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SYMBIO
MEET YOUR SUSTAINABILITY TARGET

D1.3 Report on regional stakeholder ad cross-fertilization meetings

(Version 0.3, 30/06/2025)

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Deliverable description

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Glossary of terms

ANRI	Alchemia-nova research & innovation gemeinnützige GmbH
ANTEJA	Anteja ECG D.O.O.
BABEG	Kärntner Betriebsansiedlungs- und Beteiligungsgesellschaft m.b.H.
BBEPP	Bio Base Europe Pilot Plant
BIOEAST	Central and Eastern European Initiative for Knowledge-based Bioeconomy
CMU	Cardiff Metropolitan University
CWC	Hrvatski Drvni Klaster
CSRD	Corporate Sustainability Reporting Directive
CTR	Click-Through Rate
EACB	Estrategia Andaluza de Bioeconomía Circular (Andalusian Circular Bioeconomy Strategy)
EC	European Commission
ECA	European Court of Auditors
EU	European Union
FCTA	Fundación Corporación Tecnológica de Andalucía
GA	Grant Agreement
GDPR	General Data Protection Regulation
H4C	Hubs4Circularity
LGCA	Lombardy Green Chemistry Association
MIM	Mutual Insurance Mechanism
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne
OAP	Open Access Pilot Plant
REA	European Research Executive Agency
SDG	Sustainable Development Goal
SERN	Startup Europe Regions Network
SME	Small and Medium-sized Enterprise
SYMBIO	Shaping symbiosis in bio-based industrial ecosystems based on circular by-design supply chains
TRL	Technology Readiness Level
VCG	Value Chain Generator

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Executive summary

The **Deliverable D1.3 – Report on regional stakeholder and cross-fertilization meetings**, is part of **Work Package 1 (WP1)** - Coordination and Governance of the SYMBIO project.

Its main objective is to present the outcomes of a series of regional workshops and cross-fertilization meetings conducted in six pilot regions: Italy, Slovenia, Spain, Austria, Croatia, and Belgium. These events were designed to foster stakeholder engagement, test the project's methodology in real-world contexts, and lay the groundwork for the development of circular, symbiotic bio-based business models tailored to each region.

The methodology adopted combined a unified two-day workshop format with flexible regional adaptation. The first day focused on knowledge sharing: introducing the SYMBIO project's objectives, presenting regional data on biomass availability and technological infrastructure, and discussing the integration of social value in circular value chains. The second day was dedicated to interactive sessions involving practical training on digital tools, such as the Value Chain Generator along with SME-targeted coaching and mentoring activities to support sustainability transitions and innovation capacity.

Key outcomes of these workshops include a comprehensive mapping of bio-based resources and technologies in each region, identification of innovation gaps, and validation of the SYMBIO approach to building circular-by-design value chains. The sessions also enabled stakeholders to better understand regional bioeconomy policies, explore business opportunities in emerging circular markets, and receive hands-on training with digital tools to support evidence-based decision-making. Furthermore, the workshops provided critical insights into barriers hindering cross-sectoral supply chain development and demonstration facility sustainability from TRL 5 to TRL 9, offering inputs for subsequent project deliverables and policy recommendations. Notably, significant reflections emerged on the role of social value within industrial symbiosis, highlighting the importance of integrating socio-economic objectives alongside environmental and technological considerations. Beyond this deliverable, the knowledge and insights generated will serve as critical inputs for other work packages.

In summary, D1.3 provides valuable evidence that regional engagement is key to unlocking the potential of the circular bioeconomy. By combining data-driven tools with inclusive stakeholder dialogue, SYMBIO strengthens regional innovation ecosystems and empowers local actors, particularly SMEs, to lead the transition toward a more sustainable, circular, and symbiotic industrial future.

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1. Introduction

The SYMBIO project aims to equip European regional communities with advanced tools and methodologies for developing bio-based business models built on the principles of circularity by design and industrial symbiosis. By integrating big data analytics and artificial intelligence, SYMBIO seeks to create ten symbiotic business models capable of combining high profitability with sustainability, offering solutions that are replicable across the European Union. The project provides a comprehensive framework for modelling, measuring, and monitoring industrial symbiosis and assessing its social, economic, and environmental impacts.

SYMBIO's methodology is designed to be tested and validated in twelve pilot regions across Europe, including Lombardy, Piedmont, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Carinthia, Slovenia, Croatia, Andalusia, Brussels Capital, Wallonia, and Flanders. These regions were selected based on factors such as the availability of bio-based resources, socio-economic indicators, established networks and infrastructures, and their potential for developing circular bioeconomy (CBE) supply chains close to market deployment. Through the involvement of stakeholders across all segments of the supply chain, SYMBIO employs a quadruple helix approach, ensuring collaboration among industry, academia, public authorities, and civil society. This participatory model aims to unlock local development potential, foster innovation, and facilitate sustainable pathways to Europe's green transition.

Deliverable D1.3 is part of *Work Package 1 (WP1) – Mapping and Assessing Resources and Technical Solutions Enabling Industrial Symbiosis*, which serves as the foundation for the entire SYMBIO project. The primary purpose of WP1 is to explore and assess the state of the art and perspectives of regional bio-based resources, technologies, infrastructures, and innovation ecosystems relevant to industrial symbiosis. WP1 aims to generate a harmonised and comparative knowledge base that can inform the design of circular-by-design supply chains and support the development of symbiotic business models.

Within WP1, Deliverable D1.3 represents the main outcome of Task 1.3 (Establishing regional stakeholder community and networking) and Task 1.4 (Lesson learnt and cross-fertilisation).

- *Task 1.3* focuses on building regional stakeholder communities by identifying and engaging key actors across the bio-based value chain. Its purpose is to create dialogue among diverse stakeholders to identify critical barriers, opportunities, and enabling factors for industrial symbiosis. It also seeks to initiate co-creation processes that will feed into further technical and strategic work in the project.
- *Task 1.4* aims to facilitate knowledge exchange and cross-fertilisation across different regions and stakeholder groups. It ensures that lessons learnt, and best practices are shared among regional ecosystems, supporting the alignment of regional strategies and contributing to a unified methodological approach for SYMBIO.

Deliverable D1.3 reports on the regional stakeholder engagement and cross-fertilization activities carried out under these tasks. It details the outcomes of a series of two-day workshops organized in six countries covering the twelve pilot regions. These workshops served multiple purposes: establishing local stakeholder communities, collecting regional data to inform the mapping of bio-based resources and technologies, validating SYMBIO's methodologies and digital tools in real-world contexts, and facilitating

discussions on challenges, barriers, and practical strategies for integrating social value into circular bioeconomy business models.

This deliverable consolidates the knowledge generated from these workshops, offering insights into regional bioeconomy dynamics, stakeholder perspectives, and opportunities for industrial symbiosis. It also provides valuable inputs for subsequent work packages and serves as an essential component of the project's overarching strategy to support Europe's transition towards a sustainable and resilient circular bioeconomy.

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2. About the 2-day workshops

2.1. Objectives of the 2-day workshops

In line with the activities of the Work Package 1 - Mapping and assessing resources and technical solutions enabling industrial symbiosis, SYMBIO created the 2-day workshops across six countries representing all the twelve pilot regions: Italy (Lombardy, Piedmont, Veneto, Friuli-Venezia Giulia, Emilia-Romagna), Slovenia, Andalusia (Spain), Carinthia (Austria), Croatia, and Belgium (Bruxelles Capital, Wallonia, Flanders). These workshops were designed to establish local engagement, gather input from key actors, and ensure alignment of project activities with regional bio-based priorities and contexts.

To optimize stakeholder participation and reduce engagement fatigue, the consortium designed a unified two-day workshop format for each country involved. The concept behind the two-day format was to consolidate multiple objectives—ranging from community building and knowledge exchange to capacity building and tool validation—into a single, well-structured event. This approach allowed the consortium to integrate activities from Task 1.3 (Establishing regional stakeholder community and networking), Task 1.4 (Lesson learnt and cross-fertilisation), and Task 2.3 (Implementation of support activities for industrial ecosystems) into a coherent format that maximized both stakeholder value and methodological testing. This format enabled effective collaboration between two work packages—WP1 and WP2—by aligning regional engagement and data collection efforts with digital tool validation and SME support activities.

In particular, each workshop aimed to:

- **Identify key regional resources, actors, and gaps** in the bio-based value chain;
- **Facilitate dialogue among stakeholders** across the quadruple helix (industry, academia, public authorities, and civil society);
- **Test and validate the preliminary methodological approach** of SYMBIO for circular-by-design supply chains;
- **Promote cross-regional learning** and build a **foundation for the co-creation** of symbiotic business models.
- **create synergies among regions** with similar challenges and opportunities in the transition towards a bio-based and circular industrial ecosystem.

The structure of the 2-day workshops followed a common framework developed by the project coordination team, while allowing for contextual adaptation based on regional characteristics and the maturity of local bioeconomy ecosystems. A detailed description of the structure and distribution of content across the two-day format is provided in *Section 2.3* of this report.

2.2. Target groups

SYMBIO workshops targeted regional stakeholders' communities from Italy, Slovenia, Andalusia, Carinthia, Croatia and Belgium.

Specifically, the workshops engaged:

- **Primary producers and biomass harvesters**, who represent the starting point of the bio-based value chains;
- **Converters and consumer goods producers**, whose role is central in transforming biological resources into marketable products;

- **Universities and research institutes**, contributing scientific and technical expertise in circularity, bioeconomy, and industrial symbiosis;
- **Policy makers and regional authorities**, responsible for supporting the enabling environment, funding schemes, and regulatory alignment;
- **Civil society organisations and local communities**, as final users and co-beneficiaries of sustainable and circular regional development.

These stakeholders were selected based on their relevance to the local bioeconomy landscape, their potential to influence or contribute to circular-by-design supply chains, and their strategic positioning in regional innovation ecosystems. The engagement ensured an inclusive and participatory process aligned with SYMBIO's bottom-up methodology for shaping regional symbiosis models.

The invitation process was also based on the stakeholder mapping work carried out during the data collection activities documented in *Deliverable 1.2*. This preliminary mapping enabled the identification of key regional actors and led to the achievement of *Milestone 2 – List of participants (stakeholders) in the 2-day meetings*, which consisted in developing tailored participant lists for each region. This step facilitated focused dialogue and mutual understanding of barriers and critical factors for enabling industrial symbiosis in diverse regional contexts.

In addition to the stakeholder lists generated through mapping, the consortium also leveraged the specific networks already established by the regional partners involved in SYMBIO. These networks—rooted in previous projects, institutional collaborations, and local ecosystems—played a crucial role in identifying relevant participants and ensuring meaningful engagement in each workshop.

2.3 Date and content of 2-day workshops

As previously mentioned, the regional stakeholder and cross-fertilization workshops were organized in the form of two-day events in the six SYMBIO pilot countries (**Figure 1**).

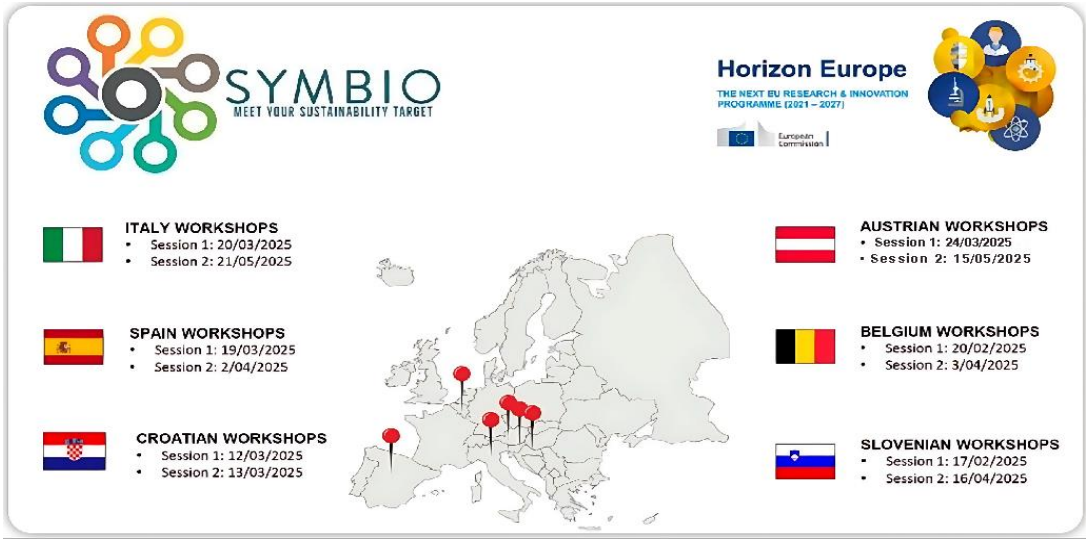

Figure 1 *2-day workshops countries.*

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These workshops were structured to combine both technical capacity building and participatory engagement with local actors across the bio-based value chain. The workshops were held online, in presence or in a hybrid form during the dates in **Table 1**.

Table 1 *2-day workshops sessions.*

COUNTRY	SESSION 1	SESSION 2
Slovenia	17/02 online	16/04 online
Belgium	20/02 online	03/04 online
Croatia	12/03 online	13/03 online
Spain	19/03 online	02/04 in presence
Italy	20/03 online	21/05 in presence
Austria	24/03 online	15/05 hybrid

Table 2 below shows the 2-day workshop topics.

Table 2 *The 2-day workshops topics.*

SESSION 1	SESSION 2
• Greater understanding of regional and local bioeconomy policies • Hands-on knowledge of mapping bio-based technologies and raw materials • Access to key findings from regional data analysis • Practical strategies to create social value through circular business models	• Exposure to cutting-edge tools such as the Value Chain Generator (VGA.AI) • Tailored support for SMEs to guide their transition toward sustainability • Empowerment of SMEs to innovate and adapt to a circular and resilient economy, with tools and strategies tailored to their specific needs

The **Session 1** of each workshop was structured into three core segments:

- Part I (by LGCA): focused on providing participants with a comprehensive understanding of regional and local bioeconomy policies, setting the framework for strategic alignment.
- Part II (by LGCA): aimed to present the results of the activities carried out under Tasks 1.1 and 1.2, with a particular emphasis on the stakeholder and resource mapping work and the associated methodological framework developed within the project.
- Part III (by CMU): dedicated to exploring practical strategies for integrating social value into circular business models. This segment was led by Cardiff Metropolitan University (CMU), as Task 1.4 leader, which presented the conceptual foundations and practical implications of social value creation, based on the data collected during regional engagement.

