



Design and Development  
of the First Version of the  
ToolBox



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**DISCLAIMER**

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## Executive Summary

Deliverable D4.2 reports on the first design and implementation phase of the PRIMED Digital Toolbox, the project's main digital environment for supporting the co-creation and replication of circular and regenerative bioeconomy value chains. It documents the adoption of a context-based conceptual design, the definition of functional and data requirements, and the development of the first operational prototype (Version 1).

The Toolbox has been implemented as a web application with a relational database that organises knowledge into twelve interlinked objects: Territory, Resources, Technologies, Bioproducts, Stakeholders, Governance, Indicators, BusinessModels, ValueChains, SuccessCases, FutureScenarios, and SupportTools.

The platform's interface is structured into six main contexts: (1) Bioeconomy Value Chains, (2) The Bioeconomy Tool, (3) Exemplar Business Models, (4) Success Cases, (5) Hypothetical Scenarios, and (6) Templates and Collaborative Tools.

Among these, the Bioeconomy Tool operationalises the six conceptual contexts (Select Territory, Explore Resource, Identify Technology, Connect Stakeholders, Create BioProduct, and Structure Business) while the other sections serve as reference and support environments.

A participatory co-design workshop with the five Living Labs informed the Toolbox structure and validated its conceptual coherence. The exercise clarified how information objects (e.g., resources, technologies, stakeholders) and concerns (economic, environmental, social) interconnect during value-chain creation, providing the basis for the system's data schema and user journey.

The first version (V1) delivers the essential functionalities to create, link, and visualise value chains, access reference materials, and use collaborative templates. Approximately two-thirds of the full functionality is implemented. Components to be expanded in Version 2 (V2) include the Circular Business Model Navigator (CBMN) integration, metrics and reporting tools, stakeholder matchmaking, and other features.

During Task 6.2, V1 will undergo iterative testing and validation within the Living Labs to refine usability, expand analytical capabilities, and strengthen interoperability with other European bioeconomy platforms.

In summary, D4.2 establishes the conceptual and technical foundations of the PRIMED Toolbox, delivering a coherent, operational prototype and a clear roadmap for its evolution toward a fully integrated, user-driven digital ecosystem.

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## I. Introduction to T4.2 - First Version of the Toolbox

The objective of Task T4.2 was to design, develop, and implement a first version of a digital toolbox aimed at facilitating, supporting, and accelerating collaboration between diverse stakeholders in social, technological, and business innovation within the bioeconomy. Rooted in the methodologies, guidelines, and models developed in WP2 and WP3, the toolbox acts as an enabler for multi-actor engagement, knowledge sharing, capacity building, and co-development of new value chains in the circular and bio-based economy.

The task specifically aimed to:

- Translate research and innovation outputs in PRIMED into accessible, functional, and actionable resources.
- Provide a structured and comprehensive set of tools, models, and resources to foster interdisciplinary collaboration and support stakeholders in shaping viable and impactful bioeconomy business models.
- Personalize content and toolkits to the needs of stakeholder categories profiled in Task 4.1, including primary producers, SMEs, researchers, technology providers, investors, policymakers, and support organisations.
- Lay the groundwork for ongoing iterations and enhancements of the toolbox through stakeholder validation, pilot use, and contributions from other EU initiatives.

The output of T4.2 is the first public version of the PRIMED Digital Toolbox, a scalable, open-access, and multi-functional platform structured to support the development and replication of Circular Bioeconomy Business Models (CBMBs) across Europe. In addition to core components such as a Business Model Navigator, a library of best practices, governance models, metric and impact tools, and training content, the toolbox incorporates open interfaces for stakeholder engagement and feedback loops.

This task was executed in collaboration with partners in charge of stakeholder engagement (T4.1), business modelling (WP2), and systemic value chains (WP3), ensuring consistency, cross-learning, and mutual reinforcement of outputs.

## 2. Initial Concept of the PRIMED Digital Toolbox

The PRIMED Digital Toolbox is conceived as a coherent integrated set of tools that facilitate systemic innovation in the European bioeconomy. It targets a wide range of actors across sectors and value chains, promoting knowledge exchange, coordination, co-creation, and long-term cooperation to unlock the full potential of regenerative and circular bio-based solutions.

The toolbox is a modular platform that will group together the different tools, template, knowledge and data gathered in PRIMED, structured around four primary functional areas:

**Conceptualization and design of new bioeconomy value chains:** Includes a Bioeconomy Tool that helps practitioners of different disciplines to create solutions that transform bioresources into valuable bioproducts using established technology stacks.

**Business Modelling and Strategy:** Includes a library of business models relevant and viable for Bioeconomy, as well as the Circular Business Model Navigator (CBMN) that facilitates the design of circular business models.

**Knowledge and Capacity Building,** provides educational content tailored for different stakeholder profiles. Focus on market insights, technical know-how, and sustainability competencies.

**Collaboration and Governance:** Tools to identify, map, and support effective stakeholder collaboration, including multi-actor platforms and living labs.

**Tools for assessment,** feasibility analysis, and policy monitoring, includes templates to track environmental, economic, and social KPIs.

The toolbox integrates data and resources from PRIMED's WPs, as well as publicly available tools, EU project outputs, and regional databases. Each component is designed to be user-centered, with a guided navigator interface that helps users find and combine tools and resources that match their specific needs, sectoral focus, or project maturity.

