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D7.3

Tools for supporting future investments decisions in urban bio-based circular projects

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List of acronyms

Acronym	Description
ABC	Activity Based Costing
AC	Air Conditioning
AI	Artificial Intelligence
BBI-JU	Bio-Based Industries Joint Undertaking
BBP	Bio-Based Process
BCC	BioCircularCities
BSAT	Bioeconomy Strategy Accelerator Toolkit
CAPEX	Capital Expenditures
CCRI	Circular Cities and Regions Initiative
CEAP	Circular Economy Action Plan
CINEA	European Climate, Infrastructure and Environment Executive Agency
CL	Circularity Level
COST	European Cooperation in Science and Technology
CPV	Common Procurement Vocabulary
Dm	Dry matter
DST	Decision Support Tool
EAFRD	European Agriculture Fund for Rural Development
ECESP	European Circular Economy Stakeholder Platform
EIB	European Investment Bank
EU	European Union

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Acronym	Description
GDP	Gross Domestic Product
GHS	Global Human Settlement
GIS	Geographic Information System
GJ	GigaJoule
GP	Good Practice
GVA	Gross Value Added
GWP	Global Warming Potential
H2020	Horizon 2020
ICT	Information and Communication Technologies
IT	Information Technologies
KCB	Knowledge Centre for Bioeconomy
km²	Square kilometre
Kton	Kiloton
LCA	Life Cycle Assessment
m³	Cubic meters
MSW	Municipal Solid Waste
MUC	Modified UNESCO Classification
NBS	Nature-based Solutions
NGO	Non-Governmental Organisation
OEM	Original Equipment Manufacturer
OFMSW	Organic Fraction of Municipal Solid Waste

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Acronym	Description
OPEX	Operational Expenditures
PDA	Project Development Assistance
PDF	Portable Document Format
PML	Project Maturity Level
R&D	Research and Development
RDH	Regional Bioeconomy Hub
SWOT	Strengths Weaknesses Opportunities Threats
TCO	Total Cost of Ownership
TJ	TeraJoule
TRL	Technology Readiness Level
UCA	Urban Circularity Assessment
UCBE	Urban Circular Bioeconomy
UCBH	Urban Circular Bioeconomy Hub
URL	Uniform Resource Locator
UWWS	Urban Wastewater Sludge
WMZ	Waste Management Zones

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1. Executive summary

HOOP aims to unlock bio-based investments and deploy local bioeconomy in Europe by providing Project Development Assistance (PDA) to eight Lighthouse Cities and Regions. This assistance includes technical, economic, financial, and legal expertise to develop investments for the valorisation of the Organic Fraction of Municipal Solid Waste (OFMSW) and Urban Wastewater Sludge (UWWS).

In the framework of Task 7.4, entitled "Assessment of existent tools for supporting future investments decisions in urban circular bioeconomy projects", the main objective is the identification and assessment of the most important existing tools for supporting future investments decisions in Urban Circular Bioeconomy (UCBE) projects. In the present deliverable, the methodological approach for the selection and the evaluation of the defined tools is described as well as the results from the evaluation. Furthermore, in the context of this task the best performing tools are recognized and guidelines for their use are prepared and included in the deliverable.

The applied methodology was based on three stages and more specifically Stage 1: Developing the extensive inventory of tools promoting UCBE projects, Stage 2: Developing the targeted inventory of tools promoting UCBE projects and analysis of tools, and Stage 3: Developing guidelines for the best performing tools.

Stage 1 involved an initial broad assessment of tools based on bioeconomy relevance and resulted in the "Extensive list" of 41 tools. In the next stage 2, additional selection criteria were included in order to select the most relevant tools. This process resulted in the development of the "Targeted list" including 21 tools. The selected tools included in the targeted list are available in the HOOP Urban Circular Bioeconomy Hub (UCBH), in the section "Tools". A thorough analysis of the tools included in the targeted list took place in stage 2. The analysis of the tools was carried out using specific questions categorized into 6 categories (technological and technical aspects, biomass considerations, logistical factors, policy and regulatory frameworks, financial-market conditions, social acceptance factors) to facilitate a detailed description and characterization of the tools and ensure it effectively captured all necessary information. Finally, in stage 3 the best performing tools were selected based on a scoring framework resulting in the "Recommended list" of 7 tools i.e. **The Project Maturity Level, Bio-Circularity Label**, **Circular Valuation Method**, **(BSAT) Bioeconomy Strategy Accelerator Toolkit**, **DECISIVE Decision Support Tool (DST)**, **BioCircularCities webtool**, **Circular City Guidance Tool**. These tools do not only facilitate the implementation of circular bioeconomy but also support collaboration among stakeholders, encourage social acceptance, and attract investments. The analysis of the relevant tools uncovered insights into both the barriers and opportunities, as well as synergies, associated with their use. Additionally, recommendations and ideas for developing new tools were identified.

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2. Introduction

2.1. Background

One of the main objectives of the HOOP project is to unlock bio-based investments and deploy local bio economies in Europe through a systemic and cross-cutting approach. Hence, HOOP aims to build the technical, economic, financial, and legal expertise needed to develop concrete investments in circular bioeconomy projects. These investments will focus on valorizing the OFMSW and UWWS to obtain safe and sustainable bio-based products. In this framework, HOOP provides PDA to 8 Lighthouse Cities and Regions wishing to bring the bioeconomy to the forefront.

The importance of this initiative lies in its potential to significantly reduce waste and promote sustainability by transforming waste materials into valuable resources. By fostering a circular bioeconomy, the project addresses key environmental challenges and contributes to the creation of a more sustainable urban ecosystem.

To further support this target, HOOP has developed the HOOP Urban Circular Bioeconomy Hub, an online platform that provides opportunities to replicate the PDAs of the Lighthouse Cities and Regions in others under the HOOP Network of Cities and Regions (currently composed of 121 cities and regions from all around Europe).

In this context, HOOP demonstrates its commitment to supporting future investment decisions in UCBE projects through WP7, titled “The HOOP Urban Circular Bioeconomy Hub” led by SAV. More particularly regarding Task 7.4 “Assessment of existing tools for supporting future investments decisions in urban circular bioeconomy projects” the aim is to identify and assess the most important existing tools that promote the implementation and investments of UCBE projects. The task also involves analyzing the state-of-the-art of existing tools, studying their characteristics, content, and usability to finally recommend the most appropriate toolset. The Task is led by DReVen Gr in collaboration with SAV, CETAQUA and SfC and is running from October 2020 to September 2024 (M1-M48).

The work conducted in the task is included in the present Deliverable 7.3 titled “Tools for supporting future investments decisions in urban bio-based circular projects”.

2.2. Objectives

Considering the above, the main objectives of Deliverable 7.3 are the following:

- Identify a detailed list of tools: Create an extensive inventory of existing tools that promote the implementation and investment in UCBE projects, meaning that they meet the following criteria: i) to have content related to circular bioeconomy activities, ii) to be interactive and iii) the data and information provided by the tool should be accessible and usable to users,

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- Analyse tool content: Evaluate the characteristics, content, and usability of these tools to identify the most promising ones.
- Assess recorded tools: Determine which tools meet the predefined requirements and select them into further consideration and analysis.
- Recommend best performing tools: Propose the most relevant tools for supporting future investment decisions at a regional level.
- Provide Guidelines: Develop guidelines on how to use the recommended tools and exploit their flexibility and complementarity.

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3. Methodology

3.1. Overview

The methodology employed in this project is designed to systematically identify and evaluate tools that support investment decisions in Urban Circular Bioeconomy (UCBE) projects. To efficiently carry out this, a three-stage methodology was developed by DREVEN GR and more specifically:

- Stage 1: Developing the extensive inventory of tools promoting UCBE projects

Stage 1 involves gathering relevant tools from various sources by applying one basic criterion, in line with circular bioeconomy activities, and results in the development of the extensive inventory of tools that promotes UCBE projects. The extensive inventory of tools serves as input for the subsequent stages of the methodology.

- Stage 2: Developing the targeted inventory of tools promoting UCBE projects and analysis of tools

Stage 2 consists of two steps. At first two additional selection criteria are applied with a view to reducing the list and selecting the most relevant tools which will be further analysed in detail as a second step.

- Stage 3: Developing recommendations and guidelines for best performing tools

In stage 3, the objective was to assess the tools included in targeted inventory through a scoring framework developed in this stage. The scoring framework was created to interpret outcomes, providing a structured method for evaluating the tools in the targeted inventory based on predefined criteria. The tools with a score above 4 were recommended as best performing tools and guidelines were prepared for each one of them.

Each stage of the methodology focuses on different aspects of tool identification, evaluation and recommendation. The three-stage methodology is illustrated in Figure 1. The subsequent sections provide detailed insights into each stage of the methodology, highlighting the processes and criteria used to achieve the project's objectives

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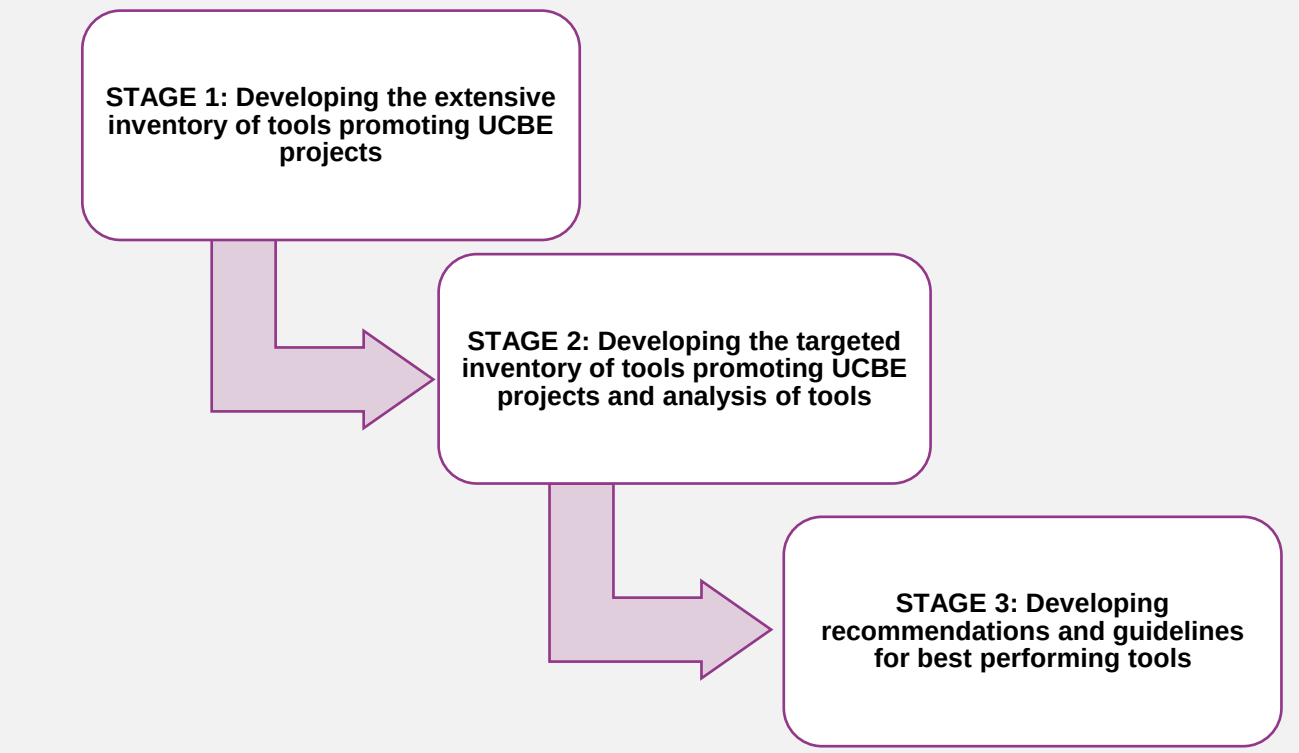
Figure 1. The three-stage methodology



3.2. Stage 1: Developing the extensive inventory of tools promoting UCBE projects

The aim of this stage was to prepare an extensive inventory of tools promoting UCBE projects. Each tool should meet one criterion:

- **The content of the tool had to be related to circular bioeconomy activities and investments.**

Ideally, the most preferable tools to select were those relevant to circular bioeconomy activities and investments that implement bio-based processes for valorising the OFMSW and UWWS.

This extensive inventory could serve as input for further evaluation and selection in subsequent stages. The identification and selection of relevant tools for this stage was guided by the experience gained from partners' involvement in European bioeconomy initiatives.

The partners involved in this project had a significant experience with initiatives aimed at advancing European circular projects. Many partners had previously participated in developing relevant tools or had substantial experience with circular project-related tools. The selection process for these tools utilized this expertise and was supplemented with additional online research.

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A search was conducted to identify relevant tools from different sources, starting with those developed in the mother projects such as Valuewaste, Scalibur, and WaysTUP!. The search then extended to online databases that primarily focus on H2020 projects (e.g., CORDIS, Scopus, BBI projects database, LIFE project database, Circular Cities and Regions Initiative webpage) and Google searches. The search query employed was: "Bioeconomy projects" AND "online tool", "Bio-based products" AND "online tool", "Bioeconomy investments" AND "online tool" "Circularity" AND "toolset". Each website was fully examined. In cases where a website redirected to articles, news, or other textual content, a detailed review was undertaken to identify any pertinent tools mentioned. Only tools available in English were considered.

The result of this stage was an extensive inventory of 41 tools promoting UCBE projects forming the initial list for the next stages of the evaluation process.

3.3. Stage 2: Developing the targeted inventory of tools promoting UCBE projects and analysis of tools

In the present stage, two main subtasks were involved:

1. At first to reduce the number of tools identified in stage 1 by applying two additional selection criteria, to develop the targeted inventory. **The two additional criteria were**:

    - **Interactivity: Tools should be user-friendly and allow for interaction.**
    - **Accessibility: Data and information should be freely accessible and usable to users.**

In order to proceed with the selection and apply the two criteria, it was decided to collect the following information for each of the 41 tools:

- **Tool name**: The name of the tool.
- **Weblink**: A direct link to the tool's website or online platform for easy access.
- **A summary description of the tool**: A summary that includes the tool's main objectives and capabilities.
- **Geographic coverage of the tool:** This is part of a broader concept of tool's applicability, particularly refers to the regions or areas where the tool can be effectively used or is available.
- **Target users:** The specific audience or group of users for whom the tool is intended.
- **Freely use and accessible, available / applicable:** The tool is freely accessible, ensuring that all users can easily utilize its features without any cost or restrictions.

This action aimed to select tools that fulfilled the criteria, ensuring that only the most relevant tools were selected. After the characterization, a total of 21 from 41 tools were selected, resulting in the targeted inventory of tools.

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2. In the second subtask the aim was to provide a detailed analysis of those 21 tools in a structured format.

   The focus shifted to a detailed analysis of the 21 selected tools in order to be able to identify and recommend the most relevant ones that will be thoroughly presented in stage 3. The next subtask included at this stage provides for the detailed analysis of the targeted tools. To achieve that, it was considered essential to define the following key elements to be analysed:

   - Technological and technical aspects
   - Biomass considerations
   - Logistical factors
   - Policy and regulatory frameworks
   - Financial-market conditions
   - Social acceptance factors

Based on the key elements identified above, finally the following five groups of criteria were established for the detailed analysis:

Group 1: Technological and technical criteria

The technological and technical criteria focus on assessing the readiness, sustainability, and adaptability of technologies designed to convert biowaste from OFMSW and UWWS into bio-based products. The tools evaluated within this group provided insights into:

- Technology readiness and sustainability: Tools were assessed on their ability to the maturity of technologies and their environmental sustainability. This includes evaluating the efficiency of technologies in diverse climates and the extent to which they can be adapted to different environmental conditions.
- Technology complexity: This criterion examines how complex the technologies are and their adaptability to various operational settings. The tools evaluated how well these technologies can be scaled and implemented in different geographic and climatic conditions.
- Facility suitability: The suitability of facilities in terms of size, processing capacity, and infrastructure readiness is critical for effective biowaste conversion. Tools were assessed on their ability to determine the appropriateness of existing facilities or the need for new infrastructure.
- Workforce capabilities: The availability of a skilled workforce is part of the successful implementation of biowaste conversion technologies. The tools evaluated the workforce's capacity to manage and operate these technologies effectively.

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- Research & Development (R&D) efforts: The tools also assessed ongoing research and development efforts aimed at enhancing the performance of bio-based products and technologies. This includes the development of new processes, materials, and methods to improve overall efficiency and effectiveness.

- Market and technical characteristics: Finally, the tools were evaluated based on their ability to analyze the technical and market characteristics that influence the viability of biowaste and bio-based products. This includes assessing market demand, competition, and potential barriers to entry.

Group 2: Biomass criteria

Biomass criteria are essential for ensuring the continuous and sustainable supply of biowaste materials. The tools evaluated in this group addressed several key challenges, including:

- Quality and availability: The tools assessed the quality and availability of biowaste feedstock, focusing on identifying reliable sources and ensuring consistent supply for bio-based product production.

- Economic barriers: Economic challenges, including the high costs associated with procuring biowaste, were a significant focus. The tools evaluated strategies to mitigate these costs and make biowaste sourcing more economically viable.

- Logistical complexities: The tools also addressed the logistical challenges of transporting biowaste, considering factors such as the unique characteristics of biowaste that complicate its transportation.

- Supply chain reliability: Ensuring a reliable and sustainable supply chain is critical for the success of bio-based products. The tools evaluated the robustness of supply chains and identified potential risks and opportunities for improvement.

Group 3: Logistical criteria

Logistical criteria focus on the entire chain of biowaste management, from collection to distribution of bio-based products. The tools evaluated in this group contributed to:

- Overcoming logistical challenges: The tools assessed the challenges associated with biowaste collection, transportation, processing, and distribution, offering solutions to enhance efficiency and reduce costs.

- Infrastructure optimization: The tools evaluated the infrastructure required for segregating and collecting biowaste, identifying opportunities for optimization and improvement.

- Transport logistics: Improving transport logistics to processing facilities is essential for minimizing waste and maximizing efficiency. The tools were evaluated on their ability to enhance transport systems for biowaste.

- Quality control: quality control is critical throughout the processing and distribution of bio-based products. The tools assessed methods for maintaining high quality standards from the initial stages of biowaste processing to the final product distribution.

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- Efficiency in distribution systems: Finally, the tools were evaluated on their capacity to increase efficiency in the transport and distribution systems for bio-based products, ensuring that they reach the market in a timely and cost-effective manner.

Group 4: Policy and regulatory criteria

Policy and regulatory criteria are essential for ensuring that biowaste conversion technologies comply with relevant laws and regulations. The tools in this group were evaluated on their ability to navigate:

- Regulatory impact: The tools assessed the impact of European Union (EU) and national regulations on biowaste conversion technologies, ensuring that they align with legal requirements and policy frameworks.

- Incentives and guidelines: The tools also evaluated the availability of incentives and guidelines that support the adoption of bio-based products, identifying opportunities to leverage these for increased market penetration.

- Stakeholder collaboration: Effective collaboration among stakeholders in the bio-based value chain is crucial for success. The tools assessed the frameworks and mechanisms that facilitate such collaboration, ensuring that all parties are aligned and working towards common goals.

Group 5: Financial-market criteria

Financial-market criteria focus on the economic aspects of biowaste conversion technologies, including investment opportunities and market dynamics. The tools in this group were evaluated on their ability to:

- Identify investment opportunities: The tools assessed the potential for investment in biowaste conversion technologies, identifying areas with the greatest return on investment and opportunities for scaling up operations.

- Facilitate access to capital: Access to capital is critical for developing and scaling bio-based products. The tools evaluated the availability of funding sources and mechanisms to support the growth of bio-based industries.

- Cost management: The tools also assessed the costs associated with constructing and operating biowaste processing facilities, offering insights into cost-saving measures and financial optimization strategies.

- Market dynamics: Finally, the tools evaluated the market dynamics that affect the accessibility and adoption of bio-based products, including consumer preferences, competition, and market barriers.

Group 6: Social criteria

Social criteria address the societal aspects of biowaste management and bio-based product adoption. The tools in this group were evaluated on their ability to:

- Promote societal acceptance: The tools assessed strategies for promoting societal acceptance of biowaste management practices, ensuring that these practices are supported by the public and other stakeholders.

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- Influence consumer attitudes: Consumer attitudes towards bio-based products are critical for their success in the market. The tools evaluated methods for influencing these attitudes and increasing acceptance and demand for bio-based solutions.

- Support social strategies: Finally, the tools were assessed on their ability to support local and national strategies that promote the social acceptance of bio-based solutions, ensuring that these strategies are aligned with broader sustainability goals.

Additionally, it was determined to gather the following information for each of the 21 tools:

- **Portfolio of good practices / case studies or Standalone Tool:** This part identifies whether the tool is part of a broader portfolio of best practices or case studies, showcasing real-world applications and successes, or if it functions as a standalone tool with its specific use case scenarios.

- **Qualitative / Quantitative / Descripted data:** This section provides the analysis of the type of data collected by the tool. Qualitative data might include user feedback and case studies, quantitative data could involve statistical metrics, and descriptive data might consist of detailed narratives and descriptions of the tool's functionalities and applications.

- **Required feedback of users:** The required user feedback is expressed through user analytics provided by the developers of the tool, aiming to offer insights into user experiences and preferences.

- **Categorization of the tool: 1. Technological tool, 2. Financial tool, 3. Legislative tool, or 4. Evaluation tool**

  To effectively manage the diverse information coverage of various tools it was considered appropriate to organize them into four distinct categories: Technologic tool, Financial tool, Legislation tool, and Evaluation tool. This structured approach ensures that each tool is categorized based on its primary focus, facilitating easier access and analysis. Technologic tool addresses the technical aspects of biomass and bio-based technologies, including supply, characteristics, and logistics. Financial tool focus on economic aspects such as cost analysis, market outlook, and investment opportunities. Legislation tool cover policies, regulations, and development plans governing the bio-based sector. Lastly, Evaluation tool include mainly metrics and methodologies for assessing sustainability, indicatively greenhouse gas emissions, life cycle assessments and etc.

To ensure a consistent analysis process for the tools, a template in the form of a table was designed. It includes sections for documenting the tool's objectives, target group, geographical coverage, free use of the tool, accessible data, different types of data, type and category of tool, as well as specific content such as technological and technical aspects, biomass, logistical, legislative, financial, and social characteristics. The table also incorporates fields for noting any synergies or barriers identified during the assessment, as well as potential opportunities for integration with other tools. By using this template (table 1), the aim was to maintain consistency in data collection and analysis, facilitating a more effective comparison of the tools. This structured approach ensured that each of the 21 tools was described and analyzed in detail, supporting the selection process.

Table 1. The analysis of tool in a form of table

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Table Analysis
A. General Information
Tool name
Home page of the tool (URL)
A summary description of the tool (Including the main objective and functionalities)
Geographic coverage of the tool
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other)
Is the tool free of use / freely accessible / applicable?
Portfolio of good practices / case studies or Standalone Tool
Qualitative / Qualitative / Descripted data
How many users have used the tool / Number of entries
Categorization of the tool 1. Technological tool, 2. Financial tool, 3. Legislative tool, or 4. Evaluation tool
B. Content of the tool
1. Technological and technical aspects
2. Biomass considerations
3. Logistical factors
4. Policy and regulatory frameworks
5. Financial- market conditions
6. Social acceptance factors

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3.4. Stage 3: Developing recommendations and guidelines for the best performing tools

The aim of this stage was to select the most relevant tools and develop the guidelines for the best performing tools among the total of 21 tools that were fully analysed. The tools included in the targeted inventory successfully met the required initial criteria but at this stage an evaluation framework was developed to rate these criteria and assess each tool's performance accordingly. This framework provides a structured approach for assessing the tools, ensuring fair and consistent evaluation. It was designed to describe the performance of each tool across the following aspects:

1. General information of the tool:

    - **Clear description of tool's scope**
    - **Availability of open access to data and resources**: how easily users can access and use the data and resources provided by the tool. It ensures that the necessary information is freely available and accessible without restrictions, allowing users utilize the tool's applicability.
    - **Quality and depth of data/information provided**: refers to how thorough and detailed the data and information offered by the tool are. This includes the accuracy, and reliability of the data, whether it is qualitative (descriptive) or quantitative (numerical). It ensures that the tool provides valuable and thorough insights that users can trust and effectively utilize.
    - **Required feedback of users**: The required user feedback was initially intended to be gathered through user analytics provided by the developers of the tool. However, due to a lack of information, it was adopted an alternative approach. User feedback was instead assessed based on broader user interactions, focusing on usability, functionality, performance, and satisfaction. This approach allowed for an understanding of user experiences even without direct analytics from the developers.

2. The content of the tool:

    - **Technological and technical aspects**
    - **Biomass considerations**
    - **Logistical factors**
    - **Policy and regulatory frameworks**
    - **Financial-market conditions**
    - **Social acceptance factors**

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Beyond the above criteria the evaluation framework additionally considers the potential of the tools to create synergies or face barriers in integration with other tools. This approach ensures that the evaluation effectively captures all critical aspects necessary for informed decision-making.

Each tool was subjected to an evaluation against the set of the defined criteria, as described above: with scores ranging from 0 to 5 assigned to each category. Each score represents a specific level of fulfilment:

- **0 – Inadequate:** The criterion was not addressed.
- **1 – Poor:** A score of 1 reflects minimal alignment with the criterion, with significant gaps or weaknesses identified.
- **2 – Fair:** The tool broadly addressed the criterion but with notable limitations. A score of 2 indicates that while the tool attempted to meet the criterion, it did so with partial success, leaving room for improvement.
- **3 – Good:** The tool addressed the criterion well. This score suggests that the tool met the criterion adequately, demonstrating a solid performance that aligns with the project's requirements.
- **4 – Very good:** The tool addressed the criterion very well, with only minor areas for improvement. A score of 4 reflects strong alignment with the criterion, indicating that the tool performs effectively and meets most of the project's needs.
- **5 – Excellent:** The tool successfully addressed all relevant aspects of the criterion. A score of 5 shows exceptional performance, where the tool exceeds expectations, fully satisfying the criterion.

To maintain high selection standards a minimum passing score above 4 was recommended ensuring that the tools meeting this threshold were considered for potential recommendation. Additionally, each tool was scored by three different DREVEN GR employees, assuring that each tool was assessed objectively and equally.

By scoring each criterion and based on evaluation results, the selection process led to a list of tools that best met the defined criteria and aligned with the established evaluation framework. These tools were integrated into the final list of recommended tools and guidelines were prepared contributing to the project's goals as well as addressing potential barriers and exploring opportunities to enhance their applicability within the project's frame.

Furthermore, a guideline template was developed in order to describe with clarity the scope and use of the recommended tools. These guidelines designed to outline the scope and functionality of each tool, provide instructions for user interaction, and highlight their technological, biomass, logistical, and regulatory, social features. The guidelines were made clearer and easier to follow. They include specific details on when and how to use each analytical tool. The focus was on making sure these guidelines are useful for people involved in regional investment planning and decision-making.

Moreover, all the targeted tools, analysed in the context of stage 2, were added to the HOOP Hub platform. This upgrade aimed to improve user experience and help with improving the platform's capability to support informed regional investment decisions in the bio-based economy. With this addition, both registered users and visitors to the Hub have access to information about the existing tools. This will help decision-makers, investors, and others to evaluate projects more effectively.

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4. Results

4.1. Overall results

The table 2 below presents the results of the three-stage assessment and selection process used to identify tools relevant to the bioeconomy.

In the third column, the results from Stage 1 are shown, which involved an initial broad assessment of tools based on bioeconomy relevance and resulted in the “Extensive list” of 41 tools. In the fourth column, the results from Stage 2 are displayed, in which further selection and analysis of the tools took place using more specific criteria. The outcome was the “Targeted list” including 21 tools. In the fifth column, the results from Stage 3 are presented, where the best performing tools were selected based on a scoring framework resulting in the “Recommended list” of 7 tools. The following table 2 shows an overview whether each tool passed the respective stage, along with the tool’s category.

Table 2. Summary of results from three-stage assessment and selection process

No.	Tool name	Extensive list [outcomes stage 1]	Targeted list [outcomes stage 2]	Recommended list [outcomes stage 3]	Tool’s category
1	Best Practices Atlas	☑	☑	X	Technologic
2	BioCircularCities webtool	☑	☑	☑	Technologic
3	ECESP – Good Practices European Circular Economy Stakeholder Platform	☑	☑	X	Technologic
4	Innovation Watch Bioeconomy Innovation Database	☑	☑	X	Technologic
5	Pilots4U	☑	☑	X	Technologic
6	S2Biom	☑	☑	X	Technologic
7	Tech4Biowaste database	☑	☑	X	Technologic

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No.	Tool name	Extensive list [outcomes stage 1]	Targeted list [outcomes stage 2]	Recommended list [outcomes stage 3]	Tool's category
8	Circular design tool	☑	☑	X	Financial
9	InnoProBio-based Products Database	☑	☑	X	Legislation
10	Knowledge Center for bioeconomy	☑	☑	X	Legislation
11	Bioeconomy Toolkit for Business	☑	☑	X	Legislation
12	Bioeconomy Toolkit for Policy Makers	☑	☑	X	Legislation
13	Bio-Circularity Label	☑	☑	☑	Evaluation
14	Circular Valuation Method	☑	☑	☑	Evaluation
15	Project Maturity Level (PML)	☑	☑	☑	Evaluation
16	ResCoM Circular Pathfinder	☑	☑	X	Evaluation
17	DECISIVE- Decision Support Tool (DST)	☑	☑	☑	Evaluation
18	Circular City	☑	☑	☑	Evaluation
19	BSAT-Bioeconomy Strategy Accelerator Toolkit	☑	☑	☑	Evaluation
20	Green Assist	☑	☑	X	Evaluation
21	The Metabolism of Cities - Data Hub	☑	☑	X	Evaluation
22	Mainstream	☑	X	X	–

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No.	Tool name	Extensive list [outcomes stage 1]	Targeted list [outcomes stage 2]	Recommended list [outcomes stage 3]	Tool's category
23	CommBebiz	☑	X	X	–
24	ECSP-Knowledge Hub (European Circular Economy Stakeholder Platform)	☑	X	X	–
25	Power4Bio Catalogue of bioeconomy solutions	☑	X	X	–
26	European Bioeconomy Library	☑	X	X	–
27	Biograce	☑	X	X	–
28	Circular Transition Indicators	☑	X	X	–
29	Circulytics	☑	X	X	–
30	Coaching Activities	☑	X	X	–
31	Green City tool	☑	X	X	–
32	Water footprint, Product gallery	☑	X	X	–
33	Extended Water Footprint Calculator	☑	X	X	–
34	Water Footprint Assessment Tool	☑	X	X	–
35	SCALIBUR	☑	X	X	–
36	CIRCUIT (Circularity Hub)	☑	X	X	–
37	Pop- Machina Social Collaboration Platform	☑	X	X	–

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No.	Tool name	Extensive list [outcomes stage 1]	Targeted list [outcomes stage 2]	Recommended list [outcomes stage 3]	Tool's category
38	REFLOW Knowledge Hub	☑	X	X	–
39	BIORADAR Self-Assessment Tool	☑	X	X	–
40	Project Ô	☑	X	X	–
41	CCRI Tools and methods	☑	X	X	–

4.2. Results of Stage 1

In stage 1, the identification of 41 tools took place. These tools were included in the "Extensive list" of tools (see Table 2).