This Session 1 was directly aligned with the objectives of **Tasks 1.3** and **Task 1.4**, contributing to stakeholder community building, knowledge exchange, and validation of regional mapping outputs.

The **Session 2** was dedicated to technical and operational capacity building and was divided into two training modules:

- Module I (by ANTEJA): introduced participants to the Value Chain Generator (VCG), explaining its purpose, structure, and functionalities, and providing a live demonstration of its application in value chain modelling.
- Module II (by LGCA): focused on empowering SMEs to innovate and transition towards a circular and resilient economy. It included dedicated coaching components, self-assessment guidance, and strategy design support tailored to SME needs.

This Session 2 was directly aligned with the objectives of **Tasks 2.3**, contributing to provide tailored mentoring, coaching and training services to regional cluster/business networks to support them in modelling circular by-design value chains and strengthen support services to their members.

This integrated workshop structure not only supported the technical objectives of **Work Package 1** but also facilitated a productive cross-collaboration with **Work Package 2**. Additional details on the tools, methods and results of the second session—more specifically linked to WP2 activities—can be found in *Deliverable D2.3*.

To ensure consistency and comparability across countries, a common agenda was developed and shared with all partners. This agenda served as a mandatory framework and was to be followed uniformly by all six regions. The standardized agenda is provided in the following section.

SESSION 1: SYMBIO Guide Industrial Symbiosis and Social Value Creation for Circular Innovation

5 min	Welcome and objectives of the event
	Coordinator of each pilot region – Local language
20 min	Policy Intro (with a focus on bioeconomy)
	Regional entity or local representative – Local language
20 min	Welcome & Introduction to the SYMBIO Project
	Coordinator of each pilot region – Local language
45 min	Mapping Bio-based Technologies & Raw Materials: SYMBIO's Regional Hub Handbook Data Collection Inventory
	LGCA - English
10 min	Regional Data Analysis: Key Findings & Insights
	Coordinator of each pilot region – Local language
1/1,5 h	Creating social value through circular business models
	CMU – English
10 min	Q&A Session
	Coordinator of each pilot region – Local language

SESSION 2: Driving SME Sustainability and Circular Innovation: Strategies, Tools, and Advocacy for a Resilient Future

5 min	Welcome and objectives of the event
	Coordinator of each pilot region – Local language
2 / 2,5 h	Empowering Circular Value Chains with the Value Chain Generator tool (VGA.AI)
	ANTEJA – English
2 h	Empowering SMEs for Sustainability: Advocacy, Mentoring, and Strategic Transition in a Circular Economy
	LGCA, Andrea Boffi – English
10 min	Q&A Session
	Coordinator of each pilot region – Local language

2.4 Benefits

The regional stakeholder and cross-fertilization workshops brought substantial benefits across all participating SYMBIO pilot regions, strengthening the foundations for regional bio-based innovation ecosystems grounded in circularity, data, and stakeholder engagement.

Each two-day workshop was designed to maximise the value for participants through a balanced combination of technical knowledge, participatory engagement, and practical tools. The benefits can be grouped into three main categories:

1. Capacity building and data-driven decision making

Participants gained a deeper understanding of regional and local bioeconomy dynamics through:

- Mapping of primary and secondary biomass sources and industrial residues;
- Insights into bio-based technologies, infrastructure readiness, and innovation gaps;
- Structured data collection based on SYMBIO's Regional Hub Handbook and Data Inventory.

This enabled stakeholders to evaluate the regional potential for industrial symbiosis and to identify the most viable and sustainable value chains based on biomass availability, market demand, and technological maturity.

2. Hands-on training with AI-based tools

All workshops included technical sessions featuring tools developed within the project, such as the Value Chain Generator (VCG.AI). These sessions provided:

- Training on how to model circular-by-design business cases using real-time data;
- Exposure to technology landscape analysis, market projections, and feedstock forecasting;

- Simulated applications of AI for sourcing, process optimization, and end-product market identification.

These tools equipped stakeholders with the capacity to make informed, evidence-based decisions and accelerate the transition toward resilient bio-based business models.

3. Support for SME sustainability and innovation

Specific attention was given to small and medium-sized enterprises (SMEs), providing them with:

- Tailored guidance on sustainability transitions using free self-assessment platforms;
- Coaching and mentoring methodologies to support internal capacity development;
- Advocacy tools to engage with policymakers, track relevant EU strategies, and position themselves in emerging bioeconomy value chains.

The workshops empowered SMEs to become active drivers of circular innovation within their territories, enhancing their competitiveness and alignment with EU Green Deal priorities.

2.5 Speakers

Each regional workshop began with an introductory intervention delivered by a local representative from the host country, providing contextual insights into the regional bioeconomy and setting the stage for the thematic sessions. Following this, the partner responsible for the region had the task of presenting the SYMBIO project to the audience. This introductory project overview was intended to provide participants with a clear understanding of the overall objectives, structure, and scope of SYMBIO. To support consistency across all workshops, LGCA prepared and shared with all partners a standard presentation in English, which could be adapted and translated into the local language as needed. This ensured that core project messages were conveyed uniformly while allowing for contextual flexibility and local relevance during delivery.

In addition to these local contributions, a group of core expert speakers was present at all workshops to ensure consistency in content delivery and alignment with SYMBIO's methodology. Their participation was structured across the two main sessions of each workshop:

Session 1

This session focused on the presentation of the SYMBIO methodology, regional data mapping, and the integration of social value into circular business models. The expert speakers included:

- **Maria Elena Saija** – *Lombardy Green Chemistry Association LGCA*: overview of the SYMBIO project structure and data collection strategy.
- **Federica Binello** – *Lombardy Green Chemistry Association LGCA*: presentation of biomass availability and regional resource mapping across Europe.
- **Luca Mattiocco** – *Lombardy Green Chemistry Association LGCA*: insights on the technological landscape and identification of industrial symbiosis opportunities.
- **Katie Beverley** – *Cardiff Metropolitan University CMU*: introduction to social value and the SYMBIO Social Value Tool.

Session 2

This session provided hands-on experience with SYMBIO's digital tools, coaching strategies, and capacity-building resources for regional stakeholders. Key contributors included:

- **Miha Škrokov** – *ANTEJA*: demonstration of the AI-based tool for circular business modelling.
- **Andrea Boffi** – *Business model expert*: SMEs sustainability strategies, and business development pathways.
- **Elisabetta Pesenti** – *Certified professional coach*: training on SME coaching and mentoring

These speakers ensured technical depth, methodological rigor, and cross-regional knowledge transfer throughout the workshop series.

2.6 Communication & Dissemination

The regional stakeholder and cross-fertilization workshops reported in this deliverable constitute a central component of SYMBIO's broader communication and dissemination strategy, which is coordinated by SERN (Startup Europe Regions Network) under Work Package 5.

These workshops not only enabled the collection of technical data and stakeholder insights but also served as key dissemination opportunities to:

- Present the goals, methodology, and tools developed by SYMBIO to local and regional actors;
- Promote awareness of industrial symbiosis and circular bio-based business models among policy makers, SMEs, academia, and civil society;
- Engage regional ecosystems and encourage their long-term involvement in the project;
- Collect feedback that will be used in further communication materials and policy recommendations.

To ensure the workshops had maximum impact and visibility, they were supported by:

- The use of a shared visual identity and branded templates;
- The promotion of each event via the project's communication channels (website, social media);
- The involvement of core speakers to ensure consistency of key messages;
- The integration of workshop outcomes into the overall dissemination narrative of the project (e.g. future policy briefs, training materials, stakeholder reports).

These activities directly contribute to the objectives defined in SYMBIO's Communication and Dissemination Plan, including stakeholder engagement, capacity building, and the exploitation of project results through knowledge transfer.

In this context, the *Deliverable D1.3* represents both a reporting tool and a dissemination output, ensuring that the knowledge generated at regional level is made accessible to a broader European audience.

To increase visibility and participation in the SYMBIO regional 2-days workshops, a targeted LinkedIn Search Engine Marketing (SEM) campaign was designed and implemented in the months leading up to the events. The objective was to raise awareness among relevant stakeholders and attract registrations from industrial, academic, and policy-related audiences in the selected regions.

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The campaign's performance was closely monitored using standard digital marketing metrics, with particular focus on Click-Through Rate (CTR), an indicator of how compelling the ad content was to users.

Key outcomes (**Figure 2)** (**Figure 3**):

- Both Slovenia and Croatia demonstrated strong performance, significantly exceeding LinkedIn's average CTR benchmark (0.4–0.65%). This suggests that the campaign's messaging and targeting strategies were particularly effective in these regions.
- Spain and Italy showed moderate engagement levels, which were in line with, or slightly above, platform expectations. This indicates a reasonable level of resonance with local audiences.
- In contrast, Belgium and Austria, despite receiving a fair number of impressions, reported lower CTRs. This highlights the need to refine content and adjust audience targeting in these regions for future campaigns.

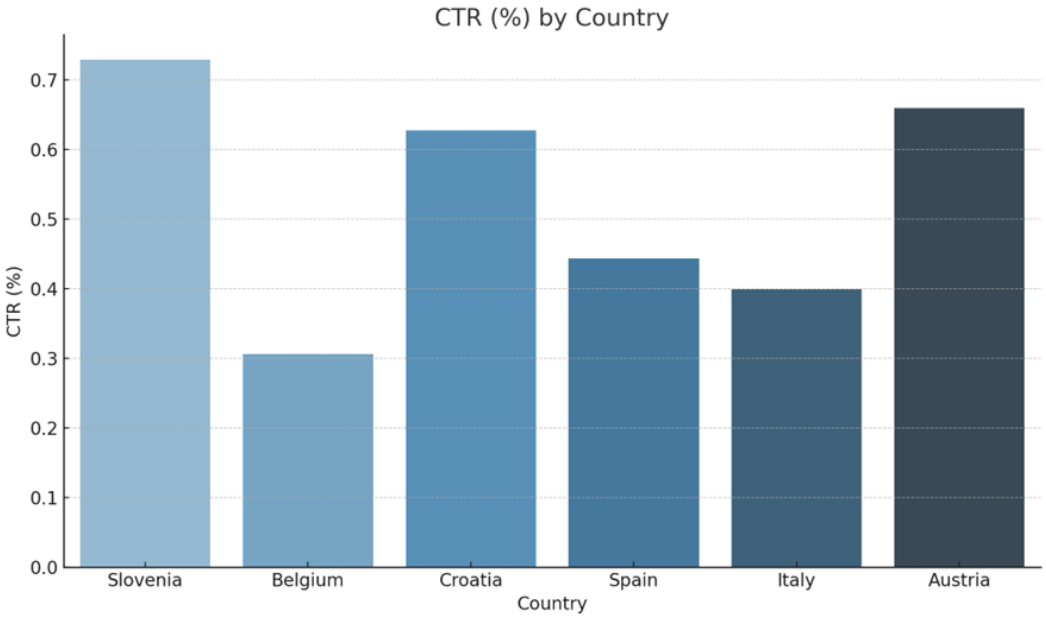

Figure 2 *CTR (%) by country.*

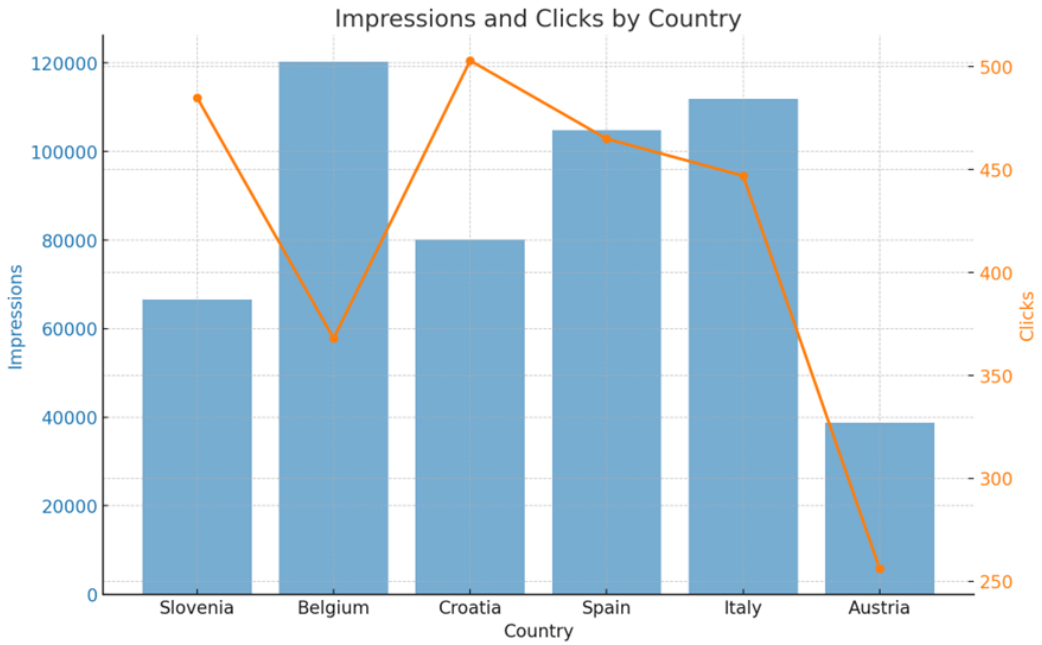

Figure 3 *Impressions and clicks by country.*

Overall, the LinkedIn SEM campaign, launched to support the visibility and participation in SYMBIO's regional 2-days workshops, performed within or above platform benchmarks in most countries. The initiative proved successful in raising awareness and driving traffic to event registration pages, while also providing the consortium with actionable insights to further optimise outreach efforts across Europe.

In addition, a dedicated webpage was created to compile all dates, agendas, and practical information for the six regional workshops (https://www.symbioproject.eu/Online_workshop.html). Once the workshop series concluded, this page was converted from an information hub into an open repository, hosting every slide deck, agenda, and related document so that stakeholders and the wider public can freely access the full body of materials generated.

2.7 Materials

To support consistent implementation, the consortium compiled a set of "Two-Day Workshop Guides" for participants and facilitators, available in the 2-day workshops dedicated page of the website (**Figure 4**).

