audit checklist.

Step 3: Alignment of certification process

The alignment of the certification process refers to ensuring that the procedures, systems, and documentation of the main certification scheme and the BioReCer framework are consistent. It covers the operational and procedural aspects of certification. The proper process alignment ensures consistency, credibility, and efficiency in implementation.

The main certification scheme shall prepare a formal declaration or recognition document acknowledging the integration of the BioReCer framework. This document should detail all aspects of the integration, including references to finalised materials such as the combined checklist, documentation checklist, and any other relevant tools or procedures aligned with the framework.

The key components of the aligned certification process are outlined below:

- **Audit process:** The implementation of the BioReCer framework within the certification scheme is the responsibility of the scheme owner. This includes developing and integrating procedures into the existing system, organising training for certification bodies, and defining specific audit processes to incorporate BioReCer requirements effectively.
- **Reporting:** The certification scheme must establish a reporting process that includes the results of the assessment of the BioReCer requirements for example, a dedicated section within the report. The audit reports should clearly identify any non-conformities related to the BioReCer framework and outline the corrective actions taken.
- **Corrective measures:** The timeline for implementing corrective measures and achieving compliance with BioReCer requirements shall follow the rules and procedures of the main certification scheme. In cases where non-compliance persists, sanctions—such as warnings, suspensions, or withdrawal of certification—are applied in accordance with the main scheme's disciplinary protocols.
- **Certificate:** The BioReCer certificate may only be issued, once the company complies with all the "basic" requirements of the BioReCer framework. The BioReCer certificate shall adopt the format of the main certification scheme and depending on the approach of integration taken, the certificate must either display the BioReCer logo or explicitly acknowledge that the certification includes compliance with the BioReCer framework. Furthermore, the certificate must be made publicly accessible by the main certification scheme to ensure transparency. The validity period of the BioReCer certificate shall also align with the rules and timelines defined by the main certification scheme.
- **Integrity audit:** The integrity audit mechanisms of the main certification scheme also apply to the integrated BioReCer framework. If any violation or infringement of the BioReCer requirements is detected, the enforcement procedures of the main scheme, including investigation and sanctioning processes, will be applied accordingly.

4.3. Development of the practical guidance document

The existing bio-based certification schemes play an integral role in ensuring and verifying the sustainability claims of products, processes, and industries. The BioReCer framework, on the other hand, introduces a set of requirements and indicators aimed at complementing existing schemes to enhance sustainability, circularity and traceability of the bio-based products. The integration of the BioReCer framework into existing certification schemes can thus enhance their robustness and strengthens their overall effectiveness.

According to the Grant Agreement, the task T4.4 shall develop a practical guidance document elaborating on how to comply and verify the BioReCer framework. This document must serve all existing biobased certification schemes interested in integrating the BioReCer framework. Thus, to fulfil this objective, a standalone document named as *"Practical guidance document on integration and verification of BioReCer framework into certification schemes"* was developed. The objective of this document is to ensure that certification schemes, certification bodies and all stakeholders within the bio-based industries interested in the BioReCer framework can access relevant, implementation-focused content. As BioReCer introduces new set of requirements, it is essential that the industries also understand these requirements and prepare accordingly when seeking certification. Therefore, the practical guidance document further supports bio-based industries in understanding BioReCer requirements.

The practical guidance document (Annex B). is developed for different stakeholders and the content is divided into two parts.

- The first part provides guidance on integrating the framework into the certification schemes, elaborating on how to operationalise it in audits, assessments, and certification procedures (See chapter 4.2)
- The second part provides detailed verification guidance, describing each requirement, indicating the compliance level of the requirement (basic or advanced), and detailing the corresponding evidence and documentation needed to verify the requirement. Where relevant, the circularity indicators are also included in the description of the requirements.

This document also contains the list of circularity indicators equations (extracted from D2.3) explaining how the indicators can be calculated, and BioReCer audit checklist that can be used by auditors while conducting BioReCer audits.

4.4. Integration of the BioReCer framework into ISCC PLUS

Credible certification schemes follow a structured process for the development of new add-ons that typically involves:

- Benchmarking the new framework against the scheme's existing requirement.
- Pilot testing to validate the practical applicability and compatibility of new requirements.
- Stakeholder consultation to gather feedback from relevant actors.

The final integration can be either as an add-in or add-on module therefore being optional or mandatory requirements, depending on the outcome of the process.

