

## **Biological Resources Certifications Schemes**

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# Report on the whole development of the BRSP

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## Publishable executive summary

The current report outlines the efforts made to design, create, and dynamise the BioRsources Stakeholder Platform (BRSP). The BRSP, as part of the Bioresources Innovation Ecosystem living-lab (BRIE-LL), is one of the cornerstones of the BioReCer project since it aims at involving numerous stakeholders with different roles and focusing on the development of optimised models for assessing environmental sustainability and traceability of biological resources. In the first 12 months of the project, the relevant stakeholders for the project have been identified and many activities have been performed aiming at involving and engaging stakeholders from different countries across Europe. The aim of the BRSP is to create a community of stakeholders that interacts with the BioReCer consortium in order to achieve the main objectives and maximise outreach and the impact of the project results.

The stakeholders' involvement and, hence, the setting of the BRSP are relevant for the achievement of different specific objectives of the project. One of these objectives refers to the validation of the developed impact assessment framework in the 4 case studies representing the main incipient bio-based supply chains in Europe (Specific Objective -SO 4). This objective is strictly related to the development of a multidimensional impact assessment and traceability framework to evaluate biological resource supply chains in Europe (SO 2). In the current report all the activities we carried out to involve the stakeholders in the key regions related to the Case Studies (CSs) will be described. The activities related to the validation and the alignment of the identified criteria for multidimensional impact assessment and traceability framework are not within the scope of the present work.

The number of stakeholders registered in the BRSP so far is 57. In order to involve potential stakeholders in the BRSP, a series of activities have been performed. As a first step, we invited stakeholders from the 4 representative regions (i.e., Spain, Italy, Greece, Sweden) to a preparatory workshop in which both the objectives and the expected outcomes have been presented. We have also tried to reach out to other stakeholders by sending an email with the most relevant information about the project.

Once we had reached a consistent number of BRSP members, we engaged them in two different activities: Focus Groups (FGs) whose aim was to collect stakeholders opinion about the general aim of the project and the potential barriers we may encounter; Analytical Hierarchy Process (AHP) analysis to collect quantitative feedback to identify the sustainability criteria relevant for the involved stakeholders.

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Besides the continuous effort we will put to promote the BRSP membership of new stakeholders, the next step we will take includes the BRSP members engagement in specific activities such as training and brainstorming sessions. Furthermore, by the end of the 3rd year, we will also involve them in other socio-economic activities such as field experiments and Delphi Surveys.



## **1** Introduction

### **1.1 Definition of BRSP and stakeholder**

The BioReCer project aims to ensure the environmental performance and traceability of biological feedstock used by bio-based industries. This important and ambitious goal will be reached thanks to the adoption of an innovative approach based on three main technological pillars: **1)** the multidimensional assessment framework for an aggregated analysis on both the biological feedstocks and their associated supply chains; **2)** the BioReCer Innovation ecosystem living-lab with a multi-agent approach; and **3)** the integration of all this knowledge to complement current certification schemes including new criteria. The second pillar emphasises stakeholders' involvement and engagement throughout the whole project's duration.

In the context of organisational studies, the term "stakeholder" encompasses a broad conceptualisation and has a multidimensional definition. In fact, it can be described as encompassing groups and individuals who possess an interest in the actions and outcomes of an organisation and upon whom the organisation relies on to accomplish its objectives (Harrison, 2021)<sup>1</sup>. Additionally, it refers to any organised group of people who share a common interest or stake in a specific issue or system (Grimble & Wellard, 1997)<sup>2</sup>. Freeman (1984)<sup>3</sup> has provided a comprehensive definition of stakeholders, as any group or individual who possesses the capacity to affect or is influenced by the accomplishment of a corporation's or organisation's purpose, objectives, or performance.

In the literature, the impact of stakeholders' engagement in many managerial decisions have been revised and discussed (Phillipson et al., 2012; Papagiannakis et al., 2019)<sup>4</sup> highlighting the positive added value of their engagement. Hence, also in our project

<sup>&</sup>lt;sup>1</sup> Harrison, J. S. (2021). Stakeholder Theory. In The Palgrave Encyclopedia of Strategic Management (pp. 1-8). Palgrave Macmillan UK.

<sup>&</sup>lt;sup>2</sup> Grimble, R., & Wellard, K. (1997). Stakeholder methodologies in natural resource management: a review of principles, contexts, experiences and opportunities. Agricultural Systems, 55(2), 173-193.

<sup>&</sup>lt;sup>3</sup> Freeman, R.E. (1984). Strategic Management: A Stakeholder Approach. Boston: Pitman Publishing.

<sup>&</sup>lt;sup>4</sup> Phillipson, J., Lowe, P., Proctor, A., & Ruto, E. (2012). Stakeholder engagement and knowledge exchange in environmental research. Journal of environmental management, 95(1), 56-65.

Papagiannakis, G., Voudouris, I., Lioukas, S., & Kassinis, G. (2019). Environmental management systems and environmental product innovation: The role of stakeholder engagement. Business strategy and the environment, 28(6), 939-950.



stakeholders are involved from the very beginning until the end of the project since they play a key role in shaping the main results. The interaction among stakeholders and the main actors involved in the projects will be achieved through an Open Innovation Approach called Bioresources Innovation Ecosystem living-lab (BRIE-LL). Living labs are defined by The European Network of Living Labs as "user-centred open innovation ecosystems based on a systematic user co-creation approach, integrating research and innovation processes in real-life communities and settings" (Hossain et al., 2019<sup>5</sup>). This can be considered as the best environment to guarantee cooperation among stakeholders in an open space to give them the opportunity to analyse the barriers and opportunities and jointly develop innovative ideas.

Going more into detail, the living-lab initiative revolves around a community of practitioners, intricately connected at the "phygital" level: both physical and digital. Regarding the physical level, in order to further enhance mobilisation and foster effective networking among stakeholders, the project has introduced a cutting-edge tool called "Bioresources Stakeholders Platform" (BRSP). It refers to an innovative tool that employs participatory group activities, such as workshops, networking sessions, and training capsules, to catalyse collaboration and facilitate the exchange of knowledge among the stakeholders in a physical space. BRSP, essentially, serves as a catalyst for effective communication and interaction, thereby enabling the seamless co-creation of project outcomes. By exploiting the power of BRSP, the project aspires to promote a robust and dynamic collaborative environment, ultimately realising innovative solutions and advancing the project's objectives. At the digital level, instead, the BRIE-LL is developed in a platform called "BioReCer ICT tool" (BIT), which works as an integration of the BRSP validation and methodological tests over case studies. It is represented by a web portal that functions as both a virtual meeting place and an ICT tool.

BRSP can be seen as an innovative tool that helps to mobilise and strengthen networking of stakeholders through participatory activities such as workshops, surveys, and training capsules complemented by the BIT's digital activities.

The multitude of group activities that will take place through the BRSP aims at identifying the needs of the main actors involved in the whole project. Such activities will provide continuous feedback and inputs to shape and/or improve all the activities that will be carried out in the different steps of the project. Furthermore, the active involvement of stakeholders will be also useful to transfer and disseminate the knowledge generated in

<sup>&</sup>lt;sup>5</sup> Hossain, M., Leminen, S., & Westerlund, M. (2019). A systematic review of living lab literature. Journal of cleaner production, 213, 976-988.



the project. All the tasks in which stakeholders will be involved will serve as collaborative platforms to discuss the applicability of the proposed models and methodologies taking into account their suggestions as well as consumers' behaviour and perceptions.

Another important role that the BRSP will play in the project is to be the essential channel for the validation and testing of the methodological approach on the selected case studies (CSs) and integration into the ICT tool BioReCer. Indeed, to test the effectiveness of the main innovations of the project four scenarios have been selected as a test-bed.

### **1.2 Objective of BRSP**

The BRSP platform is one of the two main parts of the BRIE-LL. The setting up of these two tools implies significant milestones in the field of multi-stakeholder projects. As a biobased multi-stakeholder platform, BRSP summarises the project's commitment to foster a collaborative and inclusive approach, ensuring the active involvement of stakeholders from various domains and sectors. To ensure the best socio ecological transition of both society and economy, the innovative "quintuple helix innovation system" will be deployed (see Figure 1).



Figure 1. Quintuple helix innovation system

The Quintuple Helix model (Carayannis and Campbell, 2010; Carayannis et al., 2012)6 is more innovative with respect to the traditional triple helix model (Etzkowitz and

<sup>&</sup>lt;sup>6</sup> Carayannis, E. G., & Campbell, D. F. (2010). Triple Helix, Quadruple Helix and Quintuple Helix and how do knowledge, innovation and the environment relate to each other?: a proposed framework for



Leydesdorff, 2000)7 and to the quadruple helix model (Carayannis and Campbell, 2009)8. Indeed, the triple helix describes the interactions among three pillars of the society, meaning academia (the university), industry and government, to foster economic and social development. The main innovation of the quadruple helix model relied on the introduction of the "media-based and culture-based public and civic society" which highlights the importance of communication through the media between the political system that is developing innovation policy and the public and civil society to obtain public support for new policies. The innovative quintuple helix also includes a crucial perspective referring to the natural environments of society: the environment emphasises the sustainability priorities and exigencies in order to have sustainable and inclusive growth. The quintuple helix views the natural environments of society and the economy as drivers for knowledge production and innovation, thus defining opportunities for the knowledge society and knowledge economy.

The BRIE-LL and, hence, the BRSP, pursue the objective to both facilitate and promote the interactions among the main actors of the 5 helix: government, university, civil society, industries and environment. All the activities that will be carried out, will significantly contribute, by means of such dialogue, to the achievement of the three general objectives of the project, meaning: **1**) to advance current and emerging methodologies, concepts, and tools for assessing the traceability and the environmental sustainability of biological resources; **2**) to develop an Environmental Sustainability Assessment framework to be integrated into the current certification schemes; **3**) To validate the methodologies of the BioReCer assessment in 4 case studies.

Moreover, the stakeholders involvement through the BRSP will be necessary to achieve three specific objectives:

• SO2 "To develop a multidimensional impact assessment and traceability framework to evaluate biological resource supply chains in Europe considering aggregated environmental, circularity, T&T and regulatory criteria".

a trans-disciplinary analysis of sustainable development and social ecology. *International Journal of Social Ecology and Sustainable Development* (IJSESD), 1(1), 41-69.

Carayannis, E.G., Barth, T.D. & Campbell, D.F. The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. *J Innov Entrep* 1, 2 (2012)

<sup>&</sup>lt;sup>7</sup> Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Research policy*, *29*(2), 109-123.

<sup>&</sup>lt;sup>8</sup> Carayannis, E. G., & Campbell, D. F. (2009). 'Mode 3'and'Quadruple Helix': toward a 21st century fractal innovation ecosystem. International journal of technology management, 46(3-4), 201-234.



The specific contribution coming from the BRSP is the involvement of stakeholders in order to verify, validate and align the reported criteria to guarantee that such criteria are in line with the EU Taxonomy regulation. To achieve this goal, we need to organise 4 workshops (as specified in the target metrics (TM)) to actively engage stakeholders in a fruitful discussion in order to achieve the key performance indicator (KPI) related to the definition of a common framework with the stakeholders.

• SO4 "To validate the developed impact assessment framework in 4 case studies representing the main incipient bio-based supply chains in Europe".

To accomplish this objective, stakeholders in the key regions related to the CSs need to be involved and, then, through the BRSP activities we need to promote their participation to guarantee the validity of the developed impact assessment framework. According to the TM, 50 stakeholders need to take part in the different interactive activities such as the discussion groups and the focus groups. The feedback collected in such group tasks will guarantee the quality of the certification schemes.

 SO6 "To maximize outreach and beneficial influence of the project results and reach the target users (primary producers, trade bodies, bio-based industries, certifiers, local distributors, retailers, consumers organisation and local public authorities) through an effectively established communication and dissemination plan, including innovative training capsules."

To reach this goal, the initial step is to create a community of stakeholders that can be involved along the whole value chain so that we can collect feedback from stakeholders with different expertise. The TM we need to consider is the engagement of at least 100 stakeholders in the identified 4 regions. The related KPI 15 refers to the creation of 5 value-chain communities of stakeholders.

This inclusive framework, sustained by the BRIE-LL, effectively supports and aligns with the overarching objectives of the project. Moreover, the BRSP role as a mobilisation and networking tool further strengthens the project's foundation by encouraging active participation, facilitating knowledge exchange, and creating opportunities for meaningful interactions among stakeholders.

Among other activities, the stakeholders are supposed to interact in several ways, which will be analysed in depth in the following sections, such as:

- Focus groups
- Interactive sessions
- Training capsules and Brainstorming sessions
- Surveys
- Delphi surveys
- Field experiment



By combining the strengths of BRIE-LL, in both physical (BRSP) and digital (BIT) spaces, the project establishes a solid framework for collaboration, research, and innovation, ultimately leading to the improved sustainability and traceability of biological resources.

In fact, within the living labs, stakeholders collaboratively engage in an open space, meticulously analysing existing barriers and diligently exploring opportunities to collectively develop innovative ideas. Moreover, the project encourages physical face-to-face interactions to further enhance collaboration among the participants. The advancements and breakthroughs stemming from this open space serve as valuable resources for each participant, enabling them to discover viable solutions and foster the development of commercial applications, which are further expedited through digital infrastructure.

In conclusion, the introduction of the BRSP and the BioReCer ICT Tool in the framework of the BRIE-LL, represents a significant advancement in the field of multi-stakeholder projects.

### **1.3 Expected contribution of BRSP on the project**

The creation of the project BRIE-LL and the respective introduction of the BRSP platform play a significant role in the pursuit of the project objectives. The BRSP platform will facilitate a wide range of group activities to identify key stakeholders' needs and requirements. The workplan (Figure 2a) and the infographic (Figure 2b) of the BioReCer project give us a clear picture of the importance of stakeholders feedback throughout the whole project and the continuous interaction in the different Work Package (WP) activities. The collaborative activities within the BRSP platform aim to collect stakeholders' views, impressions and input through the engagement in discussions regarding the applicability of the proposed solutions and methodologies.