4.3. Results of Stage 2

The targeted inventory encompasses 21 tools that were assessed according to multiple criteria. The evaluation covered technological and technical aspects, biomass considerations, logistical factors, policy and regulatory frameworks, financial-market conditions, and social acceptance factors. Following this assessment, the tables below (table 3 - table 23) display a detailed analysis of the 21 tools, outlining their strengths, weaknesses, and overall suitability for advancing urban circular bioeconomy projects.

It should be noted that the tools are presented according to the category in which each tool was classified and more specifically:

- *Technological tools: Best Practices Atlas (Table 3), BioCircularCities webtool (Table 4), ECESP-Good Practices (Table 5), Innovation Watch (Table 6), Pilots4U Bioeconomy Innovation Database (Table 7), S2Biom (Table 8) and Tech4Biowaste database (Table 9)*
- *Financial tools: Circular design toolkit (Table 10)*
- *Legislative tools: InnoProBio-based Products Database (Table 11), Knowledge Center for Bioeconomy (Table 12), Bioeconomy Toolkit for Business (Table 13) and Bioeconomy Toolkit for Policy Makers (Table 14).*
- *Evaluation tools: Bio-Circularity Label (Table 15), Circular Valuation Method (Table 16), Project Maturity Level (Table 17), ResCoM Circular Pathfinder (Table 18), DECISIVE – DST (Table 19), Circular City*

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(Table 20), BSAT-Bioeconomy Strategy Accelerator Toolkit (Table 21), Green Assist (Table 22) and The Metabolism of Cities – Data Hub (Table 23).

This order is chosen to provide clarity and convenience for users with specific interests, allowing them to easily locate and focus on the tools most relevant to their needs.

The analysis of tools reveals a broad spectrum of strengths across key evaluation criteria. Many tools in the biomass and biowaste sectors emphasize innovative solutions and operational readiness, highlighting technological advancements. Some tools offered details on technological and technical aspects, showcasing innovations and readiness for waste management and bio-based product development. It is interesting to note that financial information is less commonly provided across most tools, which tend to focus on other aspects. Only one tool was categorised as financial tool, while on the other hand most of the tools were categorises as evaluation tools. Evaluation tools primarily provide comprehensive assessments of sustainability, economic viability, and environmental impact. Additionally, these tools offer insights and recommendations tailored to stakeholder engagement and project's maturity. Several tools also aligned with policy and regulatory frameworks, ensuring compliance with legal structures and promoting the circular economy. Logistical tools focus on supply chain efficiency and resource management, yet there is a need for more detailed analyses of transportation and distribution dynamics. Social acceptance, including stakeholder engagement and consumer behaviour, was also a focal point for some tools, encouraging the adoption of sustainable practices.

4.3.1. TECHNOLOGICAL TOOLS

Table 3. Analysis of Best Practices Atlas

Tool's analysis: no.1	
A. General Information	
Tool name and developer:	Best Practices Atlas
Home page of tool (URL):	https://www.enabling-project.com/platforms#best-practices-atlas
A summary description of the tool (Including the main objective and functionalities):	The Best Practices Atlas is an interactive web-based tool that provides easy to find information on the best practices found around the world. In ENABLING is collected best BBP (Bio based Products and Processes) practices, from inside and outside Europe, that are wholly or partly transferable to other regions or serve as an inspiration for partners in the value chain. An interactive web-based tool will provide easy to find information on the best practices identified.
Geographic coverage of the tool:	Europe and beyond
Target user group (Specify whether it is for biomass producers (farmers,	Biomass producers, advisors, researchers, public agencies, industry, and other stakeholders in the bioeconomy value chain

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foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	
Is the tool free of use / freely accessible / applicable?	Yes
Portfolio of good practices / case studies or Standalone Tool:	Portfolio of good practices
Qualitative / Quantitative / Descripted data:	Qualitative data
How many users have used the tool / Number of entries:	952
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Technological tool
B. Content of the tool	
1. Technological and technical aspects	
The Best Practices Atlas provides a list of case studies representing the best practices for bio-based projects, aiming to support the development and implementation of bio-based circular economy initiatives. (Examples of case studies: 1. "Added values products from residues", Israel (production of biodegradable bioplastic from municipal and agricultural waste sources 2. "Bio product from grape processing", Emilia-Romagna, Italy, (A winery and distillery company use its agricultural residues to produce a varied range of bio-based products). The tool provides the following information for each case study: • Summary: An overview of the case study that includes its goals, main activities, and outcomes. • Collected by: The entity or team responsible for gathering and presenting the information. • Background context: It outlines the context and circumstances that led to the initiation of the project. A detailed description of the processes, activities, or business models used in the case study. • List of innovation: Main actors include the partners involved in the project who contribute to its innovative aspects. • Phase of innovation: This section describes the stage of innovation at which the case study currently stands. • Innovation of the process: Details about the unique and innovative aspects of the processes used in the case study. • Expected or final outcomes: The anticipated or achieved results and impacts of the case study are summarized. • Benefit for the farmers: This part highlights the advantages and improvements experienced by farmers as a result of the case study. • Benefit / added value for the bio-based product companies: The benefits and added value that bio-based product companies gain from the case study are detailed here. • Benefit / added value for the other practitioners or end-users: This section discusses how other practitioners or end-users benefit from the case study's outcomes. • Other factors that make possible a successful realization of the practice/activity: Additional elements that contribute to the successful implementation and realization of the case study.	

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The tool explores the development of bio-based products from biowaste (mainly agriculture residues) indicating technology readiness and sustainability (through e.x. pilot projects or commercial applications). Each case study demonstrates the ability and suitability to adapt bioconversion technologies to various biowaste. The tool does not provide details on the size and capacity of facilities, however there is a "Description of the process, activity or business model" for each case study. While the Atlas emphasizes successful biowaste conversion practices, it does not provide specific information on the workforce capabilities and skills required for these processes however there is a "List of main actors" are getting involved to the case study (e.g. The company has a diverse team of people with different background, as well as financial support or technology etc.) developers, testers. The tool describes the readiness of existing technology and the ability to adopt the innovation of the process for efficient conversion of bio residues into valuable products. Considering, the research and development efforts that aim at improving conversion efficiency and product quality. While the technical feasibility and market potential of products derived from biowaste are considered.
2. Biomass considerations
The Atlas includes examples of reliable and sustainable supply chains for biowaste feedstock and bio-based product production. The project highlights the collaboration among stakeholders in the bio-based value chain.
3. Logistical factors
Not specified / No applicable
4. Policy and regulatory frameworks
The Atlas links the policy and guidelines with supporting and promoting the adaptation of organic-based products. It supports local and national strategies to promote the social acceptance of bio-based product.
5. Financial-market conditions
It evaluates the market viability of converting bio-based products, taking into account economic, regulatory, and demand factors, such as market demand, pricing dynamics, regulatory considerations, and consumer acceptance. It addresses the challenge creating added-value products by turning residues into valuable products, driven by economic considerations (recognized by environmental taxation, price's reduction of final product).
6. Social acceptance factors
The Atlas focuses on efforts to influence consumer attitudes toward bio-based products.

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Table 4. Analysis of BioCircularCities webtool

Tool's analysis: no.2	
A. General Information	
Tool name and developer:	BioCircularCities webtool
Home page of tool (URL):	https://bcc.list.lu/
A summary description of the tool (Including the main objective and functionalities):	BioCircularCities tool supports the identification of the most suitable technological options (bio-circular technologies) for improving the organic waste management. The most convenient pathway towards waste biomass valorisation strongly depends on drivers and barriers related to the local surrounding political and socio-economic context, and on the potential sustainability strategic targets for the local authorities and private stakeholders endorsing the responsibility of waste biomass management. This intends to be described through the answers provided through this application, and to evaluate how far the biocircular technologies considered by the tool fit the described context. The objective of the tool is to provide some first clues about what could be suitable in terms of technological pathways, given a specific context. The BCC tool does not aim at providing a "ready to implement" business plan. The scope of the tool is generic to EU, hence potential specific restriction existing in one specific country or region in regard to one or several technologies are not identified by the tool.
Geographic coverage of the tool:	Global but not specified
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Policymakers, researchers, industry stakeholders, and local governments involved in bio-economy and circular economy projects and biowaste management.
Is the tool free of use / freely accessible / applicable?	Free. High applicability for users looking for an initial assessment and guidance on bio-circular technologies. Moderate for users needing specific data, detailed case studies, or in-depth, country-specific analyses.
Portfolio of good practices / case studies or Standalone Tool:	Standalone Assessment tool
Qualitative / Quantitative / Descripted data:	Qualitative
How many users have used the tool / Number of entries:	Not applicable

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Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Technological tool
B. Content of the tool	
1. Technological and technical aspects	
The BCC tool analyzes the feedstock type and current system characterization, including availability, sorting, and non-hazardous contaminant acceptance, evaluating compatibility with regional supply chains and potential contribution to EU biowaste recycling targets. It determines the suitability and efficiency of technologies based on the biowaste flow availability continuously and in regular quantity throughout the year, and how it is valorised or treated in the current situation. It considers the suitability of technologies and their adaptability in terms of different supply chain's level; local (from the urban area or region of concern) or larger (multi-regional, country, international) Moreover, it aims to specify if technologies existing only at pilot scale (small production capacity, potential discontinuous/batch production process, lower rentability) can be of interest to the user. Finally, it aims to identify the capacity of a municipality or organization using the tool to invest in the development of infrastructure.	
2. Biomass considerations	
The BCC tool address challenges related to types of organic waste, biomass quality, availability, and price stability compared to landfill taxes. The level of purity of the biomass feedstock is influenced by the type of collection and the occurrence of a sorting process. While the tool intends to gauge the readiness to accept to pay equivalent, lower or higher costs for a better valorisation of biowaste of concern than it is paid for landfilling. The analysis of the tool focuses on determining whether the source of organic waste is strictly local, or extends to larger geographical areas, including multi-regional or international. The user provides information about the availability of feedstock and details about its supply chain, which could be confined to a specific urban area or region, or span across multiple regions, countries, or even internationally. Finally, the tool could indicate whether there is a possibility to collaborate with research institutes or other similar companies or entities than the user's one. Some technologies that are innovative or still under development would not be possible to implement without such collaboration. The type of organic waste of concern are the following: • Forestry residues (Bark, natural wood residues, wood mixed glue or other additives from industrial activities) • Agroindustry processing losses (coffee ground, coffee silverskin, fruits, vegetables, cereals, dairy products, fish-based food, meat and derivatives, oilseed crops, sugar and starchy crops, lignocellulosic waste or by-products) • Municipal organic waste (biowaste mixed with residual waste, separately collected biowaste, separately collected garden waste) The user specifies the following information: • Quantities, collection frequencies, or detailed processing methods of organic waste or biomass. • if separate collection system is implemented, a specific sorting in order to isolate the organic fraction after it is collected. • The feedstock availability and/or its supply chain (from urban area or region of concern) or larger (multi-regional, country, international). • The user specifies or estimates the waste composition after being collected and sorted (organic fraction, plastic impurities, metal impurities, paper impurities, other impurities).	
3. Logistical factors	
It is not specified/ not applicable	

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4. Policy and regulatory frameworks
The tool allows the user to take EU regulatory into account. It offers to the users the opportunity to determine whether the end product will be complied with one or more levels of European Union (EU) quality and safety standards, as well as with available EU product certifications.
5. Financial-market conditions
The tool identifies potential investments in biowaste conversion technologies and bio-based product development. It provides economic and financial information (costs, public incentives and subsides) specific to the different technologies. It aims to identify the capacity of a municipality, company or institution using the tool to invest in the development of technical competences of operators indicating whether or not the user is willing to invest in competencies. Moreover, it could identify the investment directed towards development of infrastructure and estimating which net benefits would be targeted with the new technology. The tool aims to examine the available subventions from the EU Commission /national or regional entities: (taxes, fees, economic incentives, or subsidies) and net benefits (Value added vs. life cycle costs, considering available subsidies). Furthermore, the BCC tool provides the user with the option to specify their ideal level of market readiness. It could determine if the user would like to focus on an end product which would be competitive with their conventional counterpart from a selling cost perspective.
6. Social acceptance factors
The tool enhances societal acceptance of the product and technology, as well as the competitiveness of the end product compared to its conventional counterpart. Specifically, it promotes social acceptance of targeted end products—such as bio-based products, biofuels, bio-based materials, compost, and solid digestate—resulting from biocircular technology. The tool assesses society's acceptance of both existing and potential technologies based on user-provided information. Users indicate the level of social acceptability for the end product generated by the valorization technology and the expected social acceptance for a potential end product. Additionally, the tool evaluates the social and environmental context of the territory where the value chain will be implemented. It uses a list of influential criteria to determine which technological pathways for organic waste valorization are potentially compatible with the surrounding context, considering the specific characteristics of each criterion. This tool offers the users the opportunity to determine whether the end product will be complied with one or more levels of European Union (EU) quality and safety standards, as well as with available EU product certifications. The tool therefore allows the user to take EU regulatory into account, while at the same time enhancing social acceptance. This enables a product based on EU requirements, while at the same time increasing its social acceptability. The tool can analyze the results of the criteria both individually and in combination. The combination of criteria provides a more comprehensive analysis for the user. This allows a potential end product that meets EU compliance standards and at the same time enhancing the social acceptance.

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Table 5. Analysis of European Circular Economy Stakeholder Platform (ECESP)– Good Practices

Tool's analysis: no.3	
A. General Information	
Tool name and developer:	European Circular Economy Stakeholder Platform – Good Practices
Home page of tool (URL):	https://circulareconomy.europa.eu/platform/en/knowledge-hub
A summary description of the tool (Including the main objective and functionalities):	The **Good Practices (GPs)** section of the **European Circular Economy Stakeholder Platform** showcases relevant practices, innovative processes and 'learning from experience' examples. All information is provided by the stakeholders themselves who remain responsible for accuracy and veracity of the content.
Geographic coverage of the tool:	Primarily Europe, with insights applicable globally
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Public agencies, policymakers, industry stakeholders, researchers, NGOs, and the general public interested in circular economy practices
Is the tool free of use / freely accessible / applicable?	Yes
Portfolio of good practices / case studies or Standalone Tool:	Portfolio of good practices
Qualitative / Quantitative / Descripted data:	Qualitative & Descripted data: Each Good Practice (GP) mostly contains descripted and qualitative data. It includes the description & project's goals, implementation strategies, and key outcomes. However, specific metrics on quantities are included on case-by-case basis.
How many users have used the tool / Number of entries:	Number of case studies: 798
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Technological tool
B. Content of the tool	
1. Technological and technical aspects	
The tool deals with technologies and processes that they contribute to the development of circular concepts and strategies. The Good practices (GP) provide information of added value for implementation of the circular	

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economy via innovative processes (industrial process, consumption model, waste sorting, resource-efficient business models, e.tc.). The tool contains a description of each case study mostly explaining the current situation (the challenge) and how they can deal it with an implementation of innovative technologies and processes demonstrating the circularity of the project (the solution). The tool showcases the technological maturity and the sustainability of how different types of waste are processed and valorized into new products. The tool supports getting a quick overview, the main activity field and the main results of the technologies that already have been implemented or the technologies that will be adapted reflecting the bioeconomy and strategies of a range of different regions in Europe, and therefore to gain understanding of the possibilities and challenges related to the enhancement of bio-based economies. The tool highlights ongoing research and development efforts at adopting innovative technologies, showcasing innovative solutions and advancements. The determination of suitability of facilities in terms of size and processing capacity, the infrastructure readiness, workforce capabilities and skills, and technical and market characteristics of converting wastes is not applicable to all case studies but a case-by-case basis. The scope of the tool is the demonstration of circularity to be adapted in diverse level ranging from local levels such as cities and municipalities, to broader scales like regional, national, and international also extend to global or EU levels but also from private businesses to public bodies and knowledge communities. The element of the tool is a catalogue of good practices containing case studies from existing EU bioregions by filtering the criteria which user can select and allowing the stakeholders search in a targeted way the identification of the bioeconomy projects (Keywords, Key Area, Type of organization or company, Type of funding, identified challenges, Scope, and Sector).
2. Biomass considerations
The tool offers information on feedstock across various best practices, not exclusively associated with biowaste and bio-based products. By choosing “Biowaste” as a keyword from the tool’s filters, users can obtain information of circularity projects and biowaste on an individual basis.
3. Logistical factors
The tool provides logistical information across the different good practices not exclusively related with biowaste and bio-based products. By selecting the keyword "Logistics" from the tool's filters, users can access logistical information related to circularity projects on a case-by-case basis.
4. Policy and regulatory frameworks
The majority of GPs aim to be aligned with the EU policies and regulations standards in place supporting circular economy initiatives and reaching the EU’s climate goals. Furthermore, the provision of experienced-based data from GPs and scientific research contribute to shape new standards and policies.
5. Financial-market conditions
The tool encompasses how valorized new products derived from various waste types reintegrate value into the economy. It highlights improvements in material recyclability, the use of secondary raw materials, waste prevention, and enhanced waste collection and sorting processes for further processing. The tool emphasizes extending product shelf life through reuse, repair, maintenance, or refurbishment, promoting smarter resource use within industries via functional economy principles, and introducing innovative consumption methods while providing consumer information. Additionally, it focuses on optimizing resource and by-product flows through industrial symbiosis. Good Practices are evidenced by measurable achievements, such as reduced business costs and the creation of new markets. The tool also outlines various funding types for

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case studies, including EIB, investments, loans, procurement, and other sources, offering a practical and financial perspective on the sustainability of waste valorization initiatives.
6. Social acceptance factors
The tool emphasizes the social impact fostering behavioral change and educational contributions. The GP encourage behavioral change in consumers (e.g. improving waste collection and sorting practices) and incentivizes circular consumption through sharing, reusing, and repairing products. It focuses on enhancing final consumer satisfaction and perception to ensure the acceptance of marketable products. Additionally, the tool raises awareness of circular economy principles within educational contexts, promoting a broader understanding and adoption of sustainable practices.

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Table 6. Analysis of Innovation Watch

Tool's analysis: no.4	
A. General Information	
Tool name and developer:	Innovation Watch
Home page of tool (URL):	https://www.enabling-project.com/innovation-watch#products
A summary description of the tool (Including the main objective and functionalities):	The Innovation Watch is a web-based tool designed to gather valuable information about technologies, innovations, and processes related to the bio-based products (BBP) sector, with the goal of enhancing and expanding practices. It is an integral part of the ENABLING project, acting as a continuous observatory to aid in the development and dissemination of knowledge within the bioeconomy. This tool collects data to map out relevant projects and networks, research publications, events, fairs, and conferences annually, thereby providing ongoing insights into BBP-related technologies, innovations, and processes. The Innovation Watch provides a list of key components: 1. Articles: A selection of articles covering a range of topics, including Life Cycle Assessment (LCA) and sustainable green practices for bio-based products (BBPs), market trends and innovations in BBP chemistry, biomass and BBP supply chains, biorefinery processes, circular bioeconomy, and technical regulations. These articles are available in multiple languages and span the period from 2006 to 2019. 2. Projects: Information on value chain from biomass to BBPs, which can be transferred or serve as inspiration for other regions. This includes various aspects of the value chain such as: Agro-Forestry Wastes for BBPs, Agro-Forestry Wastes for BBPs and Bioenergy, Agro-Forestry Wastes for Bioenergy, Agro-Industrial Wastes for BBPs, Agro-Industrial Wastes for BBPs and Bioenergy, Aquatic biomass for BBPs, Bioeconomy Policy Processes, Biomass for Bioenergy, Biomass from MUC lands, MSW - Municipality Solid Wastes for BBPs, Platform & Services, Platform for BBPs Pilot Plants and Services, Standards & Regulations for BBI - Bio-based Industry. Additionally, the projects can be filtered based on funding programs such as BBI JU Horizon 2020, EU-INNOSUP, FP7, INTERREG Europe, INTERREG Program, LIFE, and National Funding Programs, with different starting dates ranging from 2008 to 2019. 3. Videos: A collection of videos and webinars from various sources focusing on bio-based products (BBPs), sustainability, and innovation. These resources can inspire and facilitate the adaptation of BBPs to different regions and sectors. 4. Products & Applications: A selection of products and applications sourced from the web. These resources aim to foster collaboration and knowledge transfer among practitioners, connecting biomass producers with processors.

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Geographic coverage of the tool:	Europe and beyond
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Biomass producers, advisors, researchers, public agencies, industry, and other stakeholders in the bioeconomy value chain
Is the tool free of use / freely accessible / applicable?	Yes
Portfolio of good practices / case studies or Standalone Tool:	Portfolio of good practices
Qualitative / Quantitative / Descripted data:	Qualitative
How many users have used the tool / Number of entries:	2478
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Technological tool
B. Content of the tool	
1. Technological and technical aspects	
The tool monitors and collects information on technological innovations and best practices in the BBP sector. It presents technology readiness and sustainability of technologies, innovations, and processes for converting biowaste into bio-based products and influences the development efforts to enhance bio-based product performance.	
2. Biomass considerations	
The tool Includes data on various types of biomass and their applications in BBPs. The Innovation Watch, through its key elements provides examples of reliable and sustainable supply chains for biowaste feedstock and bio-based product production. It highlights collaboration among stakeholders in the bio-based value chain.	
3. Logistical factors	
The tool collects information on logistical best practices and innovations in the bio-economy sector. It addresses logistical factors by mapping out relevant projects and networks, research publications, events, fairs, and conferences. This helps in understanding the logistics involved in the bio-based products sector	
4. Policy and regulatory frameworks	
The Innovation Watch links policy and guidelines with supporting and promoting the adaptation of organic-based products. It supports local and national strategies to promote the social acceptance of bio-based products.	

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5. Financial-market conditions
Not applicable
6. Social acceptance factors
The tool collects data on social acceptance and public perception of bio-based products and processes.

Table 7. Analysis of Pilots4U Bioeconomy Innovation Database

Tool's analysis: no.5	
A. General Information	
Tool name and developer:	Pilots4U Bioeconomy Innovation Database
Home page of tool (URL):	https://biopilots4u.eu/database
A summary description of the tool (Including the main objective and functionalities):	Pilots4U Database maps all existing open access pilot and demo-infrastructures across Europe, creating one, very visible and easily accessible network for the European bio-economy. This is designed to help companies and research institutions operating in the bio-economy sector to gain easier access to testing facilities, in order to bring their ideas from development to market. To ensure that the network meets the needs of the European bio-economy industry (SMEs, start-ups, large enterprises), current European pilot and demo-capabilities are compared with the needs of the European bio-based industry. Business cases of investments in additional equipment, facilities or capabilities are evaluated, and steps are taken to attract financing. Different cooperation schemes for the open access pilot- and demo-network are considered.
Geographic coverage of the tool:	Europe (detailed coverage across various countries)
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Researchers, industry stakeholders, policymakers, bioeconomy innovators
Is the tool free of use / freely accessible / applicable?	Yes / Registration is required for full access
Portfolio of good practices / case studies or Standalone Tool:	Portfolio of business cases

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Qualitative / Quantitative / Descripted data:	Data Mobilization, Networking
How many users have used the tool / Number of entries:	92 views/week - 500 views/monthly
Number of database entries	451 entries and 104 organizations
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Technological tool

B. Content of the tool

1. Technological and technical aspects

The tool is a database that presents all existing open access pilot- and multipurpose demo-infrastructures. It directly showcases the applicable technologies and infrastructure utilized and thereby illustrating their readiness and sustainability. This direct presentation provides the current state of technology and infrastructure in the field of bio-based product or process development relevant to bioeconomy. The research, development, and innovation community, along with industries and companies, are becoming aware of the nature and type of equipment and facilities that are available. They could evaluate the current capabilities and identifying gaps in the provision of equipment and expertise driving forward their respective fields and fostering innovation for bio-based products.
The Pilots4U database includes a range of technological disciplines such as Algae cultivation and harvesting Anaerobic digestion, Chemical processing, Industrial biotechnology, Material technologies, Mechanical separations, Physicochemical separations, Pre-treatment,
Pulping, Thermochemical conversions which cover diverse processes and potentially adaptable technologies suitable for various climates.
The database lists 451 entries of pilot and demo facilities, detailing their size and processing capacities, asset information, raw materials, process stage, technology, technology area, scale and detailed technical description helping users determine the suitability for specific bio-based processing needs.
By presenting the range of technologies and facilities available, the tool indirectly provides insights into the workforce capabilities and skills required for biowaste processing. However, Pilots4U project assessed workforce capabilities through gap analysis and workshops, focusing on the expertise available at pilot centers and the need for additional training or skills.
The project evaluates existing infrastructure and its readiness to support bio-based product development by analyzing the database entries and conducting gap analyses to identify deficiencies and necessary investments.
By grouping open access pilot- and multipurpose demo-infrastructures, Pilots4U facilitates research and development efforts, making it easier for organizations to access facilities for enhancing bio-based product performance.
The gap analysis and business cases developed by Pilots4U consider both technical and market characteristics, aiming to align infrastructure capabilities with industry needs and market dynamics.

2. Biomass considerations

Pilots4U identifies and assesses the needs of the bio-based industry, including sourcing challenges, through surveys and workshops, ensuring that the infrastructure network can support high-quality and available biowaste materials.

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By providing shared access to expensive pilot and demo facilities, Pilots4U helps to mitigate economic barriers for small and medium-sized enterprise (SMEs) and large companies, potentially lowering costs associated with biowaste procurement. Pilots4U's network aims to support reliable and sustainable supply chains by making accessible the necessary infrastructure and expertise required for consistent bio-based product production.
3. Logistical factors
The Pilots4U database provides information on facilities that support all stages of the bio-based processing chain, helping users to overcome logistical challenges through better infrastructure access. By assessing current infrastructure capabilities, Pilots4U identifies areas needing improvement and investment. The network's geographical spread and detailed facility information help improve transport logistics by identifying optimal locations for processing facilities relative to bio-based sources. Pilots4U's network and database facilitate efficient transport and distribution by providing access to strategically located pilot and demo facilities, reducing transportation times and costs
4. Policy and regulatory frameworks
The Pilots4U tool considers the impact of EU regulations by ensuring that its infrastructure and operations align with policy requirements. The tool, through its provision of infrastructure and expertise, underscores the adoption of bio-based products. It illustrates the creation of business models by taking into account potential funding strategies and incentives. These can be used to advocate for policy support and financial assistance for the development and implementation of bio-based processes and products. Throughout the Pilots4U tool the policy makers could gain an understanding of the most convenient terms for industry players to access scale up infrastructure can help shaping future public policies aimed at supporting effective scale-up in support of development of the European bio-based sector, in line with the European Bioeconomy Strategy.
5. Financial-market conditions
Pilots4U identifies investment opportunities through gap analysis and business cases, highlighting areas where new equipment or facilities are needed. Bringing newly developed molecules and techniques from the lab to the market. The open-access model saves time and money during scaling-up, lowers financial risks, and shortens the time for market entry. Pilots4U's shared infrastructure network reduces financial burdens on individual companies, facilitating easier access to capital. Open to all companies and research institutes, these infrastructures are shared investments. The open-access model allows stakeholders to share construction and operation costs, making facilities more affordable. Key drivers include lower costs and access to equipment and expertise not available in-house. Pilots4U's analysis addresses market dynamics to enhance bioproduct accessibility and adoption through strategic infrastructure investments. Promoting a Europe-wide network and raising awareness creates a favorable market environment for bio-based products.
6. Social acceptance factors
Pilots4U aligns its activities with local and national strategies, contributing to broader social acceptance and support for bio-based solutions through its comprehensive network and collaborative approach. The project's efforts in raising awareness and providing high-quality bio-based products help positively influence consumer attitudes and acceptance.

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Table 8. Analysis of S2Biom

Tool's analysis: no.6	
A. General Information	
Tool name and developer:	S2Biom
Home page of tool (URL):	https://s2biom.wenr.wur.nl/web/guest/bio2match
A summary description of the tool (Including the main objective and functionalities):	The S2Biom project offers a comprehensive suite of tools designed to enhance the efficiency and sustainability of biomass feedstock delivery across various regions in Europe and beyond. These tools support the design, evaluation, and optimization of biomass supply chains and bio-based products. The S2BIOM is a toolset containing data, tools, documents and reports generated in the S2BIOM project. The tools enable the user to interact with the results by making sub-selections for data that are interested in; or to design an own biomass delivery chain and evaluate the performance; or to obtain to the point information on specific issues of relevance for developing a biomass delivery chains. These can be key characteristics on logistical components, biomass conversion technologies, matching of biomass types with technologies, biomass potentials, cost and characteristics, biomass markets, sustainability issues, policies and regulations, and national biomass strategies. Under the different tabs in the main menu above you there is access to these different tools, data, documents and reports.
Geographic coverage of the tool:	European level for EU28, Western Balkans, Moldova, Turkey and Ukraine
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Biomass producers, technology experts, policy makers, entrepreneurs, researchers
Is the tool free of use / freely accessible / applicable?	Free
Portfolio of good practices / case studies or Standalone Tool:	S2Biom is a toolset containing data, tools, documents and reports
Qualitative / Quantitative / Descripted data:	Qualitative / Quatitative / Descripted data
How many users have used the tool / Number of entries:	Not applicable

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Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Technological tool
B. Content of the tool	
1. Technological and technical aspects	
The “Scenarios” and “Biomass conversion technologies database” contain information about technological and technical criteria. “Biomass conversion technologies database”: This tool provides a database on lignocellulosic biomass conversion technologies characteristics. The data included in this database are feeding the Bio2Match, the Be-Where and the LocaGIStics tools. The database contains technologies relevant for the production of bioenergy, bio-based chemicals, and materials derived from lignocellulosic biomass. The database is structured around the product market combinations that are the basis for assessing 2020 and 2030 biomass demand and consumption levels. The technologies covered can be classified into 6 main categories: treatment in subcritical water, syngas platform, gasification technologies, fast pyrolysis, direct combustion of solid biomass, chemical pretreatment, biochemical hydrolysis and fermentation, and anaerobic digestion. Understanding these technologies could help in analyzing the workforce capabilities and skills required for biowaste processing. This could help in examining the infrastructure readiness for bio-based product development. This could help in reviewing the research and development efforts to enhance bio-based product performance. The “Scenarios” provides different scenarios considering the availability of sustainable biomass and the extent of bio-based options production in large-scale, centralized conversion systems, or in small-scale, decentralized units. This could help in determining the suitability of facilities in terms of size and processing capacity. This could help in evaluating the adaptation of technologies to diverse climates. This could help in considering the technical and market characteristics influencing biowaste and bio-based product viability.	
2. Biomass considerations	
The S2BIOM project addresses the challenge in sourcing biowaste materials through the development of scenarios that consider the availability level of sustainable biomass. The “Biomass supply viewer tool” also allows users to select different types of biomass and assess their potential availability. The “Biomass supply viewer tool” allows users to select and view data for different types of biomass, their availability per year, assess their potential availability and potential combinations. It provides data at various regional levels and for different years. The tool also allows users to choose the level of detail in absolute levels (Kton dm or TJ), area weighted (Kton dm/km² or GJ/km²), and weighted average road side cost (€/ton dm). The user-defined potentials vary in terms of type and number of considerations per biomass type. This flexibility helps users understand the effect on the total biomass potential of one type of consideration against the other. These can include both increased potential (e.g., because of enhanced biomass production) or more strongly constrained potentials (e.g., because of the selection of stricter sustainability constraints). Moreover, the project considers economic factors through the “Biomass supply viewer tool”, which allows users to view the weighted average roadside cost of different types of biomass. While the provided logistical complexities in transporting biowaste due to unique characteristics does not directly address this point, the consideration of large-scale centralized systems versus small-scale decentralized units in the scenarios suggests a hidden consideration of logistical complexities. The project addresses reliable and sustainable supply chains for bio-based products through the development of a base potential that considers currently applied sustainability practices and legal restrictions. The user-defined potentials also allow for the consideration of stricter sustainability constraints.	