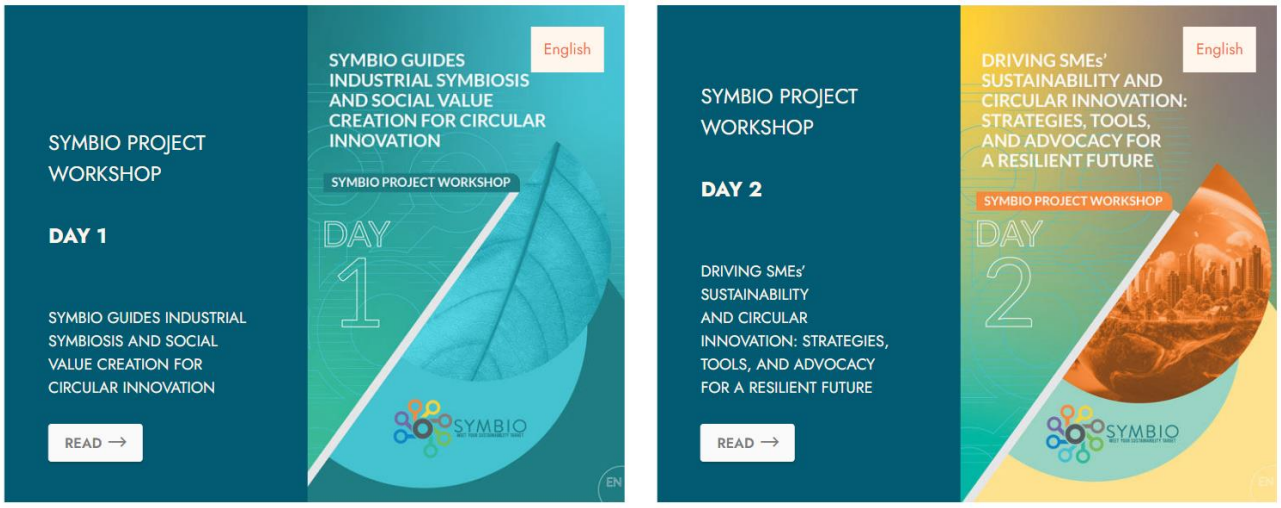

Figure 4 *2-day workshops guides (day 1 and day 2).*

Each guide mirrors the workshop agenda and sessions:

Day 1 – Introduction to Industrial Symbiosis

- Gain a comprehensive understanding of social value indicators and their relevance to bio-based business development.
- Acquire a tool that can be used within your business and with partners to facilitate discussions and planning around social value.
- Contribute to SYMBIO's framework for integrating social value into bio-based circular business models.

Day 2 – Training & Playground

- Live demonstration of the Value Chain Generator (VCG.ai) tool;
- Coaching exercises on sustainability assessment and circular road-mapping for SMEs.

To maximise uptake, every guide was translated into 8 languages — English, Italian, Croatian, French, German, Dutch, Slovenian, and Spanish — reflecting the linguistic coverage of the pilot regions. All language versions can be downloaded from the dedicated workshop webpage, which now functions as an open repository for the slide decks, and background documents referenced in this deliverable.

3. Session 1: SYMBIO Guide Industrial Symbiosis and Social Value Creation for Circular Innovation

The first day of the SYMBIO regional workshops was dedicated to introducing participants to the project's foundations, objectives, methodologies, and early results. It focused on creating a shared knowledge base among stakeholders regarding the regional bioeconomy context, biomass availability, technology landscape, and the concept of social value within circular value chains.

3.1 Key components

The agenda of the Session 1 was structured around the following key components:

1. **Project Introduction and Objectives**

The workshop opened with an overview of the SYMBIO project, including:

- The project's structure, pilot regions, methodology and results.
- Core goals such as mapping regional bio-based resources, fostering industrial symbiosis, and supporting the development of circular-by-design business models (**Figure 5**).

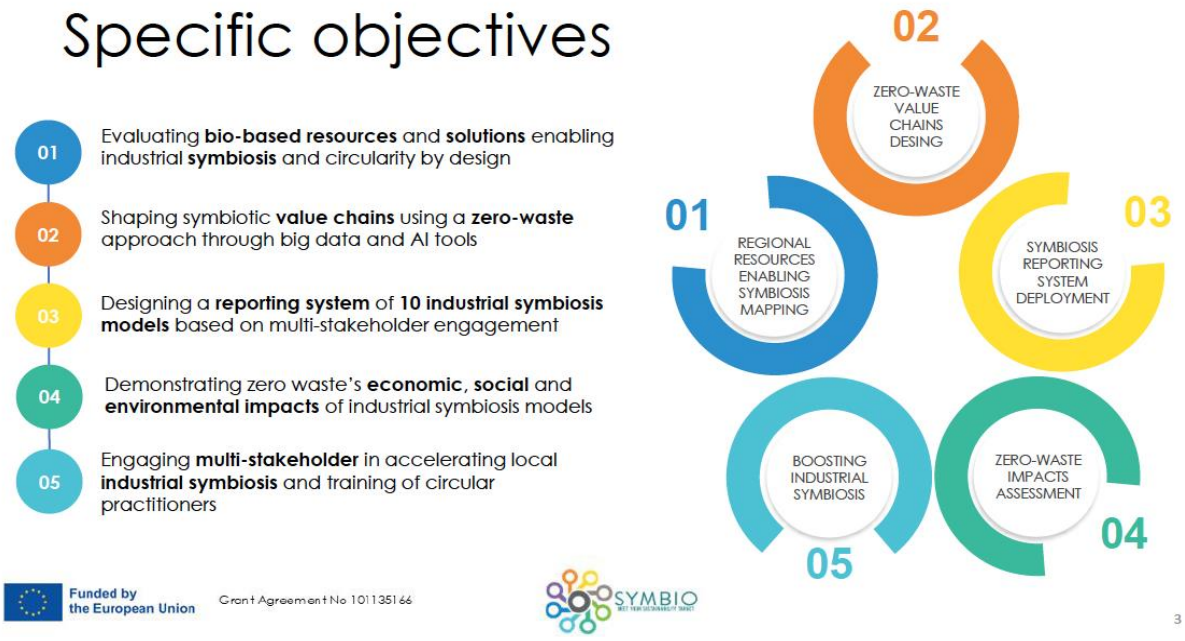

Figure 5 *SYMBIO's specific objectives.*

In the next session of the workshop, representatives and projects managers from the Lombardy Green Chemistry Association (LGCA)—Maria Elena Saija, Federica Binello, and Luca Mattiocco—presented the methodological tools and key findings related to regional data collection hubs, biomass availability, and technological mapping. This session directly addressed the fourth objective of the SYMBIO project: the creation and coordination of regional hubs for mapping bio-based technologies and raw materials across Europe.

2. Inventory of the SYMBIO project: Regional Hub Handbook and Data collection

Maria Elena Saija opened the session by presenting the SYMBIO Regional Hub Handbook and the SYMBIO Data Collection Inventory, two core tools and documents developed to guide the process of identifying and analysing regional bio-based resources. She explained that SYMBIO's 12 European pilot regions have been selected for this task, each contributing local data to a shared methodology.

The Regional Hub Handbook sets out clear selection criteria for bio-based products, considering factors such as market demand, biomass availability, environmental sustainability, technological maturity, economic viability, and accessibility & scalability. Based on these parameters, 12 bio-based products (**Figure 6**) were selected for in-depth analysis, conducting a detailed evaluation of their market potential and technological applicability across the selected regions.

Figure 6 *12 final biobased products.*

The Data Collection Inventory also laid the groundwork for defining a data collection strategy that would be as homogeneous and standardised as possible across all regions. This aspect is fundamental to ensure that the collected data can be compared and analysed consistently across different regional contexts. More information about the Regional Hub Handbook and the methodology used can be found in *Deliverable 1.1* of the project.

Starting from the guidelines provided by the Regional Data Handbook, each pilot region starts to map the regional biomass availability, business models, and technologies, correlated to the 12 biobased products and present in the 12 pilot regions. This gave rise to the Data Collection Inventory serves as a practical tool for:

- Mapping available biomass and technologies,
- Creating an inventory of biomass, industrial processes, and applications
- Standardizing data collection across regions
- promoting industrial symbiosis and supply chain efficiency

The resulting datasets were effectively compared and analysed, providing a clear picture of the current state of bio-based resources and technologies in the pilot regions. Further details and findings are available in *Deliverable 1.2*.

All data collected feed into the circular value chain analysis (WP2), which integrates findings from all pilot regions and offers a comparative and robust methodology for evaluating symbiotic potential at regional and interregional levels.

3. Biomass Availability in Europe

Following this, Federica Binello provided an overview of biomass availability in Europe, focusing on both primary and secondary biomass. The study identified nine key types of **primary biomass** (oat, alfalfa, rice, sugar beet, Wheat, soya, rapeseed maize, barley), with alfalfa, maize, and sugar beet standing out in terms of volume. Italy and Belgium emerged as the top producers of primary biomass, their distribution varies significantly due to climate conditions, agricultural practices and the availability of resources in each region (**Figure 7**).

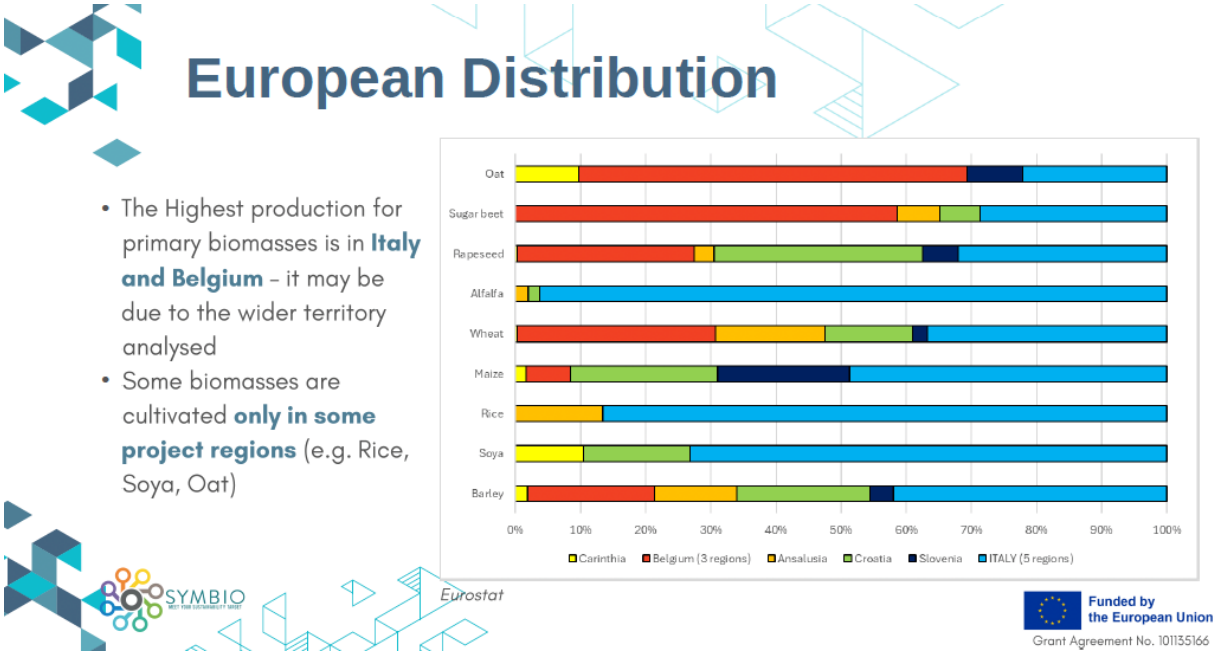

Figure 7 *12 pilot regions distribution of primary biomasses.*

The study also analysed industrial residues. The main industrial residues in terms of production volume include wood residues, municipal solid waste and whey protein hydrolysate with Italy and Andalusia showing the highest concentrations, although this outcome may be influenced by the dataset used in the analysis.

For **secondary biomass**, availability was calculated using conversion rates from the literature, allowing the team to estimate extractable oil and milk content from raw materials. The results indicate a variable distribution of these resources, highlighting that their abundance is influenced by the availability of primary biomass in each region, as secondary biomass depends on the main biomass produced (**Figure 8**).

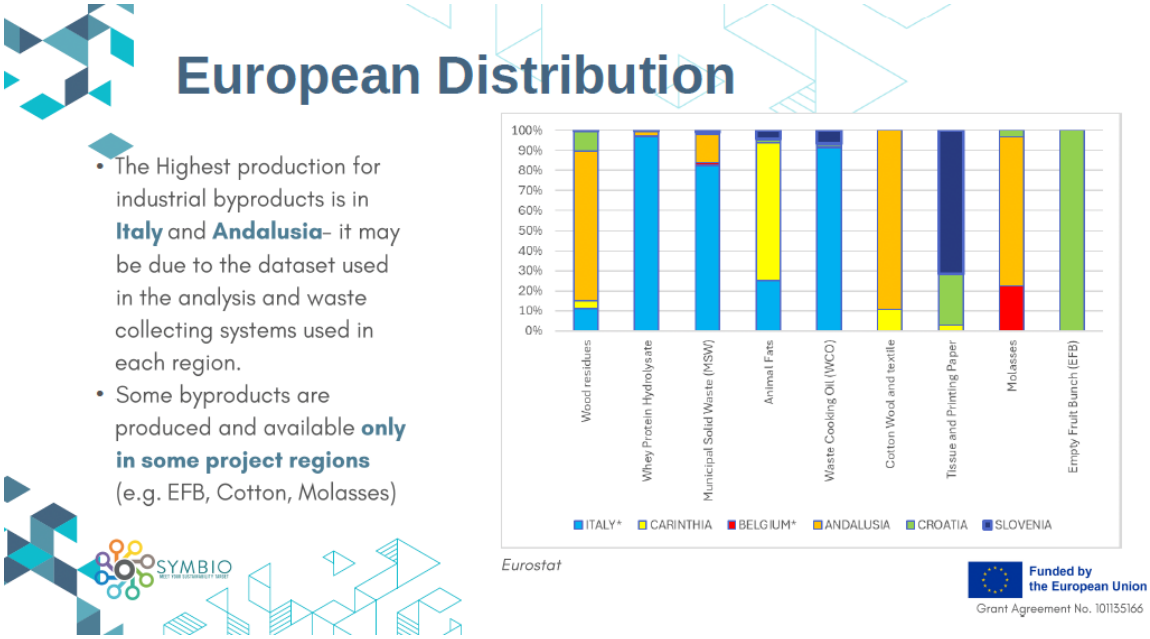

Figure 8 *12 pilot regions distribution of industrial byproducts.*

Federica Binello concluded by emphasizing three key considerations:

- Significance of biomass: biomass remains a crucial renewable source to support Europe's energy transition and carbon neutrality goals
- Regional variability: biomass potential varies across Europe due to differences in climate, land use and policies, requiring tailored strategies for each region.
- Sustainability challenges: ensuring biomass production aligns with sustainability goals (biodiversity protection, land use balance and carbon neutrality) is essential.

