BBioNets

Boosting the adoption of Bio-Based Technologies

# The Most Suitable Bio-Based Techniques in Europe: The Roadmaps for Implementation.

## A study on Italy, Spain, Greece, Ireland, Poland, and the Czech Republic

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# Article information

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| **Title** | The Most Suitable Bio-Based Techniques in Europe: The Roadmaps for Implementation. A study on Italy, Spain, Greece, Ireland, Poland, and the Czech Republic |
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| **Brief summary** | This article presents the BBioNets project roadmaps for six European regions, identifying the most suitable bio-based technologies (BBTs) for agriculture and forestry. Using a structured inventory, an assessment tool, and regional dynamics analysis, technologies were prioritised based on efficiency, cost, sustainability, and local context. The results highlight diverse solutions for waste valorisation, renewable energy, and circular bioeconomy practices. Regional roadmaps demonstrate context-specific opportunities and feasibility for adoption within five years. These findings provide a basis for informed, locally adapted decisions on bio-based technology implementation. |
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# Introduction

**The agricultural and forestry sectors are currently exposed to multiple and interconnected pressures**, including climate change, resource scarcity, market volatility, and increasing environmental constraints (Borah et al., 2024). In response to these challenges, both national and international policies have promoted alternative development models aimed at enhancing the competitiveness and resilience of these sectors while ensuring environmental sustainability. Within this framework, the **bioeconomy** has been identified as a **key strategic pathway to support the transition from a fossil-based to a bio-based society**, particularly in rural areas where agricultural and forestry resources are concentrated (Liobiekiene et al., 2023).

At the European level, this transition is actively supported through the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI), which fosters innovation by financing applied research and knowledge exchange initiatives. In particular, Operational Groups funded under the Common Agricultural Policy (CAP) and Thematic Networks supported by Horizon 2020 play a central role in promoting the development, testing, and dissemination of bio-based solutions in the agricultural and forestry sectors. These instruments aim to bridge the gap between research and practice, facilitating the uptake of innovative bio-based technologies (BBTs) tailored to local contexts (Harrahill et al., 2022).

In this context, the BBioNets project, an Horizon Europe-funded Thematic Network, focuses on capitalising and transferring the results of Operational Groups (OGs) involved in the valorisation of agricultural and forestry by-product biomass for the implementation of bio-based technologies (BBTs). The project brings together partners from Italy, Spain, Greece, Ireland, the Czech Republic, and Poland, encompassing a diverse range of agro-forestry systems and territorial conditions. A central objective of this article is the presentation of six territorial roadmaps, each corresponding to one of the project's represented regions. These roadmaps were developed to identify the most suitable BBTs for each BBioNets Forest and Agricultural Network (FAN) region, based on the integration of its needs and participatory approaches. Specifically, the methodology synthesises the prioritisation of local needs—gathered through stakeholder engagement—with variables collected in previous project tasks, including the comprehensive inventory of existing initiatives and available biomass resources. By systematically integrating these elements, the approach provides a context-specific framework to support informed and locally adapted decisions on the implementation of BBTs. The following sections describe in detail the methodology adopted to build the roadmaps and guide the selection of the most appropriate BBTs for each FAN area.

# Methodology

## Overview of the approach

The methodology developed in BBioNets to support the identification of the most suitable BBTs for each FAN region combines three main components: (i) the BBTs Inventory, which collects detailed information on technologies from OGs and EU-funded projects; (ii) the BBTs Assessment Tool, which prioritises technologies based on regional needs; and (iii) a high-level analysis of regional dynamics, which provides contextual information on local biomass availability, regulatory frameworks, and economic and environmental conditions. These elements together form the basis for developing six

territorial roadmaps, one for each project region, guiding the selection and adoption of the most suitable BBTs.

## Bio-Based Technology Inventory

The BBTs Inventory is structured around six dimensions: (i) OG/project attributes; (ii) BBT characteristics; (iii) BBT categorisation; (iv) implementation details; (v) expected effects; and (vi) costs. Data are collected through a combination of desk review, stakeholder interviews, and desk estimation of supply and substitution values. This structured approach ensures that the inventory provides a comprehensive overview of BBTs and is accessible through the BBioNets Online Knowledge Platform.