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3. Logistical factors

The “Logistical component database” has instrumental in addressing challenges in biowaste collection, transportation, processing, and distribution. It facilitates the delivery of biomass feedstock of a specified quality at the correct moment to a processing technology.
The database includes a list of parameters for pre-treatment, storage, and transport technologies. These parameters help optimize the infrastructure for segregating and collecting biowaste.
By providing detailed characteristics of each logistical component, including transport technologies aids in the efficient delivery of biomass feedstock to processing facilities.
Quality control is enhanced through the detailed characterization of each logistical component in the database. This includes information on biomass input and output specifications, which ensures the delivery of quality biomass feedstock for processing and final product distribution.
The database has increased efficiency in transport and distribution systems by providing detailed information on logistical components. This includes technical properties and financial and economic properties, which can be used to optimize transport and distribution systems for derived bio-based products.

4. Policy and regulatory frameworks

The “S2Biom policy database” offers a comprehensive overview of regulatory and economic frameworks at the EU level and for 37 other countries, impacting bioeconomy development. It includes policies related to various sectors such as agriculture, forestry, nature protection, waste management, emissions, biofuels, bioenergy, bio-based products, public procurement, and R&D. The database, accessible via the “Regulatory viewing tool”, provides detailed information on each policy measure, available as factsheets or downloadable Excel files for a country-level overview. The data also enables a benchmark analysis of national policies, considering the unique characteristics of each country for a targeted comparison. Furthermore, the collected policies aid in developing guidelines and policy options, helping policymakers understand and efficiently apply support frameworks for sustainable biomass resource mobilization across different sectors of the bio-based economy. There are recommendations aimed to enhance cooperation and synergies between Member States and internationally, to accelerate progress towards a bio-based economy. It focuses on identifying areas for improvement in cooperation and synergy, thereby establishing collaborative frameworks among stakeholders in the bio-based value chain.

5. Financial-market conditions

The “S2Biom cost-supply viewer” provides a detailed overview of biomass costs and supply in Europe, including Switzerland. It displays cost levels for selected biomass types in a cost-supply graph, which orders biomass from cheap to expensive against the average roadside cost. The costs, limited to roadside costs, include production, harvesting, and pre-treatment costs, but exclude transport and treatment costs from the roadside to the conversion installation. The cost data, gathered mostly for 2012, is based on the Activity Based Costing (ABC) methodology and takes into account national price differences for key inputs. The database also provides cost data for specific biomass types and considers local circumstances and production systems. The costs are kept constant for future years to avoid uncertainties in cost predictions and to ensure consistency with other models. Users can adapt the cost levels based on their own assumptions for future cost changes.
The "S2BIOM" project assessed the potential for importing lignocellulosic biomass from countries outside the EU28, presenting the data as cost-supply curves for 2012, 2020, and 2030. The costs, comparable to the roadside costs of European biomass, refer to the biomass present in main EU harbours after shipping, excluding any additional transport and pre-treatment costs within the EU. The import potential data, generated using the GLOBIOM and G4M models, cover various commodities including wood chips, pellets, first and second-generation ethanol, and biodiesel. The cost-supply data for imports, defined in terms of the cost

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a consumer needs to pay for the commodity after it's shipped to a main EU harbour, can be downloaded in Excel format.
6. Social acceptance factors
Not applicable
7. Toolset
Bio2Match tool is an internet-based tool guiding the user for an optimal match between biomass crops (including industrial crops) and conversion technologies. The tool uses two databases with information on the biomass properties as well as the technology criteria in order to find a match between the two. The tool gives also guidance of possible pre-treatment needed for the biomass. Starting point for the development was the Bio2Match-tool developed in the S2Biom-project (FP7 project number: 608622). This version of the tool is suited only for lignocellulosic crops and their conversion technologies. In MAGIC it is expanded to include oil crops, fibre and specialty crops including their conversion technologies. The **BeWhere tool** - model helps determine optimal locations for new biomass conversion installations in various regions, focusing on minimizing costs and emissions across the supply chain. Users can specify the type of biomass feedstock, carbon cost level, and fossil fuel cost level to view and download results for heat, power, and biofuel installations. This tool aids in selecting the best technology, location, and capacity for bio-energy production plants.

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Table 9. Analysis of Tech4Biowaste database

Tool's analysis: no.7	
A. General Information	
Tool name and developer:	Tech4Biowaste database
Home page of tool (URL):	https://tech4biowaste.eu/database/
A summary description of the tool (Including the main objective and functionalities):	The Tech4Biowaste Database provides an overview of existing and emerging technologies for biowaste utilization and valorization. It includes detailed descriptions of various technologies, including pre-processing, conversion, and post-processing technologies. The main objective of the database is to help stakeholders identify suitable technologies for converting biowaste into valuable products. The database is designed to be user-friendly, well-maintained, and accessible to a wide range of stakeholders.
Geographic coverage of the tool:	Global geographic coverage
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Biomass producers, technology providers, researchers, public agencies, industry stakeholders, and advisors.
Is the tool free of use / freely accessible / applicable?	The Tech4Biowaste database is free of use and freely accessible. However, only users who has already registered can edit/add information.
Portfolio of good practices / case studies or Standalone Tool:	Database tool connecting with technology practices
Qualitative / Quantitative / Descripted data:	The database includes both qualitative and quantitative data
How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Technological tool
B. Content of the tool	
1. Technological and technical aspects	

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The Tech4Biowaste database is designed to provide an overview of technologies for the valorization of biowaste. It includes detailed descriptions of various technologies with a Technology Readiness Level (TRL) of 4 and higher, TRL ≥ 4, ensuring readiness for practical application. The database categorizes the technologies into pre-processing, conversion, and post-processing, each with detailed descriptions and sub-categories (e.g., chemical, physical, thermochemical processes) addressing various complexities. The database includes a decision support tool (DST) with a feedstock-product matrix and a technology comparison tool to help choose the best technology for biowaste stream utilisation and valorisation. Moreover, the DST provides a detailed description about technology and process characteristics including technology provides. Sustainability aspects are implied through the focus on biowaste valorisation. The database includes information on recent advances in technology research and development.
2. Biomass considerations
The database provides information on feedstocks, technologies, and products. It includes detailed descriptions of biowaste feedstocks, subdivided into food waste and garden & park waste. Definitions and statistics are provided for each type of feedstock, helping users understand the availability and distribution of these resources. The decision support tool (DST) that includes a feedstock-product matrix and a link to the technology comparison tool. This matrix assists users in evaluating different technology options and selecting the most appropriate technology for converting specific feedstocks into desired products. Technologies that match the criteria are marked with a colored dot. By clicking on the dot, users can access more information about the technology and compare different providers through the technology comparison tool. This feature aids in understanding the potential of different feedstocks for biowaste valorization.
3. Logistical factors
The database content is determined jointly with actors across the biowaste value chain, allowing technology providers to showcase new and emerging technologies. Technology searchers can analyze and compare biowaste valorization technologies, and both categories of users can assess their commercialization potential through the associated DST.
4. Policy and regulatory frameworks
The DST does not provide specific information on policy and regulatory criteria, but the database adheres to definitions provided by the European Commission and Eurostat for biowaste and food waste.
5. Financial-market conditions
The database does not provide specific information on financial-market conditions. The database allows technology providers to present their technologies and companies, potentially increasing their market visibility. Using the DST and database the users could evaluate the biowaste and bio-based product viability which influencing the market characteristics.
6. Social acceptance factors
The database and DST enhance social acceptance by providing a transparent and accessible way, via an open-source software and using IT technologies (AI), to compare and select technologies for biowaste

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valorization. This can enhance social acceptance by providing transparency and accessibility to a wide range of stakeholders but also help build trust and confidence among stakeholders.
The database is designed to be user-friendly to encourage contributions from a community of volunteers, including technology providers and other stakeholders. Training sessions and helpdesk support are provided to assist users.
Training and support: Comprehensive training materials and support services are provided to facilitate participation and ensure the database's usability.

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4.3.2. FINANCIAL TOOLS

Table 10. Analysis of Circular design tool

Tool's analysis: no.8	
A. General Information	
Tool name and developer:	Circular design tool
Home page of tool (URL):	https://circulardesign.tools/tools/financial/
A summary description of the tool (Including the main objective and functionalities):	The EcoDesign Circle (4.0) project emphasizes the importance of circular business models in response to increasing consumer demand for sustainable products, regulatory pressures, and the need for corporate environmental and social responsibility. The project offers strategic design methods to help organizations identify opportunities within this changing landscape and turn these demands into strategic advantages. The Circular Design Toolkit is a part of Ecodesign Circle 4.0 project. The Circular Design Toolkit is a strategic resource aimed at helping businesses innovate and adapt to the growing demands for sustainability and transparency. This toolkit supports organizations in creating circular solutions that not only minimize environmental impact but also enhance financial performance by turning sustainability demands into strategic business advantages. The EcoDesign service "4.0 toolset" aims to adapt the complexity of the circular economy theme to a broad audience with different knowledge levels and professional experiences. The toolkit contains tools, methods and approaches of the EcoDesign Learning Factory and the EcoDesign Audit-Sprint. The material was developed based on interviews with experts from design and sustainability and in close collaboration with service-design agencies. In the toolkit, designers, entrepreneurs, producers, start-ups and other eco-developers and eco-experts can get inspiration by viewing "Circular Design Pitch" or find for example an assessment instrument "Circular product & service assessment". Another example is "From (EcoDesign) Idea to Market" which helps to assess various aspects of ecodesign, its benefits and economic feasibility. The Circular Business Models, Current State Overview, Life Cycle Discussion, and Life Cycle Model are key components of the Ecodesign Toolkit: • **Circular Business Model**: This tool focuses on the value proposition and works outwards. It includes guiding questions to help answer each field and a factsheet where businesses can input their information. The tool helps in considering various aspects such as key resources, activities, stakeholders, and financial aspects.

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	• **Current State Overview**: This tool provides an overview of the current state of circular strategies within an organization. It emphasizes the importance of understanding the company's vision, mission, and sustainability strategy. The tool suggests involving colleagues to reflect on the company's goals and the role of sustainability in daily work, creating a common understanding of the organization's objectives and circular maturity. • **Life Cycle Discussion**: This tool offers a discussion on the life cycle of products within the context of the circular economy. It covers various stages of the product life cycle, from research and design to after-use, and highlights opportunities for circular innovation. The tool includes guiding questions for each phase of the life cycle to inspire new ideas and solutions. • **Life Cycle Model**: Similar to the Life Cycle Discussion, this tool provides an overview of the life cycle model for services within the circular economy. It discusses opportunities for circular innovation at different stages of the service life cycle, including research and design, manufacturing, distribution, use, and after-use. The tool includes guiding questions for each phase to help identify circular service opportunities and needs. These tools help organizations create circular solutions that minimize environmental impact and enhance financial performance. The Ecodesign Circle 4.0 project aims to strengthen the awareness and practical application of the design approach to the circular economy across the Baltic Sea region, adapting the complexity of the circular economy theme to a broad audience with different knowledge levels and professional experiences. These tools help organizations create circular solutions that minimize environmental impact and enhance financial performance. The Ecodesign Circle 4.0 project aims to strengthen the awareness and practical application of the design approach to the circular economy across the Baltic Sea region, adapting the complexity of the circular economy theme to a broad audience with different knowledge levels and professional experiences.
Geographic coverage of the tool:	Baltic Sea region
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Designers, entrepreneurs, producers, start-ups, and other eco-developers and eco-experts.
Is the tool free of use / freely accessible / applicable?	Yes
Portfolio of good practices / case studies or Standalone Tool:	Standalone tool
Qualitative / Quantitative / Descripted data:	The tool provides qualitative data

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How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Financial tool
B. Content of the tool	
1. Technological and technical aspects	
Circular Business Model: Discusses design methods for successful circular innovation, emphasizing the importance of the business aspect of a product or product-service system idea. It highlights the need for innovative ways to generate revenue flows and the importance of considering new paradigms of doing business in the Circular Economy. Current State Overview: Discusses design methods for successful circular innovation and emphasizes the importance of understanding the company's vision, mission, and sustainability strategy. Life Cycle Discussion & Life Cycle Model: Discusses various opportunities for circular innovation at different stages of the product life cycle, including research and design, manufacturing, distribution, use, and after-use. Highlights the importance of energy efficiency, use of renewable energy, product durability, easy maintenance and repair, and the reusability of materials. Life Cycle Model: Discusses various opportunities for circular innovation at different stages of the service life cycle, including research and design, manufacturing, distribution, use, and after-use. Highlights the importance of energy efficiency, use of renewable energy, service contract management, data management for reuse opportunities, and the ability to design for disassembly and reuse.	
2. Biomass considerations	
Life Cycle Discussion & Life Cycle Model: Mentions the use of ecological, recyclable, or recycled materials and the importance of material purity, including packing materials and harmful substances.	
3. Logistical factors	
Life Cycle Discussion: Discusses the optimization of logistics with regard to efficiency and the environment, including the use of emission-free fuels and partnerships or new technology to optimize logistics. Life Cycle Model: Discusses the optimization of logistics with regard to efficiency and the environment, including the use of emission-free fuels and partnerships or new technology to optimize logistics.	
4. Policy and regulatory frameworks	
Circular Business Model: Mentions the involvement of stakeholder groups from the economical, political, legal, technological, and cultural spheres as crucial for the long-term success of circular business models. Current State Overview: Emphasizes the importance of involving stakeholder groups from various spheres, including economical, political, legal, technological, and cultural, for the long-term success of circular business models. Life Cycle Model: Emphasizes the importance of involving stakeholder groups from various spheres, including economical, political, legal, technological, and cultural, for the long-term success of circular business models.	

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5. Financial-market conditions
Circular Business Model: Discusses the financial aspects of circular business models, including revenue models, pricing tactics, and cost positions. Emphasizes the importance of considering both negative and positive environmental and social impacts of key resources and activities. Life Cycle Discussion & Life Cycle Model: Discusses various business models and revenue logic, including renting, leasing, sharing platforms, and the production and supply of renewable, recyclable, and biodegradable raw materials.
6. Social acceptance factors
Circular Business Model: Highlights the importance of considering the needs and problems that the services or products aim to meet, as well as the social impacts of key resources and activities. Current State Overview: Highlights the importance of understanding the company's vision, mission, and sustainability strategy, as well as the role of sustainability in daily work. Life Cycle Discussion & Life Cycle Model: Emphasizes the importance of understanding customer needs and behavior, as well as the role of marketing and sales in promoting circular products and services.

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4.3.3. LEGISLATION TOOLS

Table 11. Analysis of InnoProBio-based Products Database

Tool's analysis: no.9	
A. General Information	
Tool name and developer:	InnoProBio-based Products Database
Home page of tool (URL):	https://www.biobasedconsultancy.com/en/database
A summary description of the tool (Including the main objective and functionalities):	The InnProBio project aims to raise awareness and increase the knowledge base of public procurement practitioners about the potential in purchasing products and services made from bio-based materials. The main objective is to support the transition from fossil-based products to bio-based alternatives by providing information on technical standards, performance requirements, and certification. In this database you find a range of bio-based products that are already on the market. For each product you can find information on the product itself, for example its specifications, bio-based content, and sustainability certification. This database is only available in the English language.
Geographic coverage of the tool:	European Union
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Procurement practitioners, advisors, and public agencies
Is the tool free of use / freely accessible / applicable?	The tool is freely accessible and available for use by the target user group.
Portfolio of good practices / case studies or Standalone Tool:	The tool includes a portfolio of good practices and case studies.
Qualitative / Quantitative / Descripted data:	The tool provides qualitative and descriptive data.
How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Legislative tool

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B. Content of the tool
1. Technological and technical aspects
The database is a product comparison tool that allows users to evaluate multiple bio-based products side by side. The products in the database are sorted by application area, product type, and Common Procurement Vocabulary Code (CPV). Users can find information about the bio-based content of products, sustainability, functionality, and end-of-life aspects, such as biodegradability. This indicates that the database provides technical details about each product.
2. Biomass considerations
In the database, there is a range of bio-based products that are already on the market. Products are grouped into 9 different categories and include e.g. food catering & events, gardening & landscaping, furniture & indoor interior, clothes & textiles, construction material & infrastructure, cleaning hygiene & sanitary equipment, nursery & medical equipment, ICT Office suppliers & paper, and vehicles & mobility. The database allows users to compare different products includes various criteria such as biomass type. In particular, emphasizes the use of renewable biological resources (biomass) for the production of bio-based products. The most frequently used types of biomasses are sugar, starch, plant oils, wood, and natural fibers. This information is integral to the functionality of the database, which allows users to compare and evaluate different products based on these sustainability criteria.
3. Logistical factors
The database allows users to compare different products by ticking the 'compare' box and clicking 'compare products'. This feature can help users make informed decisions by comparing logistical factors such as availability and supplier information, which can indirectly contribute to improving transport logistics to processing facilities. The comparison includes various criteria such as product name, supplier name, CPV code, CPV product group, supplier address, subcategory, supplier country, supplier website, supplier contact person, supplier email, supplier phone, bio-based content, bio-based carbon content, bio-based content claim, bio-based carbon content claim, bio-based certificates, application and additional value of the product, additives, environmental impact, life cycle properties, life cycle properties certificates, biomass type, biomass origin, and biomass certificates. This feature can help users make informed decisions by comparing logistical factors such as availability and supplier information. The database includes detailed information about the bio-based content, sustainability, functionality, and end-of-life aspects of various bio-based products. This information can help enhance quality control throughout processing and final product distribution by providing users with the necessary details to evaluate the quality and sustainability of the products.
4. Policy and regulatory frameworks
Although the database does not provide specific details about policy and regulatory frameworks, it is built on the foundations of such frameworks that support the procurement of bio-based products and services. For instance, it aligns with the European Union's Horizon 2020 research and innovation program, which promotes the bioeconomy and encourages the use of bio-based products.
5. Financial-market conditions

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The database does not provide specific information on financial-market conditions. However, it can serve as a gateway for market research, helping to expand the public procurement product portfolio to include more bio-based products instead of relying solely on conventional fossil-based products.
6. Social acceptance factors
The database includes sustainability certification for each product, which can be an indicator of social acceptance. The database also includes information about the sustainability of products, which can be an indicator of social acceptance. However, there is no detailed information provided about social acceptance factors.

Table 12. Analysis of Knowledge Center for bioeconomy

Tool's analysis: no.10	
A. General Information	
Tool name and developer:	Knowledge Center for bioeconomy
Home page of tool (URL):	https://knowledge4policy.ec.europa.eu/bioeconomy_en
A summary description of the tool (Including the main objective and functionalities):	The Knowledge Centre for Bioeconomy (KCB) aims to enhance the knowledge base for policymaking in the bioeconomy sector. It identifies, filters, and makes relevant information accessible, bringing together researchers, policymakers, and other experts. The centre analyzes, synthesizes, and communicates available evidence to support the development of coherent, evidence-based policies across sectors, promoting a sustainable and circular bioeconomy. There are different ways for accessing content on the KCB web platform: - By browsing the 'Topic' menu - By browsing the 'Country' menu - By selecting from 'Featured content' - By selecting from 'Latest news', 'Next events', 'Latest resources' - By using keywords in a search bar Focusing on specific sectors or perspectives of the bioeconomy the Knowledge center for bioeconomy is organized by the following topics: - Policy - Economy - Forestry biomass - Algae biomass - Assessing environmental impacts - Fisheries and aquaculture biomass

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	- Forest-based bioeconomy for climate change mitigation
Geographic coverage of the tool:	Across Europe
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Policymakers, researchers, industry stakeholders, and other experts in the bioeconomy sector
Is the tool free of use / freely accessible / applicable?	The tool is freely accessible
Portfolio of good practices / case studies or Standalone Tool:	A standalone tool
Qualitative / Quantitative / Descripted data:	Qualitative and quantitative data
How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Legislation tool
B. Content of the tool	
1. Technological and technical aspects	
The Knowledge Centre for Bioeconomy (KCB) includes an online library that provides a one-stop shop for filtered and distilled knowledge on the bioeconomy to support evidence-informed EU policymaking. The library is regularly updated with the latest publications, datasets, events, news, visualizations, and other resources. The KCB supports policymaking by identifying, filtering, and structuring relevant information and making it accessible, bringing together researchers, policymakers, and other experts in the field, and analyzing, synthesizing available evidence, and communicating it in a transparent, tailored, and concise manner.	
2. Biomass considerations	
The Knowledge Centre for Bioeconomy includes topics related to sustainable biomass. These topics referrer to the following categories that are part of the broader effort to enhance information and the knowledge base on the bioeconomy: 1. Agricultural Biomass: This includes biomass derived from agricultural activities, such as crop residues, animal manure, and other agricultural by-products. 2. Forestry Biomass: This category encompasses biomass from forestry operations, including wood residues, forest thinning, and other forest management activities. 3. Algae Biomass: Biomass derived from algae, which can be used for various bio-based products and energy applications.	

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4. Fisheries and Aquaculture Biomass: This includes biomass from fisheries and aquaculture activities, such as fish waste and other marine resources.
3. Logistical factors
Not applicable
4. Policy and regulatory frameworks
The tool supports the EU Bioeconomy Strategy, which aims to enhance information and the knowledge base on the bioeconomy, including sustainable biomass supply and demand, and forward-looking, cross-sectoral assessments. The KCB deals with the complex and abundant knowledge and expertise available from different sources through knowledge management activities that enhance the knowledge base for policymaking.
5. Financial-market conditions
The Knowledge Centre for Bioeconomy includes topic related to “Economy” providing information on the economy conditions to support evidence-informed EU policymaking. Specifically, it highlights the economic impact of the bioeconomy sectors within the EU. The tool also provides insights into the growth trends within the bioeconomy sectors. Furthermore, the tool offers information on the structural variations of the EU bioeconomy across Member States. Generally, Eastern and Southern European countries have higher shares of bio-based sectors over GDP and total employment, due to their specialization in primary sectors. By providing this economic analysis, the tool helps users understand the financial-market conditions and the economic significance of the bioeconomy sectors, supporting informed decision-making and investment strategies in the bioeconomy.
6. Social acceptance factors
The tool highlights the benefits of a sustainable bioeconomy, including strengthening European competitiveness, creating jobs, mitigating and adapting to climate change, ensuring food security, managing natural resources sustainably, and reducing dependence on non-renewable resources.

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Table 13. Analysis of Bioeconomy Toolkit for Business

Tool's analysis: no.11	
A. General Information	
Tool name and developer:	Bioeconomy Toolkit for Business
Home page of tool (URL):	https://www.transition2bio.eu/toolkits/
A summary description of the tool (Including the main objective and functionalities):	The Bioeconomy Toolkit for Business provides valuable insights into how bioeconomy can be a model of green growth and offers promising business models and sustainable technologies for local deployment. It emphasizes the importance of ensuring a sustainable supply of biomass and highlights the role of the business community in driving bio-based innovation. It focuses on promoting sustainable technologies, ensuring a sustainable supply of biomass, and supporting bio-based innovation. The toolkit includes a glossary of relevant bioeconomy terms and provides an overview of EU projects supporting local bioeconomies and the development of new value chains and business models. It also features various tools and platforms that can help businesses unlock new competences, open new markets, and integrate concepts like resource efficiency and circularity into their business models.
Geographic coverage of the tool:	Across the European Union
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Biomass producers (farmers, foresters, waste managers), advisors, researchers, public agencies, industry, and other stakeholders involved in the bioeconomy
Is the tool free of use / freely accessible / applicable?	Freely accessible and available
Portfolio of good practices / case studies or Standalone Tool:	Portfolio of tools & good practices
Qualitative / Quantitative / Descripted data:	Qualitative, quantitative, and descriptive data
How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Legislation tool

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B. Content of the tool
1. Technological and technical aspects
The toolkit highlights various sustainable technologies for local deployment, including the development of new value chains and business models. It also mentions several tools and platforms that can help businesses unlock new competences and integrate concepts like resource efficiency and circularity into their business models.
2. Biomass considerations
The toolkit emphasizes the importance of ensuring a sustainable supply of biomass feedstock. It mentions the challenges related to biomass availability, quality, supply, and sustainability, and provides examples of European projects addressing these issues.
3. Logistical factors
The toolkit includes information on platforms like the Biomass Trade Platform, which facilitates the exchange of organic biomass residues and by-products between biomass producers and processors. This helps in addressing logistical challenges related to biomass supply.
4. Policy and regulatory frameworks
The toolkit provides policy recommendations and insights on promoting education, training, and skills across the bioeconomy. It highlights the role of EU cohesion policy in supporting the bioeconomy and reducing disparities in development and quality of life across Europe's regions.
5. Financial-market conditions
The toolkit mentions various EU projects and initiatives that provide funding and support for bio-based innovations. It also includes information on platforms like Bioeconomy Ventures, which offers matchmaking services between innovators and investors.
6. Social acceptance factors
The toolkit emphasizes the importance of raising awareness and educating stakeholders about the bioeconomy and its benefits. It includes recommendations for workshops and surveys to gather data on stakeholder needs and potential barriers.

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Table 14. Analysis of Bioeconomy Toolkit for Policy Makers

Tool's analysis: no.12	
A. General Information	
Tool name and developer:	Bioeconomy Toolkit for Policy Makers
Home page of tool (URL):	https://www.transition2bio.eu/toolkits/
A summary description of the tool (Including the main objective and functionalities):	The Bioeconomy Toolkit for Policy Makers is designed to support policymakers in advancing the bioeconomy. It addresses several key questions and challenges, such as how the bioeconomy can contribute to a more sustainable and resilient economy, where to find resources and detailed data on the bioeconomy, and how to develop a bioeconomy roadmap or strategy in a specific region. The toolkit emphasizes the importance of the bioeconomy's connection to other policy fields, including climate mitigation, circularity, and sustainability. It highlights the need for horizontal policies and implementation at multiple levels to foster a circular bioeconomy approach, which is essential for the European Union to deliver on its Green Deal. It offers a wealth of information on the European Commission's Knowledge Centre for Bioeconomy, policy briefs, and various tools and platforms that can guide decision-makers and stakeholders in developing their regional bioeconomy strategies.
Geographic coverage of the tool:	Across the European Union
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Policymakers, public agencies, and stakeholders involved in the bioeconomy, including researchers, advisors, and industry representatives
Is the tool free of use / freely accessible / applicable?	Freely accessible and available for use
Portfolio of good practices / case studies or Standalone Tool:	Portfolio of tools & good practices
Qualitative / Quantitative / Descripted data:	Mix of qualitative, quantitative, and descriptive data
How many users have used the tool / Number of entries:	Not applicable

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Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Legislative tool
B. Content of the tool	
1. Technological and technical aspects	
The toolkit discusses various bio-based innovations and technologies that are significant for the bioeconomy. It highlights the role of biorefineries in transitioning from fossil and mineral resources to renewable raw materials.	
2. Biomass considerations	
The toolkit seeks the importance of unexploited bio-based waste streams and the potential of regional bioeconomy strategies to utilize these resources.	
3. Logistical factors	
Not applicable	
4. Policy and regulatory frameworks	
The toolkit emphasizes the need for evidence-based and coherent policies across different sectors to develop a sustainable and circular bioeconomy. It also provides information on the European Bioeconomy Policy Forum and various EU bioeconomy projects.	
5. Financial-market conditions	
The toolkit discusses the role of EU cohesion policy in supporting the bioeconomy and mentions funding for many projects through the European Agriculture Fund for Rural Development (EAFRD).	
6. Social acceptance factors	
The toolkit highlights the importance of promoting education, training, and skills across the bioeconomy. It also mentions the need to increase the capacity of regional and national stakeholders in communicating the bioeconomy.	

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4.3.4. EVALUATION TOOLS

Table 15. Analysis of Bio-Circularity Label

Tool's analysis: no.13	
A. General Information	
Tool name and developer:	Bio-Circularity Label
Home page of tool (URL):	https://www.hoop-hub.eu/circularity_label.html
A summary description of the tool (Including the main objective and functionalities):	The HOOP Bio-Circularity Label is designed to support cities and regions in advancing their circular urban bioeconomy. This label has been developed to measure the extent to which cities and regions are implementing circular measures, policies, and initiatives. By doing so, it creates an environment that encourages investments in circular technologies, projects, and companies, ultimately facilitating the production and use of biowaste-based products. In addition to providing a status on the circular urban bioeconomy, the Label identifies areas where cities can enhance their local bioeconomy efforts. It allows cities and regions to learn from real-life examples, aiming to stimulate further growth in the circular urban bioeconomy and demonstrating the effectiveness of green policies. The Label is built around a set of indicators related to urban bio-based waste streams, including Organic Fraction Municipal Solid Waste (OFMSW) and Urban Waste Water Sludge (UWWS). The assessment evaluates political ambitions, strategies, implemented policies, societal participation and awareness, consumption and waste patterns, as well as waste treatment practices. Cities and regions that exhibit a high level of maturity in circular policies, programs, and projects are awarded the HOOP Bio-Circularity Label. The HOOP Bio-Circularity Label is based on a scoring system that assesses cities and regions on their circularity performance using nine Circularity Levels (CL). Each level reflects the maturity of the circular bioeconomy on a European scale. A higher CL indicates better performance, with CL 5 representing the European average. The distribution of the CL scoring and the Label provides a clear visual representation of a city or region's progress in circular bioeconomy initiatives.
Geographic coverage of the tool:	Europe
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Public agencies specifically cities and regions, policy decision-makers, investors, waste prevention & waste management operator company, local businesses, NGO and citizens

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Is the tool free of use / freely accessible / applicable?	Yes, the tool is freely accessible, registration. This tool is applicable as it provides an interactive way to display waste management data for regions, allowing easy comparison and analysis.
Portfolio of good practices / case studies or Standalone Tool:	Standalone Assessment Tool
Qualitative / Quantitative / Descripted data:	Qualitative and quantitative information
How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Evaluation tool
B. Content of the tool	
1. Technological and technical aspects	
The Label includes indicators for biowaste collection and recycling technology implementation rates and infrastructure assessment for biowaste management, without specific details on technology complexity, facility suitability, workforce skills, or R&D efforts.	
2. Biomass considerations	
The Label evaluates the quality of separately collected biowaste, with no details on economic or logistical challenges in biowaste sourcing.	
3. Logistical factors	
The Label includes indicators for the implementation rate of biowaste separate collection and evaluates the quality of the separately collected biowaste. In particular, the tool focuses on improving biowaste collection, transportation, and quality control, with indicators for separate collection implementation rates and infrastructure assessment.	
4. Policy and regulatory frameworks	
The HOOP Bio-Circularity Label assesses the impact of EU and national regulations on technologies converting biowaste by incorporating policy indicators aligned with the Circular Economy Action Plan (CEAP). This includes evaluating how cities and regions implement and comply with relevant circular economy policies, including regulations that directly affect biowaste conversion technologies. The Label considers the effectiveness of these policies, such as those related to waste management, recycling, and resource efficiency, to determine the maturity of a city's or region's circular bioeconomy. The assessment ensures that cities and regions are advancing towards 100% circularity, driven by both EU-wide regulations and national policies that promote sustainable biowaste management and conversion. The HOOP Bio-Circularity Label recognizes the importance of incentives and guidelines in fostering the adoption of bio-based products. As part of the policy assessment, the Label examines the presence and effectiveness of financing mechanisms, public-private partnerships, and public expenditure aimed at supporting green and circular economies. This includes the evaluation of public financing support, planned	

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budgets, and the existence of incentives such as tax reductions for circular activities and specific subsidies for bio-based product development. By highlighting these supportive measures, the Label encourages cities and regions to adopt bio-based products more widely, thus contributing to the growth of the circular bioeconomy.
The HOOP Bio-Circularity Label promotes collaboration among stakeholders in the bio-based value chain by incorporating indicators that assess the level of cooperation and integration within circular economy strategies. This includes evaluating the extent to which cities and regions engage with various stakeholders—such as industry players, public agencies, and civil society—in the development and implementation of circular policies. The Label considers how well these collaborations are structured and supported, particularly through public-private partnerships and collective initiatives aimed at enhancing circular practices across the value chain. By fostering such collaborations, the Label helps build a cohesive and effective framework that supports the broader adoption of circular and bio-based solutions.