As ISCC PLUS is a key reference voluntary sustainability certification schemes for BioReCer project, WP4 established the foundation for integrating the BioReCer framework into ISCC

PLUS. This integration was pursued through two main approaches. Firstly, two pilot assessments were conducted in collaboration with ISCC PLUS. This approach gives basis for ISCC PLUS to realize the practicality of the BioReCer framework and the verification guidance. Secondly, the results of comparative analysis of certification schemes as well as results of pilot assessments provided feedback in the development of the forthcoming ISCC PLUS Social Criteria. These two approaches are explained in detail below.

4.4.1. Pilot assessment of ISCC PLUS and BioReCer Framework

This section presents the findings from the two pilot assessments conducted as part of the BioReCer framework integration. The detailed methodology and procedures followed during these assessments are described in chapter 4.1.3 of this report. The results presented here provide concrete evidence that the BioReCer requirements are auditable and can be verified by certification bodies. Importantly, the pilot assessments were conducted following the add-on approach, i.e. by using both the ISCC PLUS and BioReCer checklists, ensuring compatibility and demonstrating how the BioReCer framework can complement existing certification schemes. Furthermore, the pilot assessments were carried out by ISCC-accredited certification bodies, thereby guaranteeing the credibility, neutrality, and reliability of the results in line with internationally recognised third-party certification standards. In accordance with data protection agreements established with the pilot partners, the names of the participating companies have been anonymised. Therefore, this chapter only summaries of the audit results are provided in this report. Table 24 shows and overall result of both pilot assessments. The details of the results are explained below.

Table 24 Overview of compliance level of pilot assessments

Country	Conformity		Non-conformity		Not applicable		Requirement not assessed		Total
	Basic	Advance	Basic	Advance	Basic	Advance	Basic	Advance	
Italy	20	13	0	0	7	0	10	2	52
Greece	26	13	1	0	0	0	10	2	52

The term “conformity” in Table 24 refers to the fact that the auditor has verified and confirmed the pilot partner’s compliance with the relevant BioReCer requirement while “non-conformity” refers that the auditor could not verify the compliance of the relevant BioReCer requirement. The term “not applicable” indicates that the auditor evaluated a specific BioReCer requirement is not relevant to the defined scope of the audit and scheme. The table also indicates “requirement not assessed”. These are the circularity requirement and indicators which were not ready during the pilot assessment, therefore, were not assessed (justification provided in chapter 4.1.1.)

4.4.1.1. Pilot assessment in Italy

The pilot partner operates a wastewater treatment plant in Italy which is in compliance with Italian and European regulations. For the purpose of the pilot assessment, municipal wastewater was identified as the raw material. The scope of the audit focused on the point

of origin—that is, the location where the waste is initially generated. The assessed output material from this process was sewage sludge.

The assessment verified the compliance with the BioReCer requirements grouped under the four core principles: protection of ecosystems, safe and sustainable use of resources, business model and value creation, and working conditions and society as shown in Figure 19. The circularity requirements and indicators were not ready when this pilot assessment was conducted and hence were not included.