The WP4 is mainly devoted to BRSP. At a very early stage of the project stakeholders will be asked to join in some activities in order to collect their impression about the project's aims as well as to identify their sustainability objectives (WP4, Task 4.1). Subsequently, the coordination and support of stakeholder involvement processes will be developed (WP4, Task 4.2), through the development of interaction protocols, implementation and coordination of the BRSPs and Training capsules and Brainstorming sessions. Furthermore, as a follow up activity, a protocol will be established to document and report the interactions between stakeholders, aiming to identify both successes and failures. This protocol would serve as a means to monitor and enhance stakeholder engagement



throughout the duration of the project. Finally, stakeholders will be also asked to provide feedback and input on the integration of the assessment framework into existing certification schemes (WP4, Task 4.4).



Figure 2. Panel (a): Workplan of the BioReCer project; panel (b): Infographic of the BioReCer project

Additionally, stakeholders would be involved in a structured survey to validate the effectiveness of the ICT tool (WP5). This survey plays a crucial role in assessing and validating the functionalities and performance of the ICT tool, ensuring its alignment with the requirements and expectations of the stakeholders. Results from T4.2 will inform the development of questionnaires for an initial round of Delphi survey, and the results will be extensively discussed in a virtual workshop with stakeholders. Building upon these results, a second round of Delphi survey will be conducted to prioritise stakeholders' interests and perceptions, enabling the adaptation of the certification schemes to meet the underlying



requirements. The Analytical Hierarchy Process (AHP) methodology will be employed to establish a prioritised list by leveraging pairwise comparisons based on expert judgments.

Finally, a field experiment will be conducted to elicit consumers' attitudes towards different certification schemes for bio-based products and biological resources. The outcomes of this experiment will facilitate a cross-comparison of the various certification schemes, considering both consumer (with ACN) and industry (with SPRING) requirements, evaluating their effectiveness in enhancing the market potential of bio-based products and aligning the certification schemes with the needs of consumers and industries.

Within the framework of WP2 (Environmental sustainability assessment: Diagnosis and mapping of current indicators and data collection of biological resources), stakeholders will be involved in the process of data collection useful to identify the biological feedstock flow within Europe especially to provide suggestions on the main potential barriers for the adoption of such feedstocks in the value chains.

With regards to WP3 (Product Tracking and Traceability (T&T) for Circular Value Chain Integration), the involvement of stakeholders is essential in order to address the knowledge gap and facilitate the integration of value chains. In fact, several expert groups will be formed, comprising representatives from Certifying, Standardisation, Sustainability fields, and consumer organisations. These groups aim to collaborate through the BRIE-LL, facilitated by domain experts. The objective is to propose T&T methods and solutions that effectively incorporate existing techniques within the sector. This integration will be achieved through shared data exchange services, enabling seamless collaboration and information sharing.

In the context of WP5 (BioReCer ICT tool), which strictly refers to the technical development of BioReCer ICT tool, stakeholders would be involved in using its preliminary version for exploring multiple sustainability assessment alternatives for the biological feedstocks. In fact, the platform's evolution roadmap will be continuously updated and development priorities in coordination with the user groups (WP4&6). The main involvement of stakeholders would be in Task 5.3, since feedback will be gathered from a diverse user pool representing different user profiles (the project will create three interfaces tailored for certifiers, biomass producers, and bio-based industries/consumers) and obtained from the project's living lab.

In WP6 (Demonstration of the developed methodologies on the 4 case studies and study of replicability /transferability) the BRSP platform plays a crucial role in validating and testing the methodological approach through demonstrative scenarios outlined in WP6. Moreover, ANFACO-CEC, as the product owner and coordinator, will ensure stakeholder feedback for consultations through the BRSP in WP4.



The outcomes and results derived from the BRSP platform will serve as a solid foundation also for WP8 (communication and dissemination). The goal of this work package extends beyond the project's lifespan and aims to ensure the communication and dissemination of the project's findings and exploitation of its results. During the project's lifespan, WP8 is informing the stakeholders directly and indirectly of project developments with a range of communication activities, e.g. website updates, social media activity, newsletters, training actions, offline communication materials (see Deliverable D8.1 Communication and Dissemination Plan), and dissemination of project results. WP8 is also actively involved in stakeholder recruitment (via information campaigns at conferences and trade fairs, by the designing of stakeholder factsheets, etc.).

In summary, establishing BRIE-LL and introducing both the BRSP platform and BioReCer ICT Tool play a crucial role in the project's effectiveness. The BRSP platform acts as a nexus for physical interaction, collaboration, and knowledge exchange among stakeholders, enabling discussions, validation, and testing of methodologies, and serving as a basis for effective communication and dissemination of project outcomes. The BioReCer ICT Tool will complement these outcomes at a digital level, providing an integration of the stakeholders' validation and methodological assessment of demonstrative scenarios. Finally, the socio-economic analysis will ensure that the new certification schemes are in line with the consumers' and industries' preferences and requirements, fostering their successful implementation and adoption.



# 2 Stakeholders' engagement and classification methodology

### **2.1 Methodology for stakeholders' engagement**

Stakeholder analysis has emerged as a valuable tool employed in various domains, such as policy-making, management, and project implementation (Brugha and Varvasovszky, 2000)<sup>9</sup>, and it serves different purposes based on the context of its application.

To facilitate stakeholder analysis, both quantitative methods (i.e., structured data collection approaches, such as modified Delphi tools) and qualitative methods (i.e., focus groups) are often utilised. These approaches offer a methodology to gather and assess information from stakeholders. See Brugha and Varvasovszky (2000) for a comprehensive review of stakeholder analysis methodologies.

Stakeholder engagement methodologies refer to a range of approaches that aim to involve individuals in decision-making processes and incorporate their perspectives. These methodologies can be divided into quantitative and qualitative methods, each offering distinct advantages and insights. On one hand, quantitative engagement approaches may be represented by: **1**) *surveys*: structured questionnaires employed to gather data from stakeholders. These represent an efficient way to collect information on stakeholder preferences, opinions, and priorities; **2**) *Modified Delphi Technique*: it involves a series of questionnaires administered to a panel of stakeholders, with the aim of reaching a consensus on a particular issue or problem. **3**) *Social Network Analysis*: it refers to mapping and analysing relationships and interactions among stakeholders. By examining network structures, information flows, and influence patterns, this analysis provides insights into stakeholder dynamics and their centrality on decision-making processes. Once quantitative raw data are obtained from stakeholders with these techniques, these can be analysed through rigorous statistical techniques to identify patterns, correlations, and trends in order to offer insights for the decision-making processes.

On the other hand, qualitative engagement methods refer to **1**) *interviews*: conducting indepth interviews with stakeholders allows for a detailed exploration of their viewpoints, experiences, and concerns, facilitates a rich understanding of individual perspectives and

<sup>&</sup>lt;sup>9</sup>Brugha, R., & Varvasovszky, Z. (2000). Stakeholder analysis: a review. *Health policy and planning*, *15*(3), 239-246.



provides nuanced insights; **2**) *focus groups:* by bringing together a small group of stakeholders, that may differ in size and composition, focus groups enable interactive discussions and idea generation. They allow for the exploration of shared experiences, diverse opinions, and potential conflicts, fostering a deeper understanding of stakeholder dynamics. **3**) *participatory workshops:* these provide a collaborative setting where stakeholders actively engage in discussions, problem-solving, and decision-making. This method promotes knowledge sharing, co-creation of solutions, and consensus-building among participants.

By employing a combination of quantitative and qualitative methods, stakeholders' engagement can be enriched with both numerical data and in-depth insights, leading to more comprehensive and robust decision-making processes. The selection of methodologies should align with the objectives of the engagement process and the specific needs and characteristics of the stakeholders involved.

Stakeholder engagement has been argued to be a fundamental activity for the effectiveness of a project. However, engaging with stakeholders and managing their issues in sustainable supply chain (SC) could be challenging. In fact, by presenting a case study on bioenergy supply chains in Chile, Siems and Seuring (2021)<sup>10</sup> argue that two-way communication with stakeholders is seen as the core of stakeholder management, but a larger willingness to learn and transform supply chain design may be needed for a true orientation toward stakeholder management. Moreover, linkage development and local anchoring are practices used to gain further legitimacy at the external level.

In this vein, also Rane et al. (2021)<sup>11</sup> agree on the importance of stakeholders' involvement in the development of a green and sustainable supply chain. By carrying out a literature review and expert interviews, the authors identified the factors for stakeholder involvement in greening the supply chain. They argue that involving stakeholders in green product design could improve supply chain efficiency.

<sup>&</sup>lt;sup>10</sup> Siems, E., & Seuring, S. (2021). Stakeholder management in sustainable supply chains: A case study of the bioenergy industry. Business Strategy and the Environment, 30(7), 3105-3119.

<sup>&</sup>lt;sup>11</sup> Rane, S. B., Thakker, S. V., & Kant, R. (2021). Stakeholders' involvement in green supply chain: a perspective of blockchain IoT-integrated architecture. Management of Environmental Quality: An International Journal, 32(6), 1166-1191.



## **2.2 Stakeholders' classification: definition of criteria**

This Section is devoted to the presentation of the initial categorisation of stakeholders based on the input provided by WP2 and other WPs (especially WP6) whereas in Section 3.3 we will provide the description of the stakeholders actually registered in the BRSP. The output of the preliminary work carried out in the other WPs mainly consist of two pieces of information: the value chain diagram and a list of potential stakeholders that could be involved in the BioReCer project. The list of potential stakeholders is also presented in the Communication and Dissemination Plan (D8.1).

Figure 3 shows the value chain diagram in which the relevant stakeholders taking part in the bio-product value chain are clearly identified. The stakeholders can be classified in the following groups/type:

- Biomass producers: includes both private and public firms whose aim is to produce both primary and secondary biomasses that could be deployed in the production process of bio-based products;
- Trade bodies: are organisations founded and funded by businesses that operate in a specific bio-based industry;
- Bio-industries: includes firms that collect both primary and secondary feedstocks to either produce bio-based products or sell them to other firms;
- Policy makers/Institutions: public institutions and organisations at regional, national and international level that may regulate the bio-based markets;
- Certification Bodies: are independent third parties that handle certification processes;
- Consumers' association: are associations that represent, advise and support citizens/consumers.





Figure 3. Value chain diagram

Based on the list of potential stakeholders provided by WP2, we defined some relevant criteria based on relevant characteristics that we need to consider for the stakeholders' involvement. The classification we consider is based on the following criteria:

- type: we need to engage representatives for all the identified groups (i.e., biobased industry, biomass producers, certification bodies, consumers' association, policy makers, trade bodies);
- geographical macro-region: the output of the BioReCer project will be tested on 4 representative regions, so it is necessary to guarantee the representativeness across different geographical areas;
- case studies (CSs): the case studies that have been identified in the BioReCer project differ for the biomasses considered. Also in this case, it is crucial to identify stakeholders with specific interests and knowledge for the different products we are going to analyse.

The list provided by WP2 included 319 potential stakeholders and the classification by type is straightforward since it is based on the categories outlined in the value chain diagram.

Regarding the second criterion (i.e., macro region), we identified 4 macro-regions:

- Northern European region including: Sweden, Finland, Denmark, Ireland, Estonia, Latvia, Lithuania;
- Southern European region that includes: Croatia, Italy, Cyprus, Malta, Greece, Spain, Portugal, Slovenia;



- Western European region including: Austria, Belgium, Germany, France, Netherlands;
- Eastern European region including: Hungary, Poland, Romania, Czech Republic, Bulgaria, Slovakia.

Even though BioReCer is a European project, we also decided to define another wider category: the international macro-region that includes the following sub-categories:

 i. European countries but not belonging to the European Union such as Albania, UK, Switzerland, Norway, Iceland, Serbia, Luxembourg, Republic of North Macedonia, Turkey;

ii. Countries outside Europe like Australia, USA, Indonesia, Hong Kong, Thailandia, China, India, Singapore, Malaysia, Brazil, Colombia, Republic of Korea;

iii. International bodies that, by definition, are institutions that are based in more than one country (e.g., European Circular Bioeconomy Fund (ECBF), REDCert).

The first reason that led to the identification of this wider region is that many certification bodies operate internationally so that it is useful to not assign this kind of institution to any specific country. The second reason is related to the potential applicability of the BioReCer outputs also to different countries outside Europe. At this first stage, our attention was devoted only to the engagement of both European stakeholders and international bodies avoiding the possibility of involving countries that do not belong to the European Union.

The last criterion refers to the case studies (CSs). As explained above, stakeholders contributions are fundamental also in the testing framework in the identified CSs. In the Grant Agreement, 4 case studies were identified:

 Case study 1 (CS1) (ANFACO-CEC, CETAQUA) refers to the fishing industry: Spain, and the Region of Galicia in particular, is one of the biggest producers of fishcannery products. This industry produces a large amount of fish waste (it ranges from 300 tons/year for those companies producing frozen fish up to 4000 tons/year for big fish-canning industries). From this industry a lot of by-products (biomasses) are produced such as fish wastes, crustaceans, algae, sludge that converges at the point of its nearby production. National firms and institutions like ANFACO-CEC (National Association of Fish-Canning Producers) and CETAQUA (Water Technology Centre from SUEZ group) worked on the development of technologies for the valorisation of biowastes coming from fishing, canning and wastewater activities.