5. Financial-market conditions

The HOOP Bio-Circularity Label helps to identify investment opportunities for biowaste conversion technologies by showcasing the circular efforts and progress made by cities and regions in implementing sustainable practices. The Label provides a platform where cities can display their advancements in circularity, particularly in the areas of biowaste management and the bioeconomy. This visibility enables private investors to recognize viable opportunities within these urban environments, fostering confidence in the potential returns on investments related to biowaste conversion technologies.
The HOOP Bio-Circularity Label facilitates access to capital by creating a competitive environment that highlights the commitment of cities and regions to circular bioeconomy initiatives. By demonstrating effective policies and circular achievements, cities and regions can attract private investors interested in supporting the development and scaling of bio-based products. The Label's platform on the Urban Circular Bio-economy Hub (UCBH) further enables the sharing of best practices, which can guide regions in crafting investment proposals that resonate with potential investors, thereby improving access to the necessary capital for scaling bio-based products.
The HOOP Bio-Circularity Label indirectly aids in managing costs associated with constructing and operating biowaste processing facilities by promoting efficient circular policies and investment strategies. Through the Label, cities and regions can share knowledge and best practices on cost-effective approaches to biowaste management, including facility construction and operation. This collaborative environment encourages the adoption of cost-saving measures and innovations that can reduce the overall financial burden on cities and regions while ensuring the successful implementation of biowaste processing facilities.

6. Social acceptance factors

The HOOP Bio-Circularity Label actively promotes societal acceptance of biowaste management practices by assessing and encouraging citizen participation and awareness initiatives. The Label includes indicators that measure how effectively cities and regions engage their populations in circular activities, such as waste separation and proper biowaste disposal. Through campaigns, educational programs, and co-creation platforms, the Label fosters an environment where citizens are not only informed but also motivated to participate in sustainable waste management practices. This collective engagement is crucial for achieving broader acceptance and successful implementation of biowaste management strategies.
The HOOP Bio-Circularity Label influences consumer attitudes by promoting the benefits and practicality of bio-based products. The Label's assessment framework includes initiatives aimed at raising awareness about the advantages of circular products, thereby driving consumer behavior towards more sustainable choices. By highlighting successful examples and increasing visibility of circular achievements, the Label helps to shift consumer perceptions, making bio-based products more appealing and acceptable in the market. This is further supported by educational campaigns that emphasize the environmental and economic benefits of adopting bio-based solutions.

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The HOOP Bio-Circularity Label supports local and national strategies aimed at increasing social acceptance of bio-based solutions by providing a structured assessment of circular policies and their societal impacts. The Label encourages cities and regions to implement and showcase effective strategies that engage citizens and stakeholders, thus enhancing public support for bio-based initiatives. By creating a platform for knowledge sharing and highlighting successful circular practices, the Label not only fosters local and national collaboration but also strengthens the overall social acceptance of bio-based solutions. This strategic support is vital for building a resilient and inclusive circular bioeconomy.

Table 16. Analysis of Circular Valuation Method

Tool's analysis: no.14	
A. General Information	
Tool name and developer:	Circular Valuation Method
Home page of tool (URL):	https://hoop-hub.eu/circular_valuation.html
A summary description of the tool (Including the main objective and functionalities):	The Circular Valuation Method is designed to promote investments in bioeconomy projects and enhance the European Urban Bioeconomy. It provides a simple and clear template for companies and public entities to evaluate the financial attractiveness of circular projects. The method uses circular indicators specifically designed for circularity and biowaste, resulting in a comprehensive assessment across multiple domains.
Geographic coverage of the tool:	Europe
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Investors (financial and impact investors), solution providers (companies, NGOs, cooperatives, privates), municipalities, and public agencies
Is the tool free of use / freely accessible / applicable?	Yes, the tool is freely accessible. This tool is applicable for users to assess the financial viability and sustainability of circular bioeconomy projects.
Portfolio of good practices / case studies or Standalone Tool:	Standalone tool
Qualitative / Quantitative / Descripted data:	Qualitative & quantitative
How many users have used the tool / Number of entries:	Not applicable

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Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Evaluation tool
B. Content of the tool	
1. Technological and technical aspects	
The method includes a Circularity Indicator to measure how restorative the material flows of a product or company are, considering the life cycle and assemblage technique. The method considers the Total Cost of Ownership (TCO), which includes all costs associated with the lifecycle of an asset. The method applies different depreciation/appreciation rules according to circular asset management and considers collective creation of value through co-design, co-ownership, and co-pricing.	
2. Biomass considerations	
Focuses on the valorization of Organic Fraction of Municipal Solid Waste (OFMSW) and Urban Wastewater Sludge (UWWS). Addresses the variability and quality of biowaste feedstock, influenced by seasonal and consumer behavior factors.	
3. Logistical factors	
Evaluates the efficiency of waste collection, sorting, and processing.	
4. Policy and regulatory frameworks	
Ensures projects comply with EU guidelines and regulations on waste management and circular economy. Aims to harmonize the roles of stakeholders in the valorization processes to facilitate further exploitation of bio-based products. Aligns with the EU Bioeconomy Strategy, the 2018 EU Circular Economy Package, and other upcoming regulations.	
5. Financial-market conditions	
Includes Total Cost of Ownership (TCO), Circularity Indicator, and different depreciation/appreciation rules. Evaluates the financial attractiveness of circular projects for both private and public investors. Supports the creation of new circular business models for Lighthouse Cities and Regions, providing necessary assistance and matching them to investor expectations.	
6. Social acceptance factors	
Measures relationships with local communities and support for local suppliers. Assesses job creation, gender equality, and employment of people with a distance from the labor market. Evaluates workplace health and safety and contributions to poverty reduction.	

Table 17. Analysis of Project Maturity Level

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Tool's analysis: no.15	
A. General Information	
Tool name and developer:	Project Maturity Level (PML)
Home page of tool (URL):	https://hoop-hub.eu/project_maturity_level.html
A summary description of the tool (Including the main objective and functionalities):	The HOOP Project Maturity Level (PML) is a standardized assessment tool designed to evaluate the maturity level of urban circular bioeconomy (UCBE) projects. It provides a structured means of assessing and ranking projects based on several criteria, with the goal of enhancing their maturity and attractiveness for securing green financing and funding for implementation.
Geographic coverage of the tool:	Europe
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	The tool is intended for a wide range of users, including project developers, promoters, investors, public and private entities, cities, and regions. It is particularly relevant for those involved in the UCBE sector, such as biomass producers (farmers, foresters, waste managers), advisors, researchers, public agencies, industry, and lobby groups
Is the tool free of use / freely accessible / applicable?	The HOOP PML tool is freely accessible and available online on the HOOP Urban Circular Bioeconomy Hub. This tool is applicable as it provides a clear, structured framework for evaluating and improving the investment readiness of urban circular bioeconomy projects.
Portfolio of good practices / case studies or Standalone Tool:	Standalone tool
Qualitative / Quantitative / Descripted data:	The HOOP PML tool incorporates both qualitative and quantitative data. It uses a structured questionnaire and ranking system to evaluate projects based on specific criteria, providing a comprehensive assessment of project maturity
How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Evaluation tool
B. Content of the tool	
1. Technological and technical aspects	
The HOOP PML tool evaluates projects across six distinct maturity levels, each with specific criteria. These criteria include identifying key constraints and opportunities, defining project goals, and ensuring compliance	

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with regulations and strategic frameworks. The tool helps project developers understand improvement areas, thereby enhancing their project's attractiveness and bankability.
2. Biomass considerations
The tool assesses the entire value chain of the project, including the sourcing of renewable feedstocks, the conversion process, and the distribution of bio-based products. The tool assesses the supply chain of feedstock and other resources to ensure suitability for producing bioproducts and services. It focuses on the valorization of the organic fraction of municipal solid waste (OFMSW) and urban wastewater sludge (UWWS) to obtain safe and sustainable bio-based products.
3. Logistical factors
The HOOP PML approach involves developing a detailed technical project and business case, including procurement needs, operating costs, and the project's scalability and replicability. It ensures that all capacities and resources needed to implement the project are identified.
4. Policy and regulatory frameworks
The tool provides Project Development Assistance (PDA) to cities and regions for implementing bio-based processes. This includes technological, legal, procurement, business, and financial aspects needed to develop investments to valorise biowaste and wastewater. It also ensures regulatory compliance and transparent governance structures.
5. Financial-market conditions
The HOOP PML tool provides a structured means of assessing and ranking UCBE projects, facilitating greater access to green financing. It helps to identify suitable business models, potential funding and financing sources, and ensures the project's economic viability. Investors look for projects with robust financial forecasts and a comprehensive risk assessment to gauge potential profitability and understand associated risks.
6. Social acceptance factors
The tool supports cities and project developers in demonstrating specific characteristics to garner interest from potential investors and align with their expectations. This includes understanding the bio-based value chain, presenting a report on the project's viability, and engaging with stakeholders and communities.

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Table 18. Analysis of ResCoM Circular Pathfinder

Table of tool's analysis: no.16	
A. General Information	
Tool name and developer:	**ResCoM Circular Pathfinder**
Home page of tool (URL):	https://www.ideal-co.nl/pathfinder/
A summary description of the tool (Including the main objective and functionalities):	The ResCoM Circular Pathfinder is a software-based tool designed to guide users through a series of product-related questions, providing recommendations for specific circular design strategies, product examples, and appropriate design tools. It is intended for use by design, R&D, and innovation departments of Original Equipment Manufacturers (OEMs) and is part of the ResCoM platform, which supports manufacturers in developing products that fit a circular economy. The ResCoM project developed a methodology and tools to support manufacturers in adopting circular economy business models. These tools help assess the economic and environmental performance of circular economy business models and integrate product design considerations. Starting tool for companies interested in circular economy thinking. It allows them to explore and identify the most suitable circular pathways for their products by answering just a few questions. Informed by best practices of other companies, the Circular Pathfinder guides the user towards circular pathways that have potential in their specific case. It explains why certain pathways, such as product remanufacturing, life extension or recycling are of interest, with examples.
Geographic coverage of the tool:	Includes European companies (Bugaboo, Gorenje and Loewe)
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Designers, R&D, manufacturers
Is the tool free of use / freely accessible / applicable?	Yes
Portfolio of good practices / case studies or Standalone Tool:	The ResCoM Circular Pathfinder tool is part of the ResCoM platform and is complemented by a series of industrial case studies
Qualitative / Quantitative / Descripted data:	Tool provides qualitative data by guiding users through product-related questions and offering recommendations for circular design strategies

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How many users have used the tool / Number of entries:	The ResCoM Circular Pathfinder tool has been applied in approximately 40 cases
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Evaluation tool
B. Content of the tool	
1. Technological and technical aspects	
The Circular Pathfinder tool helps to identify promising circular design strategies by asking a maximum of ten product-related questions and providing tailored recommendations. It includes strategies such as design for durability, upgradeability, reuse, repairability, refurbishment, remanufacturing, recycling, and bio-cycling (biodegrading). The tool is based on best practices of durable products and products that combine durables and consumables. Examples of products analyzed by the tool include: (Office furniture, washing machines, reusable beer bottles).	
2. Biomass considerations	
This aspect is not applicable.	
3. Logistical factors	
In terms of logistical factors, the Circular Pathfinder tool is designed to be user-friendly and practical for Original Equipment Manufacturers (OEMs), particularly for their design, R&D, and innovation departments. It guides users through product-related questions and provides tailored recommendations for circular design strategies. The tool has been applied in approximately 40 cases, demonstrating its practicality and relevance in real-world scenarios. It has been used with companies directly or indirectly involved in the ResCoM project, showcasing its effectiveness in identifying and implementing circular design strategies.	
4. Policy and regulatory frameworks	
The tool does not provide specific information on policy and regulatory frameworks. Therefore, this aspect is not applicable.	
5. Financial-market conditions	
The tool does not provide specific information on financial- market conditions. Therefore, this aspect is not applicable.	
6. Social acceptance factors	
Developed based on OEMs case studies, the tool has been applied in approximately 40 cases and aims to be practical and user-friendly. It addresses factors such as consumer interest in acquiring used products and the demand for warranties on reused products.	

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Table 19. Analysis of DECISIVE- Decision Support Tool (DST)

Tool's analysis: no.17	
A. General Information	
Tool name and developer:	DECISIVE- Decision Support Tool (DST)
Home page of tool (URL):	https://dst.decisive2020.eu/
A summary description of the tool (Including the main objective and functionalities):	The DECISIVE Decision Support Tool (DST) aims to enhance biowaste management by providing a comprehensive assessment of various management options. Its objective is to evaluate the performance of both centralized and decentralized biowaste management systems using environmental, economic, social, and regulatory criteria. By offering detailed inventories and assessment criteria, the tool helps competent authorities, consulting firms, and waste operators make informed decisions to improve the efficiency and sustainability of biowaste management practices.
Geographic coverage of the tool:	Across Europe
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Competent authorities, consulting firms, and waste operators
Is the tool free of use / freely accessible / applicable?	Open to registered users at no cost. It is available as a web application. It is applicable for enhancing biowaste management by evaluating various management options through comprehensive assessments.
Portfolio of good practices / case studies or Standalone Tool:	A portfolio of good practices and case studies
Qualitative / Quantitative / Descripted data:	Qualitative and quantitative data
How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Evaluation tool
B. Content of the tool	
1. Technological and technical aspects	

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The tool can operate in two modes: "Basic" and "GIS". The "Basic" mode does not require spatial information, while the "GIS" mode allows for the definition of the spatial inventory or distance input of the scenario. This flexibility helps in adapting to diverse climates and geographical conditions. The tool includes detailed inventories of waste processes, which provide information on the type of facility, annual capacity, and type of waste handled. This helps in determining the suitability of facilities in terms of size and processing capacity. The tool's inventories also include information on the labour required for each waste process, including the number of workers, annual working hours, and average gross hourly salary. This helps in analyzing the workforce capabilities and skills required for biowaste processing. Additionally, the tool assesses the infrastructure readiness by considering the space required for each waste process, including private space at the source of generation, public space for containers and collection routes, and industrial space for centralized plants. The tool includes detailed information on the inputs and outputs of each waste process, allowing for the assessment of research and development efforts to enhance bio-based product performance. This includes the evaluation of the quality of the bio-based products generated. The tool evaluates the economic aspects of each waste process, including capital expenditures (CAPEX), operational expenditures (OPEX), and potential revenues from the sale of bio-based products. This helps in considering the technical and market characteristics influencing the viability of biowaste and bio-based products.
2. Biomass considerations
The DECISIVE Decision Support Tool (DST) includes detailed inventories of waste processes, which provide information on the type of facility, annual capacity, and type of waste handled. This helps in determining the suitability of facilities in terms of size and processing capacity. However, specific challenges in sourcing biowaste materials with respect to quality and availability are not explicitly addressed in the documents, so this element is not applicable. The economic aspects of each waste process are evaluated, including capital expenditures (CAPEX), operational expenditures (OPEX), and potential revenues from the sale of bio-based products. However, specific strategies for managing economic barriers such as high costs associated with biowaste procurement are not explicitly addressed, so this element is not applicable. The tool can consider the spatial location of biowaste sources and facilities. It allows users to define the spatial inventory or distance input of the scenario, which helps in assessing the logistical aspects of biowaste management. This includes the transportation of waste between facilities or from waste facilities to places where the bio-based products are used. The tool assesses the infrastructure readiness by considering the space required for each waste process, including private space at the source of generation, public space for containers and collection routes, and industrial space for centralized plants. However, specific strategies for ensuring reliable and sustainable supply chains for bio-based product production are not explicitly addressed, so this element is not applicable.
3. Logistical factors
The DECISIVE Decision Support Tool (DST) can consider the spatial location of biowaste sources and facilities. It allows users to define the spatial inventory or distance input of the scenario, which helps in assessing the logistical aspects of biowaste management. This includes the transportation of waste between facilities or from waste facilities to places where the bio-based products are used. The tool includes detailed inventories of waste processes, which provide information on the type of facility, annual capacity, and type of waste handled. This helps in determining the suitability of facilities in terms of size and processing capacity. Additionally, the tool's inventories include information on the labour required for each waste process, including the number of workers, annual working hours, and average gross hourly salary. The tool includes detailed information on the inputs and outputs of each waste process, allowing for the assessment of research and development efforts to enhance bio-based product performance. This includes the evaluation of the quality of the bio-based products generated. The tool evaluates the economic aspects of each waste process, including capital expenditures (CAPEX), operational expenditures (OPEX), and potential revenues from the sale of bio-based products. This helps in considering the technical and market characteristics influencing the viability of biowaste and bio-based products.

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4. Policy and regulatory frameworks
The DECISIVE Decision Support Tool (DST) includes regulatory aspects as part of its evaluation criteria. The tool evaluates the presence of circular economy action plans and policies to comply with relevant policies and regulations. Moreover, the tool evaluates public financing support and incentives for waste prevention. The tool includes indicators for public-private partnerships and stakeholder engagement. It aligns with the EU Bioeconomy Strategy, the 2018 EU Circular Economy Package, and other upcoming regulations.
5. Financial-market conditions
The DECISIVE Decision Support Tool (DST) evaluates the economic aspects of each waste process, including capital expenditures (CAPEX), operational expenditures (OPEX), and potential revenues from the sale of bio-based products. This helps in identifying investment opportunities for biowaste conversion technologies and managing costs associated with constructing and operating biowaste processing facilities. However, specific strategies for facilitating access to capital for developing and scaling bio-based products, as well as navigating market dynamics affecting bioproduct accessibility and consumer adoption, are not explicitly addressed in the documents. Therefore, these elements are not applicable.
6. Social acceptance factors
The DECISIVE Decision Support Tool (DST) assesses social aspects as part of its evaluation criteria. It considers the social impact of different biowaste management options to ensure that they are socially acceptable. The tool evaluates the social acceptance of biowaste management practices by considering the social impact of different options. This includes assessing the potential for community engagement and job creation. The tool includes detailed information on the inputs and outputs of each waste process, allowing for the assessment of research and development efforts to enhance bio-based product performance. This includes the evaluation of the quality of the bio-based products generated, which can influence consumer attitudes and acceptance. The tool aligns with the EU Bioeconomy Strategy, the 2018 EU Circular Economy Package, and other upcoming regulations. This alignment supports local and national strategies promoting social acceptance of bio-based solutions.

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Table 20. Analysis of Circular City

Tool's analysis: no.18	
A. General Information	
Tool name and developer:	Circular City
Home page of tool (URL):	https://toolbox.circular-city.eu/
A summary description of the tool (Including the main objective and functionalities):	The Circular City Guidance Tool, developed as part of the COST Action It aims to help cities address complex urban challenges by promoting circular economy practices and Nature-based Solutions (NBS). The tool establishes a common language and understanding across disciplines, viewing circular economy concepts as a key approach and Nature-based Solutions (NBS) or green infrastructure as core components. The Circular City Guidance Tool is designed to address five key urban circularity challenges: restoring and maintaining the water cycle, water and waste treatment and recovery, nutrient recovery and reuse, energy efficiency and recovery, and food and biomass production. By integrating circular economy principles with Nature-based Solutions (NBS), the tool provides a framework to promote sustainable urban development. By guiding users through the interconnections between different urban demands, services, and NBS, the tool helps implement effective, integrated solutions for sustainable urban development. The tool aims to promote interdisciplinary collaboration and create resilient, sustainable, and healthy urban environments by applying these principles across various domains.
Geographic coverage of the tool:	Europe
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	City officials, urban planners, system designers, economists, engineers and researchers, decision makers
Is the tool free of use / freely accessible / applicable?	Free
Portfolio of good practices / case studies or Standalone Tool:	Standalone Tool
Qualitative / Quantitative / Descripted data:	Qualitative & quantitative
How many users have used the tool / Number of entries:	Not applicable

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Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Evaluation Tool
B. Content of the tool	
1. Technological and technical aspects	
The tool provides guidelines on the adoption of circular economy practices, including the implementation of technologies for waste management, energy efficiency, and sustainable urban development. It emphasizes innovative approaches to resource use and waste minimization.	
2. Biomass considerations	
While the tool focuses on urban circular practices, it does address sustainable resource management. It highlights the importance of local sourcing and the efficient use of materials to minimize waste and promote recycling within urban settings.	
3. Logistical factors	
Not applicable	
4. Policy and regulatory frameworks	
The tool aligns local policies with broader regulatory frameworks, such as EU regulations. It includes governance models, policy development strategies, and the role of stakeholders in implementing circular economy policies at the city level. It identifies regulatory, governance, financial and legal drivers and barriers for NBS implementation and use of recovered resources, and support institutional change to better regulatory governance.	
5. Financial-market conditions	
Financial aspects are addressed through discussions on funding mechanisms, investment strategies, and the economic benefits of circular economy projects. The tool highlights market opportunities and potential financial returns from adopting circular practices.	
6. Social acceptance factors	
The tool places significant emphasis on social inclusion and community engagement. It underscores the importance of public awareness, education, and stakeholder participation in the transition to a circular economy. It also discusses the social benefits of circular projects, such as job creation and improved quality of life.	

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Table 21. Analysis of BSAT-Bioeconomy Strategy Accelerator Toolkit

Table of tool's analysis: no.19	
A. General Information	
Tool name and developer:	BSAT-Bioeconomy Strategy Accelerator Toolkit
Home page of tool (URL):	http://bioeconomy-strategy-toolkit.eu/
A summary description of the tool (Including the main objective and functionalities):	The Bioeconomy Strategy Accelerator Toolkit (BSAT) is an online platform designed to guide decision-makers in developing or updating regional bioeconomy strategies. It is part of the POWER4BIO project, funded by the European Union's Horizon 2020 research and innovation programme. The BSAT aims to empower regional stakeholders to boost the transition towards bioeconomy regions in Europe by providing them with the necessary tools, instruments, and guidance. The toolkit is structured into several methodological phases, each with specific steps and actions to guide users through the process of developing or updating bioeconomy strategies. These phases include the assessment of regional bioeconomy potential, involvement of stakeholders, development of bioeconomy strategies, and roadmap definition. Each phase of the BSAT has distinct objectives and contains various tools such as templates, questionnaires, and guidelines to facilitate the process. Phase 1 focuses on assessing the regional bioeconomy potential and status quo, involving steps like preliminary characterization, policy analysis, and technical analysis. Phase 2 aims to create a Regional Bioeconomy Hub (RBH) and build a common regional bioeconomy vision through stakeholder involvement. Phase 3 is dedicated to developing a comprehensive bioeconomy strategy based on the regional potential identified in the previous phases. Finally, Phase 4 involves defining a roadmap that operationalizes the regional bioeconomy strategy, including deriving specific goals, assigning actions, and drafting the roadmap. The BSAT emphasizes the importance of stakeholder involvement and provides real examples, best practices, and guidelines to ensure a comprehensive and inclusive approach to bioeconomy strategy development.
Geographic coverage of the tool:	Not applicable
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Biomass producers, advisors, researchers, public agencies, industry, lobby groups.

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Is the tool free of use / freely accessible / applicable?	Open, easy-to-use, and free-to-access online platform. All the documents and resources available on the BSAT are freely accessible without the need for registration or providing any input to the tool.
Portfolio of good practices / case studies or Standalone Tool:	The BSAT is a standalone tool that also includes a portfolio of good practices and case studies.
Qualitative / Quantitative / Descripted data:	Mix of qualitative, quantitative, and descriptive data
How many users have used the tool / Number of entries:	
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Evaluation tool
B. Content of the tool	
1. Technological and technical aspects	
The BSAT includes technical analysis, which involves evaluating the investment readiness level in a region concerning the use of alternative raw materials to replace equivalent fossil-based products to produce new bioproducts. The technical analysis in Phase 1 assesses the investment readiness level in a region concerning the use of alternative raw materials to replace equivalent fossil-based products to produce new bioproducts.	
2. Biomass considerations	
The BSAT emphasizes evaluating the types of feedstocks available in the region that are part of current value chains. These include agricultural and forest waste, energy crops, industrial by-products, fractions of RSU's (Residual Solid Urban waste), pulp and paper residues, by-products from the agri-food and farming sector, plastic fractions, and sewage sludge. It also involves quantifying the resources available, assessing the current conversion processes, and identifying the actors in the possible value chains.	
3. Logistical factors	
The BSAT includes steps to assess logistical factors related to the bioeconomy, such as the infrastructure and industrial factors necessary for the efficient use of biomass. It provides guidelines on evaluating the existing transport infrastructure, logistics management, and the potential for setting up additional biomass logistics centers. The toolkit also highlights the importance of improving waste stream logistics management and evaluating the possibility of adapting existing waste logistic centers.	
4. Policy and regulatory frameworks	
The BSAT emphasizes the importance of policy and regulatory frameworks in developing bioeconomy strategies. It includes steps to assess the current policy framework in the region, identify existing policies and incentives, and develop new supporting policies and financial mechanisms. The toolkit also provides examples of good policy practices and guidelines on how to create effective policy instruments for the bioeconomy.	
5. Financial-market conditions	

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The BSAT provides guidelines on identifying available financial tools and incentives for bioeconomy projects. It includes steps to evaluate existing financial instruments, such as public and private investment, and develop new financial mechanisms to support bioeconomy strategies. The toolkit also emphasizes the importance of aligning financial resources with the goals of the bioeconomy strategy and ensuring the availability of funding for bioeconomy projects.
6. Social acceptance factors
The BSAT includes steps to assess social acceptance factors related to the bioeconomy. It provides guidelines on involving stakeholders through Regional Bioeconomy Hubs (RBHs) and building a common regional bioeconomy vision. The toolkit emphasizes the importance of engaging a wide range of stakeholders, including industry, R&D, academia, policy, and civil society, to ensure broad support for bioeconomy strategies. It also highlights the need for public consultation processes and communication channels to enhance the recognition and acceptance of bioeconomy strategies.

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Table 22. Analysis of Green Assist

Table of tool's analysis: no.20	
A. General Information	
Tool name and developer:	Green Assist
Home page of tool (URL):	https://cinea.ec.europa.eu/interfacing-green-assist-practice-beneficiary-perspective_en
A summary description of the tool (Including the main objective and functionalities):	The Green Assist is the provider of advisory services, offering on-demand, free, and customized support for green investment projects. It targets sectors of natural capital and circular economy, as well as non-environmental sectors, and is part of the European Green Deal Investment Plan. The Green Assist provides on-demand, free, and customized advisory services by distinguished experts. These experts are selected from an established pool or recruited from other advisory services. The InvestEU Advisory Hub (https://investeu.europa.eu/investeu-programme/investeu-advisory-hub_en) serves as the central entry point for project promoters and intermediaries to communicate with Green Assist and submit their applications for advisory support. While the Hub is essential for facilitating access to Green Assist, the actual advisory services and support are provided by Green Assist. For applying the Green Assist, it is required a demonstration of a list of minimum admissibility eligibility criteria: 1. The investment project or the desired Green Assist expert support must represent an environmental benefit. 2. The investment must be predominantly located in the EU-27 or other participating countries such as Iceland, Ukraine, and Moldova. 3. The project must be in an investment area or sector supported by Green Assist, such as natural capital, biodiversity, circular economy, climate change adaptation, sustainable spatial design, environmental remediation, greening non-environmental sectors, and climate mitigation. 4. The applicant must express clear investment project objectives and outline a clear vision and milestones for the project. 5. The applicant must confirm their capacity to mobilize sufficient committed and identified decision-makers to interface with the expert along the project cycle and must not be at risk of default in the short to medium term. 6. The applicant must express a clear need for expert support, which must not be duplicated by another technical advisory already received. 7. The expert support must be able to be implemented within a time duration of about 3-6 months, sufficient to advance the project maturity.

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Geographic coverage of the tool:	EU-27 or other participating countries such as Iceland, Ukraine, and Moldova
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Project promoters, financial institutions, or other project partners working on concrete investment projects.
Is the tool free of use / freely accessible / applicable?	Green Assist provides advisory services entirely free of charge
Portfolio of good practices / case studies or Standalone Tool:	It is a Standalone tool but also includes case studies of eligible projects.
Qualitative / Quantitative / Descripted data:	Descriptive data
How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Evaluation Tool
B. Content of the tool	
1. Technological and technical aspects	
Not applicable	
2. Biomass considerations	
Not applicable	
3. Logistical factors	
Not applicable	
4. Policy and regulatory frameworks	
GREEN ASSIST operates under the European Green Deal Investment Plan, which acknowledges the need for promoting and facilitating investments in the green economy. The initiative is managed by the European Climate Infrastructure and Environment Executive Agency (CINEA) and coordinated with DG ENVIRONMENT. Tool highlights the eligibility criteria and prioritization factors for receiving advisory support from CINEA. The advisory support offered by the InvestEU Advisory Hub is aligned with the objectives of the InvestEU Programme and delivered through thematic advisory initiatives in the InvestEU eligible sectors and priorities.	
5. Financial-market conditions	

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The GREEN ASSIST helps projects develop business models and financial plans, including creating credible cash-flow models and addressing investor due diligence requirements. This ensures that projects meet investor expectations and successfully secure the necessary funding.
6. Social acceptance factors
The GREEN ASSIST supports projects in improving their environmental performance, which can enhance social acceptance. By conducting an environmental impact assessment and providing tailored recommendations, GREEN ASSIST helps projects align with societal expectations and gain community support. It emphasizes the importance of adhering to the Beneficiary Charter, which ensures effective and respectful collaboration with experts. The objective of Green Assist is to provide access to advisory services that enable beneficiaries to prepare green investment projects across diversified sectors and beneficiaries.