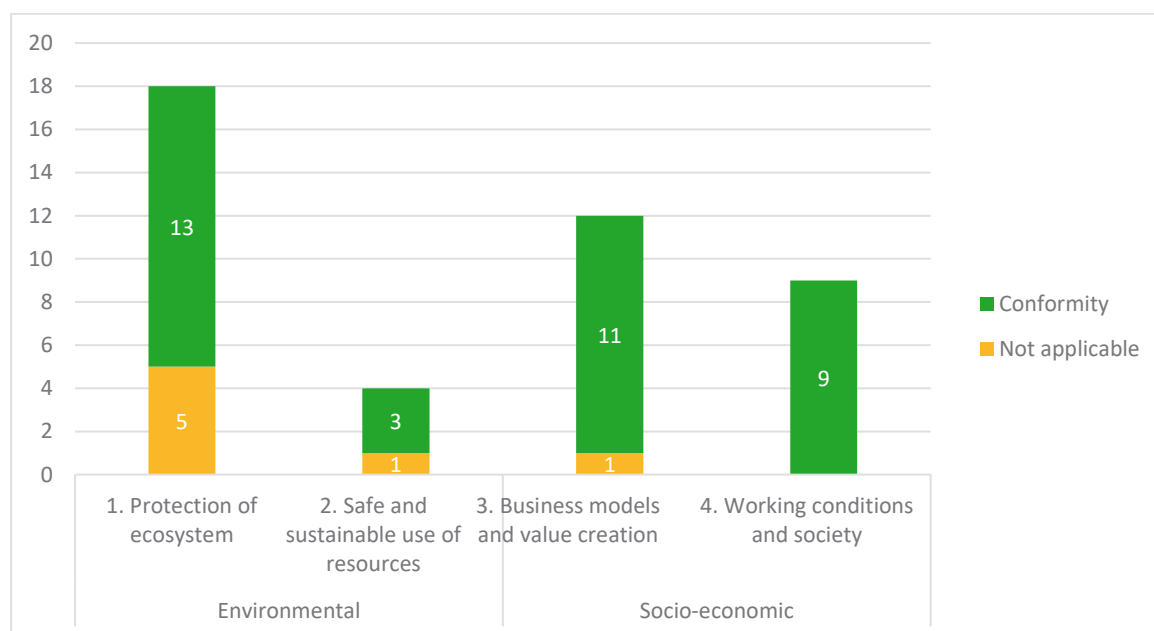


Figure 19 Results of pilot assessment in Italy

The assessment results demonstrated that, out of 43 requirements assessed, the wastewater treatment plant complies with 36 requirements. The remaining seven requirements were evaluated as “Not applicable” as the pilot partner was the point of origin and did not have further chain of custody elements. These requirements are listed in Table 25.

Table 25 Requirements “Not applicable” in pilot assessment in Italy

Req No.	BioReCer Requirement
01.01.05	The company shall indicate whether it adopts ecosystem regeneration and rehabilitation measures
01.01.07	The company assesses soil quality and soil risks and takes measures to maintain and improve them
01.03.01	The company shall have evaluations about the state of the biodiversity within the area and a plan to maintain and improve biodiversity
01.05.01	The company characterises the introduced genetically modified species
01.05.02	The company quantifies non-indigenous/invasive species and pathogens introduced into the ecosystem
02.01.01	The company considers the resilience of the ecosystem to ensure sustainability

Req No.	BioReCer Requirement
03.03.04	The company identifies whether action has been addressed to ensure the bio-based feedstock production does not negatively affect the food security of the surrounding area

Therefore, it can be concluded that the BioReCer requirements are auditable and verifiable by the auditors in case of sewage sludge.

In terms of compliance with ISCC PLUS requirements, the auditor reported that all the requirements were met. It is important to note that, given the pilot nature of the assessment and that the pilot partner was not registered as a system user within the ISCC PLUS system, therefore, some checkpoint could not be assessed. The below listed recommendations were provided by the auditors if the pilot partner seek for ISCC PLUS certification in future.

- The sustainability declaration should contain all fields requested by ISCC PLUS scheme.
- Relevant training was provided by the management, but not all the evidence of formal training related to ISCC PLUS were in place (i.e. training records like for example plan, participant list, material used). It is recommended to have record of all the trainings conducted.
- Records and traceability documents were available, but the certification body suggested better demonstrating the availability of the related documents, records, reports, information, and data, by explicitly stating they must be retained for more than 5 years, even though this is a requirement already mandated by law.

4.4.1.2. Pilot assessment in Greece

The pilot partner is based in Northern Greece and specialises in environmental management and circular economy practices. It is the collecting point and processing unit of organic waste transforming into valuable composts and organic fertilisers.

For the pilot assessment, “straw” waste and “organic waste” collected from the supermarkets were considered as the raw material. The scope of the assessment was the collecting point and processing unit, meaning where the waste is collected and processed. The output material for these feedstocks was fertiliser. Similar to the Italian case, the four core principles were assessed. The results are shown in Figure 20.