- Case study 2 (CS2) (UNIVPM, CAP HOLDING, SPRING) refers to urban and industrial activities: in Italy, in the last years, great attention has been devoted to the creation of plants and biorefineries able to treat huge amount of wastes (by way of example, Rozzano, Pero-Monza and Canegrate WastWater Treatment Plants in 2021 were able to treat, respectively, 96,000 ton/y of agri-food wastes, 60,000 ton/y of non-hazardous liquid wastes and organic fraction of municipal solid waste -OFMSW- and 15,000 ton/y of liquid wastes for a total of 171,000 ton/y). This case study will focus on OFMSW, sewage sludge and bio-based residuals (agro-waste and non-hazardous organic liquid wastes) from dairy industries that will be processed for VFA, biopolymers and biofertilizer recovery at the biorefinery of Sesto San Giovanni WWTP (Lombardia). Italian case-study includes relevant participants such as CAP HOLDING SPA (water and waste utility), Cluster SPRING and Università Politecnica delle Marche (UNIVPM).
- Case study 3 (CS3) (CERTH) refers to primary's sector activities: in Greece, and especially in Central Macedonia, agriculture is the leading sector given the fact that it produces approximately 26% of the Greek primary agricultural sector in terms of GVA. Greece has the leadership for fruits (e.g., Peaches, Apples, Cherries, Olives), Cereals (e.g. rice, wheat, etc.) and Industrial/Fodder crops (cotton, corn, rapeseed etc.). The production activities in the agricultural sector, hence, result in the production of a huge amount of by-products that can be deployed in different biobased industries such as nutraceutical and bio-fertilizers.
- Case study 4 (CS4) (PROCESSUM) refers to the forest industry: one of the largest industries in Sweden is related to the forestry sector since 70%<sup>12</sup> of the Swedish land is covered with forests. This industry produces a huge amount of different by-products such as GROT (branches, roots, tips), saw dust, bark and fibre sludge. Furthermore, there are other streams that can be valorised even if their availability is limited such as: warm water, carbon, various ashes, ESP dust, and various sludges. All these by-products and residues can be deployed as potential resources for biobased products for the production of both green chemicals and materials capable of replacing fossil-based alternatives.

Each case study is characterised by specific biomasses and, as a consequence, focuses on different stakeholders' categories. Besides these 4 CSs that refer to Europe, an additional global supply chain case study will be also analysed to validate the BioReCer framework in an international market.

<sup>&</sup>lt;sup>12</sup> https://www.forestindustries.se/forest-industry/facts-and-figures/



Both the CSs leaders and the other partners involved in the BRSP setting up (especially UNITELMA and ACN) were engaged to get in contact with the identified potential stakeholders. The involvement and engagement activities must be active throughout the project with the aim of widening the set of stakeholders trying to fill the gaps we highlighted in terms of potential interest for the case studies as well as for the geographical location. The additional actions taken to both identify and engage stakeholders in the identified sectors will be explained in detail in Section 3.

### **2.3 Limitations and barriers**

Despite engaging stakeholders is paramount for the effectiveness to reach a project's goal, it can be a challenging task, characterised by several limitations and barriers.

The first potential limitation we identified refers to international stakeholders. Indeed, as highlighted in the scientific community (Kaditi, E. A., 2009)<sup>13</sup>, there is a lack of common standards for classifying and managing biological feedstock. This implies that the requirements as well as the main aspects to be considered to define/integrate the certification scheme may differ in a significant way. Since the first test of the BioReCer framework will be performed in 4 European countries, based on the discussion among WP4 members and also with the CSs leaders, we decided, at this stage of the project, to drop out international stakeholders (i.e., referring to countries not belonging to the European Union) because it may be a potential limitation.

Another significant limitation that can also be seen as a barrier for the achievement of BioReCer objectives is related to the stakeholders' availability. On the one hand, there is an objective difficulty in reaching out to stakeholders. One major obstacle is the limited accessibility and the need for obtaining direct contact with stakeholders. In fact, identifying the relevant stakeholders and establishing meaningful connections can be challenging without direct contact (i.e., a person or an institution known in common by both the project manager and the identified stakeholder) to initiate dialogue and obtain the identified stakeholders' input and perspectives. This issue is compounded when stakeholders are dislocated geographically or belong to heterogeneous networks. On the other hand, even in the case in which the first connection has been established we need to consider also the stakeholders' time constraints. Indeed, stakeholders often have busy schedules and limited availability to engage in discussions or participate in various proposed activities in the

<sup>&</sup>lt;sup>13</sup> Kaditi, E. A. (2009). Bio-energy policies in a global context. *Journal of Cleaner Production*, *17*, S4-S8.



context of BRSP. Given their high professional profile, their commitments and responsibilities may restrict their ability to allocate time for engagement initiatives. Therefore, time constraints can result in a barrier to stakeholders' involvement, as they may struggle to prioritise their engagement with the project amidst their other pressing duties.

Furthermore, another limitation is related to the different levels of familiarity with the project's subject. This is related with two features: stakeholders' involvement throughout the project and their heterogeneous background in terms of bio feedstock knowledge.

Involving a very heterogeneous stakeholders ranging from bio-industries to citizens will require translating technical information into easily understandable language: common citizens are not used to specific terminology as bio-industries do. Moreover, stakeholders' may be engaged in different stages of the project and this implies that some of them will be more familiar with the BioReCer project than others. A continuous effort by the involved partner is required to fill knowledge gaps and, hence, to collect the best feedback from all participants. Failure to overcome these barriers can lead to problems in communication, understanding, and effective engagement.

Finally, language and communication barriers may arise. Effective stakeholder engagement requires clear and efficient communication both within and between groups. This is particularly relevant in our multi-level stakeholder engagement strategy, where groups differ in both size, task, and composition. In fact, different stakeholder groups may have their own specialised jargon, and technical terminology, or even speak different languages (i.e., Italian, Spanish, Greek, etc.). This language heterogeneity and communication styles can create barriers to effective engagement. It is essential to bridge these linguistic gaps and establish effective channels of communication to ensure that stakeholders can meaningfully contribute and understand project goals and outcomes.



## **3** Set up of the BRSP platform

### 3.1 Strategy development for stakeholders engagement

As underlined in Section 2.3, the list provided by WP2 includes a significant number of potential stakeholders that could be engaged and potentially integrated to have an almost uniform distribution of stakeholders across regions and CSs. The first step taken for the engagement activity is to reach out to the majority of the stakeholders provided by WP2 by sending an email including all the relevant information about the project. In particular, we got in contact with those for which we had a publicly available contact email address: the reason for the decision to contact only publicly available email addresses is the data protection regulation.

The text of the email is reported below:

"Dear Sir/Madame,

we are contacting you to introduce you to the innovative European BioReCer Project (Biological Resources Certifications Schemes) funded under the call HORIZON-CL6-2021-ZEROPOLLUTION-01 and invite you as a project stakeholder.

The project is designed to achieve circular economy goals and the primary objective is to ensure the environmental performance and traceability of the biological raw materials, particularly feedstocks, used by bio-industries. Moreover, the framework developed through this project ensures compliance with EU due diligence regulations. As you know, the crucial transition towards more sustainable production and consumption requires joint effort by all actors along the value-chain, the project requires valuable input from all the actors to develop the framework. The involvement of the stakeholders through some activities such as focus group discussions, workshops and interactive sessions. Thus, we cordially invite you to become a stakeholder of the BioReCer stakeholder platform (BRSP).

Some of the expected positive implications that will impact the involved stakeholders are improvement of citizen's knowledge and acceptance of bio-based products, increase in jobs in the bio industry with a consequent increase in revenues for companies engaged in the bio-based sector, and many more.

You may find further relevant information in the webpage of the project <u>https://biorecer.eu/</u> and in the flyer attached to this email. If you are interested in joining the project, do not hesitate to contact us. We will be happy to provide you with more information.

We look forward to hearing from you."



This approach was not sufficient to engage stakeholders since, as highlighted in Section 2.4 they receive a lot of communication and, hence, our email might not get the right attention. For this reason, we defined a targeted engagement strategy. UNITELMA, under the coordination of MEO Carbon, organised a first meeting to make CSs leaders aware of the identified weakness in the stakeholders' distribution. In that meaningful meeting, two actions to be taken have been defined. The first strategy refers to the stakeholders' involvement through direct contacts: all the partners involved in the BRSP set up (i.e., UNITELMA, MEOCarbon, UNI, NOVA), as well as the CSs leaders committed to contacting potential stakeholders by means of personal calls/emails. The second action was to organise one stakeholder's preparatory workshop in each of the 4 regions in which the CSs will be developed (i.e., Spain, Italy, Greece and Sweden). The aim of these workshops is to invite national stakeholders and to present the projects in the local language to overcome possible barriers related to English comprehension.

### 3.2 Preparatory workshops organisation

UNITELMA who led Task 4.1, was in charge of preparing the agenda as well as the material for the workshop in order to follow the same approach across 4 case studies. The main information related to the events are reported in Table 1. To get the maximum participation of the invited potential stakeholders, all events have been organised in hybrid mode. Indeed, a few days before the event a link to the online meeting was shared with the participants who declared their willingness to take part in the event online due to time constraints. The majority of people attended in person at the organisers' venues.

Location	Organisers	Date							
Table 1. Preparatory workshop event information									

	Location	Organisers	Date	N. of participants
CS1	Vigo (Spain) Hybrid event	CETAQUA ANFACO	11/05/23	26
CS2	Rome (Italy) Hybrid event	UNITELMA	13/03/2023	18
CS3	Thessaloniki (Greece) Hybrid event	CERTH	26/04/2023	18
CS4	Domsjö (Sweden) Online event	PROCESSUM	28/04/2023	7

A representative picture of the events is shown in Figure 4.





Figure 4. Picture of the preparatory workshops in Italy.

The agenda was set in order to have enough time to both present the project and leave time for discussion with participants. The agenda is reported below:

Introduction: Welcome greetings (10-15 mins) Presentation of the national partners involved (20 mins) Presentation of the project (1 hour) Q&A session with stakeholders devoted to:(30 mins)

- Go into the detail of the project
- Clarify their active role during the whole project
- Explain their role in the focus group and in the BRSP platform

Gathering subscriptions for focus groups that will be organised in April/May 2023

UNITELMA was in charge of preparing the material to be presented in the workshops related to the BioReCer project. nova-Institute (NOVA) as WP8 leader and partner in T4.1



provided the promotional material (e.g., roll-up banners, brochures, etc.) that was presented to the participants. Currently and also in future, NOVA establishes further promotional material for stakeholder engagement and recruitment (e.g. flyers, stakeholder factsheets, newsletter templates) both in English and requested other languages (the project brochure is already available in English and Spanish and a stakeholder factsheet is currently translated into Italian). NOVA's task is also to promote stakeholder meetings, events and workshops/training actions via the website, newsletters and social media. Also NOVA administers the stakeholder registration platform on the project's website.

The first draft of the presentation for the preparatory workshop was shared with WP4 lead, all partners involved in task 4.1 and with the CSs leaders to collect feedback. A final version, in English, was then shared with all of them and each local organiser was asked to translate the information in the local language.

The presentation of the project went through the most important issues of the project:

- the presentation of the partner involved (Figure A1 e A2 in the Annex 1);
- the main objectives of the project including also the expected impact for the involved stakeholders: the list of general and specific objectives was explained in detail and then a synthesis of the expected results as well as the expected impacts on different aspects (e.g., the environment, the bio-based industries) was presented (Figure A3 in the Annex 1);
- the main structure of the project: the development of the project in its main phases was presented to familiarise stakeholders with the specific concepts related to the project (e.g., BIT tool, BRSP). Furthermore, to provide a wider picture of the project also a description of the WPs was provided (Figure A4 in the Annex 1);
- the presentation of the four case studies (each country focused on its own CS): the CSs represent one core of the project since they work as a test-bed for the BioReCer results. Stakeholders need to be aware of the main feedstocks involved in the CSs as well as the industries in which they will be expected to operate in order to get an idea of which CS they would like to be involved in (Figure A5 in the Annex 1);
- the description of the BRIE-LL and, hence, the BRSP platform: the living lab is the "phygital" environment in which stakeholders need to interact so that a very detailed explanation was provided. In this part, the main activities we planned for the stakeholders' involvement (e.g., training capsules, focus group) were also presented to make the stakeholders aware of the kind of commitment we are expecting from them (Figure A6 e A7 in the Annex 1).



At the end of the presentation the dedicated session for Q&A started. In this time frame we answered clarification questions about the project and the potential involvement of each participant.

The last part of the workshop was dedicated to the collection of subscriptions to the BRSP platform. NOVA prepared a consent form in order to collect both personal information and the consent to use personal email addresses for future communications (see Annex 2 and the data protection regulation for stakeholder registration on the website: <a href="https://biorecer.eu/data-protection-regulation/">https://biorecer.eu/data-protection-regulation/</a>). This consent form was based on the Data Management Plan (DMP) defined in WP1 to comply with the EU GDPR requirements. In this consent form, besides the page dedicated to the collection on personal information also relevant information on data management was provided. The stakeholders explicitly consented to the data protection regulation by ticking a box and signing the form.

### 3.3 Stakeholder registration and set up the BRSP platform

In the WP8 framework, NOVA built up the BioReCer project website (<u>https://biorecer.eu/</u>) with a subpage dedicated to the BRSP platform (<u>https://biorecer.eu/brsp/</u>) - see Figure 5. On this page potential stakeholders are informed about the BRSP and can register as stakeholders by indicating: their name, their institution, an email address, the case(s) they want to be involved in, their engagement. At the end of the page, the data protection regulation is linked to which subscribers must agree to formally become members.



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#### Become a Stakeholder/BRSP Member



Figure 5. BRSP.

The project partners involved in WP4 (i.e., UnitelmaSapienza, Meo Carbon Solutions, Active Citizenship, NOVA) gave a written consent to use the stakeholders data exclusively within the BioReCer framework. Only these parties can access the stakeholder list from the website and are able to constantly monitor the stakeholders that are signing up. Currently,<sup>14</sup> we have 57 stakeholders in the BRSP platform. By having this number by the end of the first year we also comply with the TM related to SO4 that refers to 50 stakeholders to be involved in the whole value chain analysis.

Figures 6 and 7 summarise the distribution of the stakeholders according to the CSs, the type of engagement and the macro-region. The majority of stakeholders (38%) declared their interest for CS3 (i.e., primary sector) whereas a small percentage (7%) reported their interest in CS1 (i.e., fishery sector).