Overall, the analysis of biomass in Europe underscores the importance of a regional approach when assessing available resources, as their distribution is strongly affected by climatic conditions, agricultural practices, and territorial characteristics. These findings provide valuable insights for optimizing biomass utilization and developing sustainable strategies for the sector.

4. **Availability of technologies in Europe**

Lastly, Luca Mattiocco focused on the **technology dimension** of SYMBIO's approach. He outlined a three-step methodology used for technology mapping:

- Data collection and literature review to identify existing knowledge and technology gaps.
- Technology mapping to determine which bio-based technologies are active in each regional hub.
- Gap analysis and future projections to highlight future opportunities for investment and cross-sector collaboration.

He stressed the importance of regional mapping, which allows for a precise understanding of the existing technologies currently in use, the adaptability of industrial plants in converting biomass into bio-based products, to highlight technological gaps and access the feasibility of expanding production facilities and optimizing supply chains. He concluded by highlighting how these insights contribute to improving supply chain efficiency and accelerating the transition toward circular industrial ecosystems.

Luca Mattiocco also provided an overview of the **main bio-based products** identified across Europe through this mapping process. These include:

- Bioplastics, such as PLA (polylactic acid), PHA (polyhydroxyalkanoates), and cellulose-based materials, which are sustainable alternatives to traditional plastics.
- Biofuels, notably biodiesel and advanced bioethanol, offer lower-emission energy options.
- Biochemicals, such as glycerol, adipic acid, and furfural, are essential in industries ranging from cosmetics to food and pharmaceuticals.

He also highlighted the **key technological processes** enabling the production of these materials:

- Advanced fermentation, used to produce lactic acid, ethanol, and bioplastics.
- Transesterification, an important process for biodiesel production from vegetable oils and animal fats;
- Enzymatic and chemical hydrolysis, which breaks down plant materials into sugars, later converted into biochemicals like succinic acid and sorbitol.

The mapping process covered various pilot regions, including Italy, Austria, Belgium, Slovenia, Spain, and Croatia. For each region, they mapped the types of bio-products currently produced and the processes used (**Figure 9**).

Figure 9 *Regional mapping of bioproducts and processes.*

These findings show how different regions contribute uniquely to the European bioeconomy, based on available feedstocks, industrial capacity, and technology infrastructure.

In conclusion, Luca Mattiocco identified four key findings from the technology mapping:

- Adaptability of Technologies: many industrial plants have the capability to process biomass and agricultural waste, but they do not necessarily produce the desired bio-based molecules as primary outputs.
- Challenges in Market Penetration: Despite the growing interest in bio-based products there might be barriers.
- Technology Maturity and Industrial Readiness: the study has shown that some technologies are well-developed and widely adopted, while others are still in their early stages of commercialization.
- Potential for Growth: the increasing demand for sustainable materials and bio-based chemicals opens up significant opportunities for innovation, investment and cross-sector collaboration.

5. **Social Value in Circular Bioeconomy**

The final session, led by Katie Beverley (Cardiff Metropolitan University), introduced the concept of social value within the SYMBIO framework. Using an interactive Mentimeter session, participants were guided through a reflection on the motivations and barriers businesses face when integrating social goals into sustainability strategies. In a project focused on circularity, sustainability, and industrial symbiosis, her contribution reminded participants that these concepts are not only technical or environmental, but also deeply social.

Dr. Beverley opened by asking a simple yet fundamental question: what is social value? She described it as the positive impact that actions have on people, communities, and the environment. Within the SYMBIO project, this means going beyond efficiency and innovation to consider how industrial transformation can create inclusive jobs, support community well-being, promote health and nutrition, contribute to carbon neutrality, and ensure that innovation benefits everyone.

She explained that SYMBIO views social value as something to be integrated across the entire value chain—from raw material sourcing to the final product (**Figure 10**). It's not a peripheral concern, but a dimension that must be addressed alongside economic and environmental impacts.

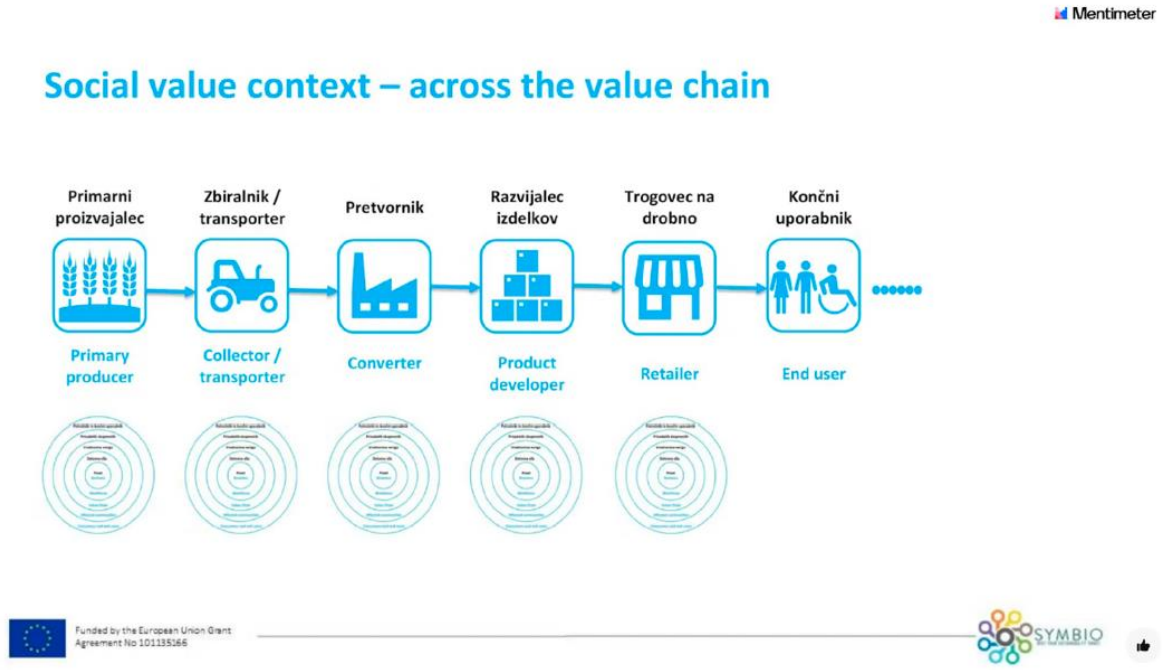

Figure 10 *Social value context across the value chain.*

To help turn this ambition into action, Dr. Beverley presented the intentions for SYMBIO Social Value Tool, a practical resource that is being created during the project to support businesses and stakeholders in integrating social value into their business models. The tool offers guidance on how to design socially responsible strategies that align with the Global Reporting Initiative and the Corporate Sustainability Reporting Directive (CSRD). In addition to regulatory alignment, it includes inspirational case studies from the bioeconomy sector, highlights key indicators for measuring social impact, and outlines the data requirements specific to value chains in the bio-based economy.

The interactive Mentimeter session formed part of the discovery phase for *Task 4.3 - Social Impact Measurement*. The questions asked of participants were intended to test assumptions based on desk-based research undertaken on social value perceptions, indicators and tools. The questions explore when and how organisations begin to consider social value in activities, the barriers and enablers they perceive to creating and measuring it, and the forms of social value that the bioeconomy could deliver.

3.2 Slovenia

The first SYMBIO regional workshop in Slovenia was held on **17 February 2025** and was structured around three key thematic blocks: the national bioeconomy context, regional biomass and technology mapping, and the integration of social value into circular business models.

Number of participants: 21

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Table 3 *Agenda Slovenia Session 1.*

AGENDA	
Miha Škrokov (Anteja ECG)	Introduction
Mario Plešej (Senior Advisor from the Ministry of Agriculture, Forestry and Food)	Introduction to the state of bioeconomy in Slovenia
Maria Elena Saija, Federica Binello and **Luca Matiocco** (LGCA)	Mapping Bio-based Technologies & Raw Materials: SYMBIO's Regional Hub Handbook Data Collection Inventory
Katie Beverley (Cardiff Metropolitan University)	Social value and the Symbio Project

Table 3 shows the agenda of the event. It was opened by **Miha Škrokov** (Anteja ECG), who introduced the objectives of the SYMBIO project and its activities within WP1. The introductory keynote was delivered by **Mario Plešej** (**Figure 11**), Senior Advisor at the Ministry of Agriculture, Forestry and Food, who provided an overview of the Slovenian bioeconomy. Mario Plešej highlighted that Slovenia's bioeconomy involves the sustainable production, processing, and utilization of biological resources across sectors such as agriculture, forestry, fisheries, and bioindustries. While the sector employs approximately 115,700 people and generates €3 billion in value added, its productivity remains below the EU average. Slovenia has high biomass potential (for example, forests cover 58% of the country's land area, and there are significant underutilized resources such as low-grade wood and agricultural residues) but small, fragmented land holdings and weak integration across the value chain hinder large-scale development.

Figure 11 *Mario Plešej presentation.*

Key challenges include the lack of clear strategic direction, low productivity in agriculture and the wood industry, and limited biorefinery capacity. Unlocking Slovenia's bioeconomy potential requires strengthening research and development, promoting circular business models (e.g., cascading use of resources), and fostering better coordination between industry, research and innovation institutions, and government bodies. Supportive policy measures streamlined approval processes, incentives in public procurement, and reliable data systems are also essential to enhance competitiveness and drive sustainable growth in the sector.

The second session featured experts from the **Lombardy Green Chemistry Association (LGCA)**: **Maria Elena Saija**, **Federica Binello**, and **Luca Mattiocco** who presented the SYMBIO Regional Hub Handbook and the Data Collection Inventory. See *Section 3.1* for more details.

The final session, led by Katie Beverley (Cardiff Metropolitan University), introduced the concept of social value within the SYMBIO framework. See *Section 3.1* for more details.

The reflective discussions with Slovenian stakeholders identified that none of the participants were currently measuring the social value of their activities. There was ambivalence regarding its importance, with just over half of participants suggesting it was 'quite important' and just under half saying that measuring social value was 'not important at all'. Although none of the participants were not proactively measuring social value, a substantial minority (just under half) had been asked by value chain partners to supply information on social impact. This supports the findings of the desk-based review that measurement of social value in the majority of businesses is responsive and unsystematic. This contributes to the challenges that participants identified in collecting and reporting on social value. Participants described social value as "hard to measure" due to "lack of standardisation" and "subjectivity" and finding it "difficult to access evidence sources".

However, participants did recognise that there was considerable potential to deliver social value through circular bioeconomy models. Using the framework of the Sustainable Development Goals, participants primarily identified socio-economic benefits through the targets and indicators associated with Goal 9, "Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation", and Goal 8, "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all".

3.3 Belgium

The first workshop in Belgium took place on **20 February 2025** and included an introduction to the project, regional overviews of bioeconomy policies in Flanders and Wallonia, mapping of bio-based technologies and raw materials, regional data analysis, and a discussion on the social value within bioeconomy business models.

Number of participants: 18

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Table 4 *Agenda Belgium Session 1.*

AGENDA	
Jessica Pellizzari (SERN)	Welcome words Introduction of the Symbio Project
Zoe Nys (Project Manager in Valbiom)	Regional Snapshots of Belgium's Bioeconomy Policies: Flanders and Wallonia
Dries Maes (Policy adviser at the Department Work, Economy, Science, Innovation and social economy)	
Maria Elena Saija, Federica Binello and **Luca Matiocco** (LGCA)	Mapping Bio-based Technologies & Raw Materials: SYMBIO's Data Collection Inventory
Tanja Meyer (European Project Coordinator at Bio Base Europe Pilot Plant)	Regional Data Analysis: Key Findings & Insights
Katie Beverley (Cardiff Metropolitan University)	Social value and the Symbio Project

Table 4 shows the agenda of the workshop. It was opened by **Jessica Pellizzari**, representing the Start-up Europe Regions Network (SERN). In her introductory remarks, she presented the SYMBIO project. Jessica Pellizzari outlined the main objectives and scope of the project, highlighting its commitment to supporting the green transition by offering tools and methodologies to design circular and profitable bio-based business models. These models are being developed and tested in 12 pilot regions across Europe, including Brussels Capital, Wallonia, and Flanders in Belgium.

Following the project introduction, **Zoé Nys**, Project Leader for the Biobased Economy at Valbiom, delivered a technical presentation on the status and policy landscape of the bioeconomy in the Walloon Region. She began by clarifying a fundamental distinction: while the bioeconomy broadly includes the use of biological resources from land and sea—such as crops, forests, fish, and micro-organisms—for food, materials, and energy, the biobased economy focuses exclusively on non-food uses of these resources. This includes the production of biobased materials, chemicals, and bioenergy.

Zoè Nys then presented recent economic data to highlight the importance of the biobased sector (**Figure 12**). According to the **Knowledge Center for Bioeconomy**, in 2021 the biobased economy (excluding food and feed) employed around **12.5 million people** in the EU and generated a turnover of approximately **€1,332 billion**. In Belgium it employed **12,000 people** and produced over **€47 billions**. These numbers confirm the growing significance of the biobased sector not just in environmental terms, but as a key economic driver as well.