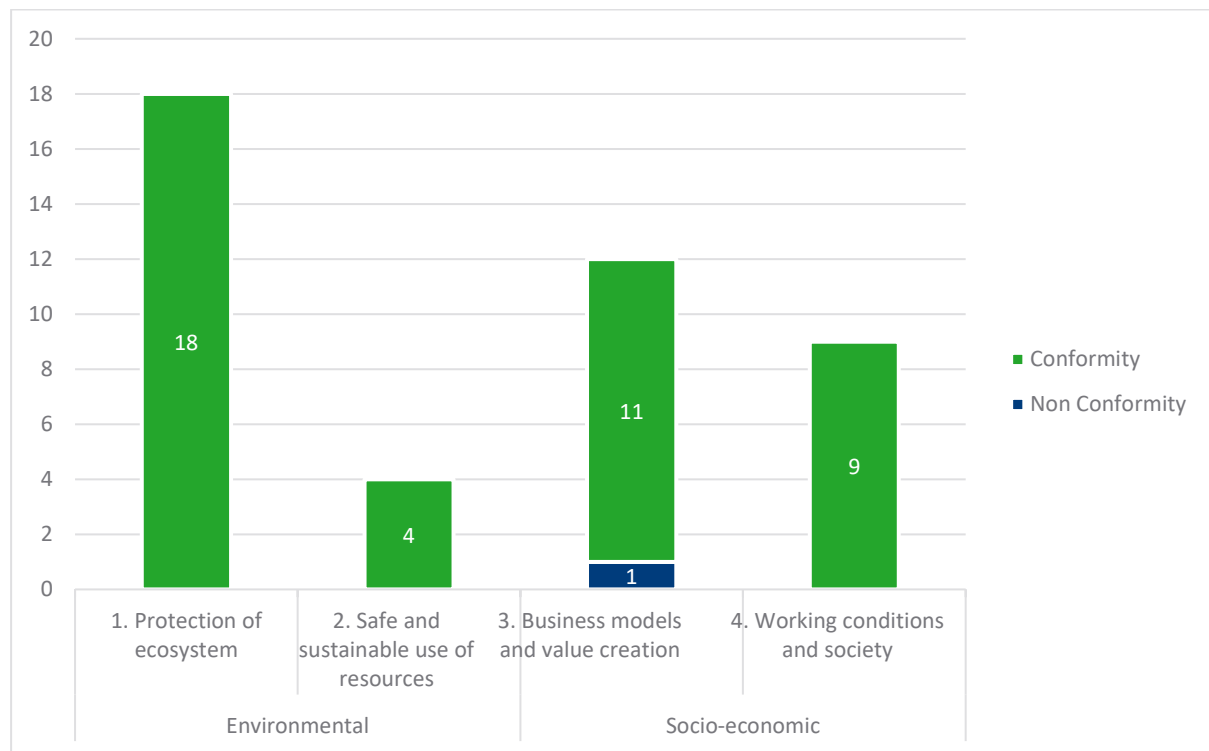
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Figure 20 Results of pilot assessment in Greece.

The results of the assessment presented a high level of compliance, demonstrating the organisation's solid foundation in sustainability practices. However, the presence of 1 non-conformity highlights the need for targeted improvements to ensure full alignment with the framework. The company could not demonstrate that it is compliant with the requirement "The company identifies whether action has been addressed to ensure food security in biomass production systems". This is a basic requirement in the BioReCer framework. Thus, it was recommended that the company take appropriate measures to address this.

Regarding compliance with ISCC PLUS requirements, most of the requirements were verified. Similar to the Italian case, the pilot partner is not a registered system user within the ISCC PLUS system, so the management system and process of the pilot partner are not in accordance with the ISCC PLUS standard. The below mentioned points were highlighted by the auditor as a recommendation for improvement. It is important to note that, given the pilot nature of the assessment, these findings were not classified non-conformities, instead, they serve as indicative observations to provide guidance for potential future improvements should the pilot partner seek ISCC PLUS certification.

- Internal processes are not aligned as per ISCC PLUS standard. ISCC provides mandatory trainings on the system basics thus, it is recommended to take such trainings when opting for the certification.
- Records and traceability documents are recommended to keep for more than five years as required by ISCC PLUS standard.
- Risk assessment according to ISCC PLUS Standard requirements should be carried out.
- Specific trainings according to ISCC PLUS Standard requirements to the related workers of the company must be provided.

- Respective ISCC PLUS sustainability declarations from point of origin should be operationalised and recorded.
- Most of the relevant documents were verified but mass balance documentation should be aligned as per ISCC PLUS standard.

4.4.1.3. Key summary

In nutshell, results of both pilot assessments provide clear evidence that the BioReCer requirements are verifiable in practice. The auditors' experience and observations during the application of the verification guidance and audit checklist further demonstrate that these documents are effective tools for verification. Consequently, the BioReCer framework and its associated documents can be utilised by ISCC PLUS as well as other existing bio-based certification schemes to complement their auditing and certification processes.

4.4.2. Contribution in the development of ISCC PLUS Social Criteria

ISCC PLUS is voluntary sustainability certification system used in diverse industries, such as food and feed, bioenergy and chemicals as well as bio-circular materials. The subject of certification is the handling and processing of alternative materials—specifically biomass, waste and residues, non-biological renewables, and recycled carbon-based materials—within the defined supply chain operations.