<sup>&</sup>lt;sup>14</sup> Data were extrapolated on August 22nd, 2023. Notice that for the analysis we exclude 3 stakeholders since they are from extra-EU countries.





Figure 6. Stakeholders distribution by case study

By looking at their engagement, meaning the sector they belong to, both bio-industries (26%) and biomass producers (20%) constitute about half of the whole set of stakeholders. Thanks to the heterogeneity of the people who took part in the national workshops, we have involved at least one representative for each stakeholder category. The outcome of the stakeholders' engagement activity led to the achievement of KPI 15, meaning the creation of 5 value-chain communities of stakeholders.





Figure 7. Stakeholders distribution by type

Based on the institutions' name, we were able to identify the macro region each stakeholder belongs to. Recall that we identified 4 macro regions (i.e., North, South, East and West) and also the international macro-region in which only institutions that operate at European level are included (e.g., European Commission). As shown in Figure 8, we achieved the objective to have at least one representative for each geographical area so that we have the possibility to get in contact with stakeholders located all across Europe. The huge percentage referring to the south region is due to the fact that 3 out of 4 CSs are located in the southern part of Europe. In the international parties we included both certification bodies and institutions that operate in different countries.





Figure 8. Stakeholders distribution by region



## **4** Stakeholder involvement plan

### 4.1 The definition of the plan

The Stakeholder Involvement Plan (SIP) works as a guide for coordinating and engaging both external and internal stakeholders in BioReCer's activities. This plan lists activities and methods for the involvement of stakeholders throughout the whole project duration and it is necessary to identify and manage the requirements that emerge in each WP where stakeholder engagement is needed. It contains all the various methods listed in the project description (grant agreement - GA), defining better the timeline and the details and will be updated with the different activities to be realised during the project and the ones based on the different WPs needs. By clearly listing the stakeholder groups, the expected activities, the expected objectives and outcomes, as agreed in the GA, the plan sets a benchmark for evaluating the effectiveness of stakeholder engagement activities.

To shape a complete document ACN realised an internal survey to understand the need of WPs and tasks herein, the type of input needed from stakeholders and a tentative plan for the activities. To this extent, a shared excel file has been sent to all the project partners to know when, where and how the different WPs would need to involve the stakeholders, to identify what contents will be covered in each session. In particular, the following inputs were required:

- Responsible Partner Name or Number;
- WP/Task;
- Event/activity description;
- Stakeholder type to be involved in the event;
- Topics to be discussed;
- Expected input from each stakeholder;
- Type of session (Survey, Training or brainstorming session, workshop etc.);
- Expected interaction (e.g., in person/online);
- Language;
- Planned month and/or specific date (when available);
- Numbers of hours/days needed;
- Number of session;
- Contribution to deliverables.



This internal survey was also useful to understand whether different events could be merged to avoid duplications: as specified above, the stakeholders' time constraint is a potential barrier and, for this reason we need to maximise the outcome of each event.

The SIP includes several methods of interaction to facilitate stakeholder engagement and ensure their active participation. These methods are designed to promote collaboration, gather feedback, and validate project outcomes. The stakeholder engagement strategy developed by ACN for the stakeholders' engagement was based on a multilevel approach, consisting of two distinct levels, which ensures the project benefits from the expertise of a smaller expert group and the diverse perspectives of a broader stakeholder community (see Section 4.2 for a detailed description). The main activities and methods of interaction as foreseen in the GA are the following:

- Focus Groups (FGs) with semi-structured surveys (to be carried out in the framework of T4.1). This activity will involve only a small group of stakeholders and was planned to be carried out at the very beginning of the project. FG consists in a discussion among a small group of people guided by a moderator that suggests the topic to be discussed. Usually the topic is defined before (the structure is similar to a survey) but the value added of this kind of information collection is given by the discussion among participants that is usually promoted by the moderator.
- Interactive Sessions (to be carried out in the framework of T4.2.2). This activity will involve the whole set of stakeholders. Indeed, under the coordination of ACN, once per year stakeholders will be invited to join a meeting in which the main achievement of the project will be presented. Based on the availability of the involved stakeholders, these interactive sessions may be in person or online to maximise the number of participants. In these meetings, stakeholders will have the possibility to both track the project's progress and observe how their inputs have been incorporated into its development. Three multistakeholder interactive meetings are proposed, and scheduled at specific milestones throughout the project.
- Training Capsules and Brainstorming Sessions (to be carried out in the framework of T4.2.3 and T8.2.3). Training sessions and dynamic brainstorming sessions will be conducted, in collaboration with NOVA, to enhance stakeholders' understanding of the assessment framework and new indicators of environmental sustainability. These sessions will be delivered online and will be accessible to all stakeholders through translated training video pills and a multilingual online repository validated by subject experts.


- Surveys and ICT Tool Validation (to be carried out in the framework of T4.2.3). During the training sessions semi-structured surveys will be collected. The aim of this activity is to collect feedback that will be used as input for the ICT tool's development in WP5.
- Structured Survey (to be carried out in the framework of T4.2.4). This activity could involve the whole set of stakeholders. After collecting feedback to be incorporated in the ICT tool, a new wave of survey will be conducted with the aim of validating the ICT tool once it will be completed by WP5.
- Delphi Surveys (to be carried out in the framework of T4.3). This activity will involve only a group of stakeholders, in particular consumers and industries. Two rounds of Delphi survey will be conducted under the coordination of UNITELMA. In the first round, topics related to certification schemes that emerged in the previous activities will be discussed. The collected results in the first round will be useful to define the structure of the second round. This round will prioritise stakeholders' interests and perceptions to adapt the certification schemes according to the underlying requirements. Data collected and elaborated will be also discussed in dedicated online workshops.
- Field Experiment (to be carried out in the framework of T4.3). As for the Delphi survey, this activity will only involve consumers and industries. In order to assess the impact of different bio-based products' and biological resources' certification schemes with a special focus on the willingness to pay a green premium for bio-based certified products. The evidence obtained from this experiment will be useful to compare different certification schemes.

These activities of interaction ensure a collaborative approach to stakeholder engagement, fostering participation and incorporating stakeholders' perspectives throughout the whole project's duration. By employing a variety of techniques, the project aims to gather valuable insights, validate outcomes, and enhance the overall success and impact of the project. As the project progresses over the course of 3 years (36 months), the SIP will be updated to maintain its relevance and coherence according to the project's development. This flexibility allows for adopting adjustments and improvements whenever necessary, ensuring alignment with all stakeholders' further needs.



# 4.2 Multilevel approach

The stakeholder engagement plan developed by Associazione Cittadinanzattiva (ACN) for the BRSP set-up is based on a multilevel approach. This is structured into two levels, a smaller and a larger one.

The first level refers to a smaller group of stakeholder: in this kind of group, experts will be actively involved throughout the whole project (by each partner), representing the key stakeholder groups previously identified, and providing a qualitative contribution through their opinions. These experts will be selected based on their extensive knowledge and/or experience in the project's topic ecosystem. They will be consulted at various stages of the project and invited to be part of the BRSP and to self-register on the project's website and will closely monitor its progress from the initial phase. Their valuable input will help provide feedback, identify specific needs and requirements, and understand stakeholders' expectations. The aim is to conduct regular reviews, fostering a continuous dialogue and multifaceted feedback on the different tasks and activities. This level of engagement ensures that the project receives the necessary qualitative feedback. In situations where feedback on specific topics is required, individual experts or a subgroup of the expert group may be approached for their input. Although members of this expert group will be requested to commit for the duration of the project, they will have the flexibility to opt in or opt out on a task-by-task basis or for the project as a whole. This flexibility allows them to align their level of involvement with their availability, expertise, and interests.

To complement the activities of the first smaller expert group, there will be a second level of stakeholder interaction. Namely, in addition to the expert group, a broader stakeholder list will be generated, thanks to the help and input of the different partners, within each of the identified stakeholder groups. These stakeholders, who have an interest in the activities of BioReCer and are listed in the BioReCer-WP2-Stakeholders list, will be encouraged to self-register on the project's website using a stakeholder form. This broader stakeholder group will be actively consulted throughout the distinct phases and tasks of the project using various methods such as surveys. In addition to the first-level groups' qualitative output, this second level of stakeholder swill be continuously updated and managed through the dedicated BioReCer website, serving as a central platform for stakeholder interaction and communication. Members of this stakeholder group will have the autonomy to join only specific types of interactions they wish to have with the project, such as participating in surveys or receiving regular updates.



The multilevel approach to stakeholder engagement would ensure that the project benefits from both the expertise of a smaller group of experts and the diverse perspectives of a broader stakeholder community. By involving these two levels, the project aims to gather comprehensive insights, considering both qualitative and quantitative aspects of stakeholder feedback. This approach enables a more holistic understanding of the project's progress, addresses the diverse needs and expectations of stakeholders, and promotes collaboration and ownership among the stakeholder community. The project's website serves as an essential tool for facilitating stakeholder engagement, providing a platform for seamless communication, information sharing, and updates throughout the project's lifecycle.

Overall, the multilevel stakeholder engagement strategy adopted for this project ensures that the project remains inclusive, responsive, and accountable to the stakeholders involved. It acknowledges the importance of harnessing expert knowledge and wider stakeholder opinions, contributing to the project's success, and fostering sustainable relationships with key stakeholders.



# **5** Stakeholders engagement

## 5.1 Focus Group discussions

Focus group (FG) is a popular technique, first introduced as a market research approach, and is very useful to collect qualitative data. The main detailed information of what is a FG and how it needs to be conducted is explained in Powell and Single (1996) and in Krueger and Casey (2002)<sup>15</sup>. In particular, it consists of a group of individuals (usually between 6 and 12) selected on their personal skills and assembled by researchers to discuss and comment on a specific topic in order to get feedback based on their personal experience. FG is currently used as a data collection technique that could be integrated with either quantitative data collection methods or other qualitative techniques such as in-depth interviews. As a research technique, the FG employs interactional discussion on a topic selected by the researcher on which participants may have specific expertise or knowledge. The researcher has the role of moderator by guiding the discussion through specific questions and by involving all participants in an active debate.

This method is often employed in social science research but in the last decades it is also deployed in the field of sustainability assessment (see, for instance, Coelho et al., 2010 and Mascarenhas et al., 2015)<sup>16</sup>. In this framework, as explained in Al-Alwani (2014)<sup>17</sup>, FGs may be useful to reach different objectives such as:

- Help in clarifying mixed evidence emerging from the literature;
- Collect information from different sources given the evidence that FGs involve a greater number of people;

<sup>&</sup>lt;sup>15</sup> Powell, R. A., & Single, H. M. (1996). Focus groups. International journal for quality in health care, 8(5), 499-504.

Krueger, R. A., & Casey, M. A. (2002). Designing and conducting focus group interviews (Vol. 18).

<sup>&</sup>lt;sup>16</sup> Coelho, P., Mascarenhas, A., Vaz, P., Dores, A., & Ramos, T. B. (2010). A framework for regional sustainability assessment: developing indicators for a Portuguese region. Sustainable Development, 18(4), 211-219.

Mascarenhas, A., Nunes, L. M., & Ramos, T. B. (2015). Selection of sustainability indicators for planning: combining stakeholders' participation and data reduction techniques. Journal of Cleaner Production, 92, 295-307.

<sup>&</sup>lt;sup>17</sup> Al-Alwani, M. (2014). Towards Sustainable Middle Eastern Cities: A Local Sustainability Assessment Framework.



- Promote communication amongst heterogeneous groups of people which could produce a variety of answers and opinions;
- Revision of the initial ideas to be used in other participation activities;
- Collect advice about priorities and sustainability related issues.

Based on this premise, the first participatory activity that we organised with stakeholders was a FG. The main goal of the FGs was twofold: on the one hand, we aimed at creating a debate about the sustainability objectives in order to get feedback from different stakeholder groups. On the other hand, the results from the discussion in the FGs need to be integrated with a quantitative approach (i.e., Analytical Hierarchy Process) so that we aimed at collecting suggestions about the criteria to be introduced in the analysis.

A total of 4 FGs was organised, one per CS, by inviting both the stakeholders already registered in the platform and potential stakeholders that signed the consent form before taking part in the activities. The topics that need to be discussed within the FGs were discussed with CSs leaders. The lineup consisted of:

- <u>General opinion about use and traceability of biological feedstock</u>: possible questions refer to the opinion about the deployment of secondary feedstocks, their belief about the potential impact of such feedstock on health, their awareness about the current destination/treatment of these materials, the role played by consumers' acceptance of products obtained by primary or secondary feedstocks.
- 2. <u>Potential barriers</u>: in this case the topics to be debated refer to potential obstacles to the deployment of primary and secondary feedstocks in terms of quantity of by-products available, seasonal stability of production, economic viability/sustainability due to the huge initial investment, and the role of certifications.
- 3. <u>Potential opportunities/advantages also for the involved stakeholders</u>: questions refer to the social impact of potential increase in the use of bio-based products that includes the increase in job opportunities related to bio-based industry, the increase of revenues for firms involved in the bio-based sector, reduction of the environmental impact of both production and consumption activities, increase of the economic value of biological resources.
- 4. <u>The role of policy makers</u>: this part involves discussion about the significant role played by regulation and potential financial compensation for firms investing in the bio-based sector.

A summary of the main results emerging from the FGs will be presented in Subsection 5.3.



## **5.2 Analytical Hierarchy Process**

The Analytic Hierarchy Process (AHP) is a method of "measurement through pairwise comparisons and relies on the judgments of experts to derive priority scales", and it has been one of the most widely used multiple criteria decision-making tools (for a review see Saaty, 1980).<sup>18</sup> It is used by decision makers and researchers in several contexts (i.e., social, economics, business, political studies, etc.) because it is a simple and powerful tool that allows rationalising decision-making processes by understanding the relative importance of criteria and the ranking of alternatives based on these criteria (Handfield et al., 2002; Vaidya and Kumar, 2006)<sup>19</sup>.