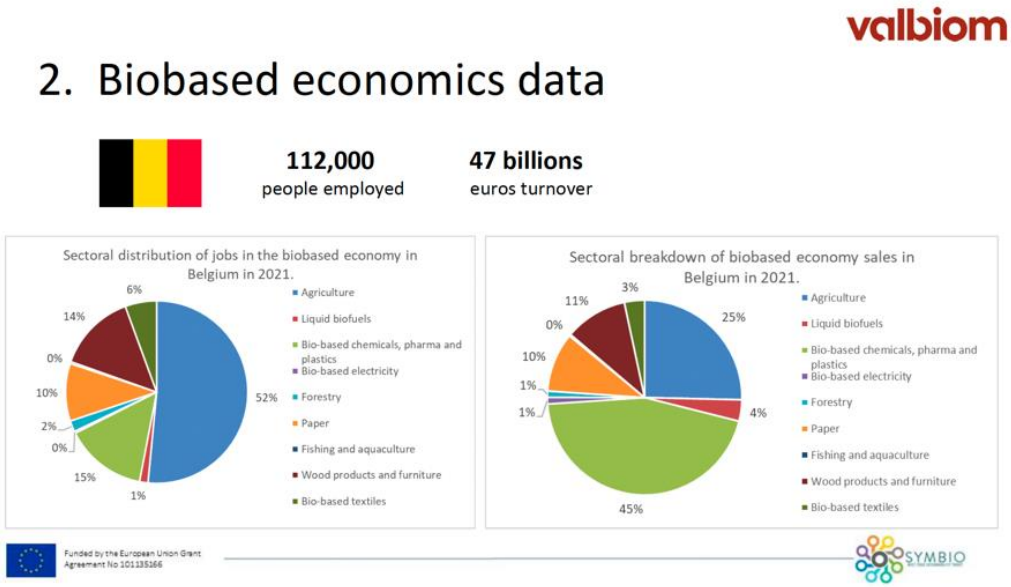

***Figure 12** Belgium biobased economic data.*

Moving to the policy landscape, Zoè Nys explained that Wallonia currently does not have a dedicated strategy for the biobased economy. Responsibility for supporting the sector is divided among the region's ministries of agriculture, energy, and economy. However, the region has launched a comprehensive **Circular Wallonia Strategy**, running from 2021 to 2024 and supported by a budget of **€200 million**. Within this strategy, the biobased economy is treated as a cross-cutting priority, and Valbiom plays a coordinating role for the related actions.

She went on to describe the Walloon biobased ecosystem as a vibrant and diverse community involving public authorities, universities, research centres, private sector actors and clusters. To support this ecosystem, she shared several useful resources. She pointed participants to the Walloon directory of the biobased economy , Valbiom's own platform for news, reports, tools, events and newsletter, Circular economy ecosystem in Wallonia, Knowledge Center for Bioeconomy. In closing, Zoè Nys invited attendees to the upcoming BIOKET conference, a major event on bioeconomy technologies taking place in Brussels from 11 to 13 March 2025.

In the following presentation of the SYMBIO workshop, **Dries Maes**, from the Department of Economy, Science and Innovation of the Flemish Government, provided an in-depth look at the development and implementation of bioeconomy policy in Flanders. Dries Maes opened his presentation with a series of key statistics that underlined the region's weight within Belgium (**Figure 13**).

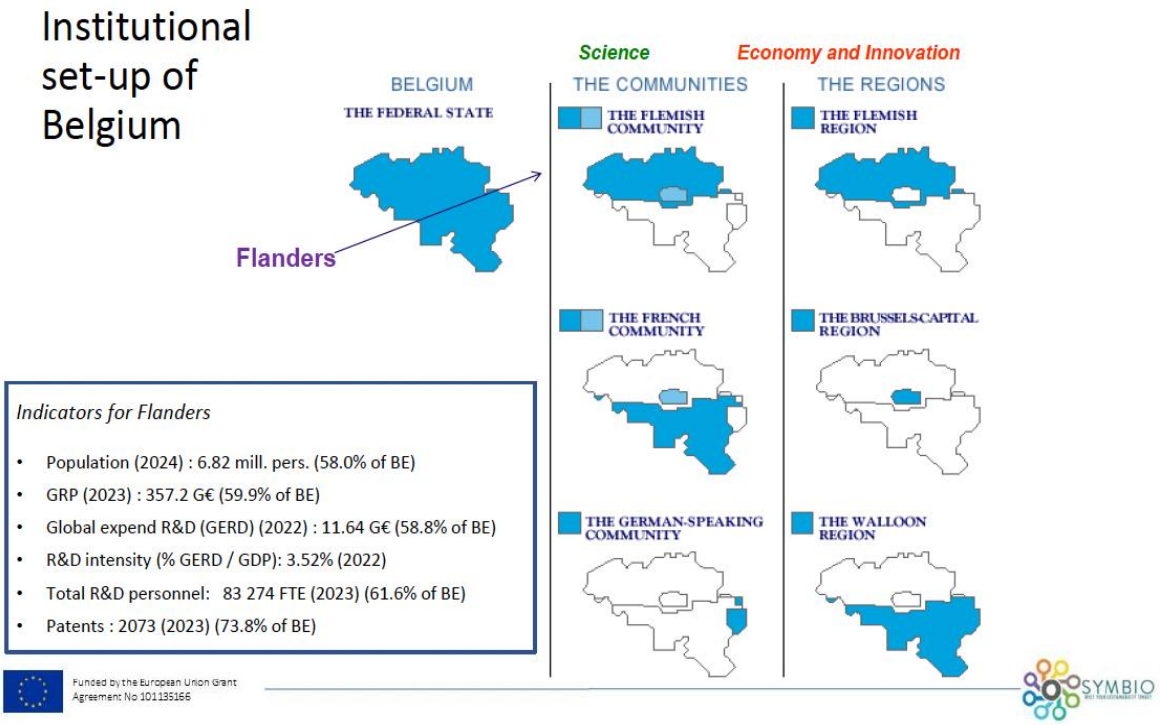

***Figure 13** Flanders indicators.*

He then retraced the region's path toward a more structured bioeconomy policy, starting from the early adoption of the Knowledge-Based Bioeconomy (KBBE) concept, and leading to the formulation of the Flemish Bioeconomy Strategy in 2013. This strategy, still in force today, is based on five pillars: developing coherent policies, boosting education and innovation, ensuring sustainable biomass use, enhancing the competitiveness of bioeconomic sectors, and strengthening international partnerships. The Interdepartmental Working Group on Bioeconomy was created to maintain coordination across these efforts.

Building on this strategic framework, the Flemish Government launched a dedicated Bioeconomy Policy Plan (VR 2020 1812 DOC.1464/4BIS) in December 2020. According to Dries Maes, this plan is articulated into four complementary pillars: challenges for Research and research agenda for bioeconomy, Economic development, Innovative collaboration among companies, farmers, and intermediary actors, Policy support and coherence.

A particularly dynamic element of Flanders' bioeconomy ecosystem is the role of spearhead clusters such as Catalisti, Flanders' Food, MEDVIA, and the Blue Cluster, which cover everything from chemicals to biotechnology and marine applications. To conclude, Dries Maes referred to Circular Flanders (VR 2020 1007 MED.0240/1BIS), a broader policy initiative launched in July 2020, which reinforces the region's bioeconomy strategy. This initiative is structured around six thematic areas (including circular construction, chemistry & plastics, water loops, bioeconomy, food chain, manufacturing) and is supported by 7 strategic levers (policy and policy measures, innovation & entrepreneurship, circular procurement, financing, communication, jobs & skills, research).

In the next session of the workshop, representatives from the **Lombardy Green Chemistry Association (LGCA)**—**Maria Elena Saija, Federica Binello**, and **Luca Mattiocco**—presented the methodological tools and key findings related to regional data collection hubs, biomass availability, and technological mapping. See *Section 3.1* for more details.

During one of the final sessions of the SYMBIO technical workshop, **Tanja Meyer**, European Project Coordinator at **Bio Base Europe Pilot Plant (BBEPP)**, delivered a compelling presentation focused on **regional data analysis**, **pilot-scale innovations**, and **real-world industrial symbiosis cases**. Her contribution provided participants with a concrete sense of how SYMBIO's objectives—particularly those related to circularity, innovation, and the development of resilient supply chains—translate into practice through infrastructure, collaboration, and demonstration projects. She began by presenting the mission and capabilities of Bio Base Europe Pilot Plant, a state-of-the-art open access demonstration facility located in Belgium.

She referenced the Pilots4U database, a European registry of open-access pilot facilities, as a foundation for the analysis, underlining BBEPP's visibility and active participation in initiatives like ShapingBio, which foster collaboration across the EU bioeconomy ecosystem (**Figure 14**) (**Figure 15**).

Figure 14 *Open Access Pilot Plants in Belgium.*

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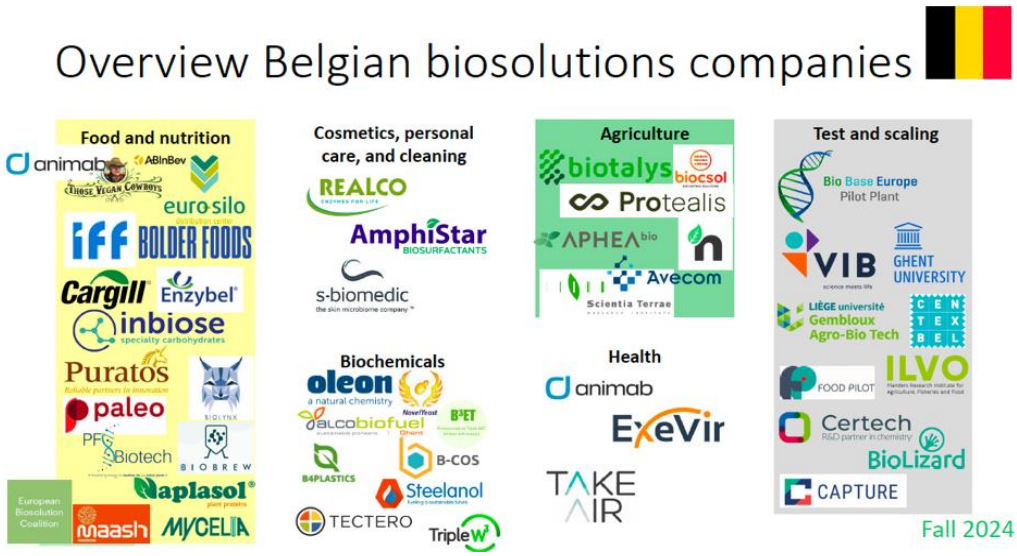

Figure 15 *Belgian BioSolutions companies.*

The final session, led by **Katie Beverley** (Cardiff Metropolitan University), introduced the concept of social value within the SYMBIO framework. See *Section 3.1* for more details.

The reflective discussions in the Belgian regions identified that delivering social value through circular bioeconomy business models was important to the participants, with all responding that the consideration of social value in their design was 'extremely important' or 'quite important'. However, none of the participants had worked directly on social value creation. This supports the assumption drawn from the desk-based review that most businesses in the bioeconomy exhibit a low level of maturity when it comes to innovation for social value with responsibility for monitoring being designated to a small group of individuals, often within compliance and reporting functions. Some participants were aware, however, of 'purpose-led' businesses in the region who intentionally designed social value into their business offer. These included Minagro, Realco, Woolconcept and Isohemp.

Barriers identified to measuring and reporting social value were in line with the findings of the desk-based review, with participants citing "no common metrics" and "lack of quantification". Subjectivity was also identified as a barrier, with one participant raising the issue of "interpretations". Meanwhile, "investors interest" was raised by another participant, supporting the assumption drawn from the literature that the delivery of social value may be viewed by investors as an unnecessary economic cost.

Belgian stakeholders identified four Sustainable Development Goals that the bioeconomy could be considered to contribute to: Goal 9, "Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation", Goal 11, "Make cities and human settlements inclusive, safe, resilient and sustainable", Goal 12, "Ensure sustainable consumption and production patterns", and Goal 13, "Take urgent action to combat climate change and its impacts".

Key themes emerging from the discussion of social values included (**Figure 16**):

- addressing depopulation and deprivation through the increase of rural and coastal employment and new revenue streams for agricultural and fisheries workers
- support for farming and fishing cooperatives
- improving the gender balance across supply chains through business policies and selection of value chain partners (for example, choosing to work with female co-operatives)
- providing career pathways for people far away from the labour market
- promoting open innovation, shared infrastructure and access to research and development
- local value chains for sustainable communities
- business models that share benefits with local communities
- engaging local communities in the development of business models.

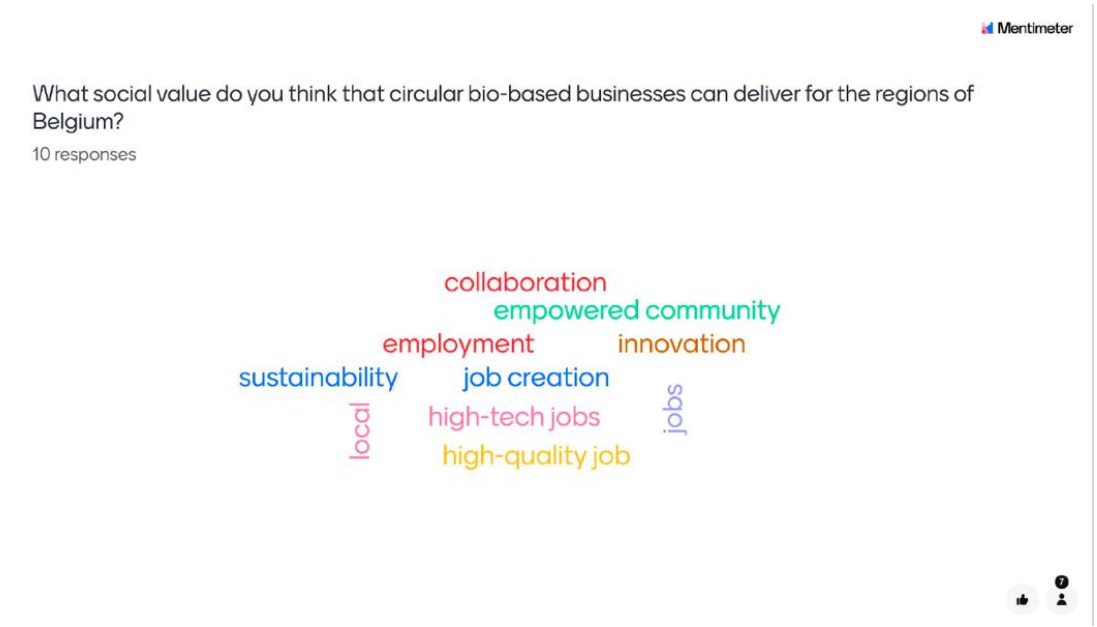

Figure 16 *Mentimeter feedback.*

3.4 Croatia

The first day of online workshop held on the **12sd of March 2025**, focused on the advancement of the SYMBIO project and the development of bioeconomy in Croatia. The meeting was structured into multiple presentations, each shedding light on various aspects of bio-based business models, biomass availability, and the integration of social value in bioeconomic initiatives.