## BBTs Assessment Tool

The BBT Assessment Tool integrates data from the inventory with stakeholder inputs to rank BBTs according to technical, economic, environmental, and social factors. The results are visualised in a 2D plot, where the axes represent cost and effectiveness, and the bubble size reflects overall sustainability. This tool enables the identification of the top most suitable technologies for each region, providing a transparent and evidence-based prioritisation framework.

## Regional Dynamics

A high-level analysis of regional conditions complements the inventory and assessment tool. This study examines biomass availability, regulatory frameworks, financial support mechanisms, and R&D infrastructure, classifying each region according to its capacity to implement BBTs. The classification informs subsequent selection steps and highlights regional strengths and constraints.

## Steps to build the territorial roadmaps

The development of the six regional roadmaps followed a five-step process (Fig.1):

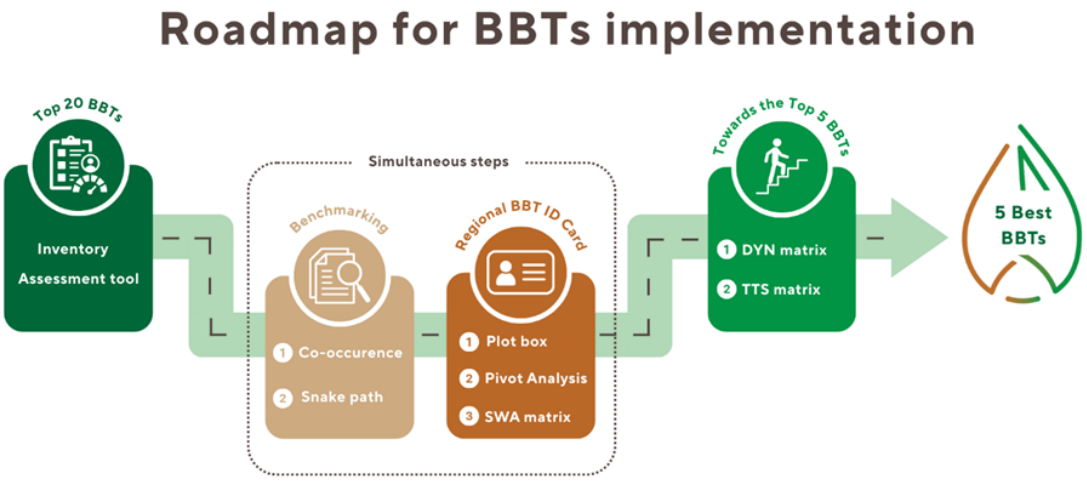



*Figure 1: The roadmap implementation scheme.*

- **Selection of the top 20 BBTs** per region using the assessment tool.

- **Benchmarking**, comparing these BBTs with those in other regions to identify co-occurrences and regional specificities.
- **Regional BBT Identity Card**, using box plots and the SWA (Strength-Weakness-Ambiguous) matrix to identify the key factors characterising the most suitable BBTs.
- **Selection of the top 5 BBTs**, integrating the regional identity card with the regional dynamics matrix (DYN) to ensure context-specific suitability.
- **Final evaluation**, applying the **Techno-Territorial Synergy (TTS) matrix** to cross-reference BBT characteristics with regional conditions, allowing the identification of the five most suitable BBTs for each FAN region.

This structured approach ensures that the roadmaps are evidence-based, regionally adapted, and aligned with stakeholder priorities, facilitating the effective implementation of BBTs across diverse agro-forestry contexts. Learn more about the methodology, in BBioNets' Deliverable 2.5 (Cagliero et al., 2025).

# Results and perspective

The BBioNets roadmaps for the six project represented regions highlight a diverse set of BBTs) adapted to local agricultural and forestry conditions, biomass availability, and regional dynamics. Across the Mediterranean, Atlantic, and Continental regions, the top-ranked BBTs focus on waste valorisation, circular bioeconomy solutions, renewable energy production, and soil enhancement. In Greece, olive cultivation residues drive technologies such as composting, polyphenol extraction, and lignocellulosic biorefineries. Italy shares similar olive-focused solutions, complemented by approaches applicable to other permanent crops. Spain emphasises lignocellulosic biorefineries, composting, and nutrient recovery, particularly in olive-growing areas. In Ireland and Poland, BBTs target grass, straw, and livestock residues, supporting biochar, compost, and anaerobic digestion, with strong potential for cross-country collaboration. The Czech Republic prioritises soil management, biochar production from forestry residues, and renewable energy from lignocellulosic biomass. Further details about the results are available in BBioNets' Deliverable 2.5 (Cagliero et al., 2025).