The measurement in ratio scale is obtained comparing those factors in pairs. The weight of each factor in the hierarchy will be found in a process where each factor is compared with its parent factor. The priorities (weights) throughout the hierarchy will be found by multiplying the priority of one factor in each level for the priority of the factor with which the first is linked (parent factor).

## **5.3 Outcomes**

#### 5.3.1 FGs outcome

#### 5.3.1.1 Case Study 1 - Spain

The Spanish CS organised two FGs, one devoted to the discussion of the use of sewage sludge and one devoted to the fishery sector. The meetings took place on 11.05.2023 from 11:00 am to 1:00 pm (CET). Before the FGs, the preparatory workshop was held at ANFACO-CECOPESCA's (ANFACO) facilities co-organized by ANFACO and CETAQUA. Individual invitations were sent to key stakeholders, participating either online or in person. The meeting was conducted in Spanish to facilitate communication. A total of 26

<sup>&</sup>lt;sup>18</sup> Saaty, T.L. (1980), The Analytical Hierarchy Process, McGraw-Hill, New York.

<sup>&</sup>lt;sup>19</sup> Handfield, R., Walton, S. V., Sroufe, R., & Melnyk, S. A. (2002). Applying environmental criteria to supplier assessment: A study in the application of the Analytical Hierarchy Process. *European journal of operational research*, *141*(1), 70-87.

Vaidya, O. S., & Kumar, S. (2006). Analytic hierarchy process: An overview of applications. *European Journal of operational research*, *169*(1), 1-29.



people representing 18 stakeholders took part in the meeting, 6 in-person and 12 online. The summary of participants is shown in Table 2.

Table 2. List of participants (Case study 1)

Type of Stakeholder	Type of participation				
Seafood Processing industry	Online				
Fisheries - shipowner association	In Person				
Manufacturing - algae extracts	Online				
Residues management	Online				
Seaweed harvesting - sisterhood of seafood collector	Online				
Seaweed harvesting	In Person/Online				
Seaweed harvesting - local authorities	In Person				
Pharmaceutical	In Person				
Cosmetics /Pharmaceutical	Online				
Processing industry - tuna	Online				
Processing industry - oils	In Person				
Fisheries & seafood processing	Online				
Cosmetic ingredients association	Online				
Water treatment company	In person /Online				
Nutraceutical	Online				
Residues management	Online				
Energy company	Online				
Cosmetics	Online				

A general presentation of the project was made by Pedro Villanueva (CETAQUA) whilst CS1 was jointly presented by Rodrigo G. Reboredo (ANFACO) and Ánder Castro (CETAQUA). After the presentation, attendees (online and in person) were informed that they can register as stakeholders on the BioReCer project web page and that their participation in the Focus Group was only possible after registration.

The discussion part was recorded with the permission of the participants for a better interpretation of the results. The FGs lasted one hour and a half aiming at opening the



discussion to as many participants as possible, intervening only to stimulate the dialogue. The main topics discussed are given below:

### a) General opinion about the use of secondary feedstock

In the discussion space, uncertainties, barriers and perceptions about biomasses and their potential uses were addressed, gathering the current knowledge of the agents involved and identifying limitations and gaps in policy development. Participants were invited to raise issues of interest and the importance of active stakeholder participation to obtain their feedback was highlighted. Participants were invited to take the floor and raise issues of interest.

The general opinion on the use of secondary feedstock was positive, with recognition of various opportunities, but there are barriers and challenges, such as legal constraints, logistical issues, and quality concerns, that need to be addressed for the effective utilisation of these resources in the fishing industry. In particular, the involved stakeholders actively discussed the importance of, respectively: **1**) secondary feedstock in the fishing industry; **2**) seaweed harvesting and processing; **3**) the wastewater treatment industry and sludge production.

Regarding the fishing industry, the importance of utilising discards from the fishing industry was highlighted, specifically fish viscera and species with no commercial value, for fishmeal production and other potential uses like shark cartilage. Moreover, the fish cleaning byproducts, particularly tuna, which are currently destined for fishmeal production, may represent an opportunity to use cooking waters for valorisation. From the discussion, it also arose that waste in tuna processing is mostly from the production process, ending up as meal or unutilised cooking layers and vegetable oils. Indeed, the existence of frozen product residues and separately obtainable skins are seen as opportunities. Lastly, the advancing use of algae as an alternative bio-resource has emerged from the discussion.

Also, regarding this latter topic, the general opinion is optimistic with recognition of its potential as a valuable resource. In fact, it has been pointed out that although algae contain polysaccharides and can yield value-added products, low yields have limited their exploration in this field. Stakeholders acknowledge the significant biomass of algae but note the current difficulties in managing and regulating it.

Finally, also the opinion on sewage sludge is overall positive taking into consideration its valorisation and potential use in high added-value products. Overall, further research is needed, as well as innovative approaches, and the integration of local solutions to enhance the valorisation of sewage sludge, acknowledging the legislative complexities and barriers associated with its management.

#### b) Potential barriers to the use of such products



Despite the positive general opinion, several barriers characterise the fishing industry, as well as seaweed and wastewater and sludge treatment.

In fact, from the discussion, it has been argued that legal and quota management barriers hinder the commercialisation of discards from the fishing industry. Moreover, another challenge lies in segregating these by-products due to cost and manual processing, while shellfish processing generates various by-products with logistical and storage issues. Logistical challenges, traceability, storage, and transportation hinder better valorisation of such by-products.

Other barriers are related to the lack of utilisation of skins for collagen, possibly due to the preference for pork collagen and quality issues when some skins are cooked, as well as difficulties coming from the heterogeneous composition of fishing discards, resulting from the diverse species and quantities involved.

Regarding the valorisation of algae and waterweed, there are currently difficulties in managing and regulating it. Some barriers are related to distribution costs, periodic management challenges, and the lack of scientific data in this context. The relatively low yields of these feedstocks have limited their exploration. The quality of yields is also limited due to traceability and harvesting conditions, emphasising the need for standardised harvesting. Moreover, low yields may result from specific requirements for the raw material collected.

Regarding the limitations for sewage sludge, some of them are related to the restriction on depositing sewage sludge in landfills (i.e., in Galicia), highlighting the need for innovative technologies and approaches for sludge valorisation. Moreover, legal barriers and the requirement to meet criteria similar to petrochemical products for competitiveness have been identified. Another important challenge referred to difficulties in scaling up to a centralised level due to economic viability and production volumes. In fact, the minimum viable scale for valorisation is still huge (i.e., around 300,000 equivalent inhabitants), and would imply large-scale treatment plants.

The importance of proper management of discards was also emphasised. It was noted that in Spain, technologies utilising supercritical fluids for oil extraction are already in use, which is relevant to the biomaterials discussed in the meeting. During the discussion the potential of producing probiotics from fish waste was highlighted. The importance of traceability and stringent controls in the sector were emphasised, as well as the significance of consumer acceptance of waste-derived products. Finally, it has been argued that the need for reliable certification schemes addressing waste biomass is also important.

#### c) Potential opportunities/advantages for the involved stakeholders



Due to stakeholders' time constraint, we did not focus that much on this topic. Therefore, this topic will be discussed in depth in further FG sessions.

#### d) The role of policy makers

From the discussed aspects related to the use of secondary feedstock and waste valorisation, the role of policymakers can be crucial. In fact, some of the most important barriers are related to their intervention in legal and quota management barriers, seaweed regulation, the legislative complexity and legal barriers in the management of sewage sludge (i.e., as different requirements established by each Member State, even within a country different regulation for sewage sludge management). Polycimakers could hence create favourable regulatory frameworks that promote sustainable practices and circular economy principles, encouraging industries to invest in the valorisation of waste materials. Their role is also essential in the development of reliable certification schemes addressing waste biomass.

#### 5.3.1.2 Case Study 2 - Italy

The Italian CS meeting took place on 07.06.2023 from 11:00 am to 1:00 pm (CET). Individual invitations were sent to key stakeholders, participating online. The meeting was organised by UnitelmaSapienza and the discussion was conducted in Italian to facilitate communication. A total of 8 stakeholders were involved. The summary of participants is shown in Table 3.

Type of Stakeholder	Type of participation
Non-profit consortium	Online
University	Online
Company - Provision of energy and environmental services	Online
Public water main	Online
Company - Provision of electricity and gas	Online
Startup - Reuse wastewater company	Online
Company - Sustainable agriculture	Online

Table 3. List of participants (Case study 2)



Startup	Online

Annarita Colasante (UNITELMA) began the online meeting by thanking the participants and introducing the purpose and steps of the meeting. She introduced the project, goals and expected results of BioReCer to the stakeholders. She presented the structure of the project, explaining the goal of the 4 phases. Francesco Fatone (UNIVMP), who is leading the Italian CS based on industrial and urban waste, added that the topic of BioReCer is central because of the Italian Recovery and Resilience Plan focusing on these issues, and at the technological level there are promising developments. He pointed out that BioReCer aims to take a step forward for biobased certification. After these presentations, stakeholders were invited to introduce themself and, then, the discussion about the topic of interest was opened.

#### a) General opinion about the use of secondary feedstock

The involved stakeholders showed their interest and knowledge regarding the urban and industrial waste. Indeed, all but one who is more involved in the primary sector, are representatives of either biomass producers or bio-based industry. They have great experience since they are also participating in other national and European projects so they are aware about the use of secondary feedstock and also about their current fate. One of them drew the attention on the sewage sludge current fate highlighting that, despite this potential, is underused due to end users (e.g., farmers) scepticism. Indeed, they shed light on this critical aspect in the eventual valorisation of sewage sludge: they declared to export everything out of the region (about 90 percent is used in agriculture with composting, less than 10 percent is then taken to specialised centres for disposal). The permitting activities are very complex and incompatible with the research itself, which must bring a potentially scalable result. UNIVPM agreed with this point of view but they also underlined that not all sludge is the same and therefore should be treated differently. Another stakeholder who is involved in the OFMSW treatment, explained how they are currently using this as a secondary feedstock to produce both bio-plastics and organic fertilisers. Another example of circular bioeconomy using this kind of secondary feedstock was presented by another stakeholder who told about their experience in the biogas production.

#### b) Potential barriers to the use of such products

The most important barrier identified by all stakeholders is the lack of regulation that could, on the one hand, facilitate the transition to a circular bioeconomy through the adoption of



technological innovation, and, on the other hand, simplify the process and the permits needed to deploy secondary feedstocks. The other important barrier to the adoption of such feedstock is related to the cost/benefit evaluation: in some cases, the cost to implement new technologies for waste treatment is significantly higher than the expected benefit and, hence, some firms prefer the status quo. In this regard, it was pointed out by UNIVPM that risk management plays a crucial role.

Social acceptance, especially regarding consumers/end-users, is one of the most prominent barriers. Indeed, all participants agreed on the importance of training, informing and educating to reduce ignorance in this area, including among legislators. The most striking example was about the use of wastewater: even if there is a clear legislation on the use of this water, people are sceptical and prefer to use "clean water" also for the irrigation purpose. One of the stakeholders highlighted that the end-user's perception about this topic could change in case of water emergency: this was the case of one Italian region that, given the water scarcity, began using wastewater.

Finally, another important issue that could represent a barrier in the adoption of secondary feedstocks is the potential health risk. Especially when we talk about the use of sewage sludge or OFMSW, legislation should be very precise in determining thresholds and in establishing effective controls. Stakeholders agreed on the importance of traceability: having clear evidence of traceability means having a more serious product and, therefore, can be a marketing strategy also to increase end-user's acceptance. Indeed, consumers are often unable to understand what is being talked about (e.g., biological/organic/100% natural, etc.) and, as a consequence, they still prefer to use products/feedstock they have always used since they perceive these goods as "safe". Clearer information can help break down this barrier. One of the stakeholders told in their activity they have positive experiences with end-users but, even though their customers are aware of the added value of secondary feedstock, standardisation and traceability could foster end-users' acceptance and, hence, increase the market share of circular products.

## c) Potential opportunities/advantages for the involved stakeholders

Due to stakeholders' time constraint, we did not focus that much on this topic. Participants agreed on the fact that being part of this project could be beneficial for them especially in these activities in which they may exchange experiences as well as ideas.

## d) The role of policy makers

The role of legislation and policy makers was the hot topic of this FG. Indeed, all the stakeholders highlight how policy makers should work both at regional and national level,



to improve the legislation framework and, hence, facilitate the adoption of secondary feedstocks.

Some of the participants put emphasis on how the complexity of the permitting activities works as a huge barrier for innovation: they suggest having a more flexible legislation in the research phase and a stricter one in the implementation phase. They also agree on the importance of easing the legislation to facilitate the work of industries that are setting up both the production and recovery in order to promote and support the development of circular bio-based activities. Finally, policy makers should understand the importance of certifications of the whole value chain to avoid the creation of bottlenecks in the use of secondary feedstocks.

#### 5.3.1.3 Case Study 3 - Greece

The Greek Stakeholder FG was held on 26.04.2023 from 10:00 am to 12:30 pm (CET) at the Library Room (CERTH) in hybrid format. The discussion was conducted in Greek to facilitate communication. A total of 6 stakeholders were involved. The summary of participants is shown in Table 4.

Table 4. List	of participants	(Case study 3)
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Type of Stakeholder	Type of participation
Company - provision of sustainable composting and organic recycling model	Online
Cooperative platform - public actors, research and entrepreneurship	Online
Company - certification scheme	Online
Public administration	Online
Public funding organization	Online
Association - circular economy	Online

Dr Patsios welcomed the Stakeholders and made an introduction to the meeting's focal points of discussion. He made the connection with the previous meeting, clarified the



project's scope and made a reference to the questionnaire that CERTH had prepared and sent to the stakeholders prior to the meeting. Subsequently, Dr Patsios asked the Stakeholders to introduce themselves, identify their role in the agrifood value chain and express their main points of interest.