Number of participants: 26

Table 5 *Agenda Croatian Session 1.*

AGENDA	
Darijan Radic (STEEM)	Welcome words Introduction of the Symbio Project and its objectives
Tajana Radic (STEEM)	Regional Data Analysis: Key Findings & Insights, Bioeconomy development in Croatia
Maria Elena Saija, Federica Binello and **Luca Matiocco** (LGCA)	Mapping Bio-based Technologies & Raw Materials: SYMBIO's Data Collection Inventory
Tanja Meyer (European Project Coordinator at Bio Base Europe Pilot Plant)	Regional Data Analysis: Key Findings & Insights
Katie Beverley (Cardiff Metropolitan University)	Social Value in Bioeconomy Business Model, Exploring Ecosystem Mapping and Key Dynamics: Interactive Session with stakeholder
Darijan Radic (STEEM)	Q&A session

Table 5 shows the agenda of the event. The meeting commenced with a presentation by **Darijan Radic**, introducing Project SYMBIO. The project aims to provide tools and methodologies for constructing bio-based business models rooted in circular design and industrial symbiosis. The core components of the SYMBIO project include:

- High-Profits, Sustainable Business Models: SYMBIO focuses on creating profitable and sustainable business models that have been tested in 12 pilot regions across the EU, including Croatia.
- Measurement and Monitoring System: The project intends to establish a system for measuring and monitoring industry symbiosis, including its social, economic, and environmental impacts.
- Inclusive Approach: It emphasizes the inclusion of all supply chain participants in the green transition, assessing resources and technical solutions for enhancing industrial symbiosis.
- Data Utilization: The approach leverages big data and artificial intelligence to facilitate zero-waste value chain designs.

- Expected Outcomes: SYMBIO anticipates achieving biomass security through diversified supply chains while identifying gaps in circular infrastructure to accelerate the implementation of zero-emission technologies Darijan Radic highlighted the need for effective communication and stakeholder engagement for fostering industrial symbiosis in the bioeconomy landscape.

Following the SYMBIO overview, **Tajana Radic** provided insights into regional data analysis related to bioeconomy development in Croatia. Key highlights include:

1. Biomass Availability: Croatia has a processed area of 624,000 hectares with a total primary biomass production of 4,020,000 tons, primarily consisting of barley, corn, wheat, rapeseed, and soybeans.
2. Technological Development: Croatia is in the early stages of establishing capabilities for sustainable chemical production. The emphasis is on utilizing by-products as raw materials for biodiesel and pet food, as well as developing biodegradable materials.
3. Case Studies:
    - BIO-MI: A company focused on developing biodegradable and compostable thermoplastics, which has created materials certified under EN 13432.
    - AGROPROTEINKA: A leader in the eco-friendly management of animal by-products, processing them into feed and energy sources.

As each company exemplifies the integration of sustainability within their operational frameworks, he underscored Croatia's growing potential in sectors such as biodegradable materials and renewable energy through biogas production.

The second session featured experts from the **Lombardy Green Chemistry Association (LGCA)**: **Maria Elena Saija, Federica Binello**, and **Luca Mattiocco** who presented the SYMBIO Regional Hub Handbook and the Data Collection Inventory. See *Section 3.1* for more information.

The final session, led by **Katie Beverley** (**Cardiff Metropolitan University**), introduced the concept of social value within the SYMBIO framework. See *Section 3.1* for more details. The Croatian participants engaged in reflection on the possibilities for the circular bioeconomy to deliver social value. Themes emerging included: the provision of new, better-paying jobs in rural areas, addressing historic issues of depopulation; increased innovation in traditional sectors; and reduced costs of waste management and increased resource productivity for growers. These were reflected in the Sustainable Development Goals that participants thought were most relevant to the regional bioeconomy - Goal 8: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all"; Goal 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"; Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable"; and Goal 12: "Ensure sustainable consumption and production patterns". Some participants thought that there was the potential to deliver against every SDG goal. All participants agreed that considering social value in the early stages of the design of business models was "very important" or "quite important", but, in common with other regions, only one participant had been involved in developing the social aspects of the business model. This was also reflected in responses to the question of when businesses begin to think about social value, which participants indicated was usually in the reporting phase.

Barriers to reporting social value identified by participants included lack of trusted measurement indicators, a perception that current measurement approaches are subjective and not robust, the administrative burden (particularly in small businesses), conflicting priorities within the business and a lack of knowledge on how to approach social value measurement.

3.5 Spain

The first SYMBIO workshop in Spain, held on **March 19, 2025**, focused on presenting the project's objectives and exploring Andalusia's role in the circular bioeconomy. The session featured regional strategies, social value integration, and data mapping tools to support bio-based innovation and industrial symbiosis.

Number of participants: 24 (**Figure 17**).

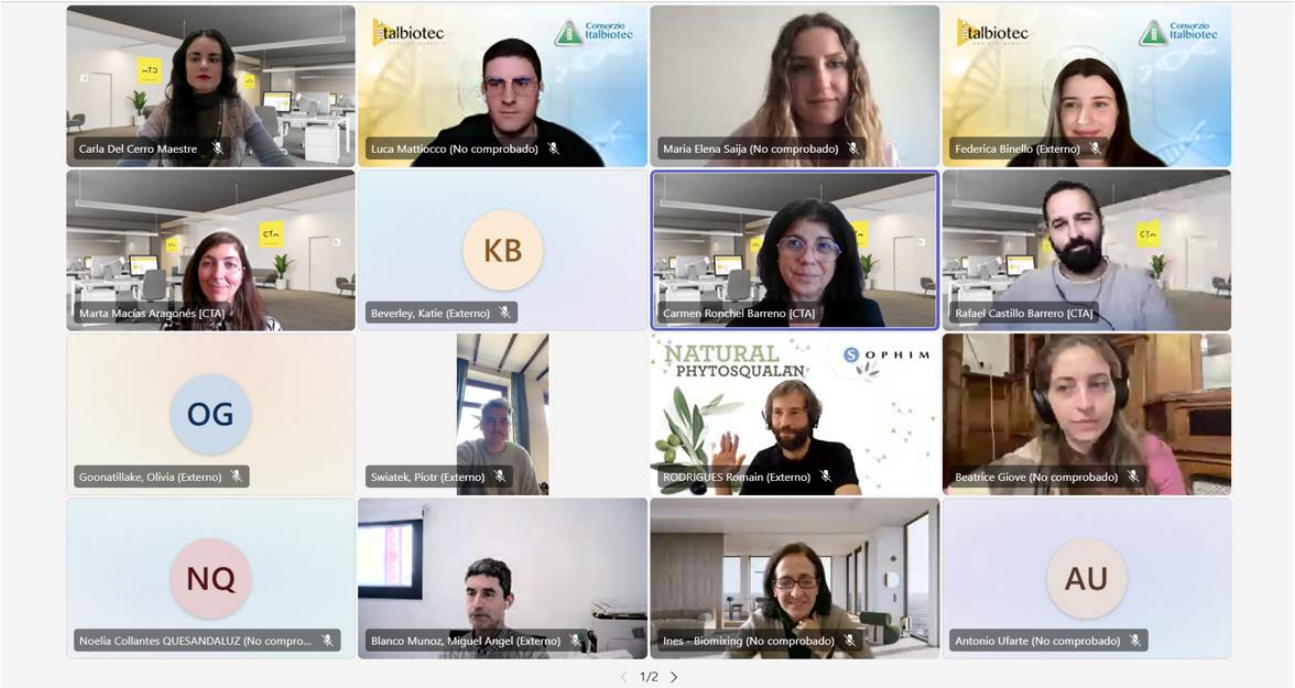

Figure 17 *Participants at the Spain workshop Session I.*

Table 6 shows the agenda of the event. The workshop began with an overview of the SYMBIO project, presented by **Rafael Castillo Barrero**. The focus was on the project's role in promoting industrial symbiosis across 12 European pilot regions, including Andalusia in Spain. Other regions involved range from Carinthia in Austria and Wallonia in Belgium to various territories in Italy, Croatia, and Slovenia.

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Table 6 *Agenda Spain Session 1.*

AGENDA	
Rafael Castillo Barrero (CTA)	Welcome words Introduction of the Symbio Project
Mar Cátedra, (Consejera Técnica de la Secretaría General de Agricultura, Pesca, Agua y Desarrollo Rural de la Junta de Andalucía)	Bioeconomía Circular en Andalucía: Estrategia e impacto en sectores clave
Katie Beverley (Cardiff Metropolitan University)	Social Value in Bioeconomy Business Model, Exploring Ecosystem Mapping and Key Dynamics: Interactive Session with stakeholder
Maria Elena Saija, Federica Binello and **Luca Matiocco** (LGCA)	Mapping Bio-based Technologies & Raw Materials: SYMBIO's Data Collection Inventory
CTA	Q&A session

Mar Cátedra, representing the Regional Ministry of Agriculture, Fisheries, Water and Rural Development of Andalusia, delivered a comprehensive and forward-looking presentation on the region's **Circular Bioeconomy Strategy**. Mar Cátedra began by situating Andalusia's strategy within the broader global and European context. She recalled how the 7th Global Forum on Food and Agriculture (Berlin, January 2025) emphasized the urgent need to "cultivate a sustainable bioeconomy", with agriculture and food systems playing a central role. At the European level, recent initiatives confirm this trajectory. The European Commission's 2024 communication, "A Future Built with Nature", promotes biotechnology and biofabrication as key enablers of sustainable development. Meanwhile, the 2025 European Competitiveness Compass calls for closing the innovation gap and preparing a revised EU Bioeconomy Strategy.

Mar Cátedra then turned to Andalusia's unique position as an agricultural powerhouse. This diversity of crops, production systems, and territorial characteristics positions Andalusia as an ideal region to pilot and scale circular bio-based models that can inspire European replication.

A central part of the presentation was devoted to the quantification of available biomass, based on the REGEN Andalucía system. The main contributing sectors include:

- Agriculture and livestock (both intensive and extensive),
- Agri-food industry (especially olive oil, wine, beer, tomato, rice, and horticulture),
- Fisheries, aquaculture, and municipal biowaste management.

Officially adopted in September 2018, the Andalusian Circular Bioeconomy Strategy EABC was developed through a collaborative process involving public institutions, research centers, businesses, and civil society.

The strategy is structured around four main working groups: Resources, Transformation, Knowledge, and Logistics.

These groups help define priorities, monitor data, and promote actions adapted to the region's needs. The biomass figures collected for 2022–2023 confirm Andalusia's enormous potential to build new, circular value chains based on agricultural residues and bio-based innovation.

Looking ahead, Cátedra outlined the key strategic lines for the 2025–2030 period:

- Supporting the sustainable generation and availability of biomass;
- Encouraging industrial transformation to produce bio-based products and bioenergy;
- Promoting awareness and public engagement on circular bioeconomy topics;
- Fostering cross-sectoral cooperation for new markets and value chains;
- Strengthening research, technological development, innovation, and knowledge transfer;
- Ensuring alignment with new European and regional regulatory frameworks.

At the core of this approach is a strong emphasis on public–private collaboration as the foundation for resilient and impactful implementation.

The second session featured experts from the **Lombardy Green Chemistry Association (LGCA): Maria Elena Saija, Federica Binello**, and **Luca Mattiocco** who presented the SYMBIO Regional Hub Handbook and the Data Collection Inventory. See *Section 3.1* for more details.

The final session, led by **Katie Beverley** (**Cardiff Metropolitan University**), introduced the concept of social value within the SYMBIO framework. See *Section 3.1* for more details. In Andalusia, the potential for the circular bioeconomy to contribute to slowing or reversing rural depopulation was particularly strong. Depopulation, community empowerment, and opportunities for young people to get decent work were all identified as important aspects of social value that the regional actors would like to see delivered. All participants thought it was either "extremely important" or "very important" to consider these aspects in the design of business models, although, in common with other areas, only a small number of participants had been involved in identifying opportunities for social value creation. One participant came from a purpose-driven business in which the delivery of social value is embedded in the business model design, whilst another was involved in monitoring and measuring of social value for sustainability reporting. In common with other regions, barriers in measuring and reporting social value were identified as the lack of standardised metrics and approaches, a lack of common guidelines, difficulties with data collection (including a lack of clarity on what data to collect), and the time, cost and administrative burden associated with collecting data.

3.6 Italy

The first SYMBIO workshop, held on **20 March 2025**, focused on the project's objectives, regional data collection, and the creation of social value through circular business models. The session also addressed the mapping of bio-based technologies in Italy, with a focus on European policy frameworks supporting the bioeconomy transition.

Number of participants: 20

Table 7 *Agenda Italy Session 1.*

AGENDA	
Maria Elena Saija (LGCA)	Welcome and Objectives of the Event
Ilaria Re (LGCA)	Introduction to European Policies with a Focus on the Bioeconomy
Maria Elena Saija (LGCA)	Welcome Address and Introduction to the SYMBIO Project
Maria Elena Saija, Federica Binello and **Luca Matiocco** (LGCA)	Mapping Bio-based Technologies & Raw Materials: SYMBIO's Data Collection Inventory – Italian focus
Piotr Świątek, Katie Beverley (Cardiff Metropolitan University)	Creating Social Value through Circular Business Models
	Q&A session

Table 7 shows the agenda of the event. It started with **Ilaria Re** (Lombardy Green Chemistry Association) presentations, which offered participants a clear and structured overview of how the **European bioeconomy strategy** has evolved over the past decade, what milestones have been reached, and where it is headed in the coming years (**Figure 18**).