As part of the benchmarking exercise conducted within the BioReCer project, it was noted that ISCC PLUS comprehensively incorporates environmental and social sustainability criteria at sourcing points of agricultural and forest feedstocks. The scheme currently places strong emphasis on the traceability of the certified bio-based materials throughout the supply chain, from origin to final product. However, social sustainability requirements are not yet part of the scheme across the entire supply chain.

To address this gap, ISCC PLUS is currently developing a dedicated ISCC PLUS Social Criteria aimed at extending social sustainability requirements across the entire supply chain. These requirements are in line with international human rights and social standards. The BioReCer project under WP4 (T4.4.2) conducted two benchmarking exercise (explained in Chapter 3) i.e. (i) benchmark various certification schemes against ISCC's existing criteria (including social criteria) and, (ii) ISCC requirements (that are currently applicable only at the sourcing points- farm and forest sourcing area level) against BioReCer framework requirements.

As a contribution of BioReCer project, specifically WP4, to this development, the benchmark results related to social criteria were shared with the ISCC PLUS team. This helped to provide an overview of the social criteria among other certification schemes. The results of the benchmarking activity were therefore taken into consideration during the drafting process of the ISCC PLUS social criteria. For example, the inclusion of the requirement "4.1.5. The company has effective complaints and grievance mechanisms and take measures to resolve the reported complaints and grievances", to help raise the business-related human right abuse, was recommended by BioReCer framework and will be incorporated into ISCC PLUS Social Criteria.

Additionally, the results of the two pilot assessment, specifically related to the social requirements, were also shared with the ISCC PLUS team. The pilot assessment was carried out by ISCC PLUS accredited auditors from recognised certification bodies. This provided evidence to ISCC PLUS on the verifiability of the BioReCer social requirements. This is foreseen to complement the pilot testing phase of ISCC PLUS Social Criteria.

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The development and revision of the ISCC PLUS system requirements follows a structured, multi-stakeholder approach. This process typically begins with research, benchmark and feasibility assessments, followed by the drafting of documents and establishing working groups (if needed). A public consultation phase and pilot testing are then conducted, after which the final outcome is integrated into the ISCC PLUS System. The draft of the Social Criteria document is now planned to undergo formal stakeholder consultation processes prior to its implementation. However, due to the time required for such consultations, the finalisation and implementation of the social criteria will extend beyond the duration of the BioReCer project. As ISCC PLUS is an independent body, it is not obliged to fulfil goals of the project within the project timeline. Nevertheless, the BioReCer project supported ISCC PLUS in benchmark and feasibility assessment via pilot assessment and provided feedback on the drafting the ISCC PLUS Social Criteria document. The project contributed to strengthening and supporting the development of ISCC PLUS Social Criteria requirements for the entire supply chain and therefore fulfilling the milestone of the project i.e. framework integrated into one certification scheme.

5. Conclusions

WP4 was responsible for conducting a comparative analysis and developing a practical guidance document to support the integration of the BioReCer framework into existing certification schemes for bio-based materials. One of the key achievements of WP4 is the completion of a comprehensive gap analysis (Chapter 3), which identified how the BioReCer framework aligns with or complements existing certification scheme requirements. This analysis revealed both areas of alignment and gaps where BioReCer can enhance current practices, thereby informing the development of practical integration tools.

The practical guidance document (as introduced in Chapter 4)—another major deliverable—serves as a reference for certification scheme owners. The document includes:

- i. instructions for integrating the BioReCer framework,
- ii. verification guidance outlining required evidence and documentation, and
- iii. an audit checklist for use during certification procedures

Together, these elements form a structured and practical toolkit to facilitate both the integration and verification of the BioReCer framework into existing certification schemes including bio-based waste streams and by-products which is the focus of this project.

The third major achievement of WP4 was the successful implementation of pilot assessments in collaboration with ISCC PLUS, a leading voluntary sustainability certification scheme. These assessments provided real-world evidence that the BioReCer requirements are practically verifiable and can be audited together with the existing certification processes. Notably, the assessments were carried out by an ISCC-accredited certification body, ensuring credibility and reliability of the results. The findings also contributed to ISCC PLUS's ongoing development of a Social Criteria, reflecting BioReCer's added value to established certification schemes. Therefore, also achieving one of the milestones of the project.

Finally, the existing standardisation gaps have been identified in order to push the development of harmonised documents at European level by the relevant CEN/TC 411.

Together, these outputs offer a robust, evidence-based pathway for integrating the BioReCer framework into credible and established certification systems and standards, thereby strengthening sustainability, traceability, and social responsibility in the bio-based economy.