### a) General opinion about the use of secondary feedstock

All stakeholders mentioned their expertise and vivid interest in the agrifood value chain. Stakeholders were asked to answer some questions to assess their general knowledge about the use and the current fate of secondary feedstock that will be studied in BioReCer. All the stakeholders expressed a satisfactory level of awareness regarding the agrifood sector. Some of them have a strong background in forestry sector and others in urban waste category, while the majority of them have very limited knowledge regarding fishery sector.

The use of secondary feedstocks is sometimes related to worries about potential health hazards. In this regard, the majority of the stakeholders consider these feedstocks as non-hazardous raw materials, and an important share of them are not aware of any risks related to their use. Only one stakeholder raised an issue related to the use of OFMSW. Even though the vast majority of participants were not concerned about potential health risks, they agreed about the importance of introducing additional measures and to execute more tests in order to fully assure the consumers regarding the product's safety. Related to this topic, stakeholders also expressed their opinion about the existing Hazard Analysis Critical Control Point (HACCP) and almost all of them agreed on the fact that there should be an update on the existing HACCP. In this context, the representatives of the industries mentioned that strict quality control tests are performed regarding the secondary biological feedstocks that are processed, so as to ensure the quality, safety and technical characteristics of the raw materials.

#### b) Potential barriers to the use of such products

Among the potential barriers to the adoption of secondary feedstocks, knowledge and acceptance of such products play a crucial role. CERTH addressed a question regarding the data availability of the secondary biological feedstocks' characteristics and more specifically, if any relevant databases exist and if it is a concept that can be easily implemented. One of the stakeholders argued that it could be possible to collect data on an administrative region level (NUTS-2) and mentioned that a value chain established on a regional level may be more feasible. The stakeholder's awareness on the existence of non-conventional uses of secondary biomass (excluding food, feed and energy production) is quite good since more than half stated that they were aware of the current uses of biobased materials from the agri-food chain in products used in Greece. Focusing on the uses of biological feedstocks that have commercial application, they declared that very few



products exist which are generated on an industrial scale. Apart from the products generated by the industries that belong to the stakeholder's group, some examples were mentioned such as garments from wine residues and applications in the nanotechnology field.

Regarding the acceptance of goods produced with secondary feedstocks, the vast majority of participants declared they are eager to buy such products and the remaining part are not opposed. The majority of them consider it possible to prefer a valorised product compared to a conventional one. However, the majority of the stakeholders underlined the high costs of the valorised products as a deterring factor for their market uptake.

Besides the aspects discussed so far, stakeholders identified as potential barriers also the transparency of information (traceability) that was rated as the most important, the seasonal stability of production, and legal and administrative issues.

### c) Potential opportunities/advantages for the involved stakeholders

The stakeholders expressed their opinion about the potential opportunities for their involvement in the BioReCer project. All of them agreed on the fact that the most important advantage is the reduction of environmental impact of the use of biological secondary feedstocks. The opportunity related to the increase in jobs related to bio-based industry and of revenues for firms involved in the bio-based sector also gathered the consent of the majority of them. Interestingly, many stakeholders highlighted as one advantage the improvement of citizens' perception of bio-based goods. Finally, the sustainable (social, environmental and economic) benefit not only for the involved stakeholders but also for the society as a whole is the reduction of natural resources depletion even though the biological resources will be produced in small quantities, at least at the beginning.

## d) The role of policy makers

None of the participants believed that the legislation adequately covers initiatives to utilise secondary raw materials. A couple of stakeholders expressed their concerns on the legislation's gaps which lead to the non-compliance with the law. This is why stricter legislation should be established, like RED II for energy. Concerning the Greek government's political agenda for implementing bio-economy/circular economy, the majority of representatives taking part in the FG were aware of the EU's Green Deal and the Greek legislation. None of the participants believed that the legislation adequately covers initiatives to utilise secondary raw materials. One example that was also proposed by one of the stakeholders is the Regional Development Fund of Central Macedonia (RDFCM) that states the obligation for the use of recycled construction excavation and demolition wastes in construction materials.



Finally, regarding the financial support provided by policy makers, none of the stakeholders was aware of the existence of subsidies/financial compensation for biological feedstock producers.

#### 5.3.1.4 Case Study 4 - Sweden

Two FGs for the Swedish CS were organised, both online. The first one was held on 24.05.2023 from 12:00 am to 1:00 pm (CET) and 4 stakeholders took part. The second was held on 25.05.2023 from 9:00 am to 10:00 am (CET) and 3 stakeholders took part. The summary of participants is shown in Table 5.

Table 5. List of participants (Case study 4)

Type of Stakeholder	Type of participation
Forestry sector interest Association	Online
Big international pulp & paper company	Online
Startup	Online
SME	Online

#### a) General opinion about the use of secondary feedstock

Stakeholders declared to have a quite good general knowledge about the secondary feedstocks related to the forestry industry as well as to their current use and fate. They highlighted some concerns related to the quantity available as well as to the existing certification scheme to guarantee their quality. Indeed, they in the discussion emerged that, sometimes, it is necessary to look across borders to get material and then there may be an issue with criteria, e.g. if it is sustainable or not. Furthermore, it is also dependent on who is receiving the feedstock and what qualities and volumes are required. Sometimes there is a lack of certified (FSC) raw materials in quantity, then the certified quality could be lacking as well. Focusing on the current fate, the focus was on bark whose fate is incineration for energy production. There is a shortage of material and available volumes of bark is not known since the companies who own the secondary raw material do not have the need to trace that. The general trend is that there is a willingness to make use of the residues, but there is a trade-off with the need of bioenergy (instead of fossil energy). Another interesting point of discussion related to the use of feedstocks for energy



production was related to the Ukrainian war that is currently affecting the availability of the Russian birch wood.

Regarding the potential impact on health due to the use of secondary feedstocks, none of the attendees produces food or hygiene products, hence, this may influence their perception on this question. As a general comment, they thought that the products are not tested enough today, but it depends on applications and end of life applications should also be addressed more thoroughly. Furthermore, uncertainties related to legal requirements have a negative impact as investments need security. Indeed, there are still gaps in the legislation, especially concerning the definition of "substances of concern": it is clearly stated that they cannot be utilised, but it is not detailed exactly what these are. Furthermore, regarding the use of trees as a feedstock, there is the issue related to contamination with heavy metals. In fact, the use of trees is complex and it has been reported that heavy metals may accumulate and hence the biomass needs to be carefully checked. Screening for heavy metals has been conducted for a long time.

Concerning the consumer's acceptance is in general high. There are several examples of products derived from secondary feedstocks. Some examples include textiles, glue components, tires, asphalt additives and energy applications (e.g. battery applications). The replacement of fossil materials is the focus of interest in the industry. However, stakeholders highlighted how customers may accept higher prices on food or clothes that are close to their body but this is not the case for construction or furniture (e.g., bio-based resins for particle board inside the furniture). According to the stakeholders' point of view, this is related to regulation. In general, regulations drive the development, and the general public may be a bit reluctant. From an industry point, they need to reach their 2030 goals, but in some fields, there is also a sustainability pull from customers. Some customers are aware and often choose sustainable products. Although there is regulation to reduce the carbon footprint of products, it does not guarantee the use of bio-based components if there are alternative ways (more economical or simple like recycling) to achieve this reduction without introducing them. Brand owners have a greater knowledge of the benefits of introducing bio-based components/products in their offerings. There is a lack of knowledge for part of the consumers, and they are afraid that bio-based products may be of lower quality and even deteriorate faster than those based on fossil material. The acceptance of bio-based materials is very dependent on the application field. One stakeholder expressed the following opinion: the first step is the acceptance of products derived from biomass from consumers. The second step is to study how to make it economically viable.

#### b) Potential barriers to the use of such products

Stakeholders agree on the identification of the availability of resources/material as one of



the most important barriers to the use of secondary feedstock. Indeed, limited availability could lead to the emergence of a trade-off between the conventional use (e.g., bark incineration for energy production) and valorisation to higher value products. This results in a risk for companies to invest and signing contracts for a given volume for the needed biomass may be challenging. The Ukrainian war (and the resulting energy crisis) is affecting the availability of feedstocks because their incineration for energy generation is being prioritised. Some stakeholders declared that small organisational changes are sufficient to increase the availability of e.g. bark (there are techniques to separate the bark from paper wood). There are good chances of scaling up and there are good chances for implementing similar technologies in other areas of the world where a similar infrastructure as exists in the Nordics (e.g., Canada or North America).

Seasonal stability is not perceived as a huge concern in the forestry industry.

### c) Potential opportunities/advantages for the involved stakeholders

Stakeholders agree on the evidence that deploying secondary feedstocks will generate new jobs due to the evidence that new materials will create new markets that also may need new technologies which, in turn, requires new skills and training. Furthermore, citizens want bio-based products and thereby create a pull for the industry to deliver bio-based solutions: higher demand will positively affect job creation. Another important aspect is related to the products' import. Bio-based products derived from secondary raw feedstock, in fact, are a possibility to curb the dependency on certain types of products that we currently import (for example, rubber from Asia). Valorisation of forest residual streams is often building a new type of technology which will result in European jobs and European supply chains in addition to the increased value from valorisation of the residual streams.

Another opportunity, even though it is an advantage for everybody, is the positive impact of the environment. The environmental impact is considered to be very important for the future. IKEM, in Sweden, has an agenda describing their transition to 2030, e.g. details potential sustainable carbon sources. Existing bio-based alternatives or sustainable alternatives have already demonstrated that it is possible to live a convenient life utilising sustainable alternative. It has been highlighted that, even if bioeconomy as well as circular economy represent a great opportunity, there is a need to educate people about what they are. This "education" also depends on policy makers that, on the one hand, do not exploit the potential of bioeconomy and circular bioeconomy, and, on the other hand, they do not set a clear threshold to identify what we could define as a bio-based product.

#### d) The role of policy makers

The role of policy makers is crucial in fostering the transition to bioeconomy and/or circular bioeconomy. Stakeholders agreed on this aspect highlighting how a regulatory framework



will probably accelerate the transition and that policy makers should comply with the Red II directive. Sweden currently lacks a bioeconomy strategy, but it is on its way.

Financial support is needed, especially for producers, to compensate for the cost of new technologies adoption and to mitigate the financial risk that investors in the bioeconomy sector may face. Furthermore, policy makers not only need to provide monetary incentive but they also need to highlight bio-based alternatives for materials and their origin. Furthermore, the origin of the materials needs to be highlighted.

#### 5.3.1.5 5.3.1.5 FGs summary and way forward

Summing up the insights from the four focus groups, common challenges include complex regulations and legal barriers, lack of guaranteed volumes for by-products and secondary feedstocks, and the need for clearer quality requirements and awareness of bio-based product benefits. The synthesis of the topics discussed are summarised in Table 6.

Торіс	Summary
	<ul> <li>Spain</li> <li>Good general knowledge about the secondary feedstocks related to fishing industry, seaweed harvesting and processing, and the wastewater treatment industry and sludge production.</li> <li>Positive general opinion on the use of secondary feedstock, with recognition of various opportunities, but there are barriers and challenges.</li> </ul>
	Italy
General opinion	· Good general knowledge about the secondary feedstocks related to the urban and
about the use of	industrial residue use and current fate;
secondary	$\cdot$ Issues related to the deployment of sewage sludge (usually exported out of the
feedstock	region);
	· Use of OFMSW for producing bio-plastics or fertiliser.
	<ul> <li>Greece</li> <li>Good general knowledge about the secondary feedstocks related to all CSs of the BioReCer project current fate;</li> <li>No potential health risks perceived;</li> <li>Suggested revision of the HCCP protocol to improve safety.</li> </ul>
	Sweden

#### Table 6. summary of the FGs output



	<ul> <li>Good general knowledge about the secondary feedstocks related to the forestry industry as well as to their current use;</li> <li>Acceptance is high for products such as food or personal, but this is not always</li> </ul>						
	<ul> <li>the case for other products like furniture;</li> <li>Lack in legislation that do not clearly identify what can be considered as "dangerous";</li> </ul>						
Potential barriers to the use of such products	Spain Legal and quota management; Logistical and storage issues, as well as the lack of guaranteed volumes for by-products; Management and regulation of seaweed harvesting and processing; Legislative complexity and differing requirements among regions for wastewater treatment; High distribution costs and low yields impede the use of algae. <b>Italy</b> Lack of regulation; Unbalanced cost/benefit in deploying urban waste as a secondary feedstock; Social acceptance, especially related to end-users; Potential health risk especially for the case of sewage sludge and OFMSW. <b>Greece</b> Knowledge and acceptance of goods produces with secondary feedstocks; Lack of data availability of the secondary biological feedstocks' characteristics; users' acceptance is not perceived as a barrier; Lack in transparency of information (traceability). <b>Sweden</b> Limited availability of secondary feedstocks						
Potential opportunities/ advantages for the involved stakeholders	<ul> <li>of residual wood or waste streams</li> <li>Spain <ul> <li>The involvement of multiple stakeholders and the exploration of synergies between different sectors.</li> </ul> </li> <li>Italy <ul> <li>Interconnection among stakeholders.</li> </ul> </li> </ul>						



	Greece							
	· Reduction of environmental impact of the use of biological secondary feedstocks;							
	Increase in jobs related to bio-based industry;							
	Increase in revenues for firms involved in the bio-based sector;							
	Reduction of natural resources depletion.							
	Sweden							
	· New material may need new technologies which requires new skills and trainning-							
	new qualified jobs							
	- Reduction of raw material imported							
	Spain							
	· Improvements of regulatory frameworks (i.e., reviewing legal and quota							
	management barriers, seaweed regulation, reducing legislative complexity and legal							
	barriers in the management of sewage sludge);							
	· Development of reliable certification schemes addressing waste biomass.							
	Italy							
	Improvement of the legislation framework;							
The role of policy	$\cdot$ Speed up the process of the permitting activities, especially in the initial phase.							
makers	Greece							
	· Improvement of the insufficient legislation;							
	• Introduce and/or increase the financial support for firms operating in the bio-							
	based sector.							
	Sweden							
	· incentives for using bio-based alternatives materials needs to be createdOrigin							
	of the materials needs to be highlighted							

Despite these common challenges, some of them are sector-specific. For instance, in the fishing industry, challenges lie in the management of by-products and discards, especially in utilising fish skins for collagen and addressing issues in seaweed harvesting and processing. The wastewater treatment industry faces difficulties in sewage sludge management and scaling up for centralised valorisation, while regulations prohibiting direct agricultural application of sludge act as barriers. For instance, in Italy, complex regulations and permitting processes hinder waste valorisation, and social acceptance and awareness need improvement. Furthermore, the utilisation of secondary feedstocks faces challenges in the availability of certified raw materials, potential health hazards related to heavy metal



contamination, and varying consumer acceptance across different industries and applications.