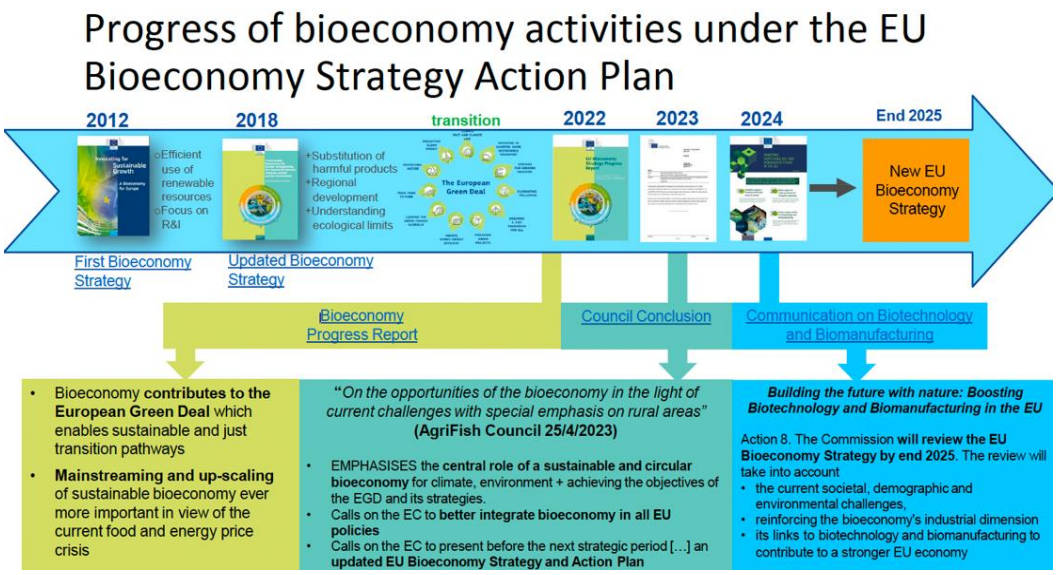

Figure 18 *EU Bioeconomy Strategy.*

She began by recalling that the first EU Bioeconomy Strategy was adopted in 2012, laying the groundwork for integrating bio-based approaches into sectors such as agriculture, industry, energy, and waste management. Since then, the EU has taken multiple steps to strengthen its bioeconomy model, culminating in a major update in 2018 and an extensive bioeconomy progress report released in 2022. The EU Bioeconomy Strategy Progress Report pursues a series of strategic objectives aimed at building a more sustainable and resilient future. At its core, it seeks to ensure food and nutritional security, a fundamental right that must be preserved even as we transition to new production models. Equally important is the need to manage natural resources responsibly, safeguarding ecosystems while ensuring their availability for future generations. Over the past years, the European bioeconomy has recorded a number of notable achievements. One of the most significant has been the rise in national and regional strategies dedicated specifically to bioeconomy development, the expansion of the bio-based industry itself, increased private and public investment in the bioeconomy, and improvements in the management of biological resources. However, there are still some challenges, such as promoting sustainable consumption models and training a specialized workforce to support the green transition. In terms of general trends in the development of the bioeconomy in Europe, 28 regions have a dedicated strategy for the bioeconomy.

Looking at macro-regional initiatives, there are:

- BIOEAST, which involves 11 countries from Central and Eastern Europe;
- Nordic Bioeconomy, promoting cooperation across Northern Europe;
- and bioeconomy strategies in the Baltic Sea region.

The second session featured experts from the **Lombardy Green Chemistry Association (LGCA): Maria Elena Saija, Federica Binello**, and **Luca Mattiocco** who presented the SYMBIO Regional Hub Handbook and the Data Collection Inventory. See *Section 3.1* for more details.

The final session, led by Katie Beverley (Cardiff Metropolitan University), introduced the concept of social value within the SYMBIO framework. See *Section 3.1* for more details.

Social value themes discussed by the Italian participants included social cohesion and new job creation. All participants considered social value “quite important” to consider in the development of new business models, but, in line with other regions, only a very small number of participants had ever been involved in activities to incorporate social value in businesses. Key barriers to measuring social value were identified to be a lack of standardised metrics, a lack of knowledge about how to undertake measurement, a lack of stakeholder engagement and the perception that measurement is difficult and time-consuming.

3.7 Austria

On **March 24, 2025,** the first Austrian workshop featured LGCA presenting the Italian mapping of bio-based technologies and raw materials for SYMBIO, while Katie Beverley explored how circular business models can generate social value.

Number of participants: 21

Table 8 *Agenda Austria Session 1.*

AGENDA	
Oliver Kathol (BABEG)	Welcome and Objectives of the Event
Maria Elena Saija, Federica Binello and **Luca Matiocco** (LGCA)	Mapping Bio-based Technologies & Raw Materials: SYMBIO's Data Collection Inventory – Italian focus
Katie Beverley (Cardiff Metropolitan University)	Creating Social Value through Circular Business Models
Oliver Kathol (BABEG)	Q&A session and invitation to the CIRPLEX Summit in Carinthia

Table 8 shows the agenda workshop. The Information Session and Workshop meeting for the SYMBIO project began with an introduction by **Oliver Kathol**, outlining the project's goal of creating bio-based business models in Carinthia as a demo region, and announced a second in-person workshop set for 15th of May during the Cirplex Summit in Klagenfurt.

The second session featured experts from the **Lombardy Green Chemistry Association (LGCA)**: **Maria Elena Saija**, **Federica Binello**, and **Luca Mattiocco** who presented the **SYMBIO Regional Hub Handbook** and the **Data Collection Inventory**. See *Section 3.1* for more details.

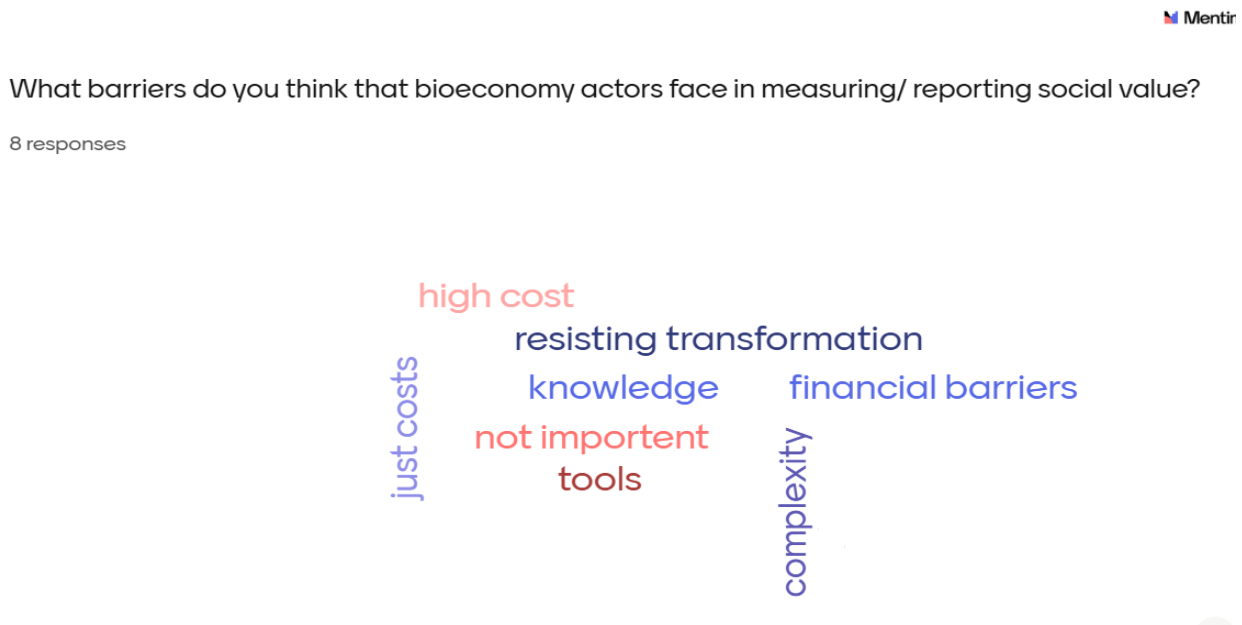

Figure 19 *Open Social value questions.*

The final session, led by **Katie Beverley** (Cardiff Metropolitan University), introduced the concept of **social value** within the SYMBIO framework. See *Section 3.1* for more details. During the reflective discussion, social value themes identified by regional participants were mainly socio-economic (**Figure 19**), focusing on the potential for circular bioeconomy to promote cross-sectoral innovation and new business models, and the opportunities for community engagement. This corresponded to the Sustainable Development Goals that were identified as being particularly relevant to the region: Goal 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation", Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable" and Goal 12: "Make cities and human settlements inclusive, safe, resilient and sustainable". Two other goals were also identified as important: Goal 3: "Ensure healthy lives and promote well-being for all at all ages" and Goal 13: "Take urgent action to combat climate change and its impacts", reflecting a finding of the desk-based research that the bioeconomy is often assumed to deliver benefits for the health of people and the environment, although there is evidence to suggest that this is not always the case. Participants suggested some companies within the region who are delivering social value, including Mondi, Lignovations and Offner Holzindustrie.

4. Session 2: Driving SME Sustainability and Circular Innovation: Strategies, Tools, and Advocacy for a Resilient Future

The second workshop of the SYMBIO project focused on key themes such as SME sustainability, circular innovation, and the use of digital tools to support the bioeconomy transition.

4.1 Key components

The agenda of the Session 2 was structured around the following key components:

1. **Empowering Circular Value Chains with the Value Chain Generator tool (VGA.AI)**

The workshop was opened by **Miha Skrokov** together **with a co-lead expert**, who was usually a local language speaker from the respective country to ensure the most effective communication. They presented VCG.AI, a German start-up integrating artificial intelligence and big data with circular economy principles. This innovative platform contributes to the SYMBIO project by offering a scalable digital tool for:

- Product and application development, enabling industries (e.g., chemical sector) to create and diversify bio-based product portfolios.
- Technology and market monitoring, providing real-time insights into tech evolution, market trends, and IP landscapes.
- Feedstock sourcing, ensuring sustainable and efficient allocation of biomass, guided by prediction models.

A concrete demo showcased the fermentation of slaughterhouse waste into value-added chemical products. VCG.AI analysed the entire value chain—covering technical concepts, TRL assessments, patent data, scientific publications, and EU project outputs. The study identified 5 fermentation processes and various pre-treatment techniques, 12 chemical products (e.g., biofuels, amino acids, organic acids) and 36 application sectors, from pharmaceuticals to agriculture.

The platform also mapped over 220 relevant companies across Europe, facilitating the creation of linked circular value chains.

Then they introduced a methodology to build circular value chains at regional level. The process included:

1. Mapping feedstock availability (e.g., animal fats from meat industry);
2. Identifying viable technologies (e.g., fermentation, hydrolysis, etc.);
3. Filling gaps in local capacities by connecting with external suppliers;
4. Assessing market demand and existing infrastructure.

Case studies included potential value chains for the 12 biobased products identified in SYMBIO project were shown. The discussion emphasized the need for logistics optimization and adapting technologies to local conditions. Despite existing biogas plants and CBE JU pilot projects, further regulatory support and incentives are required. Stakeholders await the upcoming EU Bioeconomy Strategy update (May 2025) to align national policies accordingly.

2. Empowering SMEs for Sustainability: Advocacy, Mentoring, and Strategic Transition in a Circular Economy

The next session was presented by **Andrea Boffi**. He began by acknowledging that while most European SMEs are aware of sustainability challenges, only a small portion have made substantial investments in resource efficiency. He presented a step-by-step approach to sustainability transition, beginning with understanding external pressures (such as climate regulations and stakeholder expectations), followed by assessing a company's impact, setting strategic goals, and eventually reporting progress.

Andrea Boffi also discussed the role of advocacy, explaining how SMEs can influence policy by understanding the EU decision-making process. As a case study, he analysed the adoption of the EU Single-Use Plastics Directive, demonstrating how industry and civil society worked together to drive legislative change. He encouraged participants to explore opportunities to influence upcoming strategies such as the EU Bioeconomy Strategy 2025.

Elisabetta Pesenti followed with a detailed explanation of business coaching and mentoring as tools to foster professional growth and organizational change. She outlined the differences between coaching (focused on goal achievement) and mentoring (focused on long-term development), and shared case studies from Martini and ENGIE showing how these tools had been used to support individuals returning from parental leave and to implement organisational transformation.

She encouraged participants to develop structured mentoring programmes, invest in professional coaching, and create communities of practice. She underlined how these methods not only improve individual performance but also help companies build resilience and prepare for the challenges of sustainability.

4.2 Slovenia

The second workshop held on **April 16, 2025**, in Slovenia focused on AI-driven regional value chains, SME sustainability strategies, and mentoring support. Speakers included representatives from SYMBIO, VCG.AI, AB Corporation, and expert coaches. **Table 9** shows the agenda of the workshop. See *Section 4.1* for more details.

Number of participants: 15

Table 9 *Agenda Slovenia Session 2.*

AGENDA	
Miha Škrokov (ANTEJA)	Introduction and a summary of the SYMBIO project
Gašper Božič (ANTEJA)	VCG.AI in Action: Using AI to Future-Proof Regional Value Chains
Andrea Boffi	how SMEs can leverage the sustainability transition
Elisabetta Pesenti	mentoring and coaching

4.3 Belgium

The second Belgium workshop on **April 3, 2025**, featured insights on AI for resilient value chains, SME strategies for sustainability, and tailored mentoring. **Table 10** shows the agenda of the workshop. See *Section 4.1* for more details.

Number of participants: 10

Table 10 *Agenda Belgium Session 2.*

AGENDA	
Miha Škrokov (ANTEJA)	Introduction and a summary of the SYMBIO project
Gašper Božič (ANTEJA)	VCG.AI in Action: Using AI to Future-Proof Regional Value Chains
Andrea Boffi	How SMEs can leverage the sustainability transition
Elisabetta Pesenti	Mentoring and coaching

4.4 Croatia

On **March 13, 2025**, an online meeting was convened to discuss advancements in the bioeconomy sector within Croatia, emphasizing the potential integration of artificial intelligence (AI) and circular economy strategies. The agenda involved presentations from VCG AI on their technological platforms, discussions on bioeconomy value chain implementations, and insights into coaching and mentoring methodologies for fostering inclusive workplaces. **Table 11** shows the agenda of the workshop. See *Section 4.1* for more details.

Number of participants: 22

Table 11 *Agenda Croatia Session 2.*

AGENDA	
Gašper Božič (ANTEJA)	VCG.AI in Action: Using AI to Future-Proof Regional Value Chains
Miha Škrokov (ANTEJA)	Introduction and a summary of the SYMBIO project
Andrea Boffi	How SMEs can leverage the sustainability transition
Elisabetta Pesenti	Mentoring and coaching

4.5 Spain

The second workshop took place in Seville on **April 2nd, 2025,** hosted by project partner CTA (Technological Corporation of Andalusia) (**Figure 20**).

Held under the title "Promoting SME Sustainability and Circular Innovation: Strategies, Tools, and Promotion for a Resilient Future," the session was led by innovation and biotechnology experts from CTA, with active participation from the project coordinator LGCA – Lombardy Green Chemistry Cluster and project partner ANTEJA ECG. **Table 12** shows the agenda of the workshop. See *Section 4.1* for more details.