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Table 23. Analysis of The Metabolism of Cities - Data Hub

Tool's analysis: no. 21	
A. General Information	
Tool name and developer:	The Metabolism of Cities - Data Hub
Home page of tool (URL):	https://data.metabolismofcities.org/dashboards/
A summary description of the tool (Including the main objective and functionalities):	The Data Hub is a platform designed to facilitate the collection, processing, visualization, and analysis of data for urban circularity assessments. It serves as a central repository for various types of data, enabling cities to manage and analyze their information effectively.
Geographic coverage of the tool:	Worldwide
Target user group (Specify whether it is for biomass producers (farmers, foresters, waste managers), advisors, researchers, public agency, industry, lobby, other):	Public agencies, researchers, and city planners
Is the tool free of use / freely accessible / applicable?	Freely accessible and applicable
Portfolio of good practices / case studies or Standalone Tool:	Portfolio of good practices and case studies
Qualitative / Quantitative / Descripted data:	The tool supports both qualitative and quantitative data. It involves the collection and processing of various types of data, including geospatial data, material flow and stock data, demographic data, economic data, and biophysical information. The analysis section involves writing up data articles using visualizations and tools provided by the system, which can include descriptive data.
How many users have used the tool / Number of entries:	Not applicable
Categorization of the tool (Technological, Financial, Legislative, Evaluation tool):	Evaluation tool
B. Content of the tool	
1. Technological and technical aspects	
The tool supports both qualitative and quantitative data. It involves the collection and processing of various types of data, including geospatial data, material flow and stock data, demographic data, economic data, and	

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biophysical information. The analysis section involves writing up data articles using visualizations and tools provided by the system, which can include descriptive data.
2. Biomass considerations
The tool does not explicitly mention feedstock considerations. However, it emphasizes the importance of accurate data collection and processing to ensure reliable assessments of urban material flows and stocks.
3. Logistical factors
Logistics are addressed through the practical necessities for the application of the UCA method, such as the use of the Data Hub for data collection, processing, and visualization. This hub facilitates the management of data from multiple cities, ensuring efficient data handling and analysis
4. Policy and regulatory frameworks
Policy and regulatory frameworks are addressed in Layer 1: Urban Context of the Data Collection section. This layer involves identifying policies related to material stocks and flows within your territory, such as air pollution, mining, circularity, and water quality standards. The document highlights the role of policy and regulatory frameworks in supporting the adoption of the UCA method and mentions that the practical necessities for the application of the method, including the use of the Data Hub, will be shared during the facilitation of the method application for cities.
5. Financial-market conditions
Financial-market conditions are addressed in Layer 2: Sector Economic Activities of the Data Collection section. This layer focuses on specific economic information on the sector's activities, including value created (GDP, GVA), actors (companies), and employees. It involves gathering data on key local economic activities, including GDP and the number of people employed in key sectors, aiming for data covering at least three years.
6. Social acceptance factors
The tool does not explicitly address social acceptance factors. However, the emphasis on collaboration between various departments and the use of the Data Hub for community engagement suggests that social acceptance is considered important for the successful implementation of the UCA method.

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4.4. Results of Stage 3

In stage 3 the scoring of the 21 tools was conducted according to the scoring framework described in Stage 3. In Table 24 the scoring results of the 21 tools from the targeted inventory are presented. The average scores were resulting from the assessment of three independent evaluators from DREVEN GR. Analytical scoring results are provided in Annex I, including individual scores given by each evaluator for the performance of each tool across different aspects as described in Stage 3.

Table 24. The scoring results of the 21 tools from the targeted inventory

No.	Tool Name	Average final score
1	Best Practices Atlas	3.2
2	BioCircularCities webtool	4.1
3	ECESP - Good Practices	3.8
4	Innovation Watch	3.2
5	Pilot4U Open Access Data Base	3.8
6	S2BIOM Sustainable supply of non-food biomass	3.8
7	Tech4Biowaste database	3.7
8	Circular design toolkit	3.7
9	InnProBio-based Products Database	3.5
10	Knowledge center for bioeconomy	3.8
11	Bioeconomy Toolkit for Business	3.8
12	Bioeconomy Toolkit for Policy Makers	3.6
13	Bio-Circularity Label	HOOP tool – excluded
14	Circular Valuation Method	HOOP tool – excluded
15	Project Maturity Level	HOOP tool – excluded
16	ResCoM Circular Pathfinder	3.0
17	DECISIVE-Decision Support Tool (DST)	4.2
18	Circularity City	4.1

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No.	Tool Name	Average final score
19	The BSAT-Bioeconomy Strategy Accelerator Toolkit	4.4
20	GREEN ASSIST	3.0
21	The Metabolism of Cities – Data Hub	3.8

Table 24 indicates that all 21 tools (3 HOOP tools were excluded from scoring) achieved a score above 3.0, while 8 achieved a score between 3.5 – 4.0. Finally, 4 tools exceeded the score of 4.0 It should be highlighted that those 4 tools were included in the "Recommended list" along with the HOOP tools.

Shall the reader note that the three HOOP evaluation tools were included in this recommended list without scoring. This is not due to a biased evaluation process, but to the fact that these HOOP tools were designed to mitigate the weaknesses of already existing tools, and thus developed to become an improved version of available resources. Moreover, to maintain the objectivity of the evaluation process and avoid any conflict of interest, these tools were not included in the assessment.

Furthermore, the average scoring of the 4 best performing tools is presented in table 25.

Table 25. The scoring results of the 7 tools from the recommended list

No.	Tool Name	Average final score
1	Project Maturity Level	HOOP tool – excluded
2	Bio-Circularity Label	HOOP tool – excluded
3	Circular Valuation Method	HOOP tool – excluded
4	The BSAT-Bioeconomy Strategy Accelerator Toolkit	4.4
5	DECISIVE-Decision Support Tool (DST)	4.2
6	BioCircularCities webtool	4.1
7	Circularity City	4.1

Finally, the guidelines for the 7 recommended tools were prepared in the present stage. The guidelines provide detailed insights into the functionalities, user instructions, and practical applications of each selected tool, ensuring their effective utilization in advancing circular bioeconomy initiatives.

In the following chapter the guidelines for each recommended tool are presented.

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4.5. Guidelines

4.5.1. PROJECT MATURITY LEVEL TOOL

The Project Maturity Level (PML) Tool was developed in the framework of the HOOP Project and is available at https://hoop-hub.eu/project_maturity_level.html. It is a free evaluation tool designed to assess the maturity of Urban Circular BioEconomy (UCBE) projects. The tool's main objective is to help project developers, promoters, investors, public and private entities, cities, and regions evaluate and enhance the readiness of their projects for green financing and implementation. It is particularly relevant for those involved in the Urban Circular BioEconomy (UCBE) sector, such as biomass producers (farmers, foresters, waste managers), advisors, researchers, public agencies, industry, and lobby groups.

The tool provides a structured framework for assessing project maturity based on various criteria. The HOOP PML tool incorporates both qualitative and quantitative data. The method uses circular indicators specifically designed for circularity and biowaste, resulting in a reliable assessment across multiple domains. The resulting report can be used to attract investments by demonstrating the value of the examined project.

Requirements

The user may log in to save data entered in the tool. If not logged in, results will be displayed but cannot be saved or downloaded.

Registration is available for new users, with a new password or a Linkedin account.

4.5.1.1. How to Use the Project Maturity Level Tool

Using the Project Maturity Level (PML) Assessment Tool, the user can follow the steps below:

1. **Optional login**: Logging in allows the questionnaire to be saved automatically, but it is optional.
2. **Complete the questionnaire:** Answer the 43 questions across the six PML sections. Each question helps to assess specific aspects of your project's maturity.
3. **Track your progress:** As you fill out the questionnaire, your Project Maturity Level is calculated in real-time. Your data is saved automatically if you are logged in.
4. **Review and download results**: After completing the questionnaire, download a detailed PDF report. The report includes your overall maturity level, responses to the questions, and a graphical representation of your project's development stage.
5. **Enhance project value**: Use the report to showcase your project's maturity and readiness, helping to attract investments and demonstrate its potential to stakeholders.

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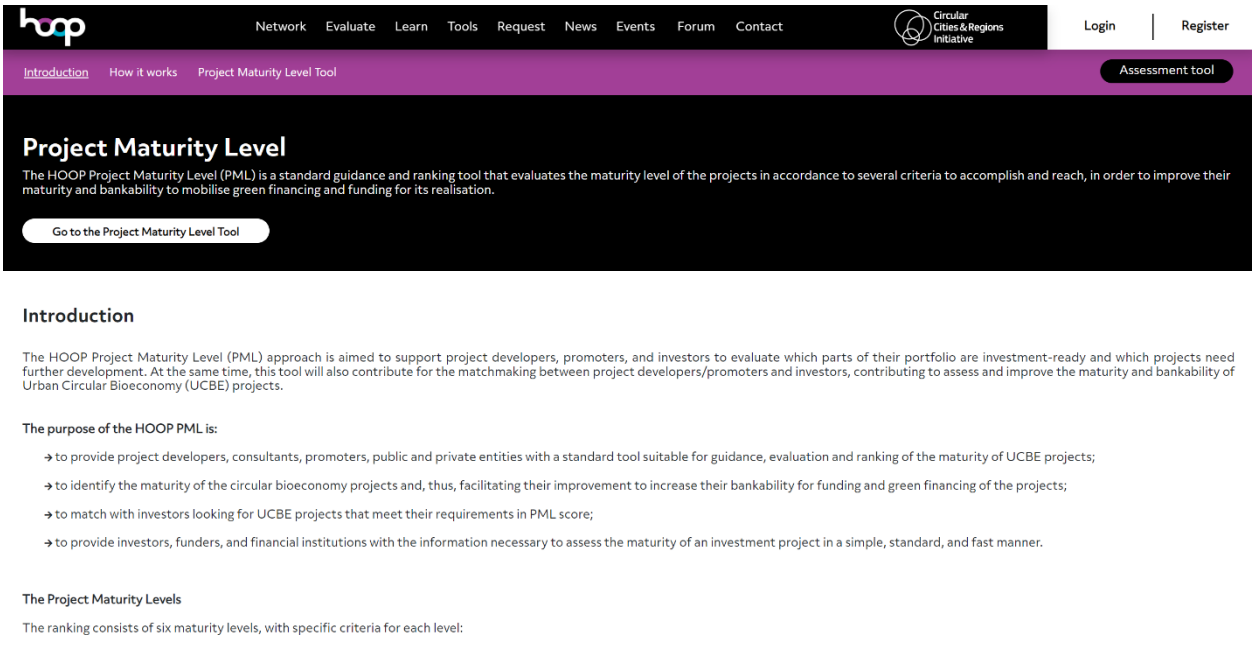
4.5.1.2. Project Maturity Level Tool Highlights

The homepage of this tool is illustrated in figure 2. The main section of this tool includes the following:

- **Introduction section:** A clear, concise explanation of the HOOP PML framework. Highlights the purpose of the tool, which is to help project developers, promoters, and investors assess project maturity and improve bankability for green financing.
- **Purpose of the HOOP PML:** Lists the objectives of the tool, including providing guidance for evaluating UCBE projects, facilitating matchmaking between developers and investors, and simplifying investor assessments.
- **Project Maturity Levels overview:** Brief descriptions of the six PML levels, from PML 1 (Potential project identified) to PML 6 (Investment offer or tendering requirements created).
- **Call to action:** A prominent button that directs users to the Project Maturity Level Tool, inviting them to start assessing their projects.

Figure 2. Homepage of PML tool, featuring an introduction to the HOOP PML framework, its purpose for improving project bankability, an overview of the six Project Maturity Levels, and a call-to-action button to start the assessment



As illustrated in Figure 3, the PML tool includes three key tabs:

- **Introduction:** Brief overview of the HOOP Project Maturity Level (PML), its purpose, and how it helps project developers and investors assess and improve the readiness of Urban Circular Bioeconomy (UCBE) projects.

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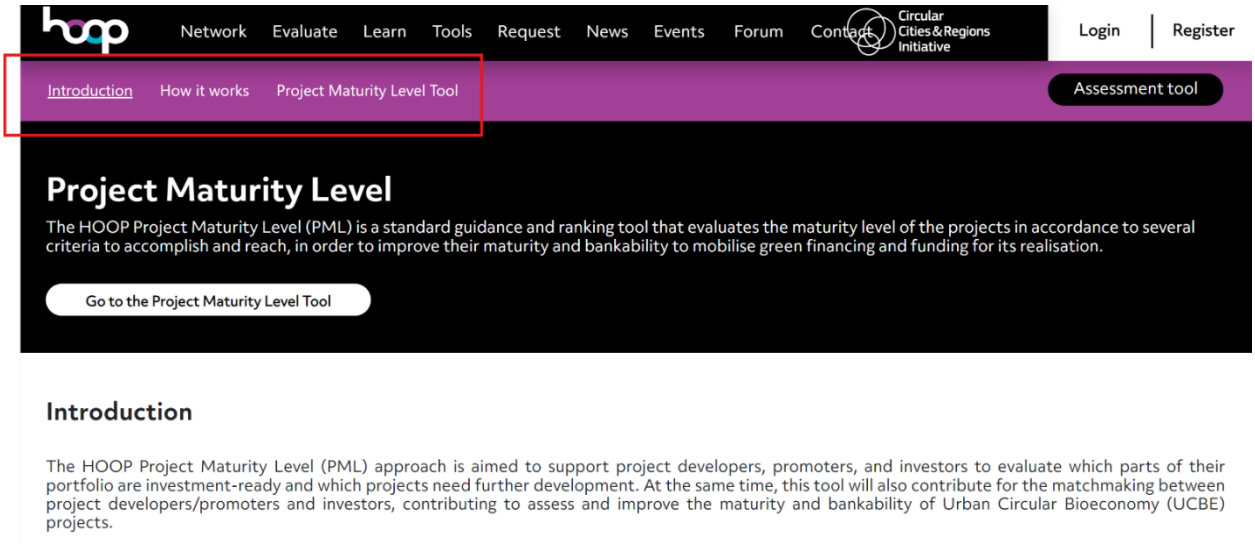
- **How It works:** Explains the PML approach, outlining the six maturity levels (PML 1 to PML 6), and detailing how projects progress through these stages to become investment ready.

- **Project Maturity Level Tool:** Interactive tool where users can evaluate the maturity of their projects based on PML criteria, receiving feedback on next steps to enhance project bankability and readiness for investment.

Figure 3. Tabs of the PML tool homepage, including Introduction, How it works and Project Maturity Level Tool



4.5.1.2.1. PROJECT MATURITY LEVEL TOOL

As illustrated in figure 4, Project Maturity Level Tool includes a questionnaire that consists in 43 questions, divided into six Project Maturity Levels (PMLs), with each PML section containing questions tailored to assess specific areas of your project:

- **PML 1 -** Concept development: Focuses on initial ideas, objectives, and stakeholder identification.

- **PML 2 -** Feasibility analysis: Assesses the technical, economic, and legal feasibility of the project.

- **PML 3 -** Design and planning: Evaluates the detailed project design, resource planning, and risk assessment.

- **PML 4 -** Execution: examines the implementation process, including resource allocation, progress monitoring, and quality control.

- **PML 5 -** Commissioning and handover: Looks at final testing, user training, and project handover procedures.

- **PML 6 -** Post-implementation review: assesses project outcomes, long-term impact, and lessons learned.

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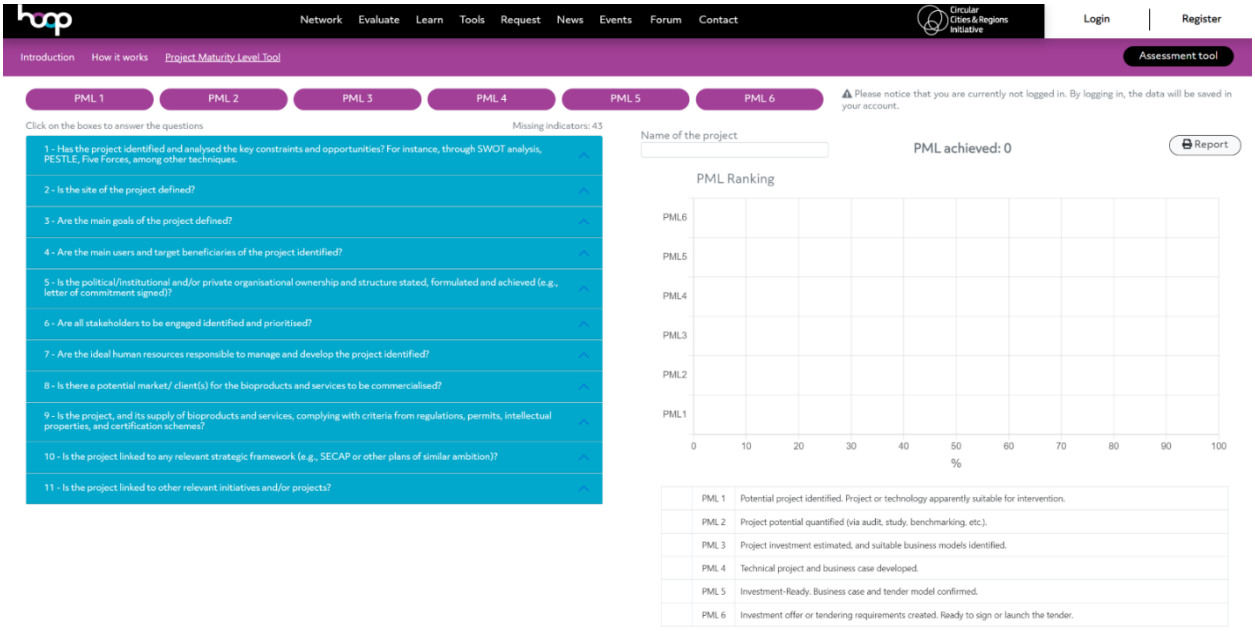
Figure 4. Project Maturity Level tool questionnaire with 43 questions across six PMLs, calculating maturity in real-time and providing a downloadable report



To view the questions of each PML, users need to click on the corresponding PML button (pink) on the top of the screen. For each PML level, users are prompted with questions like "Is the project linked to other relevant initiatives and/or projects?" and "Are the main goals of the project defined?". Each box opens up, upon clicked, for users to view the multi-choice options.

On the right side, a PML Ranking graph tracks the project's current level based on the percentage of completed indicators, helping users visualize their maturity progress. The "PML achieved" score tracks the percentage of completed indicators across the PML levels. On the same side, there is a project name field, where the users can input the name of their project for personalized tracking, and a report generation button, where the users can generate a report based on project assessment.

Note: The data is saved automatically if you are logged in. The Project Maturity Level is calculated in real-time as you answer each question. Upon completion, a report detailing your project's maturity level, the questions answered, and a corresponding graph can be printed and downloaded as a PDF.

4.5.2. BIO-CIRCULARITY LABEL TOOL

The HOOP Bio-Circularity Label was developed within the framework of the HOOP Project and is available at hoop-hub.eu/circularity_label.html. It is a free evaluation tool designed to support cities and regions in advancing their circular urban bioeconomy. The primary objective of the Label is to measure how effectively cities and regions are implementing circular measures, policies, and initiatives. By providing this measurement, the tool encourages investments in circular technologies, projects, and companies, thereby facilitating the production and use of biowaste-based products.

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The Bio-Circularity Label not only provides a status on the urban circular bioeconomy but also identifies areas for improvement in local bioeconomy efforts. It allows cities and regions to learn from real-life examples, stimulating further growth in the urban circular bioeconomy and demonstrating the impact of green policies. The assessment uses indicators related to urban bio-based waste streams, such as Organic Fraction Municipal Solid Waste (OFMSW) and Urban Wastewater Sludge (UWWS). The assessment evaluates 4 key areas, known as dimensions:

- **Policy:** Political ambitions, strategies and implemented policies
- **Society:** Participation, awareness and initiatives
- **Consumption & waste:** Including water and organic waste
- **Resource management:** Collection, reuse, recycling, distribution, use, etc.

Cities and regions with a high level of circular maturity are awarded the HOOP Bio-Circularity Label.

The Label employs a scoring system that assesses circularity performance across nine Circularity Levels (CL), with CL 5 representing the European average. Higher CLs indicate better performance. The Label's scoring and distribution offer a clear visual representation of a city or region's progress in circular bioeconomy initiatives.

Note: While anyone can use the tool, you must be logged in as a member of the HOOP Network of Cities and Regions to receive the Circularity Label.

Requirements

The user may log in to save data entered in the tool. If not logged in, results will be displayed but cannot be saved or downloaded.

4.5.2.1. How to Use the Bio-Circularity Label Tool

Using the Bio-Circularity Label Tool, the user can follow the steps below:

1. **Optional login:** Logging in allows the questionnaire to be saved automatically, but it is optional.
2. **Start with the questionnaire:** Begin by answering the questions to assess your city's policies, waste management practices, and societal initiatives.
3. **Review the outcome:** After completing the questionnaire, review your city's circularity score and if you are a member, you can receive a Bio-Circularity Label.
4. **Explore the interactive map:** Use the map to see how other cities and regions are performing in terms of circularity.
5. **Implement recommendations:** Finally, use the recommendations provided to plan and execute strategies for improving your city's bio-circularity.

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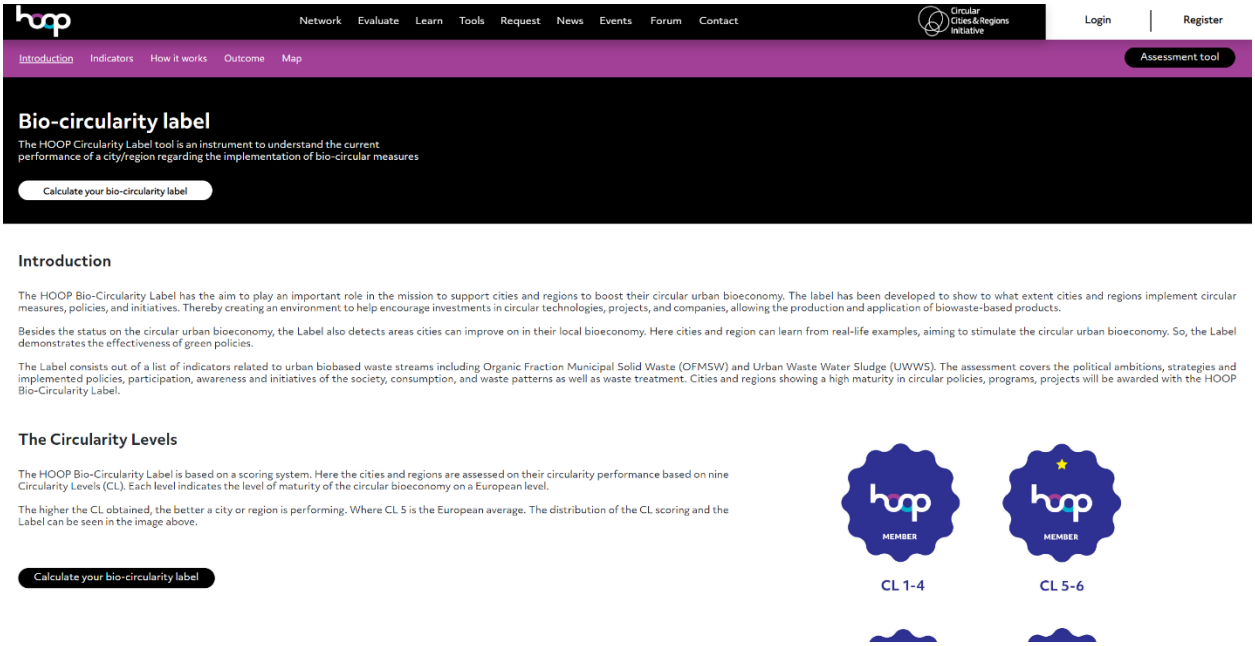
4.5.2.2. Bio-Circularity Label Tool Highlights

The homepage of the Bio-Circularity Label Tool, as illustrated in figure 5, is structured with the following key sections:

- **Introduction:** Overview of the tool's purpose in supporting cities and regions to boost their bio-circularity.
- **Circularity Levels:** Explanation of the nine levels of circularity performance.

A button is available to calculate your Bio-Circularity Label directly.

Figure 5. Homepage of Bio-Circularity Label Tool, featuring an introduction, explanation of the nine Circularity Levels, and a button to calculate the Bio-Circularity Label



As illustrated in figure 6, the Bio-Circularity Label tool includes the following key tabs:

- **Introduction:** *Overview of the tool's purpose, explaining its role in assessing and promoting bio-circularity within cities and regions by evaluating their waste management and recycling efforts.*
- **Indicators:** *Key performance metrics used in the evaluation, such as recycling rates, biowaste collection, water usage, and innovative bioproducts.*
- **How it works:** *Explains the process of data collection, scoring, and how the tool analyzes the input to generate the Bio-Circularity Label and corresponding reports.*

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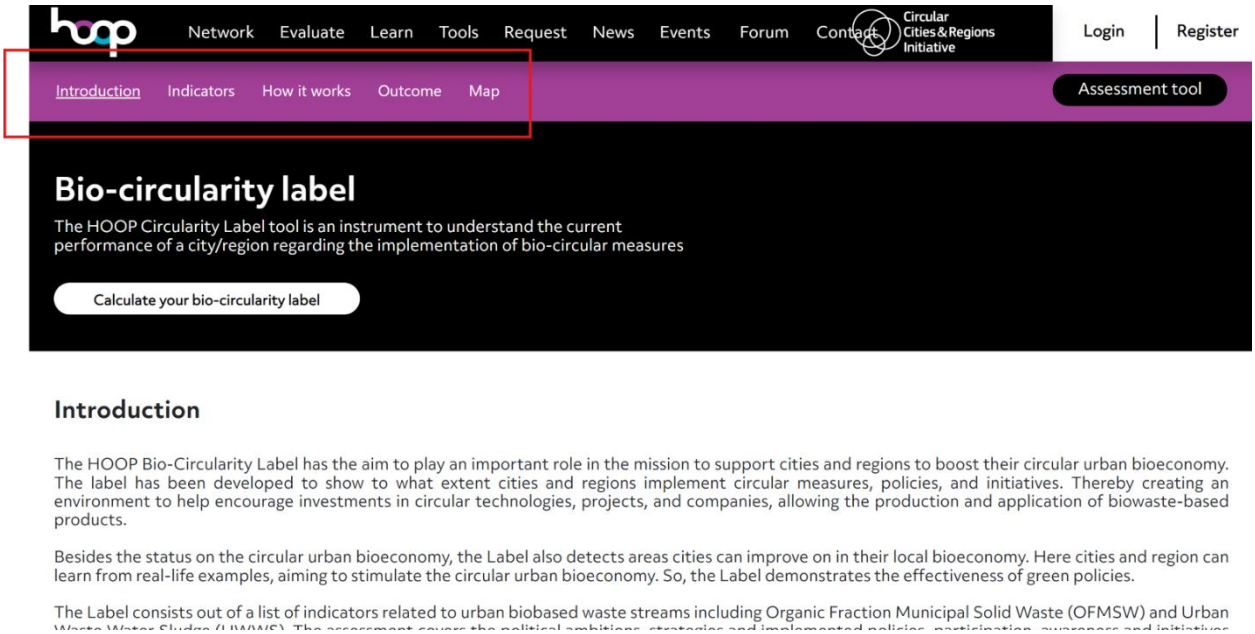
- **Outcome:** *Report displaying the results, based on Bio-Circularity Label's responses.*
- **Map:** *Visual overview of participating cities and regions, showing their circularity levels and relevant data.*

Figure 6. Homepage of Bio-Circularity Label Tool, featuring tabs for Introduction, Indicators, How it Works, Outcome and Map



The main function of the tool can be accessed from the Introduction tab, pressing the "Calculate your bio-circularity label" button. In the following section, a brief description of the calculations' content is presented.

4.5.2.2.1. BIO-CIRCULARITY LABEL

The Bio-Circularity Label tool is a questionnaire, as illustrated in figure 7. On the top there are the dimensions displayed as clickable buttons, on the left the detailed questions for each dimension and on the right the results.

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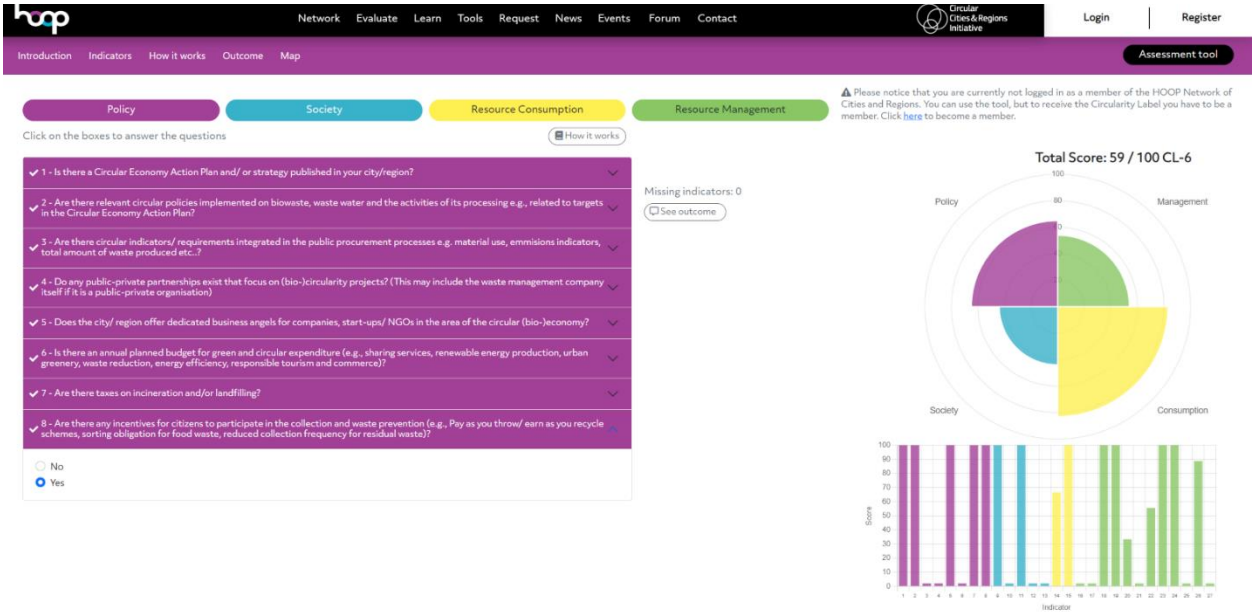
Figure 7. Bio-Circularity Label tool questionnaire with 27 questions divided into four dimensions (pink, blue, yellow and green buttons on the top)



It is designed to assess the circular bioeconomy performance of your city or region. Key details:

- Total questions: *27*
- Dimensions: The questions are categorized into the four dimensions (pink, blue, yellow and green buttons on the top)
- Question types: multiple choice and yes/no
- Time to complete approximately 60 minutes
- Saving progress: You can save your progress and return later
- Score & label: upon completion, you'll receive a score (max 100) and a Bio-Circularity Label, assuming your city is a member of the HOOP Network.
- Unavailable data: If specific data is unavailable, select "Data not available."

To view the questions of each dimension, users need to click on the corresponding dimension button (pink, blue, yellow and green) on the top of the screen.