Overall, the roadmaps demonstrate that context-specific prioritisation, based on regional needs, participatory approaches, and techno-economic assessments, enables the identification of the most feasible and impactful BBTs. Across the regions, the selected technologies show strong potential for adoption within five years. Future perspectives suggest that **these BBTs could further contribute to the development of resilient and circular bioeconomy practices**, with opportunities for adaptation to additional crops, agroforestry systems, and regional contexts.

***Table 1: The roadmap BBTs output by country.***

| Country | BBTs identified through the ROADMAP |
|---|---|
| Greece | ES67-OleoValoriza/OLIV2, EL82-OLIHERB/OLIVE, DE4-LIGNO, PL100-Polski Ocet, CZ109-TH-Comp |
| Ireland | DE4-LIGNO, IT8-MNTNC, IE13-BBFB/CHAR, PL74-PolishApples, EL82-COMPO |

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|---|---|
| Italy | ES67-OleoValoriza/OLIV2, EL80-OLIHERB/OLIVE, EL88-ΕΛΑΙΩΝΑΣ/OLFER, ES59-AGUACAVALUE |
| Spain | DE4-LIGNO, EL80-OLIHERB/OLIVE, EL82-COMPOST-INNO/COMPO, ES67-OleoValoriza/OLIV2, EL84-AGROSCHOOLBUS.BIO |
| Poland | IE1-Biorefinery Glas, EL81-BioAnimalChar, IT36-Stabilized Litter, IT8-Mountain Carbon, DE4-LIGNO |
| Czech-Republic | CZ106-TH-soil_organisms/SOIL, CZ105-QK-potato-growing/TATER, DE4-LIGNO, IT2-FABER/FABER, FR12-SeCoPPA/ALFLF |

*Note: For more detailed information on each BBT, please enter the corresponding code in the BBioNets Knowledge Platform under the Inventory section.*

# References


1. Cagliero, R., Mirra, L., Basset, F., Moino, F., & Borsotto, P. (2025, April). BBTs Roadmap Implementation – Deliverable 2.5. CREA. BBioNets H2020.
2. Borah, A., Sahu, S., Srivastava, R. P., Singh, M., & Tyagi, D. B. (2024). Exploring the Economic Challenges Threatening Global Agriculture and Food Security. Ecology, Environment & Conservation (0971765X), 30.
3. Liobikienė, G., & Miceikienė, A. (2023). Contribution of the European bioeconomy strategy to the green deal policy: Challenges and opportunities in implementing these policies. Sustainability, 15(9), 7139.
4. Harrahill, K., Macken-Walsh, Á., O'Neill, E., & Lennon, M. (2022). An analysis of Irish dairy farmers' participation in the bioeconomy: Exploring power and knowledge dynamics in a multi-actor EIP-AGRI operational group. Sustainability, 14(19), 12098.

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# Document information

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| Coordinator | Munster Technological University<br>Ms. Carmen Girón Domínguez<br>(carmen.dominguez@mtu.ie) |
| Project overview | BBioNets constitutes a thematic network that relies on, promotes, and further advances the work carried out by EIP-AGRI Operational Groups (OGs) with respect to **management and/or processing of agricultural and forest biomass with Bio-Based Technologies (BBTs)**. The project has set up 6 regional Forest and Agriculture Networks – FANs (IE, ES, IT, EL, PL, CZ) that identify local needs, prioritise specific BBTs and share BBT knowledge ready for practice to farmers and foresters, boosting the (re)definition of value chains, stimulating cross-fertilisation beyond borders, and bringing Europe to the forefront of farming, forestry and bioeconomy with economically viable and sustainable practices. |
| Consortium | MTU, Cagasc, IUNG Institute of Soil Science and Plant Cultivation State Research Institute, crea, CTA, American Farm School Thessaloniki, TEPRO, FOCUS, Bio East Hub |


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