Number of participants: 19

Table 12 *Agenda Spain Session 2.*

AGENDA	
CTA (Technological Corporation of Andalusia)	Welcome coffee and presentation of the event
Gašper Božič, **Miha Skrokov,** ANTEJA	Boosting circular value chains with the value chain generator tool (VGA.AI)
Andrea Boffi, LGCA	Boosting SMEs' path to sustainability: support, mentoring, and strategic transition in the circular economy.
CTA	Q&A

Figure 20 *Session 2 of SYMBIO workshop in Seville (Spain).*

4.6 Italy

The second workshop was held on **March 21, 2025**, in Italy (**Figure 21**). **Table 13** shows the agenda of the workshop. See *Section 4.1* for more details.

Number of participants: 15

Table 13 *Agenda Italy Session 2.*

AGENDA	
Gašper Božič (ANTEJA)	VCG.AI in Action: Using AI to Future-Proof Regional Value Chains
Miha Škrokov(ANTEJA)	Introduction and a summary of the SYMBIO project
Andrea Boffi	How SMEs can leverage the sustainability transition
Elisabetta Pesenti	mentoring and coaching
Study visit to ARVAtech: The precision agriculture specialists	

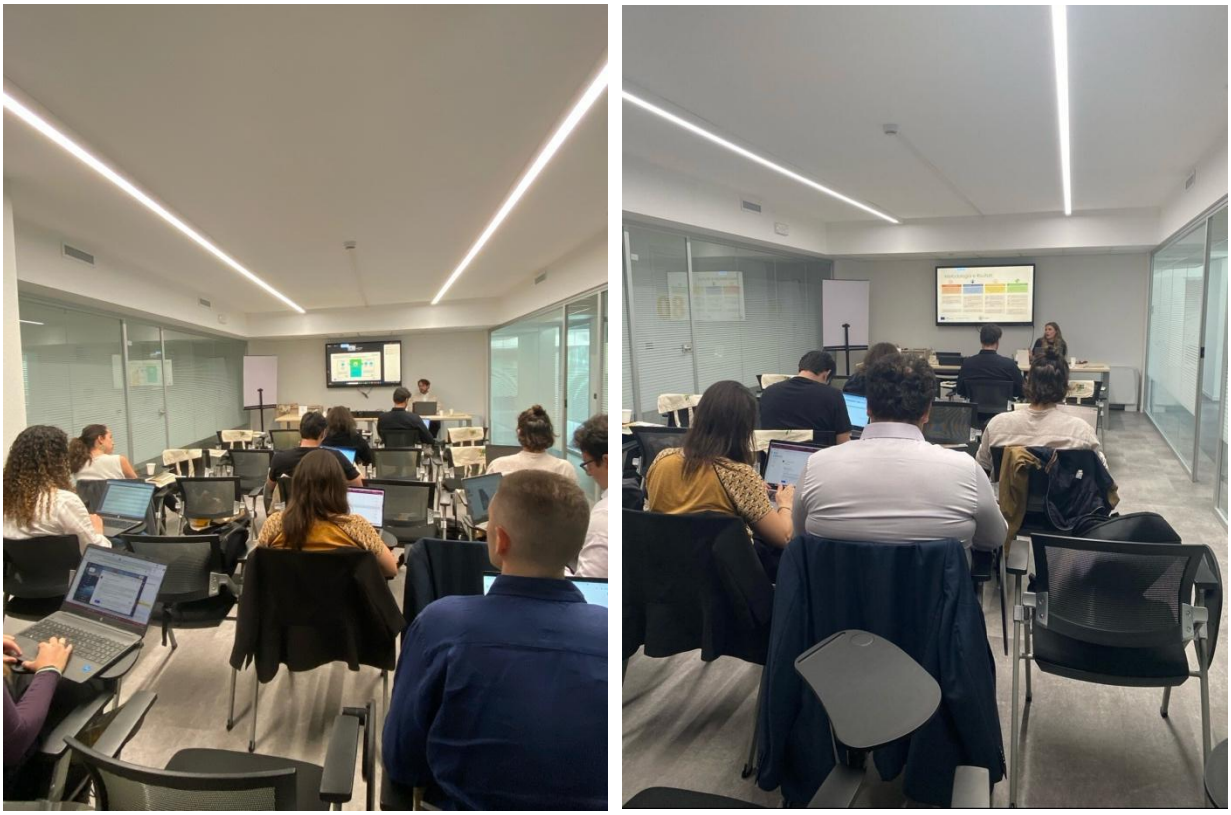

Figure 21 *Session 2 of SYMBIO workshop in Milan (Italy).*

The SYMBIO workshop Session 2 was combined with a **study visit at ARVAtech in Rescaldina (MI)**, an innovative company specializing in precision agriculture technologies (**Figure 22**). The event, that put together 14 participants, was organized in collaboration with the SYMBIO and AGROMATEC projects, offering participants a unique opportunity to explore cutting-edge solutions applied to the agri-food sector. The visit began with a company presentation, during which ARVAtech representatives introduced the company's strategic vision, focused on integrating robotics, advanced sensors, and data analytics to enhance the productivity and sustainability of agricultural systems. This was followed by an overview of ARVAtech's main products, highlighting applications in environmental monitoring, soil mapping, and automated crop management. Participants had the chance to see these technologies in action during a live showcase, demonstrating their practical impact directly in the field. A highlight of the visit was the live demonstration of the Moondino robot, an autonomous platform designed to assist with in-field data collection and targeted interventions. Attendees observed the robot's capabilities up close as it navigated complex environments, captured real-time agronomic data, and contributed to more efficient, low-impact farming operations. The visit offered valuable insights into the latest advancements in agri-tech, showcasing real-world applications of digital bioeconomy and underscoring the growing role of artificial intelligence and robotics in agriculture. The event concluded with a networking and discussion session, where participants exchanged insights, shared experiences, and explored opportunities for future collaboration, reinforcing the link between research, industry, and regional innovation.

Figure 22 *Study visit to ARVAtech.*

4.7 Austria

The second workshop held on **May 15, 2025,** in Austria aimed to showcase circular by-design strategies for regional bio-based industrial ecosystems. Participants explored how to create viable business models and symbiotic value chains using AI, innovation, and mentoring approaches. **Table 14** shows the agenda of the workshop. See *Section 4.1* for more details.

Number of participants: 15

Table 14 *Agenda Austria Session 2.*

AGENDA	
Egon Britzmann, Project Manger at BABEG	Welcome and objectives of the workshop
Senior Researcher Sandra Schulnig (Carinthia University of Applied Sciences)	Spotlight on "BeSoGreat": From Brewer's Spent Grain to Innovative 3D Printing Materials
Gašper Božič, Business Development, ANTEJA	VCG.AI in Action: Using AI to Future-Proof Regional Value Chains
Andrea Boffi, Elisabetta Pesenti; Lombardy Green Chemistry Association	Mentoring, Coaching and Training Session
Exchange and Networking	

The SYMBIO workshop was opened by **Egon Britzmann** (BABEG), who introduced the event by outlining the importance of promoting industrial symbiosis within bio-based ecosystems (**Figure 23**). He explained how Carinthia is strategically investing in research, innovation, and infrastructure to support the green transition, and highlighted BABEG's role in attracting businesses and fostering international cooperation in sustainable sectors. Britzmann emphasized that the SYMBIO project aligns with Carinthia's objectives by helping build circular value chains and supporting local industries in adopting sustainable models. The project, he explained, is being tested in 12 pilot regions across six European countries and provides tools to monitor economic, environmental, and social impacts of industrial symbiosis.

Figure 23 *Session 2 of SYMBIO workshop in Austria.*

The next session focused on the **"BeSoGreat" project**, presented by **Manuela Facchin** and **Sandra Schulnig** (**Figure 23**). They shared how the initiative evolved from the earlier LIFE RESTART project, with the aim of valorising brewers' spent grain (BSG), a by-product of beer production. Facchin and Schulnig explained that for every 100 litres of beer, about 20 kg of BSG are generated, presenting both an ecological challenge and an economic opportunity. The goal of BeSoGreat is to implement a 'Circular Business Model' for brewer's spent grain and starting a pilot production of biocomposites to contribute to a sustainable and circular economy on a cross-border scale.

They showcased several applications, including flowerpots, bite protections, and ash capsules, and noted that the project, active until the end of 2025, has already reached its 17th month of implementation.

In the second part of the workshop, the session "VCG.AI in Action: Using AI to Future-Proof Regional Value Chains" was delivered by Miha Skrokov and Gašper Božič from ANTEJA, followed by a session led by Andrea Boffi and Elisabetta Pesenti from LGCA, dedicated to helping SMEs navigate the transition to sustainability (**Figure 24**).

Figure 24 *Session 2 of SYMBIO workshop in Austria.*

5. Results and Conclusions

In conclusion, Deliverable D1.3 demonstrates the significant progress achieved in engaging regional stakeholders and fostering cross-regional collaboration within the SYMBIO project. Through a coordinated series of workshops across six countries, the project successfully established regional communities, validated methodological tools, and generated valuable data and insights into the regional bioeconomy landscapes and industrial symbiosis potential. The findings captured in this deliverable not only confirm the relevance of a participatory, data-driven approach to shaping circular bio-based value chains but also highlight critical challenges and opportunities specific to each region. The outputs of D1.3 will serve as a fundamental contribution to subsequent work packages, particularly in refining business models, informing policy recommendations, and advancing SYMBIO's overarching objective of supporting Europe's transition towards a sustainable, competitive, and symbiotic bio-based industrial ecosystem.

5.1 Barriers to Cross-Sectoral Supply Chain Development and Demonstration Facility Sustainability from TRL 5 to TRL 9

Despite a strong policy push and pockets of technological excellence, all SYMBIO pilot regions report a common "scale-up gap" when moving innovations from pilot (TRL 5-6) to demonstration (TRL 7-8) and

first-of-a-kind commercial facilities (TRL 9). The gap is driven by intertwined regulatory, financial, technical, and organisational barriers that slow down cross-sector collaboration, raise the cost of demonstration plants, and undermine long-term facility viability.

1. **Fragmented Governance and Complex Permitting**
   - Multiple, overlapping permitting rules, differing waste classifications and the absence of harmonised definitions for bio-based intermediates create long approval timelines, especially in dense urban settings.
   - Administrative bottlenecks in implementing regional bioeconomy strategies (e.g., Andalusia Circular Bioeconomy Strategy) delay inter-sector coordination and discourage investors from financing demonstration projects.
2. **Finance and the "Valley of Death"**
   - SMEs and start-ups struggle to navigate a complex mix of EU, national and regional funding instruments; high proposal transaction costs deter smaller actors from applying.
   - Capital-intensive demo plants face an unfavourable risk/return profile; private lenders demand proof of long-term feedstock contracts and off-take agreements that are rarely available at TRL 7.
3. **Technology-Scale-Up Challenges and Infrastructure Gaps**
   - Many conversion routes are proven only at lab or small-pilot scale; scarce open data on yields and process robustness hampers engineering design for TRL 7 facilities.
   - Regions such as Wallonia and Croatia cite a lack of shared pilot/-demo infrastructure and inadequate transport links for bulky low-value biomass, forcing companies to ship material long distances or halt projects altogether.
   - A lack of pilot infrastructure remains a significant constraint in regions such as Slovenia and Croatia, hindering the ability of stakeholders to test and scale new processes under industrially relevant conditions.
4. **Feedstock Security and Logistics**
   - Demonstration facilities need reliable, year-round biomass streams with traceability; fluctuations in seasonal residues, competition with established markets and inadequate pre-treatment capacity jeopardise supply-chain continuity.
   - Cross-sector exchanges are further limited by confidentiality concerns around composition data (notably in biotech and specialty-chemicals value chains in Flanders).
5. **Knowledge, Data and Standards**
   - Language barriers and inconsistent data templates led to gaps and misclassifications during the regional mapping exercise, illustrating how basic information asymmetries already hinder early collaboration.
   - Limited transparency on emerging technology performance and biomass conversion rates introduces uncertainty into techno-economic and life-cycle assessments, making investors discount project returns.
   - A significant knowledge gap exists regarding potential partners with whom to establish circular value chains. Stakeholders often lack visibility into which actors, even outside their usual sectors, could be strategically valuable for cooperation.

- There is also a widespread lack of knowledge about the current state of technologies capable of valorising co-products and waste streams, limiting the ability to identify feasible and innovative symbiotic solutions.
- Businesses often have little to no experience with the new circular products resulting from innovative value chains, which contributes to caution and slows market uptake.

6. **Market Uptake and Demand Risk**
   - Uncertain long-term demand for premium-priced bio-based products dampens willingness to commit to large demo plants; Andalusia reports that market competitiveness concerns curb industrial symbiosis potential even when technical routes exist.
   - Lack of product standards and labelling schemes complicates downstream certification and slows customer acceptance of novel materials.
7. **Human Capital and Organisational Capacity**
   - Skills gaps persist in bio-processing scale-up, advanced fermentation engineering and integrated supply-chain management; research institutions often run pilot lines, but industry lacks personnel trained to operate them at semi-commercial scale.
   - Coordination bodies and clusters are not always resourced to mediate multi-actor partnerships or to manage the intellectual-property issues that arise in pre-competitive consortia.
8. **Social Value Creation**
   - Identifying and measuring social value in business activities is perceived to be complex, time-consuming and expensive
   - Whilst bioeconomy policies highlight the potential for the bioeconomy to deliver social value, there is limited practical support for businesses looking to maximise social value in their businesses models
   - There are limited examples of businesses who have successfully incorporated social value into their business models
   - Businesses perceive a lack of relevant, comprehensive and robust tools for measuring social value
9. **Networking and Cross-Sector Collaboration Barriers**
   - A lack of established networks significantly hinders collaboration with sectors far outside the scope of stakeholders' current operations. Without structured forums or platforms to facilitate cross-sector dialogues, opportunities for industrial symbiosis remain untapped.
   - Regional policy barriers also obstruct the valorisation of certain value chains. For example, in Andalusia, Spain, regulations currently permit olive pomace only for olive pomace oil extraction, preventing its use in other innovative applications, despite technical feasibility.

Addressing these barriers is essential to unlock the ten circular-by-design value chains foreseen in SYMBIO WP2–WP4. The regional workshops confirmed that solutions must combine streamlined multilevel regulation, blended-finance models for demo plants, open-access pilot infrastructure, robust data-sharing protocols, and targeted skills programmes. These priorities will inform the upcoming cross-fertilisation actions and policy recommendations developed in WP3 and WP5.