4.5.2.2.2. OUTCOME

After completing the questionnaire, a report is generated that displays your city or region's performance across the four dimensions, as illustrated in figure 8. The report includes the following elements:

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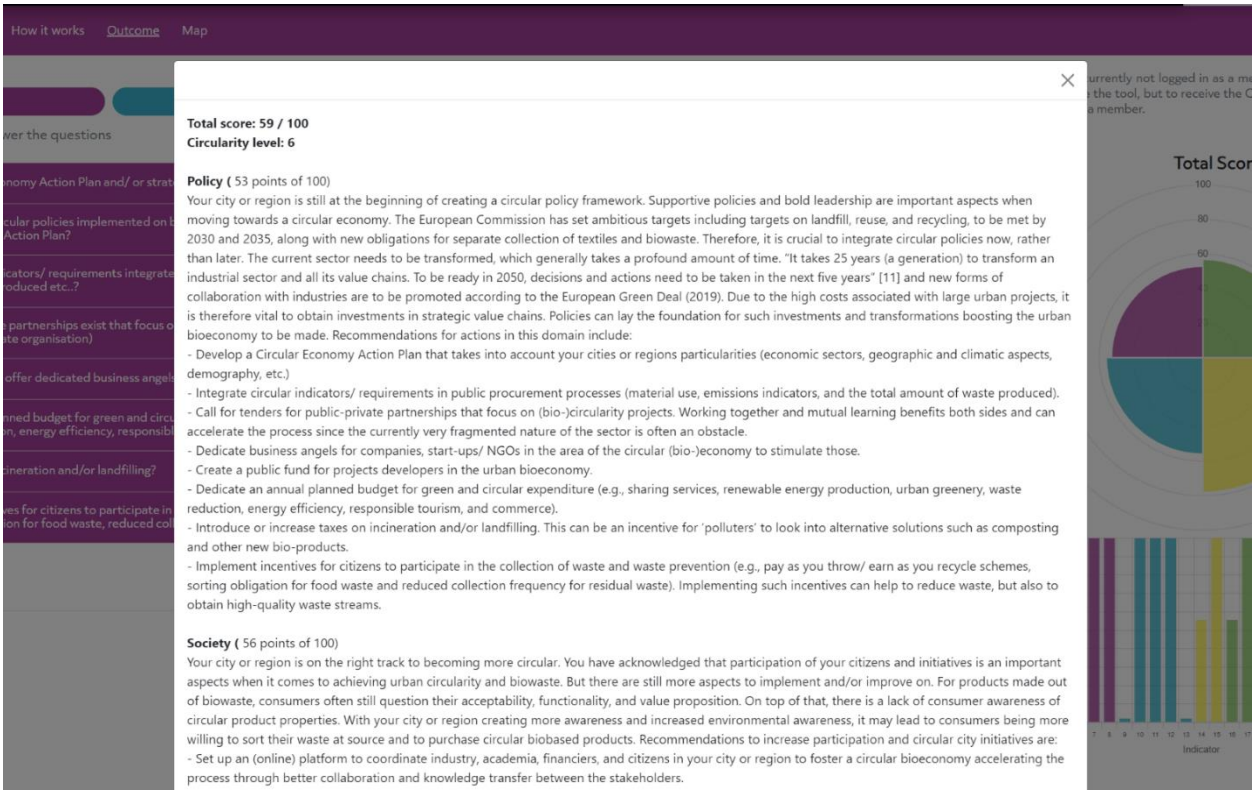
- **Scoring:** Displays the overall circularity level, with a detailed breakdown for each dimension.
- **Label assignment:** Based on the score, a Bio-Circularity Label is provided.
- **Recommendations:** Offers suggestions for improvement and identifies investment opportunities.

Figure 8. Outcome tab of Bio-Circularity Label tool, displaying overall circularity scores, a Bio-Circularity Label, and improvement recommendations



The feedback highlights your city or region's strengths and areas for improvement, providing actionable recommendations to enhance circular economy practices. These might include integrating circular policies, fostering public-private partnerships, and improving waste management and citizen engagement strategies.

Note: While anyone can use the tool, you must be logged in as a member of the HOOP Network of Cities and Regions to receive the Circularity Label.

4.5.2.2.3. MAP

The Bio-Circularity Label Tool includes a map, as illustrated in figure 9, that highlights various cities and regions involved in the initiative. This map uses indicators to mark these locations and includes the following features:

- **Lighthouse Cities and Regions:** Key cities or regions pioneering circular bioeconomy practices. Lighthouses are cities and regions participating in the HOOP project.

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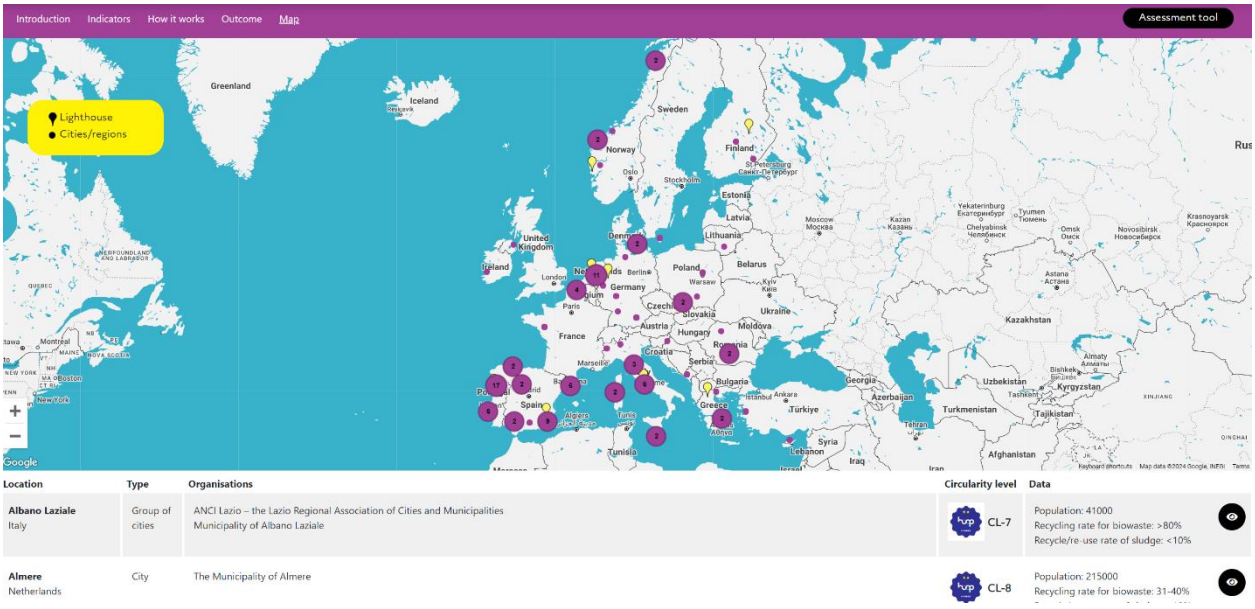
- **Cities/Regions:** Additional locations participating voluntarily in the program.

Figure 9. Map of the Bio-Circularity Label tool, highlighting Lighthouse Cities and Regions and other participating locations, with details on organization type, circularity level, population, and recycling rates



For each location, the map provides details such as the type of organization, circularity level, population, and recycling rates. This visual overview helps users track participation and progress across different areas.

Additionally, this map is interactive, allowing users to click on different regions or cities to view the following additional information, as displayed in figure 10:

- Incentives for citizen participation in biowaste collection/prevention [yes/no]
- Quantity of household water use supply per capita per year (m³/capita)
- Total OFMSW (Organic Fraction of Municipal Solid Waste) produced per capita (kg/capita)
- Recycle/re-use rate of sludge (%)
- Share of recycled biowaste (%)
- Share of households serviced by biowaste collection (%)
- Share of biowaste separately collected (%)
- Innovative bioproducts generated from organic materials [yes/no]

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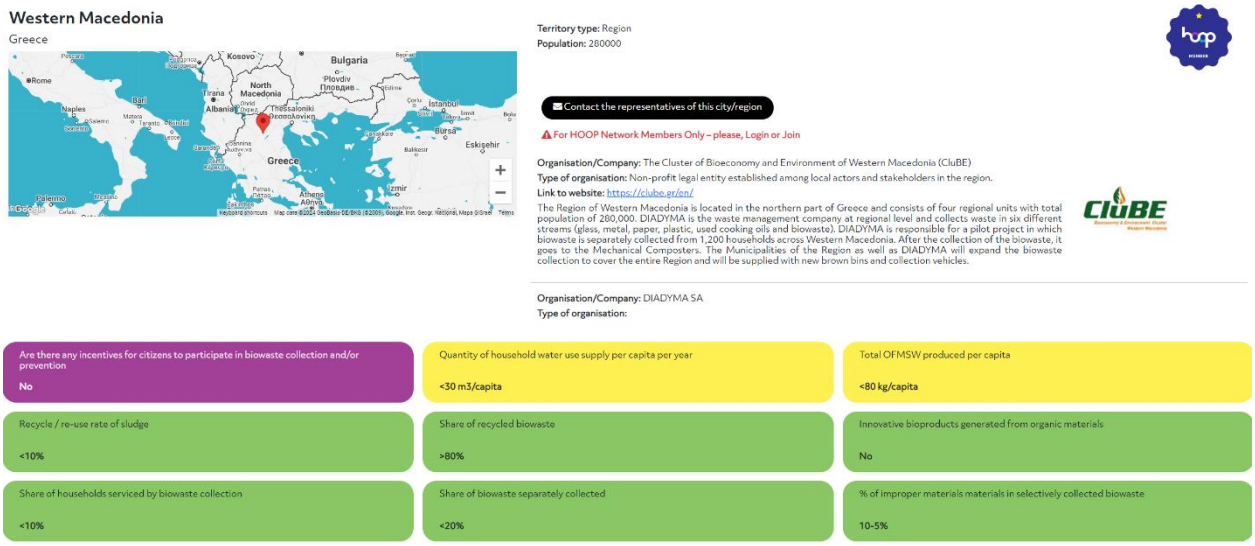
- Percentage of improper materials in separately collected biowaste (%)

Figure 10. Interactive map of the Bio-Circularity Label tool, showing additional information for each region or city, including incentives for biowaste participation, water use, OFMSW production, recycling rates, and innovative bioproducts



4.5.3. CIRCULAR VALUATION METHOD TOOL

The Circular Valuation Method Tool was developed in the framework of the HOOP Project and is available at hoop-hub.eu/circular_valuation.html. It is a free evaluation tool whose main objective is to help the user to assess the financial viability and sustainability of a circular bioeconomy project. The tool is aimed at investors as well as solution providers (companies, NGOs, cooperatives, privates), municipalities and public agencies. It provides a comprehensive tool for the user to evaluate the financial attractiveness of a circular bioeconomy project.

The Project Maturity Level (PML) tool is designed to promote investment in urban circular bioeconomy projects. It uses a standardized set of criteria to assess the project's maturity, enhancing its attractiveness for funding and successful implementation.

Requirements

The user may log in to save data entered in the tool. If not logged in, results will be displayed but cannot be saved or downloaded.

4.5.3.1. How to Use the Circular Valuation Method Tool

Using the Circular Valuation Method Tool, the user can follow the steps below:

1. **Optional login:** Logging in allows the questionnaire to be saved automatically, but it is optional.

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2. **Complete the questionnaire:** Answer the 25 questions that assess both qualitative and quantitative indicators. This process takes about 90 minutes.

3. **Review results:** Once completed, download the PDF overview to evaluate the circular potential of your project.

4. **Boost investments:** Use the report to attract investments by demonstrating the value of your project.

4.5.3.2. Circular Valuation Method Tool Highlights

The homepage of this tool is illustrated in figure 11. The main section of the tool is structured into several key sections:

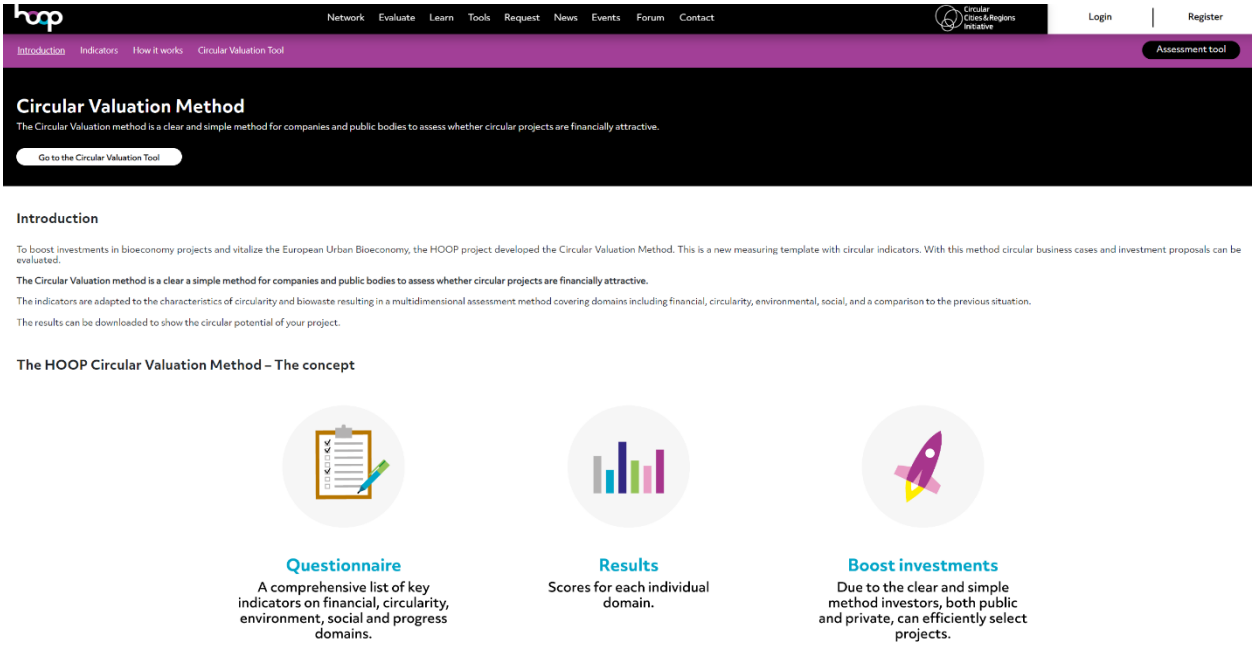
- **Introduction:** An overview of the tool's purpose, explaining its use in assessing the financial attractiveness of circular projects.

- **Concept overview:** Featuring three main components—questionnaire, results, and boosting investments.

- **Domains:** The five domains—financial, circularity, environment, social, and progress—cover a broad scope. They include both quantitative and qualitative indicators that assess various aspects of circular business models, environmental impact, and social factors.

This design provides a clear, user-friendly structure for understanding and accessing the valuation tool.

Figure 11. Homepage of Circular Valuation Method Tool, featuring introduction, concept overview and domains



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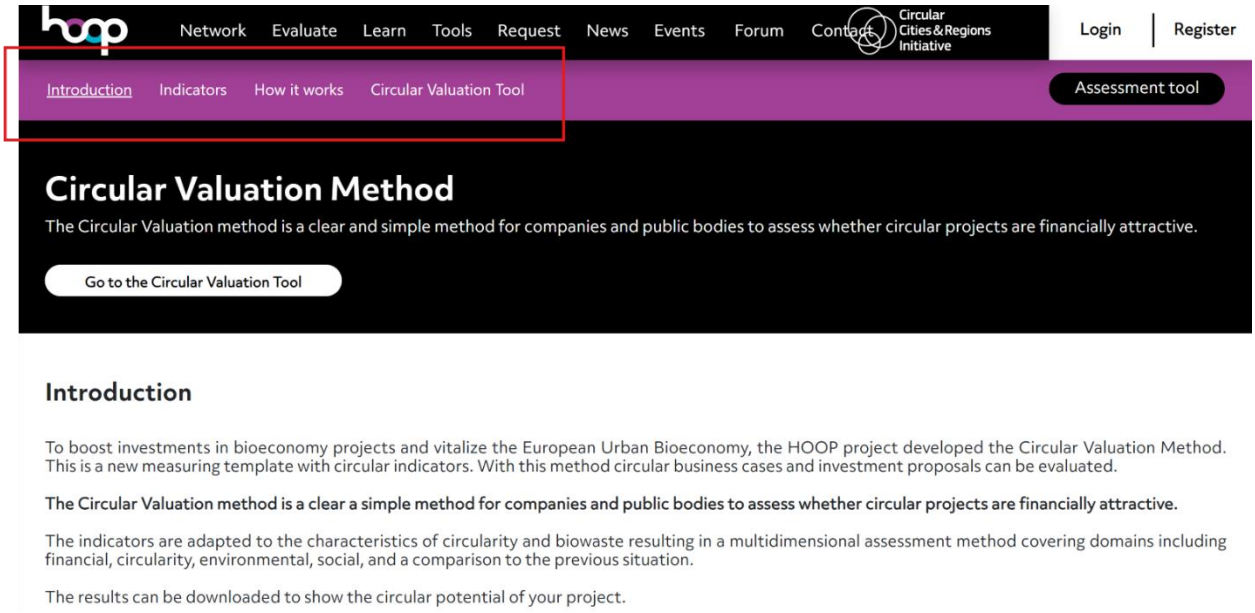
As illustrated in figure 12, the Circular Valuation Method tool includes four key tabs:

- **Introduction:** Overview of the tool's purpose for evaluating circular bioeconomy projects.
- **Indicators:** Lists key indicators across financial, circularity, environmental, and social domains.
- **How it works:** Describes the process, with 25 questions assessing both qualitative and quantitative indicators.
- **Circular Valuation Tool:** Provides access to the tool for performing project evaluations.

Figure 12. Homepage of Circular Valuation Method Tool, featuring tabs for Introduction, Indicators, How it works and Circular Valuation Tool



4.5.3.2.1. CIRCULAR VALUATION TOOL

This tool includes a questionnaire, as illustrated in figure 13, designed to take around 90 minutes to complete. It includes 25 multiple-choice and yes/no questions that assess both qualitative and quantitative indicators across the following four domains:

- **Circularity:** Focuses on aspects like waste processing, recyclability, and the use of virgin materials.
- **Environment:** Assesses factors such as water usage, energy consumption, and CO_2 reduction.
- **Social:** Examines relationships with local communities, labor standards, and human rights.
- **Progress:** Evaluates the potential for innovation, competition, and collaboration within the market.

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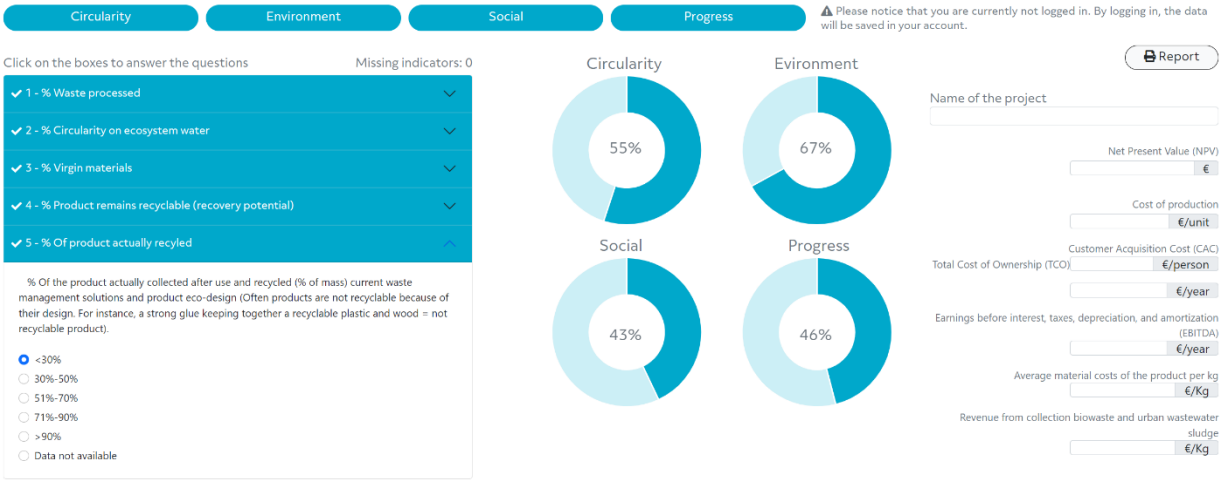
Figure 13. Circular Valuation tool questionnaire with 25 questions divided into four domains (blue buttons on the top)



To view the questions of each domain, users need to click on the corresponding domain button (blue) on the top of the screen.

The responses are automatically saved if the user is logged in. Once completed, users can download a PDF overview of the results, which can help demonstrate the value of their project and attract investments.

4.5.4. BSAT - BIOECONOMY STRATEGY ACCELERATOR TOOLKIT

The Bioeconomy Strategy Accelerator Toolkit (BSAT) was developed as part of the POWER4BIO project, funded by the European Union's Horizon 2020 research and innovation program, and is available at bioeconomy-strategy-toolkit.eu. It is a free evaluation tool designed to assist decision-makers in developing or updating regional bioeconomy strategies. The BSAT is aimed at empowering regional stakeholders to facilitate the transition towards bioeconomy regions in Europe by offering tools, instruments, and comprehensive guidance.

The toolkit is structured into several phases, including assessing regional bioeconomy potential, engaging stakeholders, creating strategies, and defining a roadmap for bioeconomy development. Each phase is equipped with templates, questionnaires, and guidelines to assist users throughout the process. By providing a comprehensive framework for stakeholder involvement and strategy development, the BSAT enhances collaboration and helps regions attract investments, facilitating the transition to a circular bioeconomy. The BSAT also emphasizes the importance of stakeholder involvement and offers best practices and case studies to ensure a well-rounded approach. The glossary for tool is found in Table 30 in Annex II.

4.5.4.1. How to Use Bioeconomy Strategy Accelerator Toolkit

Using the BSAT Tool, the user can follow the steps below:

1. **Choose a path:** Select either to develop a new bioeconomy strategy or update an existing one.

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2. **Assess regional bioeconomy potential:** Collect regional data (resources, industries, etc.), use templates to perform a SWOT analysis and create a report on your region's bioeconomy potential.

3. **Engage stakeholders & develop a shared vision:** Identify and map key stakeholders, organize workshops and gather stakeholder input and produce a report outlining a shared bioeconomy vision.

4. **Develop or revise the bioeconomy strategy:** Review existing strategies or create a new draft, incorporate findings from the SWOT analysis and stakeholder feedback and finalize the strategy after stakeholder consultations.

5. **Define roadmap & implementation plan:** Set key priorities and conduct financial and regulatory assessments, engage stakeholders to define action plans and develop a detailed roadmap with timelines and responsibilities.

6. **Monitor progress:** Regularly evaluate the implementation and update the strategy as needed.

4.5.4.2. Bioeconomy Strategy Accelerator Toolkit Highlights

The homepage of this tool is illustrated in figure 14. It contains a brief overview of the toolkit's purpose and scope on the top and a Get Started section (figure 15) on the bottom, featuring the main functionalities of the tool, which are the following:

- **Develop a new bioeconomy strategy:** Methodology to set up new bioeconomy strategies for regions without a bioeconomy strategy.

- **Update an existing bioeconomy strategy:** Methodology to update the existing bioeconomy strategies for regions with existing bioeconomy strategy and/or roadmap.

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Figure 14. Homepage of BSAT, offering tools to develop or update regional bioeconomy strategies with practical guidelines and resources

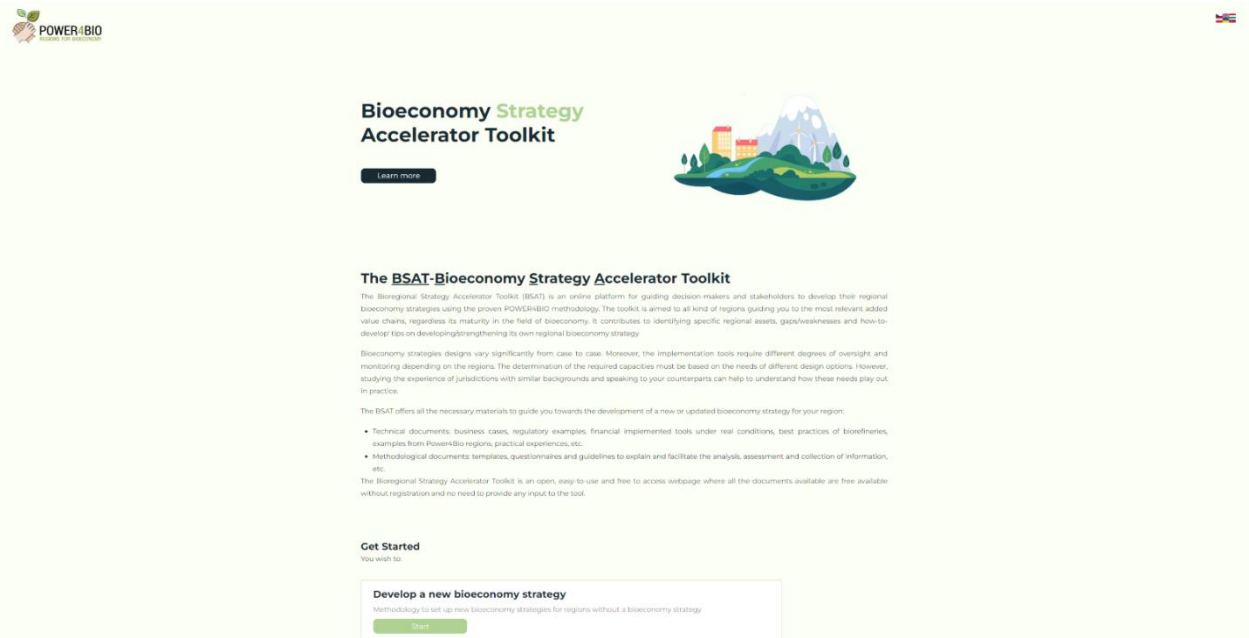
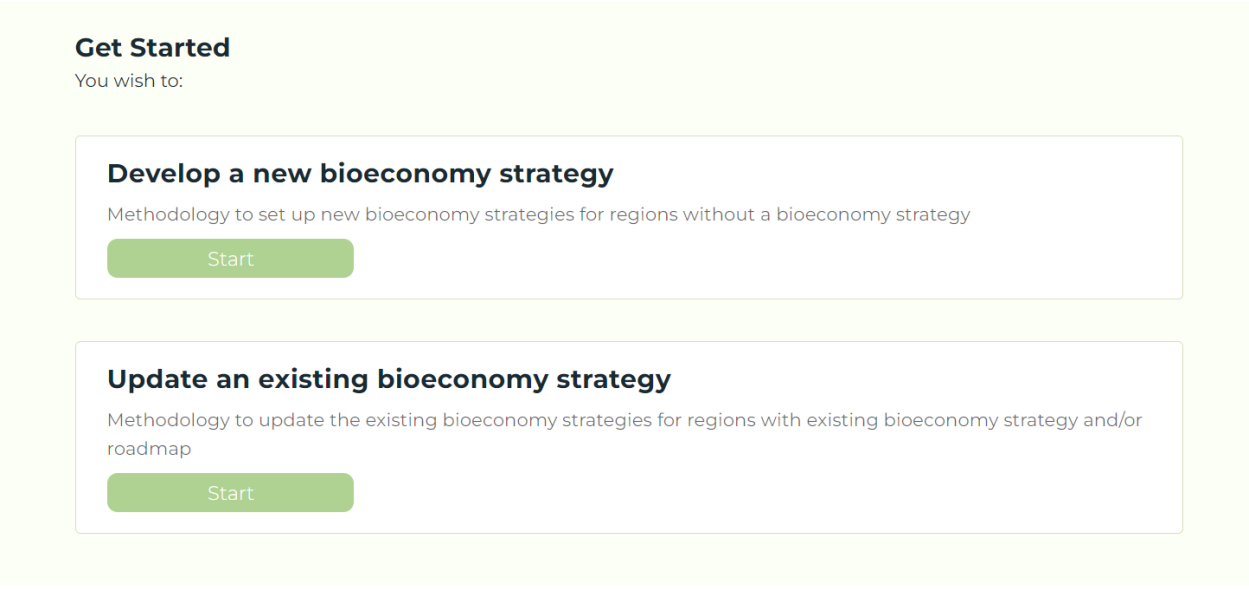


Figure 15. Get Started section of BSAT



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These functionalities are divided into 4 phases: Assessment of Regional Bioeconomy Potential and Status Quo, Involvement of Stakeholders and Development of a Shared Vision, Development or Revision of Bioeconomy Strategy, Roadmap Definition and Implementation Plan. In the following paragraphs a brief description of each phase is provided.

4.5.4.2.1. ASSESSMENT OF REGIONAL BIOECONOMY POTENTIAL AND STATUS QUO

The objective is to characterize the region's bioeconomy potential by analyzing technical, economic, and social factors and completing a SWOT analysis.

Recommended steps:

1. Collect regional data: On availability of natural resources (biomass, agriculture, forestry, waste streams), existing bioeconomy technologies, infrastructure, and innovation capacity, regional bio-based industries, market potential, and investment climate and public perception of bio-based products and services, job creation, education, and skill levels.

2. Use analysis tools: Use technical templates to assess regional assets and gaps, apply questionnaires to engage relevant experts and perform a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) based on the data collected.

Following the recommended steps and using the material provided by the tool, the user will be able to produce a SWOT analysis report that identifies bioeconomy potential, challenges, and opportunities. This report will serve as input for stakeholder engagement in Phase 2.

4.5.4.2.2. INVOLVEMENT OF STAKEHOLDERS AND DEVELOPMENT OF A SHARED VISION

The objective is to create a common bioeconomy vision by engaging key stakeholders in the region and establishing a Regional Bioeconomy Hub (RBH).

Recommended Steps:

1. **Identify and analyze stakeholders:** Identify stakeholders from the Quadruple Helix model (industry, academia, policy makers, and civil society). Use stakeholder mapping templates to categorize and analyze the influence and interest of different groups.

2. **Engage stakeholders:** Organize participatory workshops and consultations to gather input. Use guidelines and questionnaires to engage stakeholders in discussions about bioeconomy opportunities, challenges, and priorities.

3. **Develop shared vision**: Facilitate consensus-building discussions to define a common bioeconomy vision for the region. Prioritize key action fields (e.g., bioenergy, biochemicals, bio-based materials).

Following the recommended steps and using the material provided by the tool, the user will be able to engage stakeholders and produce a report documenting the shared bioeconomy vision. This report will serve as the foundation for prioritizing action fields and further strategy development in Phase 3.

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4.5.4.2.3. DEVELOPMENT OR REVISION OF BIOECONOMY STRATEGY

The objective is to develop a regional bioeconomy strategy based on Phase 1 analysis and Phase 2 stakeholder input.

Recommended steps:

1. **Review existing strategies:** Analyze existing bioeconomy strategies in the region (if available) and identify gaps or areas for revision. Use comparison templates to benchmark against bioeconomy strategies from other regions.

2. **Draft strategy:** Incorporate findings from the SWOT analysis, stakeholder feedback, and regional priorities into the strategy. Ensure the strategy addresses critical areas: resource management, innovation, investment, regulatory environment, and public awareness. Utilize best practices and case studies from other regions as models.

3. **Consult:** Share the draft strategy with stakeholders and conduct a series of consultations. Collect feedback and refine the strategy accordingly.

Following the recommended steps and using the material provided by the tool, the user will be able to develop or revise a bioeconomy strategy document. This document will outline the strategic objectives and actions needed to advance the regional bioeconomy.

4.5.4.2.4. ASSESS ROADMAP DEFINITION AND IMPLEMENTATION PLAN

To develop a detailed roadmap that operationalizes the regional bioeconomy strategy.

Recommended steps:

1. **Define key priorities:** Identify the priority areas from the bioeconomy strategy that require immediate attention (e.g., innovation funding, regulatory reforms, stakeholder engagement).

2. **Analyze financial and regulatory frameworks:** Conduct a financial assessment to determine available resources and potential funding sources (e.g., public funding, private investment, EU programs). Review the regional and national regulatory environment to ensure compliance and identify opportunities for policy support.

3. **Engage stakeholders:** Continue engaging stakeholders, particularly those involved in the strategy's priority areas. Organize workshops to develop action plans for each priority, including specific tasks, timelines, and responsibilities.

4. **Draft the implementation plan:** Create a detailed roadmap with step-by-step actions, responsible entities, timelines, and performance indicators. Ensure the roadmap is flexible enough to adapt to new opportunities or challenges.

5. **Monitor and evaluate:** Set up mechanisms for regular monitoring and evaluation of the strategy's implementation. Use performance indicators to assess progress and make adjustments as needed.

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Following the recommended steps and using the material provided by the tool, the user will be able to produce a detailed roadmap and implementation plan. This document will outline the key actions, timelines, resources, and monitoring mechanisms necessary for implementing the regional bioeconomy strategy.