6. List of abbreviations

Abbreviation	Full Form
AFNOR	Association Française de Normalisation
AI	Artificial Intelligence
AIDA	Artificial Intelligence Data Analytics
ASC	Aquaculture Stewardship Council
BioReCer	Biological Resources Certifications Schemes
BIT	BioReCer ICT Tool
CA	Conformity assessment
CB	Certification body
CABs	Accredited Conformity Assessment Bodies
CEN	European Committee for Standardisation
CENELEC	Comité Européen de Normalisation Électrotechnique
CO ₂	Carbon Dioxide
DIN	Deutsches Institut für Normung
DSS	Decision Support System
EC	European Commission
EFTA	European Free Trade Association
EIA	Environmental Impact Assessment
ESB	European Standardisation Bodies
ESO	European Standardisation Organisations

**Integrated environmental and traceability assessment framework
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Abbreviation	Full Form
ESPR	Ecodesign for Sustainable Products Regulation
ETSI	European Telecommunications Standards Institute
EU	European Union
FAO	Food and Agriculture Organisation
FP	Framework Programme
FSC	Forest Stewardship Council
GEOSTM	Georgia Standards Body
GHG	Greenhouse Gas
GRI	Global Reporting Initiative
ICT	Information and Communication Technologies
IEC	International Electrotechnical Commission
ILO	International Labour Organisation
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
ISB	International Standardisation Bodies
ISCC	International Sustainability and Carbon Certification
ISEAL	International Social and Environmental Accreditation and Labelling Alliance
ISO	International Organisation for Standardisation
KPI	Key Performance Indicator
MCS	Management Control System

Abbreviation	Full Form
M	Months
ML	Machine Learning
MSC	Marine Stewardship Council
NGO	Non-Governmental Organisation
NSB	National Standardisation Bodies
OECD	Organisation for Economic Co-operation and Development
OJEU	Official Journal of the European Union
PEFC	Programme for the Endorsement of Forest Certification
QI	Quality Infrastructure
RSB	Roundtable on Sustainable Biomaterials
SReq	Standardisation Requests
SBP	Sustainable Biomass Program
SDGs	Sustainable Development Goals
SIS	Swedish Standardisation Body
SLR	Systematic Literature Review
SMEs	Small and Medium-sized Enterprises
SURE	Sustainable Resources Verification Scheme
UN	United Nations
UNI	Ente Italiano di Normazione
UNECE	United Nations Economic Commission for Europe

Abbreviation	Full Form
VCSs	Voluntary certification schemes
VSM	Value Stream Mapping
WP	Work Package

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Annex A

Please see supplementary document “D4.3_ Annex A” attached to this report. It contains the following:

Tab Name	Description
1.1. ISCC benchmark_Forest	Results of the benchmarking process using ISCC as a reference against selected certification schemes in the forestry sector.
1.2. ISCC Benchmark_Agri	Results of the benchmarking process using ISCC as a reference against selected certification schemes in the agricultural sector.
2. Traceability Analysis	Results of the content analysis of selected certification schemes to identify traceability-related requirements.
3. PreliminaryEval_Bench	Presents the results of a preliminary evaluation identifying BioReCer requirements that are not covered by any of the selected certification schemes. It also illustrates how these requirements are addressed across different stages of the value chain.
3.1. BioReCer Benchmark	Benchmarking results identifying similar requirements among selected certification schemes compared to the draft BioReCer Framework.
3.2. Gap analysis compiled	Analysis of gaps between selected certification schemes and the draft BioReCer Framework.
3.3. QuantificationOfResults	Results of the gap analysis quantified, in order to process the data in visible results with graphs
3.3.1 Similarities % per Pillar	Percentage of similarities between selected certification schemes and the draft BioReCer Framework, grouped by BioReCer Pillar.
3.3.2. Similarities % per Req.	Percentage of similarities between selected certification schemes and the draft BioReCer Framework, broken down by individual BioReCer requirements.
4. Pilot Audit Results	List of audit results for the Greece and Italy case studies, including the checklist of requirements (Requirement_MCS VG V1) used during the audit and the final set of requirements developed by WP2 (Req_updated_V2).

Annex B

The practical guidance provides recommendations for certification scheme owners on how to adopt it and explains each requirement with details on what to check during an audit. Please find this practical guidance attached as a supplementary document titled "D4.3_Annex B."

Annex C

Please find attached the BioReCer audit checklist, adapted for use with the ISCC PLUS certification scheme, as a supplementary document titled "D4.3_Annex C".