The way forward for these focus groups involves collaborative efforts to overcome challenges and promote the sustainable utilisation of biomaterials. In the fishing industry, stakeholders should focus on research, education, and innovative approaches to maximise the valorisation of by-products and discards, along with exploring synergies between different sectors. The wastewater treatment sector requires standardisation, clear rules, and incentives to support virtuous paths and innovative technologies while emphasising education and information dissemination for successful waste valorisation and circular economy practices. In the agri-food value chain, stakeholders must address challenges through a proper legislative framework, certification schemes, and promoting circular economy principles to facilitate the utilisation of secondary biological feedstocks. Strengthening legislation and communication efforts can support the transition to a biobased economy and encourage consumer acceptance of bio-based goods.

Policymakers play a critical role in developing clear frameworks and providing incentives to accelerate the adoption of bio-based alternatives and support the growth of the biobased economy. Overall, collaboration, education, and innovation will be essential to unlocking the potential of by-products and secondary feedstocks for sustainable economic growth and environmental benefit.

#### 5.3.2 AHP: criteria selection and aggregate results

The AHP analysis required two steps: i) in the first step, 6 criteria, common to all case study and that characterise topics need to be compared by participants; ii) in the second step, case-study specific alternatives had to be compared with respect to the criteria. In this specific case, we proposed the same set of criteria across all the groups, providing different case-study specific alternatives. According to the literature (see, for instance, Van Schoubroeck et al., 2019;<sup>20</sup> Lindfors, 2021<sup>21</sup>) and to specific suggestions from project's partners and CSs leaders, we selected the six common criteria described in Table 7.

<sup>&</sup>lt;sup>20</sup> Van Schoubroeck, S., Springael, J., Van Dael, M., Malina, R., & Van Passel, S. (2019). Sustainability indicators for biobased chemicals: A Delphi study using Multi-Criteria Decision Analysis. *Resources, Conservation and Recycling*, *144*, 198-208.

<sup>&</sup>lt;sup>21</sup> Lindfors, A. (2021). Assessing sustainability with multi-criteria methods: A methodologically focused literature review. *Environmental and Sustainability Indicators*, *12*, 100149.



#### Table 7. List of AHP criteria

Criteria	Туре	Example
C1	Economic	Subsidies; bioproducts market potential; higher public acceptance of bioproducts.
C2	Environmental Sustainability	Reduction on: energy consumption, GHGs emissions, renewable sources use (and depletion); water use.
C3	Social	Increase in employment rate, rural area development, community involvement; territorial regeneration.
C4	Technological	Simplification of the traceability of the value chain; simplified information about sustainability indicators.
C5	Legislation	Legal framework harmonisation among regions/countries; licensing and paperwork; having a clear and simple framework.
C6	Traceability	Having a reliable traceability of supply chains; solve the problem of lack of certification schemes.

We asked participants to evaluate criteria according to their relative importance on a 9level scale as reported in Table 8, indicating the Numerical Rating (NR). This means that they had to assess whether, and to what extent, one criterion is more (or less) relevant than another.



#### Table 8. Numerical rating of criteria

Numerical rating	Verbal judgements of preferences
1	Equally preferred
2	Equally to moderately
3	Moderately preferred
4	Moderately to strongly
5	Strongly preferred
6	Strongly to very strongly
7	Very strongly preferred
8	Very strongly to extremely
9	Extremely preferred

An example of the sheets that participants filled is reported in figures 9 and 10 below (these refer to CS1):

	C1	C2	C3	C4	C5	C6										
C1	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!										
C2		1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!				INSTRUCTION						
C3			1	#DIV/0!	#DIV/0!	#DIV/0!				You solely need	to fill the yell	ow cells wit	n numbers	. Put a nur	nber between	1 and 9
C4				1	#DIV/0!	#DIV/0!				according to whether you believe criteria in the row are more relevant that the					the	
C5					1	#DIV/0!				criteria in the c	olumn. On the	contrary, if y	ou believe	that crite	ria in the colu	imns are
C6						1				more relevant t	han those in th	he rows. writ	he the nur	nber corre	sponding to 1	/NR.
Total	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!										
										For example: if	you believe th	at C4 is "stro	ongly prefe	rred" to C	3, you will wr	te the
	C1	C2	C3	C4	C5	C6	Total	Average		value 5 in the c	ell E5. If, on th	e contrary, y	ou evaluat	te that C3	is "strongly p	referred"
C1	1.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		to C4, you repo	rt the value 0.2	20 (= 1/5) in	the cell E5			-
C2	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!								
C3	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		Recall to check	that CR is less	s or (at least	) equal to	D.1		
C4	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!								
C5	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!								
C6	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!								
Total	1.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!								
	1	C1	CD													
	Amax #Duv/ol	CI HDIV/01	CR #DUV/OL													
	#010/0:	#DIV/0:	#010/0:													
CRITEF	IA					<u>.</u>										
C1	Economic	: Subsidie	s; bioprodu	cts market p	otential; hig	her public a	ceptance of	bioproducts								
C2	Environm	ental Sus	tainability:	Reduction of	on: energy co	onsumption,	GHGs emiss	ions, renewable	urces use (and dep	pletion); water use						
C3	Social: Inc	crease in e	employment	rate, rural a	rea develop	ment, comm	unity involve	ment; territorial	generation							
C4	Technolo	gical: sim	plification o	f the treacea	ability of the	value chain	; simplified i	nformation abou	ustainability indica	ators						
C5	Legislatio	n: Legal f	ramework h	armositatior	among reg	ons/countri	es; licensing	and paperwork;	ving a clear and si	mple framework;						
C6	Treaceabi	ility: Havi	ng a reliable	e traceability	of supply c	hains; solve	the problem	of lack of certifi	ion schemes;							

Figure 9. Example of the sheets that participants filled for AHP analysis (1)



A1	A2	A3	A4		INSTRUCTION			
					Fill in only yellow cells. In this case you are asked to express, on a			
					scale from 1 (minimum value) to 9 (maximum value) how much			
					important is each criterion for any alternative proposed.			
A								
Economic								
Environme	nmental Sustainability							
Social	Social Social							
Technolog	ical							
Legislatior	1							
Treaceabi	ity							
ATIVES - CS	51	1						
Chemical	bio-based i	industries:	VFAs (Volati	le Fatty Acids), pe	ptides or Omega3 and, collagen			
Pharmace	utical bio-l	based indu	sries: peptid	es with bioactivity	y as antihypertensive or anticancer and, compounds extracted from macroalgae			
Nutraceut	ical bio-ba	sed indusri	es: peptides	or Omega3				
Continence of a concernment of the second se								
	A1	A1 A2 A1 A2 A A Economic Environmental Sustai Social Technological Legislation Treaceability ATIVES - CS1 Chemical bio-based i Pharmaceutical bio-based Nutraceutical bio-based Nutraceutical bio-based	A1 A2 A3 A1 A2 A3 A1 A2 A3 A2 A3 A3 A3 A4 A	A1       A2       A3       A4         Image: Constraint of the sector of	A1       A2       A3       A4         A1       A1       A1       A1         A1       A1       A1       A1         A2       A1       A1       A1         A3       A1       A1       A1         A4       A1       A1       A1         A5       A1       A1       A1         A1       A1       A1       A1         A2       A1       A1       A1         A3       A1       A1       A1         A4       A1       A1       A1         A5       A1       A1       A1         A1       A1       A1       A1       A1         A1			

Figure 10. Example of the sheets that participants filled for AHP analysis (2)

We asked participants to fill the cells with numbers from 1 to 9. We stressed that they had to introduce a number (NR) between 1 and 9 in the case in which they evaluate the criteria in the row more relevant than the criteria in the columns. If, in participants' opinion, the criteria reported in the row are less relevant than those in the column, they had to write the number corresponding to 1/NR. As an example: if they believed that C4 was "strongly preferred" to C3, they would write the value 5 in the cell E5. If, on the contrary, they would evaluate that C3 was "strongly preferred" to C4, they had to report the value 0,20 (= 1/5) in the cell E5.

We also pointed out that in filling in the cells for weighting criteria, participants had to be "consistent" with the evaluations that they assigned to the different criteria. Indeed, a value (consistency ratio) that measures such consistency was included in the sheet. In fact, this value, called "CR", was computed at the bottom of the sheet "weight" and highlighted in green. We also stressed that this value had to be less or (at least) equal to 0,1.

Once participants provided their judgments for criteria, they had to express, on a scale from 1 (minimum value) to 9 (maximum value), how important is each criterion for any alternative proposed. Differently from the criteria, the list of alternatives was case-study specific.

The list of alternatives related to each of the case study is reported in the following tables:



Alternatives CS1	Туре	Example	
A1	Chemical bio-based industries	VFAs (Volatile Fatty Acids), peptides or Omega3 and collagen.	
A2	Pharmaceutical bio-based industries	Peptides with bioactivity as antihypertensive or anticancer, and compounds extracted from macroalgae.	
A3	Nutraceutical bio-based industries	Peptides or Omega3.	
Α4	Fertilisers/soils recovery	Nutrients such as ammonia and phosphate, and biochar.	

## Table 9. Alternatives of Case Study 1

## Table 10. Alternatives of Case Study 2

Alternatives CS2	Туре	Example	
A1	Chemical bio-based industries	VFAs (Volatile Fatty Acids).	
A2	Chemical bio-based industries	Biopolymers.	
A3	Fertilisers/ soils recovery	Fertilisers and amendments rich in nutrients.	



|--|

Alternatives CS3	Туре	Example	
A1	Composite wood bio-based industries	Fibres from cereal/industrial and wood from tree pruning.	
A2	Bio-fertilizers bio-based industries	fibres from cereal/industrial crops by-products, wood from tree pruning and fruit pomace.	
A3	Nutraceutical bio-based industries	Pectin from peach pulp, oil from peach kernels and polyphenols from olive pomace.	

## Table 12. Alternatives of Case Study 4

Alternatives CS4	Туре	Example	
<b>A1</b>	Chemicals bio-based industries	Biopolymer, bioplastic.	
Α2	Construction	Biopolymers.	
A3	Bio-energy	Warm water, heat and electricity.	
Α4	Bio-fertilizers and soil amendments	Biochar, phosphorus and nutrients.	

In order to obtain results from the AHP analysis, we had to aggregate individual responses for each of the four case studies. Several studies provided a guide to aggregate individual



judgements for group decision making (i.e., Bahurmoz, 2006)<sup>22</sup>. Once participants have filled pairwise judgments of both criteria and alternatives, data have been aggregated in order to obtain the highest ranked alternative for each of the case studies. In order to aggregate individual preferences, given the homogeneous hierarchy of stakeholders' expertise within each case study, we computed the arithmetic mean of the final outcomes. As a sensitivity check, we replicated the AHP analysis by applying the geometric mean, as proposed by Bahurmoz (2006), and the results remained overall consistent.

Tables 12, 13, 14 and 15 below report the aggregated alternatives' weights with respect to criteria for each case study.

	A1	A2	A3	A4	Priorities
C1	6	2	4	8	0,27
C2	6	2	4	8	0,21
C3	5	5	5	5	0,17
C4	5	5	5	5	0,08
С5	5	9	6	7	0,16
C6	4	8	7	6	0,12

Table 13. Alternatives' weights with respect to criteria of case study 1

N. of respondents in Case Study 1: 2

Table 14. Alternativ	ves' weights wi	th respect to cr	iteria of case study 2
	5		,

	A1	A2	A3	Priorities
C1	4,33	7,00	6,67	0,19
C2	5,00	6,67	7,00	0,29
C3	2,67	3,33	5,00	0,05

<sup>&</sup>lt;sup>22</sup> Bahurmoz, A. M. (2006). The analytic hierarchy process: a methodology for win-win management. *Economics and Administration*, 20(1).



C4	6,33	4,67	6,00	0,09
С5	6,33	4,67	7,33	0,30
C6	4,67	4,00	5,67	0,07

N. of respondents in Case Study 2: 3

Table 15. Alternatives' weights with respect to criteria of case study 3

	A1	A2	А3	Priorities
C1	7,5	7,75	6	0,14
C2	6,75	7,75	7,25	0,22
С3	4,5	4	6	0,19
C4	5	6,5	7	0,15
С5	5,75	6,75	7,25	0,22
C6	5,5	5,75	5	0,09

N. of respondents in Case Study 3: 5

Table 16. Alternatives' weights with respect to criteria of case study 4

	A1	A2	A3	A4	Priorities
C1	7	7,5	8	7	0,21
C2	7	7	7,5	7,5	0,48
С3	2	2,5	3,5	3	0,10
C4	4,5	3,5	5	4,5	0,07
С5	6	6,5	7	6,5	0,09
C6	3,5	4	5	5	0,04

N. of respondents in Case Study 4: 2



We then weighted the pairwise criteria-alternatives judgement for the respective level of priority. Once obtained information from the weighted criteria-alternatives matrix, we computed the ranking of alternatives for each case study, by computing the arithmetic mean across criteria. Finally, we were able to select the highest ranked alternative by looking at the largest eigenvalue of their comparison matrix.

#### 5.3.2.1 5.3.2.1 AHP outcome: results by case study

#### CS1

As regards case study 1, the most important alternative is **A4** "**Fertilisers/soils** recovery: Nutrients such as ammonia and phosphate and, biochar"

Table 17. Ranking of alternatives for case study 1

A1	A2	А3	A4
1,07	1,05	1,09	1,23

As it is visible from Table 16, Alternative 4 is the highest ranked alternative for this case study, showing that alternative 4 (1,23).