4.5.5. DECISIVE - DECISION SUPPORT TOOL (DST)

The DECISIVE Decision Support Tool (DST) was developed within the framework of the DECISIVE Project and is available at dst.decisive2020.eu. It is a free evaluation tool designed to enhance biowaste management by providing a comprehensive assessment of different management options. The tool's main objective is to evaluate the performance of centralized and decentralized biowaste management systems, using environmental, economic, social, and regulatory criteria. The tool offers detailed inventories and assessment guidelines, enabling competent authorities, consulting firms, and waste operators to make informed decisions that improve the sustainability and efficiency of biowaste management practices.

The DECISIVE Decision Support Tool (DST) is designed to encourage sustainable investments in waste management systems and improve biowaste management across Europe. By using environmental, economic, and regulatory indicators, the tool provides a reliable and in-depth assessment of various biowaste management options. The resulting report demonstrates the efficiency and sustainability of the evaluated waste management systems, making it easier for authorities and operators to secure investments for implementing optimized solutions.

Requirements

Ensure you have an account:

1. New users must create an account.
2. Existing users can log in with their credentials. If needed, retrieve your credentials via the "Forgot Password" option.

The glossary for the tool is found in Table 29 in Annex II.

4.5.5.1. How to use DECISIVE Decision Support tool (DST)

Using the DST Tool:

1. **Create a new project**: Click "Create New Project," name it, and select either Basic Mode (no spatial data) or GIS Mode (spatially accurate).
2. **Define study zone**: Define the geographical area for biowaste assessment by manually adding sources in Basic Mode or drawing the area on a map using the polygon tool in GIS Mode.
3. **Define waste management zones (WMZ)**: Group sources into zones for different waste management processes.

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4. **Set up scenarios**: Define waste management processes for each stage (e.g., collection, treatment, disposal) using the Waste process database.

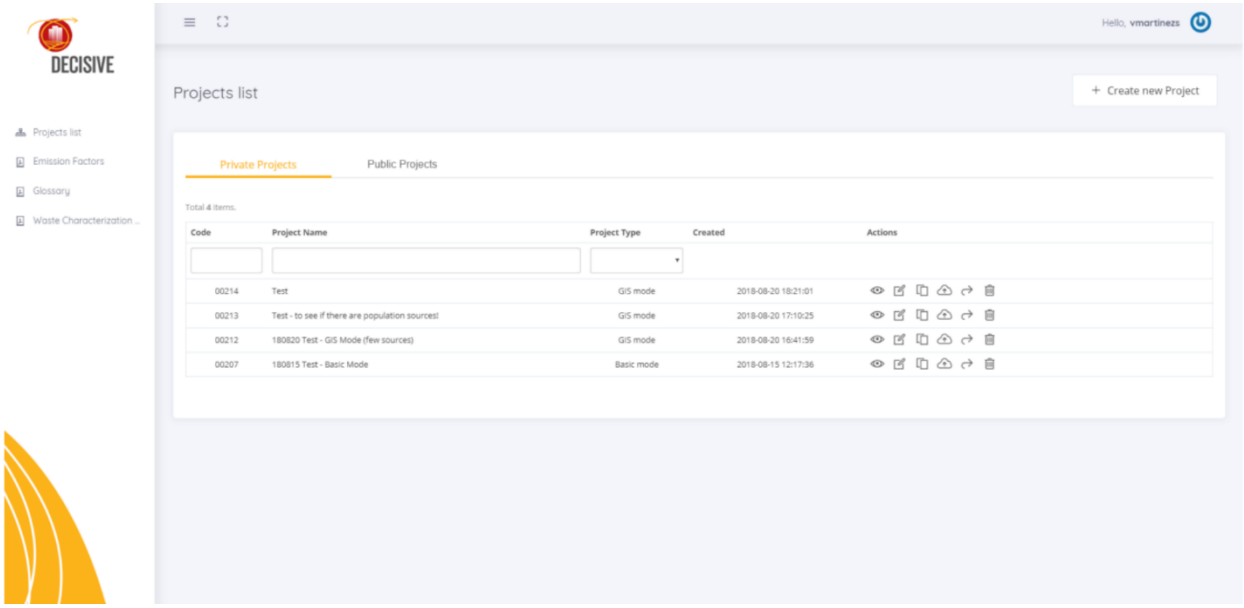
5. **Input or Calculate distances**: Manually enter distances in Basic Mode, while in GIS Mode, the tool automatically calculates distances based on spatial data.

6. **View results**: Analyze environmental, economic, and social impacts in summary or download them as an Excel file.

4.5.5.2. DECISIVE Decision Support Tool (DST) Highlights

Its homepage, as illustrated in figure 16, is structured into three main sections: a menu on the left, including the Projects list, Glossary, Emission factors, Waste characterization properties, and Waste process documentation, a Project list at the center, including private and public projects, and an option to Create new project in the top-right corner.

Figure 16. Homepage of DECISIVE DST, structured with a left-side Menu, a central Project list, and a "Create new project" option in the top-right corner



4.5.5.2.1. CREATING NEW PROJECT

From the homepage, select **Create new project** at the top right corner of the screen. **Name your project** and choose **either Basic or GIS mode**, both illustrated in figure 17:

- ✓ **Basic mode:** General use without precise spatial data.

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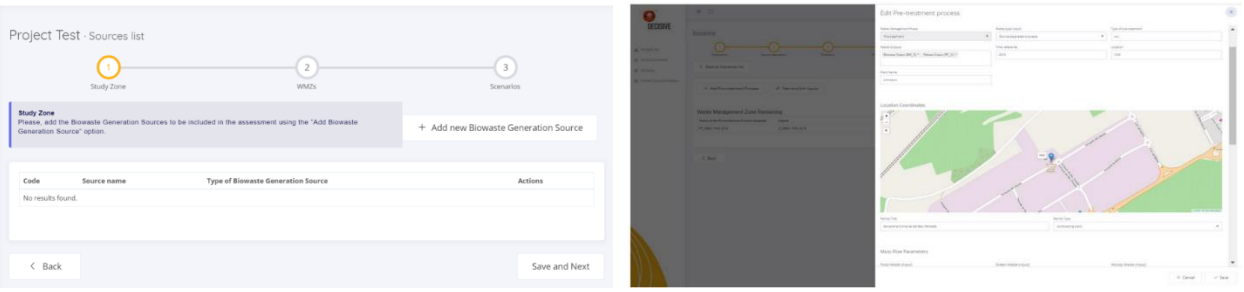
- ✓ **GIS mode:** Ideal when spatial accuracy is crucial; leverages real-world locations for waste sources and facilities.

Figure 17. Basic (left) and GIS mode (right) – Working procedures of DECISIVE DST



Both modes include the following 5 steps: **Study zone definition**, **Waste management zone definition**, **Scenario definition**, **Average distance introduction,** and **Assessment results**. In the following paragraphs a brief description of each step is provided.

Study zone definition

Define the geographical area for your assessment by adding biowaste generation sources (e.g., households, restaurants) in Basic mode:

- **Add biowaste generation sources:** Select Add biowaste generation source from the top-right corner. Create a new source or copy one from the Biowaste generation source database.
- **Input source details:** Enter the name, type (e.g., households, restaurants), amount (e.g., 100 households), and unit (e.g., inhabitants).
- **Assign generation processes:** Define the amount of biowaste generated and its composition for each source.

Or drawing a polygon on a map in GIS mode:

- **Draw study zone:** Use the polygon tool to define the geographic boundaries of your study zone on the map.
- **Link data**: The tool will link your polygon to the Source Inventory (GIS), displaying biowaste generation sources from OpenStreetMap and GHS population grid datasets.
- **Adjust scope**: If the polygon contains too many sources, reduce the area for smoother data handling.

  Tip: In GIS mode, keep study zones small if dealing with large datasets for smoother tool operation.

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Waste management zone definition

Group biowaste sources into WMZs, where waste is handled similarly (e.g., composting or centralized treatment). In Basic mode:

- **Assign sources to WMZs:** Group biowaste generation sources into Waste Management Zones, where waste is handled in similar ways (e.g., home composting, centralized treatment).

In GIS mode, WMZs are geographically defined:

- **Create WMZs:** Draw subzones within the study zone to define areas with different waste management practices. If overlapping WMZs are created, the tool assigns the source to the first-defined WMZ.

Scenario definition

Specify the waste management processes (generation, collection, treatment, etc.) for each WMZ. Choose processes from the Waste Process Database or create new ones if necessary.

- **Add scenario:** Select Add Scenario from the project menu and name the scenario. The tool will assign a code to it.
- **Define waste processes:** Choose processes for each stage of the biowaste management system from the Waste Process Database. These stages include:
    - Generation
    - Source separation
    - Collection
    - Pre-treatment
    - Treatment
    - Transportation
    - Final disposal
    - Bio-based product use
- **Custom processes:** If a required waste process does not exist in the database, create a new one.

In GIS mode assign geographical coordinates for each process using the Facility Spatial Inventory (includes facilities like landfills, recycling plants, etc.).

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Average distance introduction

Input or calculate distances for collection and transportation. In Basic mode, enter distances manually:

- **Manual input:** Enter the average distances for collection and transportation stages in kilometers.

While GIS mode automatically calculates them based on spatial data:

- **Automatic calculation**: The tool calculates distances based on the spatial locations of biowaste sources and facilities. Choose between collection from each source directly to a facility and waste is collected from source to source, then transported to a facility.

- **Manual adjustments**: Optionally modify calculated distances.

Assessment results

The tool calculates the biowaste mass flow and provides assessment results, including environmental, economic, and social impacts. Results can be viewed in a summary, radar diagram, or downloaded as an Excel file.

- **Scenario Mass flow**: After defining the scenario and distances, the tool calculates the mass flow of biowaste, including nutrients and impurities.

- **Scenario Assessment results:** View assessment indicators (e.g., Climate Change impact, Economic Costs, Labor, etc.) via overview of scenario setup, visual representation of assessment criteria and detailed scenario data with mass flows and assessment results.

4.5.6. BIOCIRCULARCITIES TOOL

The BioCircularCities Webtool was developed to support the identification of suitable bio-circular technologies for enhancing organic waste management and is available at bcc.list.lu. This free technological tool helps users assess the most convenient technological pathways for waste biomass valorization based on local political, socio-economic contexts, and sustainability targets. The tool is intended to guide users toward potential bio-circular solutions, providing initial insights rather than a fully detailed business plan. While it offers broad applicability, it may not account for specific restrictions or regulations in particular regions.

The BioCircularCities Webtool is designed to improve decision-making in bio-circular waste management by evaluating the suitability of various technologies. It considers local political and socio-economic drivers and barriers, offering users a first look at potential technological pathways for waste biomass valorization. This tool aims to help stakeholders identify technologies that fit their specific regional context, paving the way for enhanced circular bioeconomy practices.

While it does not provide detailed business plans or specific regulations, the tool equips policymakers, researchers, and local authorities with essential insights to make informed decisions and attract investment in sustainable, bio-circular technologies.

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4.5.6.1. How to Use the BioCircularCities Tool

Using the BCC Tool, the user can follow the steps below:

1. **Characterize biomass**: Assess the types, purity, availability of organic waste, and evaluate existing waste management practices and challenges.
2. **Define end products**: Define the desired end products (e.g., biofuels, compost) and assess their market readiness and competitiveness.
3. **Evaluate environmental performance**: Establish goals for reducing emissions and resource use, while evaluating the positive and negative environmental impacts of potential technologies.
4. **Identify political and economic incentives**: Explore relevant policies, cost-benefit analysis, and funding opportunities.
5. **Review results**: Review the listed technologies and their scores and click the "More Info" button for further details on each technology.
6. **Export/save results**: Export the results for further analysis.

4.5.6.2. BioCircularCities Tool Highlights

The homepage of this tool is illustrated in figure 18. It contains a header which has buttons for loading saved responses and exporting completed answers. The main content area includes the context, the purpose of the tool and how it works. Each section in the main area includes a “More Information” button for additional details.

The left side of the page includes the following, as illustrated in figure 19:

- **Home:** Navigate back to homepage.
- **Step 1: Characterization of available feedstock and current existing organic waste management system:** Assess the types, purity, and availability of organic waste and evaluate the existing waste management practices to understand the context and challenges.
- **Step 2: Type of end product targeted:** Define the desired end products, their market readiness, social acceptance, and competitiveness, focusing on high, medium, or low economic value outputs.
- **Step 3: Environmental performances:** Set objectives for environmental performance, including emissions reduction and resource efficiency, and assess the positive and negative impacts of potential technologies.
- **Step 4: Other political and economic incentives:** Identify relevant policy incentives and economic factors, including funding opportunities and cost-benefit analysis, to support the implementation of bio-circular technologies.
- **Results:** Users can review the results based on their input and assess the most suitable technologies.

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Figure 18. Homepage of BCC tool, featuring a header for data management and a left-side navigation menu for evaluating feedstock, end products, environmental performance, incentives, and results

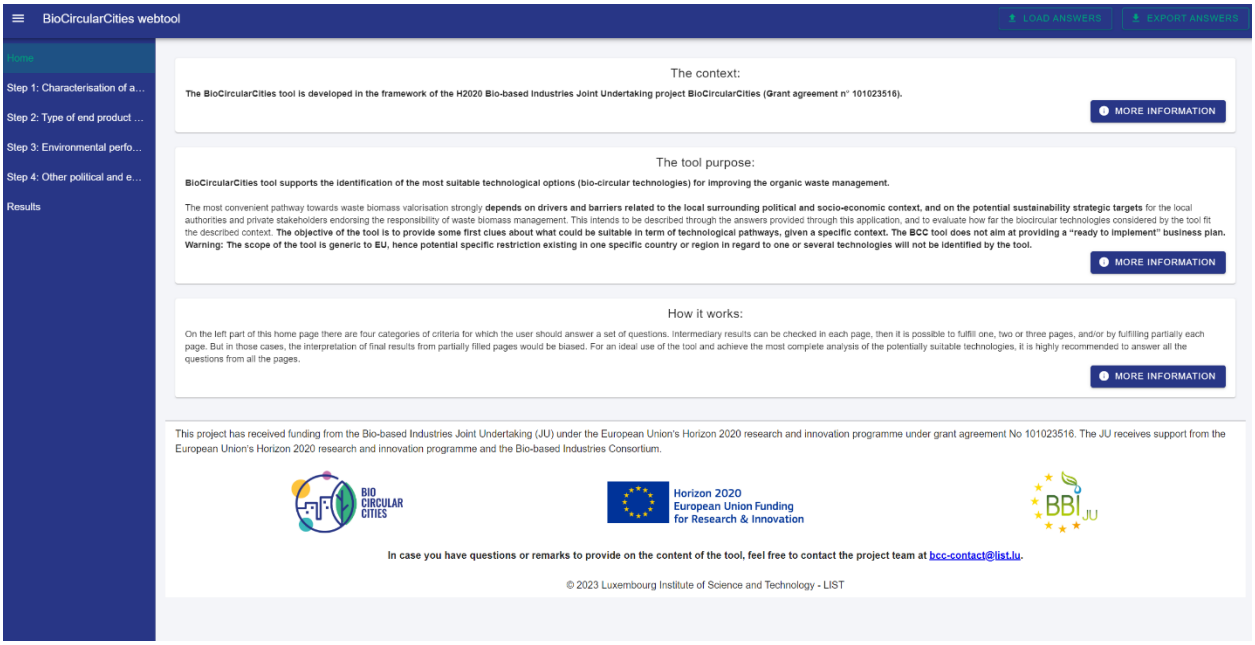
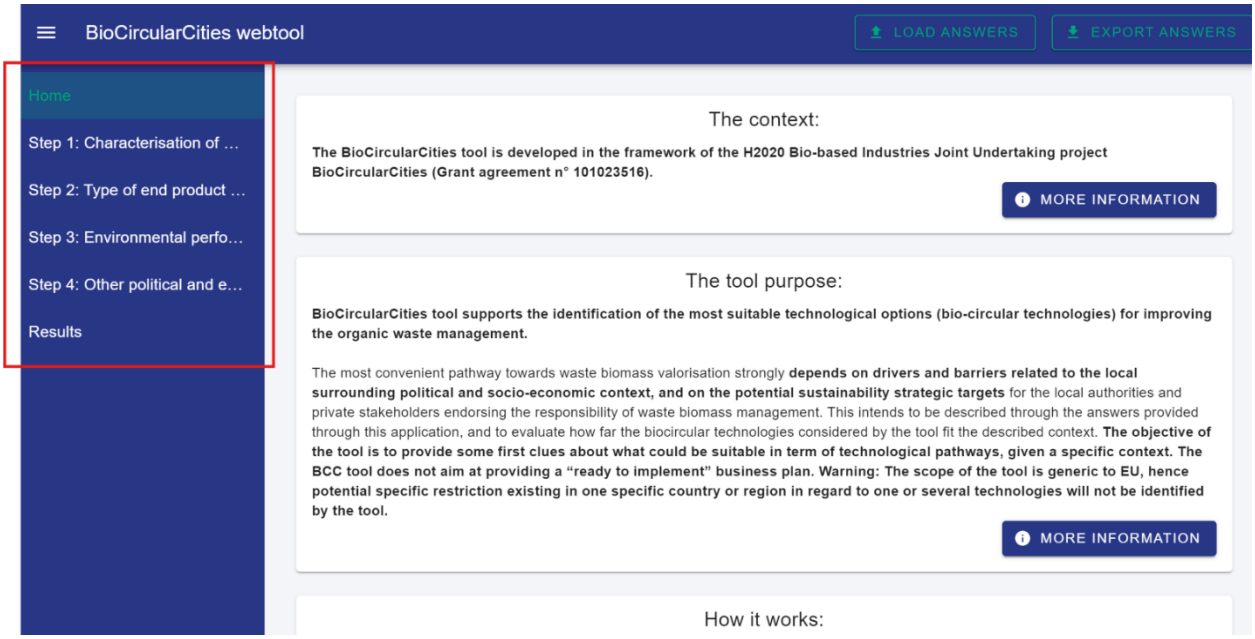


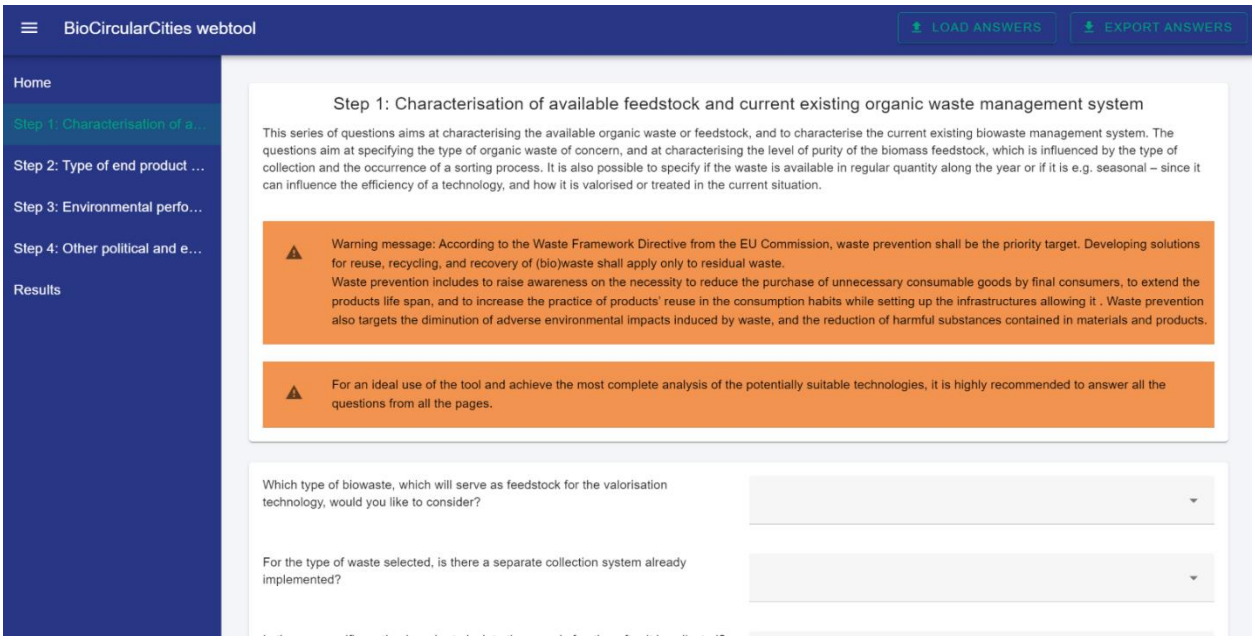
Figure 19. Navigation menu of the BCC Tool, detailing the step-by-step criteria for evaluating feedstock, end products, environmental performance, and incentives, with options to return to the homepage and review results



4.5.6.3. Steps - Criteria

Each step includes a set of questions. Users can click each step to access these corresponding questions and intermediary results. As illustrated in figure 20, each step's interface contains a brief description at the top of the page explaining the goal of the step, such as specifying the desired type of end products or understanding current waste management systems, and the corresponding questions right below it.

Figure 20. Step interface of BCC tool, displaying a description and the corresponding questions for each step



Intermediary results can be checked on each page, then it is possible to fill one, two or three pages, and/or by fulfilling partially each page. But in those cases, the interpretation of results from partially filled pages would be biased. For an ideal use of the tool and to achieve the most complete analysis of the potentially suitable technologies, it is highly recommended to answer all the questions from all the pages.

Step 1: Characterization of available feedstock and current existing organic waste management system

This series of questions aims at characterizing the available organic waste or feedstock, and to characterize the current existing biowaste management system. The questions concern the following:

- Type: Identify and categorize the types of organic waste available.
- Purity: Assess the level of purity and any sorting processes in place.
- Availability: Determine if the waste is available year-round or seasonally.

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- Practices: Document existing waste management methods and technologies.
- Challenges: Identify any challenges or inefficiencies in the current system.

Step 2: Type of end product targeted

This series of questions aims at specifying your expectations regarding the type of end product(s) that would result from the bio-circular technology that would be implemented. The questions concern product types and market readiness. The questions concern the following:

- Product types: High value for bio-based fine and specialty chemicals, medium value: Biofuels, bioplastics, and commodity chemicals and low value for compost and solid digestate.
- Market readiness: Assess the market readiness for each type of end product and evaluate social acceptance and competitive positioning.

Step 3: Environmental performances

This series of questions is dedicated to identify the potential objectives targeted in terms of environmental performances. The questions concern the following:

- Emissions: Set targets for reducing greenhouse gas emissions and other pollutants.
- Resource use: Aim to minimize resource consumption and improve efficiency.
- Positive impacts: Evaluate benefits such as waste reduction, soil improvement, and carbon sequestration.
- Negative impacts: Identify and mitigate potential negative effects.

Step 4: Other political and economic incentives

This last series of questions is dedicated to refine your statement on some criteria related to policy incentives and economic issues. The questions concern the following:

- Policy alignments: Identify relevant policies and incentives that support the adoption of bio-circular technologies and assess how these policies impact technology feasibility.
- Cost-benefit: Evaluate the costs and financial benefits of each technology.
- Funding opportunities: Explore available funding mechanisms and economic incentives.

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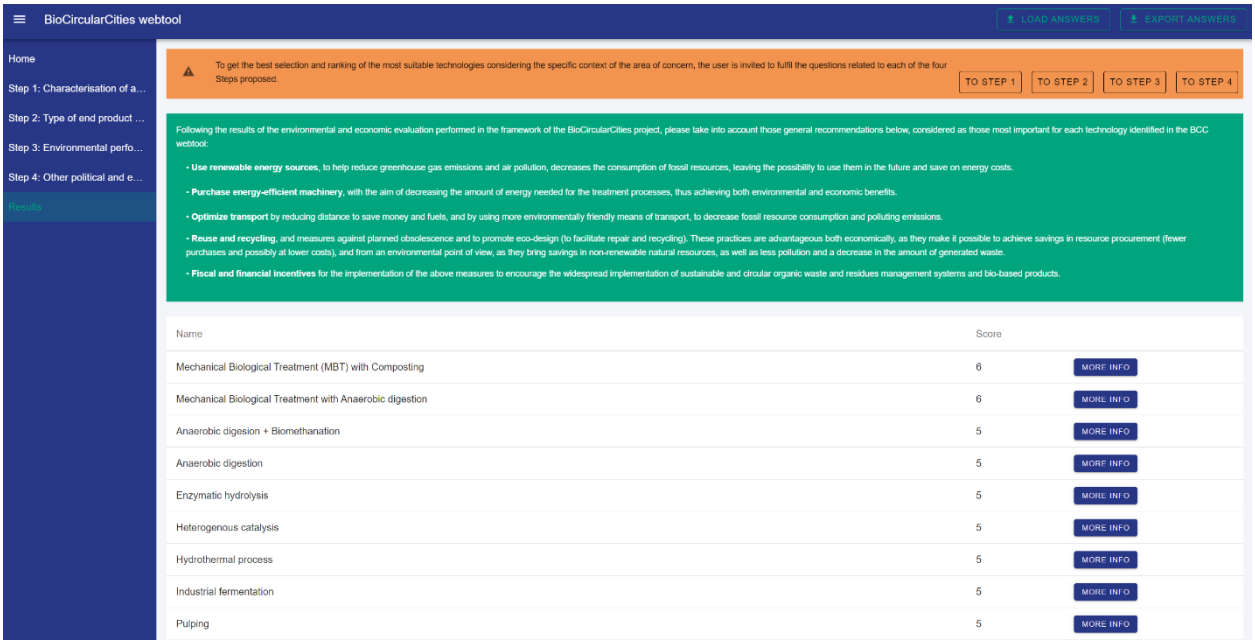
4.5.6.4. Results

The results section of the BioCircularCities Webtool, as displayed in figure 21, lists various technological solutions for waste biomass management. Each row in the table represents a specific technology, with the following columns:

- Name: The first column lists the names of different technologies related to bio-circular waste management.
- Score: A column labelled "Score" currently shows a value of "0" for each technology, possibly indicating that no evaluation has been performed yet or that scores have not been assigned.
- More Info: Each row has a button labelled "More Info," which presumably links to additional details about each specific technology.

Figure 21. Results interface of the BCC Tool, listing waste biomass management technologies with names, scores, and "More Info" buttons, along with recommendations and navigation buttons for the evaluation process



At the top, there's a banner with recommendations based on environmental and economic evaluations. These recommendations emphasize the use of renewable energy sources, energy-efficient machinery, optimized transport, and recycling measures, alongside fiscal incentives for sustainable practices.

Additionally, navigation buttons at the top right allow users to move between the four steps of the tool, indicating a step-by-step process for evaluating and selecting suitable technologies.

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4.5.7. CIRCULAR CITY GUIDANCE TOOL

The Circular City Guidance Tool was developed as part of the COST Action “Circular City Re.Solution” and is available at toolbox.circular-city.eu. It is a free evaluation tool designed to help cities tackle complex urban challenges by promoting circular economy practices and Nature-based Solutions (NBS). The main objective of the tool is to establish a common understanding across disciplines, integrating circular economy concepts with green infrastructure to address key urban circularity issues such as water cycle restoration, waste treatment, nutrient recovery, energy efficiency, and food and biomass production.

The Circular City Guidance Tool offers a framework for sustainable urban development by guiding users through the connections between urban demands and NBS. It encourages interdisciplinary collaboration to foster resilient, sustainable, and healthy urban environments.

The Circular City Guidance Tool is designed to promote the integration of circular economy principles and NBS to address key urban challenges, such as restoring the water cycle, waste treatment, and nutrient recovery. By applying a structured framework for circular urban development, the tool enhances interdisciplinary collaboration across various fields and provides cities with the tools needed to create resilient and sustainable environments. The resulting framework helps urban planners, decision-makers, and system designers demonstrate the value of their integrated solutions, making it easier to attract investments and implement sustainable urban practices.

4.5.7.1. How to Use the Circular City Guidance Tool

To effectively use the Circular City Guidance Tool, the user begins with the Navigator to identify the urban circularity challenge you are interested in. Then the user explores the associated demands, the services required to address those demands, and the NBS that can provide those services.

Next, the Calculators are used to assess and quantify various aspects of urban circularity in the region. Input relevant data to generate detailed reports on water sources, nutrient collection, biomass recovery, and green roof performance and analyze the results to understand the current circularity levels and identify areas for improvement.

Finally, based on the insights gained, the user plans and implements strategies to enhance urban circularity, leveraging the NBS and services identified through the Navigator.

4.5.7.2. Circular City Guidance Tool Highlights

The homepage of this tool is illustrated in figure 22. It includes the following:

- **Introduction:** On the right side there is an introduction explaining the purpose of the tool. It describes how the guidance system relies on five urban circularity challenges (yellow core) and the framework’s interactive nature. There are acknowledgments to the COST Action Circular Cities initiative and EU funding.

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- **Navigator diagram:** On the left side there is the navigator, a visual diagram with concentric circles, each representing different components: urban circularity challenges, demands, services, and nature-based solutions. This interactive diagram allows users to explore connections by clicking on each part.

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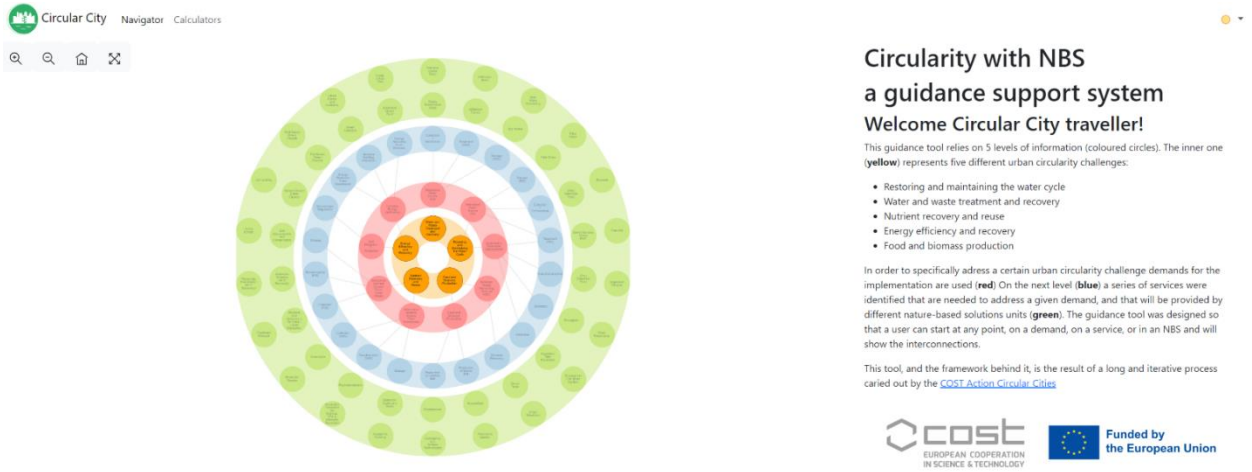
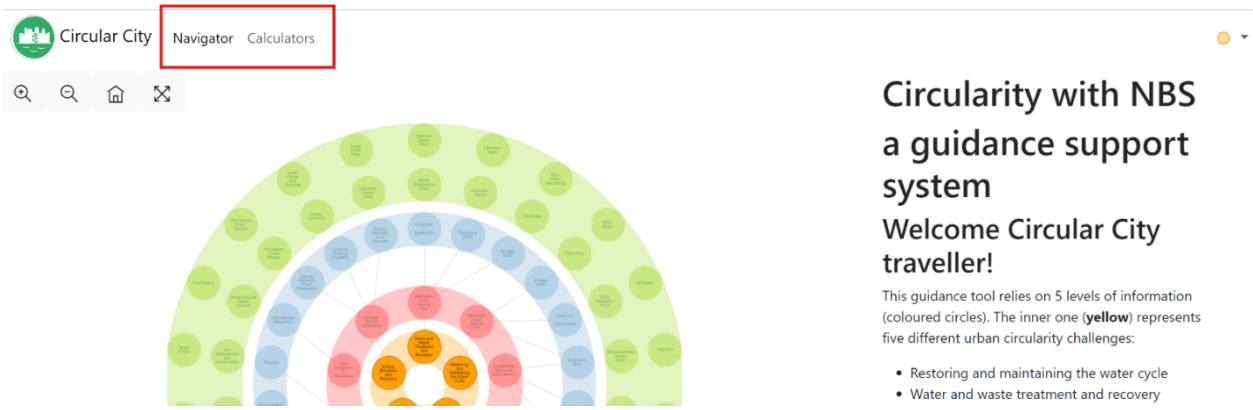
Figure 22. Homepage of Circular City Guidance Tool, including introduction on the right and navigator on the left



This guidance tool includes two main components/tabs, as illustrated in figure 23:

- **Navigator:** Interactive tool that displays information about five urban challenges and explains how to address them.
- **Calculators:** Assessment tool that visualizes information about circular economy practices.

Figure 23. Tabs of Circular City Guidance Tool, including navigator and calculators



4.5.7.2.1. NAVIGATOR

The Navigator helps to identify the urban circularity challenge the user is interested in, and explore the associated demands, the services required to address those demands, and the nature-based solutions (NBS) that can provide those services.

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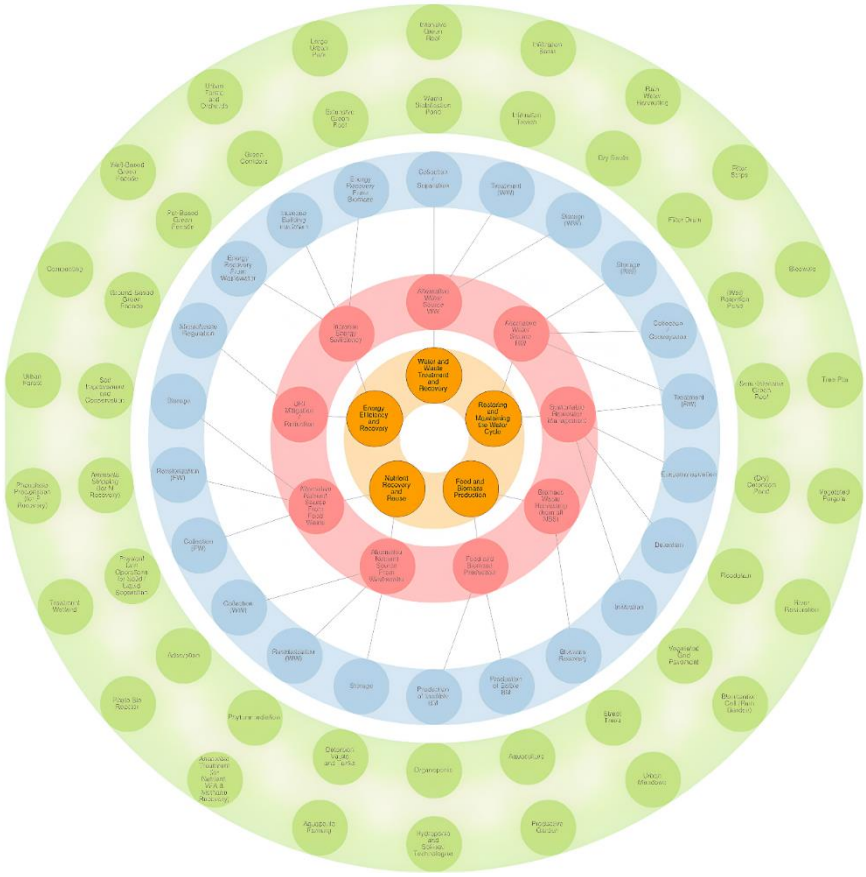
This guidance tool, as illustrated in figure 24, relies on 5 levels of information (coloured circles). The inner one (yellow) represents five different urban circularity challenges:

- Restoring and maintaining the water cycle
- Water and waste treatment and recovery
- Nutrient recovery and reuse
- Energy efficiency and recovery
- Food and biomass production

Figure 24. Navigator tool of the Circularity City Guidance Tool, displaying 5 levels of information



In order to specifically address a certain urban circularity challenge demands for the implementation are used (red). The next level (blue) identifies a series of services that are needed to address a given demand. The

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services will be provided by different nature-based solutions units (green). The guidance tool was designed so that a user can start at any point, on a demand, on a service, or in an NBS and will show the interconnections.

By clicking on any circle, users can explore the interconnections between demands, services, and NBS units, and access detailed information about the specific topic represented by that circle on the right of the tool, as presented in figure 25.

Figure 25. Interaction with the Navigator tool of the Circularity City Guidance Tool, where users can explore interconnections between the 5 levels of information by clicking on any circle

Note: This tool and the framework behind it are the result of a long and iterative process carried out by the [COST Action Circular Cities]

4.5.7.2.2. CALCULATOR

The Calculator (figure 26) includes five calculators to evaluate the current circularity levels in cities by generating reports. These are alternative water source, alternative nutrient collection, alternative nutrient revalorization, biomass recovery and green roof calculator.

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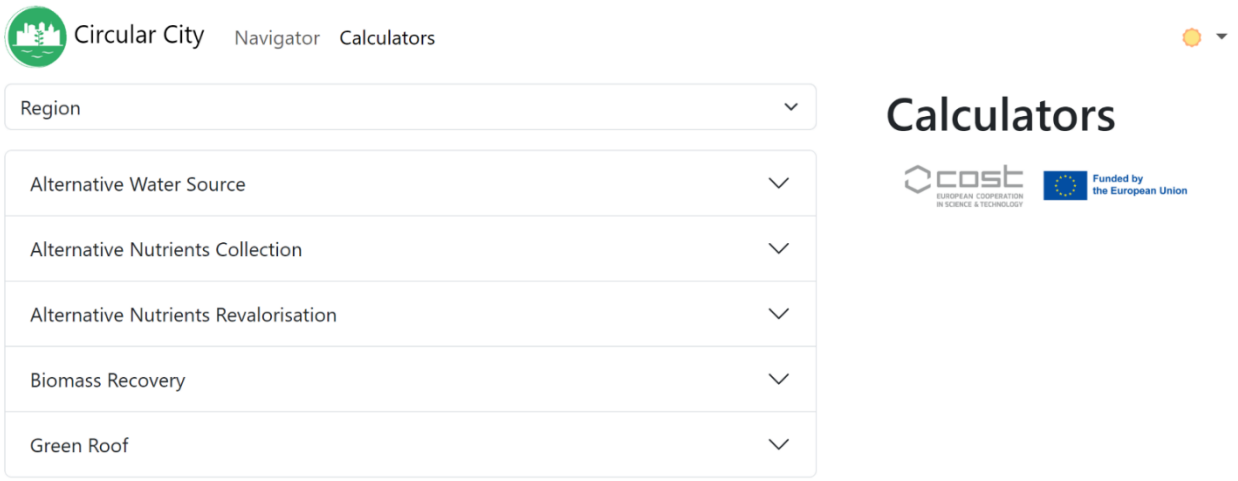
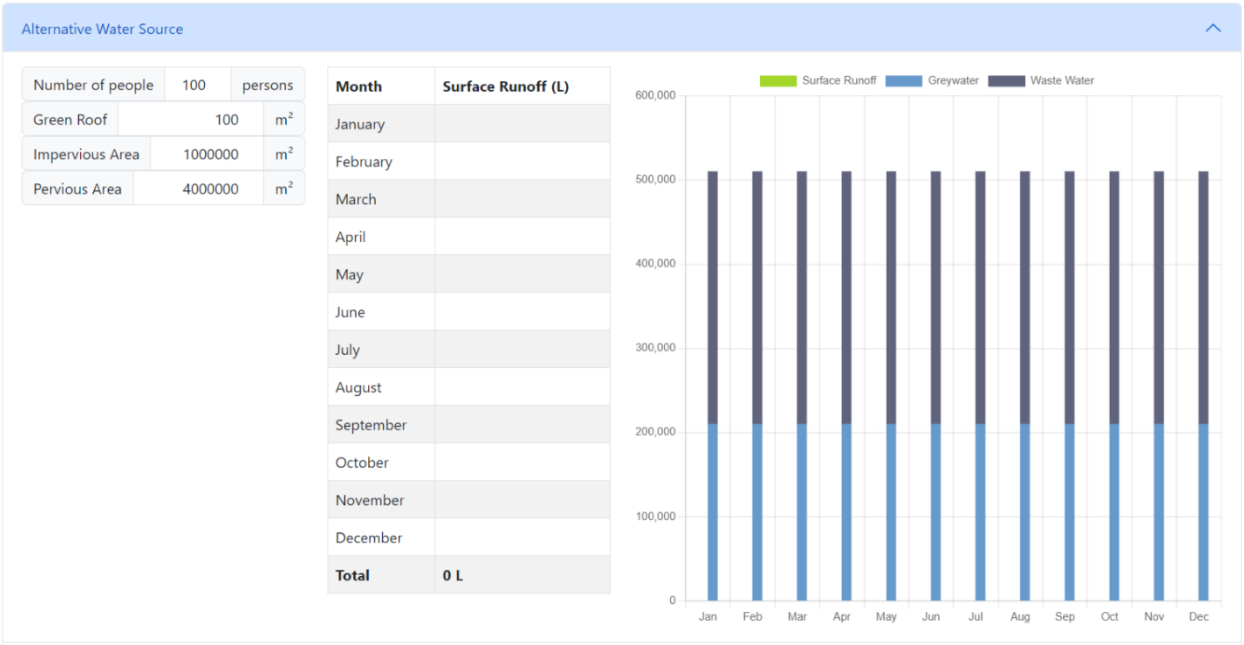
Figure 26. Calculator tools of Circular City Guidance tool



Alternative Water Source Calculator

Alternative water source calculator (figure 27) evaluates potential alternative water sources to reduce reliance on traditional water supply systems. It helps cities manage water resources more efficiently by identifying opportunities to use runoff, greywater, and wastewater for non-potable purposes, thereby enhancing water conservation and resilience.

Figure 27. Alternative Water Source calculator of Circular City Guidance tool



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This calculator visualizes the following in monthly basis:

- **Surface Runoff:** Calculate the volume of water that will run off from impervious surfaces during rainfall events.
- **Greywater:** Estimate the amount of greywater generated from daily activities.
- **Wastewater:** Calculate the total wastewater produced, including both greywater and blackwater.

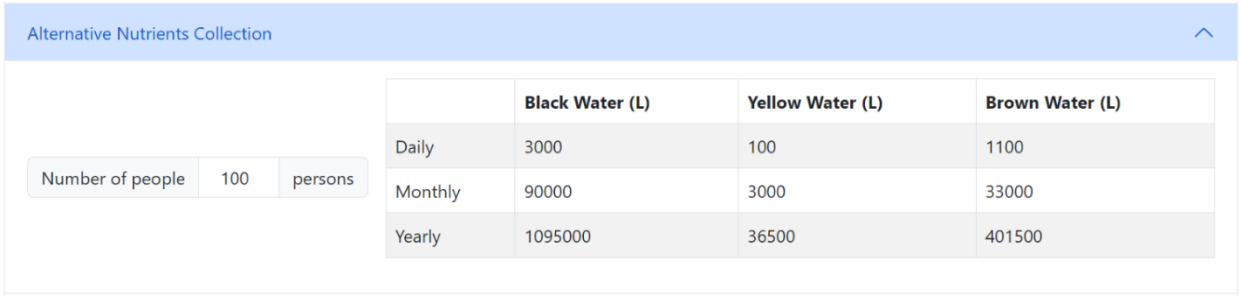
To generate these calculations, the following information is needed as input:

- **Number of people:** Total number of people, as it affects the volume of greywater and wastewater generated.
- **Green Roof Area:** The size of green roofs, which can reduce surface runoff and improve water retention.
- **Impervious Area:** Total area covered by surfaces like roads, pavements, and roofs that prevent water from infiltrating into the ground.
- **Pervious Area:** Total area where water can infiltrate into the ground, such as gardens or open fields.

Alternative Nutrient Collection Calculator

Alternative nutrient collection calculator (figure 28) optimizes the collection of nutrients from urban waste streams. It assists in designing systems for separating and collecting nutrients from black, yellow, and brown water, enabling the recovery and reuse of valuable resources, and reducing pollution and waste management costs.

Figure 28. Alternative Nutrient Collection calculator of Circular City Guidance tool



This calculator visualizes the following:

- **Black Water:** Wastewater from toilets, including human faeces and urine.
- **Yellow Water:** Typically refers to urine alone, but in some contexts, it can also include wastewater from urinals.

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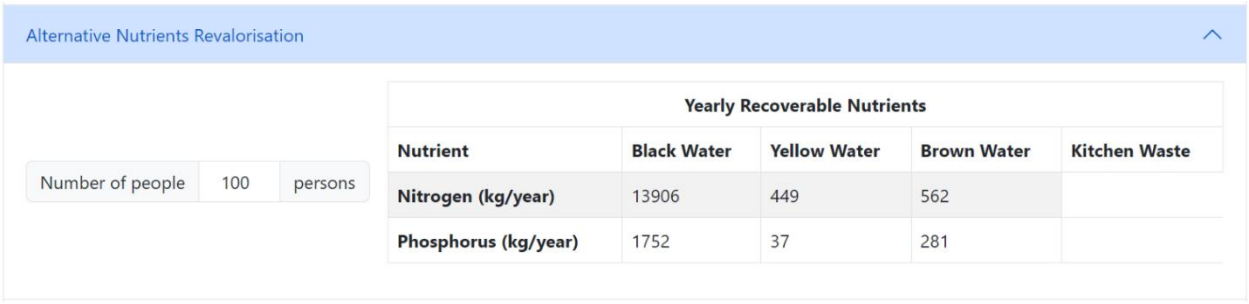
- **Brown Water:** Refers to wastewater containing faecal matter (like black water, though sometimes used to emphasize the presence of solid waste).

To generate these calculations, the total number of people is needed as input, as it affects the volume of wastewater generated.

Alternative Nutrient Revalorization Calculator

Alternative nutrient revalorization calculator (figure 29) estimates the potential for nutrient recovery from urban waste. Supports the implementation of systems that recover nitrogen and phosphorus from waste streams, contributing to sustainable agriculture practices and reducing the need for synthetic fertilizers.

Figure 29. Alternative Nutrient Revalorization calculator of Circular City Guidance tool



This calculator visualizes annual recoverable nitrogen and phosphorus from black, yellow, and brown water. To generate these calculations, you need to input the total number of people, as it affects the volume of wastewater generated.

Biomass Recovery Calculator

Biomass recovery calculator (figure 30) assesses the potential for biomass recovery from urban green spaces. It facilitates the efficient management and use of biomass from grass clippings, tree pruning, and urban planting, promoting renewable energy production and organic waste recycling.

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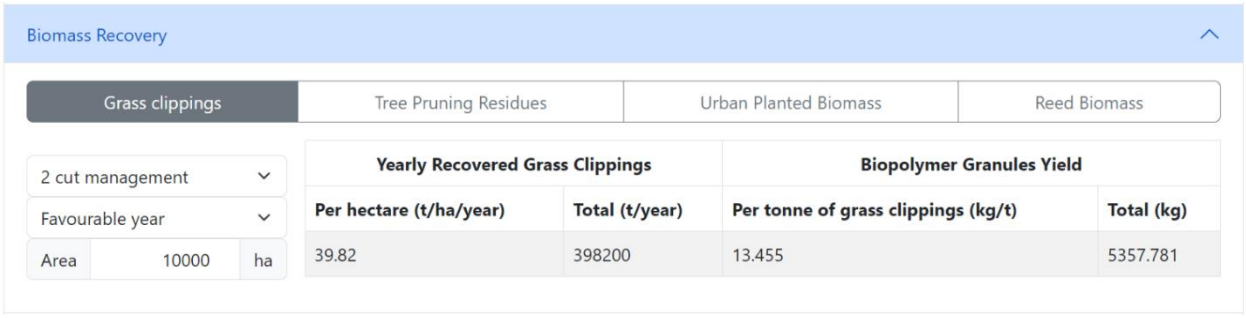
Figure 30. Biomass Recovery in Grass Clippings calculator of Circular City Guidance tool



This calculator visualizes the following:

- **Grass Clippings:** Residue from mowing lawns and grassy areas.
- **Tree Pruning Residues:** Biomass resulting from trimming and pruning trees.
- **Urban Planted Biomass**: Biomass from plants in urban settings, such as flowers, shrubs, and small trees.
- **Reed Biomass:** Biomass from reed plants, often found in wetland areas.

To generate these calculations, the following information is needed as input:

- **Management Practices:** Unknown management, 2 cut management, 4 cut management, mulching management
- **Weather Conditions:** Normal year, favorable year
- **Area:** The specific area of land being considered for biomass production.

Green Roof Calculator

Green roof calculator (figure 31) evaluates the performance and benefits of green roofs. It provides insights into the environmental and energy benefits of green roofs, such as improved water retention, reduced urban heat island effects, and energy savings from natural cooling, helping cities to promote sustainable building practices.

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Figure 31. Green Roof calculator of Circular City Guidance tool

Month	Evaporation (mm/month)	Energy Saved (kWh/m²)	Area Equivalence for 1 AC unit (m²)
January	62.79	42.73	49.75
February	65.55	44.61	43.04
March	76.17	51.84	41.01
April	67.95	46.24	44.49
May	73.48	50.01	42.51
June	74.08	50.42	40.81
July	95.42	64.94	32.74
August	112.46	76.54	27.78
September	100.23	68.21	30.16
October	90.61	61.67	34.48
November	66.42	45.2	45.52
December	59.85	40.73	52.19

This calculator visualizes the following in monthly basis:

- **Evaporation:** This involves estimating the amount of water evaporated from the green roof, which can affect cooling and energy savings.
- **Energy Saved:** This determines how much energy is saved due to the cooling effect of the green roof, which reduces the load on air conditioning systems.
- **Air Equivalence for One Air Conditioning Unit:** This finds out how much green roof area is equivalent to the cooling provided by a specific air conditioning unit.

To generate these calculations, the following information is needed as input:

- **City:** This affects local climate data.
- **Orientation:** Affects the environmental conditions around the green roof, influencing its performance.

Crop Factor: Determines the specific evapotranspiration rate of the plants on the green roof, impacting water use and cooling efficiency.

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5. Conclusions

The present deliverable focuses on the identification and assessment of the most important existing tools for supporting future investment decisions in UCBE projects. In the deliverable the methodological approach for the selection and the evaluation of the defined tools is described. Furthermore, in the context of this task the best performing tools are recognized and guidelines for their use are prepared.

Concerning the applied methodology, it was based on three stages and more specifically Stage 1: Developing the extensive inventory of tools promoting UCBE projects, Stage 2: Developing the targeted inventory of tools promoting UCBE projects and analysis of tools, and Stage 3: Developing guidelines for the best performing tools. The extensive inventory included 41 tools, which were narrowed down to 21 in the targeted inventory, and finally, 7 tools were recommended based on a scoring framework.

The development of the targeted inventory of tools and the thorough analysis conducted was based on specific criteria such as technological and technical aspects, biomass, logistical, legislative, financial, and social characteristics. In addition, a scoring system was applied to the most relevant tools in order to reveal the best performing ones. The final recommended tools are in total 7 tools and particularly the following: **The Project Maturity Level, Bio-Circularity Label**, **Circular Valuation Method**, **(BSAT) Bioeconomy Strategy Accelerator Toolkit**, **DECISIVE Decision Support Tool (DST)**, **BioCircularCities webtool**, **Circular City Guidance Tool**. These tools not only facilitate the implementation of circular bioeconomy strategies but also support collaboration among stakeholders, encourage social acceptance, and attract investments.

Focusing on the 7 recommended tools an overview of **potential synergies and complementarity aspects** is presented below.

Both **tools BioCircularCities webtool and DECISIVE- Decision Support Tool (DST)** can complement each other by combining the BioCircularCities webtool's analysis of biomass type and system characterization with the DECISIVE DST's spatial inventory and logistical assessments. Additionally, integrating the **BioCircularCities webtool's** analysis of biomass type and system characterization with the **Circularity Valuation Method's** financial attractiveness and sustainability assessments can provide detailed evaluation of biowaste management projects. Moreover, combining the **Circular City Guidance tool's** focus on urban circular practices with the **Bio-circularity Label's** societal acceptance and policy compliance assessments can enhance the overall effectiveness of circular bioeconomy initiatives in urban settings.

In addition, integrating the **BioCircularCities webtool's** analysis of biomass type and system characterization with the **Circular City Guidance Tool's** guidelines on adopting circular economy practices can provide in depth evaluation of biowaste management projects and sustainable urban development.

Also, combining the **Circular City Guidance Tool's** focus on urban circular practices with the **BSAT's guidelines** on developing bioeconomy strategies can enhance the overall effectiveness of circular bioeconomy initiatives in urban settings. Finally, integrating the **BSAT's guidelines** on developing bioeconomy strategies with the **Project Maturity Level** tool's project maturity assessments can provide an approach to enhancing the investment readiness of bioeconomy projects.

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In exploring the potential of various tools to enhance project development and sustainability initiatives, it is crucial to consider also their **flexibility**. Each tool offers unique features that, when effectively utilized, can significantly improve outcomes. Following, it is highlighted how these tools can be further exploited to maximize their benefits, providing an approach to advancing circular economy and bioeconomy strategies.

The **Project Maturity Level** tool has the potential to enhance flexibility through its progress tracking features, which could allow users to monitor the development of their projects over time and identify areas for improvement. Additionally, a resource library might provide access to templates, guidelines, and best practices for advancing projects through the maturity levels. Furthermore, mentorship programs could connect less experienced project developers with seasoned experts, offering guidance and support.

The **Bio-Circularity Label** tool offers benchmarking features that allow cities and regions to compare their circularity performance with peers, fostering healthy competition and knowledge sharing. Additionally, public engagement tools might raise awareness about circular economy initiatives and encourage citizen participation in biowaste management practices. Detailed reports and visualizations could further highlight the economic and environmental benefits of circular initiatives, attracting investments.

The **Circularity Valuation Method** tool is characterised with enhanced flexibility and particularly customizability through its advanced financial modelling tools, which could assess the economic viability of circular projects and identify potential funding sources. Additionally, risk assessment modules might evaluate potential risks and provide mitigation strategies for circular projects. Furthermore, networking and collaboration tools could facilitate partnerships between municipalities, investors, and solution providers.

The **Bioeconomy Strategy Accelerator Toolkit (BSAT)** may enhance flexibility and complementarity through its interactive workshop modules, which could guide stakeholders through the strategy development process, encouraging active participation and collaboration. Additionally, a repository of best practices and case studies from other regions might provide valuable insights and inspiration for developing bioeconomy strategies.

Regarding the flexibility of the **DECISIVE Decision Support Tool (DST)** it implements a scenario comparison feature, which could allow users to evaluate multiple waste management options side-by-side, identifying the most sustainable and cost-effective solutions. Additionally, real-time data integration from waste management facilities and environmental monitoring systems might ensure up-to-date assessments and recommendations. Furthermore, stakeholder engagement modules could facilitate community input and feedback, aligning the tool's recommendations with local needs and preferences.

The **BioCircularCities webtool** presents strong evidence of flexibility by integrating local data sources and GIS systems, which could provide more accurate and region-specific recommendations. Additionally, customizable evaluation criteria might allow users to adapt the tool to their specific regional needs and priorities, making it more versatile. Furthermore, collaboration features could enable multiple stakeholders to work together on the same project, improving communication and decision-making.

Moreover, significant elements of flexibility were identified in **The Circular City Guidance tool** and more specifically dynamic visualizations, which could illustrate the impact of different circular economy practices and Nature-based Solutions (NBS) on urban sustainability, enhancing user understanding. Furthermore, policy integration features could help users align their circular economy initiatives with local, national, and international

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regulations. Additionally, complementarity might be promoted by integrating the tool with platforms used by urban planners, engineers, and environmental scientists.

Moreover, the analysis of relevant tools highlighted not only barriers but also opportunities and synergies associated with their use.

Barriers identified:

- Technological complexity: Some tools require advanced technical knowledge, making them challenging for non-expert users.
- Data availability: The effectiveness of these tools depends heavily on both the availability and accuracy of the data they rely on.
- Regulatory compliance: Tools may struggle to align with varying regulatory requirements across different regions, limiting their broader application.

Opportunities and synergies identified:

- Interdisciplinary collaboration: Tools promote collaboration across various disciplines, enhancing the integration of circular economy principles.
- Stakeholder engagement: Tools may promote stakeholder involvement, fostering a shared vision and collective action.
- Investment attraction: Tools can help demonstrate project value, attracting investments.

Regarding **ideas and recommendations** for improving the tools at different levels, these can be summarized under the following subjects:

- Urban bioeconomy projects: Future tool development for urban bioeconomy projects should prioritise creating integrated data platforms to assist the project overview, simplifying user interfaces for better accessibility as well as implementing real-time monitoring for timely adjustments.
- Bio-based products: Develop tools that combine lifecycle analysis, environmental impact assessments, and economic viability metrics for bio-based products. This can help users understand the holistic impact of their choices. Moreover, invest in tools that can easily integrate with existing databases and systems, allowing users to pull in relevant data on bio-based resources, market trends, and sustainability metrics. Incorporating predictive analytics into future tools is essential, as it will enable users to forecast trends in bio-based product markets and anticipate shifts in consumer behavior.
- Opportunities and synergies among new tools: Encourage the development of tools that can easily share data and insights with one another, creating a more cohesive ecosystem of bio-based product tools. Additionally, platforms where researchers, businesses, and policymakers can share insights, data, and best practices regarding bio-based products should be promoted.

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7. Annex I: Analytical scoring results

Table 26. Average scores of targeted list of tools based on general information criteria

Tool Name	Clear description of scope of the tool	General interaction with the users	Availability of open access to data and resources	Quality and depth of data/information provided
Best Practices Atlas	4.3	3.3	3.7	2.7
BioCircularCities tool	5.0	4.7	4.0	4.7
ECESP – Good Practices	3.7	4.3	5.0	3.7
Innovation Watch	4.0	3.7	4.0	3.0
Pilot4U Open Access Data Base	4.0	4.3	4.0	4.3
S2BIOM Sustainable supply of non-food biomass	4.3	4.0	3.7	5.0
Tech4Biowaste database	4.3	3.7	4.7	3.3
Circular design toolkit	3.7	2.0	5.0	3.7
InnProBio Bio-based Products Database	3.7	2.7	5.0	3.7
Knowledge center for bio-economy	4.3	3.7	5.0	4.0
Bioeconomy Toolkit for Business	5.0	2.7	4.0	3.0
Bioeconomy Toolkit for Policy Makers	5.0	2.3	4.7	3.3
ResCoM Circular Pathfinder	4.7	4.3	5.0	4.0
DECISIVE (DST)	4.3	4.3	3.3	4.3
Circularity City	5.0	5.0	4.7	4.3
BSAT-Bioeconomy Strategy Accelerator Toolkit	4.7	4.0	5.0	4.3
GREEN ASSIST	5.0	3.7	4.7	3.7
The Metabolism of Cities – Data Hub	4.0	3.3	4.3	4.7

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Table 27. Average scores of targeted list of tools based on content criteria

Tool Name	Technological & Technical criteria	Biomass criteria	Logistical criteria	Policy & Regulatory criteria	Financial - Market criteria	Social criteria
Best Practices Atlas	4.0	4.3	0.0	3.3	3.0	3.7
BioCircularCities tool	4.7	4.3	0.0	4.7	4.7	4.7
ECESP – Good Practices	2.7	3.3	2.3	4.3	4.0	4.3
Innovation Watch	3.7	3.3	3.0	3.3	0.0	4.3
Pilot4U Open Access Data Base	5.0	3.7	3.0	3.0	4.0	3.0
S2BIOM Sustainable supply of non-food biomass	4.3	4.3	4.0	4.3	4.3	0.0
Tech4Biowaste database	4.7	4.3	2.7	2.3	3.0	4.0
Circular design toolkit	4.3	3.7	3.7	4.3	4.3	4.7
InnProBio Bio-based Products Database	3.7	4.0	3.0	3.7	2.3	3.3
Knowledge center for bioeconomy	4.3	4.3	0.0	4.7	3.3	4.0
Bioeconomy Toolkit for Business	3.0	4.0	4.0	4.7	4.0	4.0
Bioeconomy Toolkit for Policy Makers	3.7	4.0	0.0	4.7	4.3	3.7
ResCoM Circular Pathfinder	4.7	0.0	3.7	0.0	0.0	3.7
DECISIVE Decision Support Tool (DST)	4.3	3.7	4.7	4.7	3.7	4.7
Circularity City	4.0	4.0	0.0	4.7	4.7	5.0
The BSAT-Bioeconomy Strategy Accelerator Toolkit	4.3	5.0	4.0	5.0	3.7	4.3
GREEN ASSIST	0.0	0.0	0.0	5.0	4.7	3.7
The Metabolism of Cities – Data Hub	4.3	3.3	3.7	3.7	3.7	3.3

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Table 28. Final score of targeted list of tools

Tool Name	Final Score
Best Practices Atlas	3.2
BioCircularCities tool	4.1
European Circular Economy Stakeholder Platform – GOOD PRACTICES	3.8
Innovation Watch	3.2
Pilot4U Open Access Data Base	3.8
S2BIOM Sustainable supply of non-food biomass	3.8
Tech4Biowaste database	3.7
Circular design toolkit	3.7
InnProBio Bio-based Products Database	3.5
Knowledge center for bioeconomy	3.8
Bioeconomy Toolkit for Business	3.8
Bioeconomy Toolkit for Policy Makers	3.6
ResCoM Circular Pathfinder	3.0
A DECentralIzed management Scheme for Innovative Valorization of urban biowastE	4.2
Circularity City	4.1
The BSAT-Bioeconomy Strategy Accelerator Toolkit	4.4
GREEN ASSIST	3.0
The Metabolism of Cities – Data Hub	3.8

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8. Annex II: Technical Guidelines

The Annex II includes two tables. The table 29 is referred to the glossary for the DECISIVE- DST and the table 30 is referred to supporting tools and resources for the BSAT tool.

Table 29. Glossary of DST

Term	Definition
Private Projects	User-created projects that are private and can only be viewed, edited, or shared by the user, with an option to propose them for public use.
Public Projects	Projects approved by administrators or shared by other users, which are accessible to all and can be viewed, duplicated, and downloaded.
Waste Process Documentation	A summary of all data used to develop the waste management processes within the tool.
Glossary	A list of key terms, abbreviations, and their definitions relevant to the tool.
Waste Characterization Properties	Information on the chemical properties of different biowaste fractions, which is used for calculating mass flows.
Emission Factors	A list of Global Warming Potential (GWP) values for various emissions included in the DST.

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Table 30. Supporting Tools and Resources of BSAT

Supporting Tools and Resources	Description
Templates	SWOT analysis, stakeholder mapping, action plan templates.
Guidelines	Step-by-step guides for data collection, strategy development, and consultation processes.
Case Studies	Examples of successful bioeconomy strategies from other regions.
Regulatory and Financial Resources	Tools for assessing legal and funding environments.

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