#### CS2

As regards case study 2, the most important alternative is **A3** "Fertilisers/soils recovery: Fertilisers and amendments rich in nutrients"

Table 18. Ranking of alternatives for case study 2

A1	A2	А3
0,87	0,93	1,12



Also in this second case study, the highest ranked alternative refers to fertilisers and soils recovery, while the lowest ranked alternative is A1 "Chemical bio-based industries", which deals with chemical bio-based industries.

### CS3

As regards case study 3, the most important alternative is **A3** "**Nutraceutical bio-based** industries: Pectin from peach pulp, oil from peach kernels and polyphenols from olive pomace"

Table 19. Ranking of alternatives for case study 3

A1	A2	A3
1,01	1,12	1,13

In this case study, the different ranking of alternatives is not as wide as the two previous case studies. In fact, alternatives despite alternative A3 being the most preferred, the importance of alternative A2 "Bio-fertilisers bio-based industries" (1,12) is really close to the A3 value (1,13), and also A1 "Composite wood bio-based industries" importance is still high (1,01).

#### CS4

As regards case study 4, the most important alternative is **A3 "Bio-fertilisers and soil amendments: Biochar, phosphorus and nutrients".** 

Table 20. Ranking of alternatives for case study 4

A1	A2	АЗ	A4
1,01	1,04	1,15	1,09

Also in this case, as in the case study 3, the ranking of preference does not show huge differences, implying that all the alternatives have been declared to be really important,



although A3 being the most important one (1,15). The second most ranked option was A4 "Bio-fertilisers and soil amendments" (1,09), followed by A2 "Construction" (1,04) and A1 "Chemicals bio-based industries" (1,01).



# 6 Conclusion

One of the pillars of the BioReCer project is the involvement of stakeholders in every phase of the project. The most important tool to both create and guarantee connections among relevant stakeholders is the BRSP tool. In the current document the main steps taken to build up the platform were summarised.

Thanks to the collaboration with other WPs, the value chain diagram as well as the stakeholders categories have been identified. Based on this information, we classified stakeholders and we defined the best strategy to involve them. To this extent, the stakeholder involvement plan (SIP) was drafted and the multi-level engagement was defined. To achieve the best outcome in terms of the number of stakeholders involved in the project, preparatory workshops have been conducted to present in detail both the aim and the expected objective that the BioReCer project aims to achieve. Furthermore, we also got in contact with other stakeholders that we were not able to reach "directly" (i.e., through direct contacts) by means of emails containing detailed information. Thanks to these activities we were able to build up the BRSP platform. Currently, 57 stakeholders belonging to all the relevant categories (i.e., bio-based industries, consumers, biomass producers, policy-makers, certification bodies) are subscribed to the BRSP platform and they are distributed across the four regions in which the main projects achievement will be tested (i.e., Italy, Sweden, Greece, Spain). Based on both KPI 15 and TM related to SO6, we may confirm that we achieved both of them by having more than 50 stakeholders involved in 5 different value chains.

The main goal of the activities described in Task 4.1 is to build up the BRSP. Indeed, as described above, the workshops as well as the massive email delivery were useful to involve stakeholders to be members of the platform. Furthermore, once in the platform we reached a large enough number of members, two engagement activities were performed to collect preliminary feedback, meaning the FGs and the AHP analysis. Actions described in Task 4.2 are devoted to the coordination and support of stakeholder involvement process. Indeed, a protocol to ensure a successful interaction with the stakeholders that want to be members of the BRSP has been developed.

One of the main barriers that we have encountered is related to the language in which stakeholders should communicate with each other and with the BioReCer community. CSs leaders have raised this potential issue during one of the internal meetings. During the preparatory workshops that were held in the 4 CSs regions (i.e., Spain, Italy, Greece and Sweden), some of the participants confirmed this concern related to communication in English. To reduce the impact of this barrier, we opted to hold some of the activities predicted in the GA in local languages. Also, NOVA will prepare information material (brochures, factsheets) in the requested languages.



During the first 12 months of the project, joint to the development of the SIP, besides the stakeholders' involvement and registration in the BRSP, four FGs have been organised. This is the first engagement activity for the BRSP members. The debate was useful to collect feedback on general sentiments about biological feedstocks and the factors that could potentially hinder or foster the large-scale adoption of bio-based products. Additionally, we also wanted to assess the stakeholders' sustainability objectives and, to this extent, we deployed a quantitative analysis by using the Analytical Hierarchy Process. To identify the main relevant category to be included in the AHP, we collected both suggestions from the scientific literature and from project's partners.

We may conclude that all the activities listed in Task 1 have been successfully completed and, considering that the activities included in Task 2 will last until Month 36, we have also partially completed some of the activities included in this task. In the next months we need to put effort into continuing to increase the number of stakeholders in the BRSP in order to have the largest possible audience to interact with until the end of the project.

This deliverable D4.1 was written by UNITELMA with the support of all project's partners. The results collected and presented in the current document are useful to understand the stakeholders' relevance for the BioReCer project and all the engagement activities that have already been finalised and those that will be carried out in the next months. This provides a clear picture of the timing of feedback collection and how it is included in the BioReCer project.



# 7 Way Forward

After having succeeded in the BRSP building-up, we have also initiated the interaction with the involved stakeholders by means of FGs and AHP analysis. As already explained, the main goal of the BRSP is to create an interactive environment to constantly collaborate with the involved stakeholders. To this extent, different activities are in the pipeline for the next few months. ACN, in collaboration with all the WP4 and project partners, will organise the first interactive session in which the main achievement of the project will be presented to the stakeholders. Contrary to FGs that were organised in a very early stage of the project, this meeting will take place after the completion of the activities planned for the first year of the project. This will allow the consortium to present both some tangible results and, furthermore, to collect feedback also on technical issues related, for example, to the BIT tool. We are planning to organise this first interactive session by the end of 2023 and will be further conducted annually. Further description on these events will be reported in Deliverable D4.4 (to be submitted by M36)

Another engagement activity we are planning to realise is realisation of both training capsules and brainstorming sessions. The former activity aims at raising awareness about the assessment framework proposed in WP2 and WP3. This activity could be very useful also to overcome one of the barriers we identified regarding the lack of knowledge of some specific terminology or features. The objective of the latter activity is twofold: collect feedback that will be useful to develop the BIT and assess the new environmental sustainability indicators identified in the WP2 framework. All these activities will be conducted in the next year (2024) and a description of the main feedback collected will be provided in Deliverable D4.4 (to be submitted by M36).



# List of abbreviations

ACN	Cittadinanzattiva - Active Citizenship Network	
АНР	Analytical Hierarchy Process	
ANFACO	Asociación nacional de fabricantes de conservas de pescados y mariscos-centro técnico nacional de conservación de productos de la pesca	
BIT	BioReCer ICT Tool	
BRIE-LL	Bioresources Innovation Ecosystem living-lab	
BRSP	Bioresources Stakeholders Platform	
CEAMSA	Compañia Española de Algas Marinas	
СЕТ	Central European Time	
CETAQUA	Fundación centro gallego de investigaciones del agua	
CR	Consistency Ratio	
cs	Case Study	
DMP	Data Management Plan	
ECBF	European Circular Bioeconomy Fund	
FG	Focus Group	
FSC	Forest Stewardship Council	
GA	Grant Agreement	
GDPR	General Data Protection Regulation	
GROT	Branches, roots, tips	
ІСТ	Information and Communication Technologies	
KPI	Key Performance Indicator	


OFMSW	Organic Fraction of Municipal Solid Waste
R&D	Research and Development
RDFM	Regional Development Fund of Central Macedonia
SC	Supply Chain
SIP	Stakeholder Involvement Plan
SO	Specific Objective
T&T	Tracking and Traceability
TCG	Technical Chamber of Greece TCG
ТМ	Targeting Metrics
UNIVPM	Università Politecnica delle Marche
VFA	Volatile Fatty Acid
WP	Work Package



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# **Annex 1: Project presentation slides**















Figure A 4. slide of the BioReCer Sustainability Assessment Multidimensional framework











# BRIE Living Lab

"An Open Innovation Approach called Bioresources Innovation Ecosystem (BRIE) living-lab (LL) is presented as an appropriate vehicle to support and reach BIORECER objectives, constituted by a community of practitioners tightly connected by a web portal functioning as a virtual meeting place and ICT tool, but also by physical face-to face interactions. In living labs, **stakeholders cooperate in an open space to analyse the barriers and opportunities and jointly develop innovative ideas.** Each player can use the innovations derived from this open space, to find solutions and develop commercial applications, accelerated through digital infrastructure."

www.biorecer.eu

Figure A 6. slide of the BioReCer BRIE-LL presentation

BioReCer workshop, UnitelmaSapienza

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# **Annex 2: Consent form**

# **Stakeholder registration**

Name	
Institution	
Email-Address	
Country	

# In which of the four case studies are you interested in?

- Case Study 1 Fish Cannery Industry and Wastewater Treatment Sludge in Galicia (Spain)
- **Case Study 2** Urban waste in Lombardia (Italy)
- **Case Study3** Agricultural waste in the Region of Central Macedonia (Greece)
- **Case Study4** Residues from the forest industry in Västernorrland (Sweden)

# I wish to engage with BIORECER stakeholders as

(Select the option that most applies to you and in context to the type of input you feel most comfortable giving to the project)

- Biomass producers
- Trade body
- Bio-industry
- Policy maker
- Institution
- Certification Body
- Consumer association
- Other (specify)

☐ I have read and agree with the data protection regulation. I also agree that my data will be stored online and inaccessible for the public.



# Data protection regulation

## I. Introduction

With the following information, we would like to give you as a "data subject" an overview of the processing of your personal data by us as well as your rights from the data protection laws.

Your personal data will always be processed in accordance with the General Data Protection Regulation (GDPR) and all applicable country-specific data protection regulations. We have implemented numerous technical and organizational measures to ensure the highest possible protection when processing your personal data.

II. Scope The following data protection regulations apply to the following websites: https://biorecer.eu/ and all our other online presences (e.g. our social media pages).

## **III.** Controller

Controller within the GDPR is: nova-Institut für politische und ökologische Innovation GmbH Leyboldstraße 16 50354 Huerth Germany Tel. +49 2233 - 4814-40 Fax +49 2233 - 4814-50 Email contact@nova-institut.de

## **IV. Data Protection Officer**

If you have any questions or suggestions regarding data protection issues, you can contact our data protection officer at any time:

Niklas Hanitsch secjur GmbH Steinhöft 9 20459 Hamburg Germany Tel. +49 40 228 599 520 Email: dsb@secjur.com

## V. Technology

### 1. SSL / TLS encryption

To ensure the security of data processing and to protect the transmission of confidential content, we use SSL or TLS encryption. You can recognize the existence of an encrypted connection by the fact that the address line of your browser displays "https://" instead of "http://" and by the lock symbol in vour browser line.

# 2. Data collection when visiting the website / storage of log files When using our website for purely informational purposes, we

only collect personal data that your browser sends to our server (server log files). Every time you access our website, a number of general data and information are collected, which we store in the server log files.

- Purpose of processing Correct delivery of the contents of our website
- Optimization of the contents of our website
- Guarantee of a permanent operability of our IT systems and the technology of our website · Static evaluation to improve the level of data protection and
  - **IX.** Contact
- data security Provision of information to law enforcement agencies in the event of a cyber attack

### Processed data

Usage and metadata (e.g. browser types and versions used, the operating system used by the accessing system, the website from which an accessing system accesses our website (so-called referrer), the sub-websites which are accessed via an accessing system on our website, the date and time of an access to the website, an abbreviated internet protocol address (anonymized IP address), the internet service provider of the accessing system)

### Security measures

The server log files are anonymous data that are stored separately from all other of your personal

## Legal basis

Legitimate interest (Art. 6 Para. 1 Cl. 1 letter f GDPR). Our legitimate interest corresponds to the above-mentioned purposes.

### VI. Cookies

We use cookies on our website. These are files that your browser automatically creates and that are stored on your IT system when vou visit our site. Information is stored in the cookie, which in each case arises in connection with the specifically used terminal device. This does not mean, however, that we obtain direct knowledge of your identity.

1. Technically necessary cookies We use technically necessary cookies. These are cookies that are necessary for the operation and functions of our website.

# Purpose of processing Offering our services

Enabling the use of our website functions

# Legal basis

Legitimate interest (Art. 6 Para. 1 Cl. 1 letter f GDPR). Our legitimate interest corresponds to the above-mentioned purposes.

 Technically not necessary cookies
We use technically not necessary cookies. These are cookies that are not technically essential for the operation of the website or the provision of specific page functions. As a rule, these are thirdparty cookies that can be used to analyze and trace the surfing behavior of users.

## Purpose of processing

- Range measurement and tracking Evaluation of visitor behavior and profiling
- Optimization of our offer
- Legal basis

Consent (Art. 6 Para. 1 Cl. 1 letter a GDPR).

### Right of withdrawal

You can revoke your consent to the use of cookies at any time.

# VII. Transmission and disclosure of personal data

Within the scope of our activities, we transmit personal data to external parties (e.g. persons, companies or legally independent organizational units). You can find details on this below under "Services used" with the respective service providers.

VIII. Data processing in third countries We process personal data in a third country. These are countries outside the European Union (EU) and the European Economic Area (EEA).

We only process data in third countries where an adequate level of data protection exists in accordance with Art. 44-49 GDPR. Details of the specific level of data protection in the respective third country can be found below under "Services used" with the respective service providers.

1. General information

We offer you different ways to contact us (e.g. by e-mail, chat or telephone).

Processed data

- Inventory data (e.g. first and last name, address)
- Contact information (e.g. e-mail address, phone number) Meta and communication data (e.g. IP address)
- Content data (e.g. entered text content, photographs, videos)

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