The PRIMED Digital Toolbox is designed with a strong emphasis on stakeholder-centricity, ensuring it responds to the needs, expectations, and capacities of the diverse actors involved in advancing the circular and regenerative bioeconomy. The foundation for this design approach was laid in Task 4.1, which mapped and profiled stakeholders through a structured methodology grounded in real-world engagement across the project's Living Labs.

To ensure representation of the full ecosystem of innovation, the stakeholder/user typology is set to encompass six key categories:

- Citizens and Civil Society Organisations
- Local and Regional Authorities
- Industry and Business Actors, including technology providers and end-users
- Raw Material Suppliers and Primary Producers
- Academia and Research & Technology Organisations (RTOs)
- Investors and Financial Institutions

For each of these profiles, the toolbox provides knowledge and tools that reinforce their roles in bioeconomy value chains, provide access to tailored business model templates, governance approaches, and capacity-building materials, and opportunities for matchmaking and co-creation, leveraging communication and collaboration tools to identify synergies and build partnerships.

## Overarching Objectives of the PRIMED Digital Toolbox

The overarching objective of the PRIMED Digital Toolbox is to accelerate the development of a sustainable, inclusive, and scalable circular bioeconomy by addressing systemic barriers that hinder progress. It seeks to foster effective collaboration across diverse stakeholder groups, ranging from primary producers to policymakers, by creating the conditions for mutual understanding, shared vision, and coordinated action. The toolbox aims to bridge the persistent gap between research and practice, making complex methodologies accessible and actionable for real-world implementation. It also supports the upskilling of local and regional actors by enhancing access to contextualised knowledge, best practices, and applied insights. Ultimately, the toolbox promotes transparency, replicability, and continuous improvement across regions, enabling the bioeconomy ecosystem to grow through collective intelligence, openness, and evidence-based decision-making.

### ***Enable Multi-Actor Collaboration***

The transition to a circular bioeconomy requires sustained cooperation among a wide array of actors, including farmers and cooperatives, small and medium enterprises, technology developers, researchers, investors, and policy-makers. Yet, mismatched expectations, siloed information flows, and unclear governance structures often hamper joint efforts. The toolbox addresses these barriers by providing:

- Partner Matchmaking: identify potential collaborators based on complementary expertise, geographic proximity, or shared objectives.
- Governance Frameworks: templates and guidelines for setting up multi-stakeholder steering committees, defining roles and responsibilities, and establishing decision-making processes.

### ***Translate Methodologies into Actionable Tools***

Many stakeholders face a “research-practice gap”: robust methodologies and frameworks exist but remain locked in academic papers or workshops. To overcome this the toolbox should contemplate:

- Scenario Planning Tools: “What-if” simulators that model the effects of scale, location, or technology choices on project outcomes, helping users identify the most viable pathways before committing resources.
- Interactive Navigators: Guided workflows that walk users through complex processes, such as designing a sustainable value chain, by breaking them into simple, sequential steps, enriched with real-life examples.
- Dynamic Templates: Downloadable, customizable documents (e.g., business model canvases, feasibility checklists) that can be tailored to specific sectors or regional contexts, ensuring theoretical rigor meets practical relevance.
- Embedded Guidance: Contextual help and case annotations built directly into each tool, so users never have to leave the platform to understand how a method applies to their situation.

### ***Accelerate Learning and Capacity Building***

Knowledge asymmetries and skill gaps often slow down the adoption of innovative bioeconomy solutions. The toolbox combats this by incorporating contextual case-study library, as a searchable database of success stories and lessons learned, tagged by region, feedstock, technology readiness, and stakeholder constellation.

### ***Foster Transparency, scalability, and Replicability***

Scaling bioeconomy solutions across diverse regions demands that successful models be openly shared, validated, and adapted. The toolbox advances this by:

- Curated Case Repositories: Detailed documentation of validated business cases, governance approaches, and partnership structures, including key performance results and critical success factors.
- Open-License Resources: All templates, datasets, and case materials are released under permissive licenses, ensuring free and unfettered reuse.
- User Contribution: Easy-to-use interfaces for submitting new data and case studies with built-in moderation workflows to ensure quality.

## Preliminary Implementation Plan for the Toolbox

The development of the first version of the PRIMED Digital Toolbox was initially planned following a structured, five-phase implementation plan designed to ensure that both technical development and user requirements are addressed systematically.

Each phase contributed incrementally to the delivery of a functional and user-centered toolbox. The plan was designed to deliver a first version of the toolbox within the first 18 months of the project but also to establish a robust foundation for further refinement, content expansion, and stakeholder uptake in the following stages of PRIMED.

### ***Phase 1: Identification of Requirements (M6–M8)***

The first phase focused on the identification and formalisation of the functional and technical requirements of the PRIMED toolbox, grounded in stakeholder needs and practical use cases.

This involves engaging with primary producers, entrepreneurs, researchers, technology providers, industry professionals, investors, policymakers, and support organisations. Through this engagement, the core concepts and functionalities required by different user groups will be identified. The output will be a comprehensive requirements document detailing the necessary features, data needs, and user interactions.

In parallel, a benchmarking exercise is conducted to review existing platforms and tools developed in other European projects, with the objective of identifying functional gaps and opportunities for synergies.

### ***Phase 2: Analysis and Conceptual Design (M8–M10)***

Building on the requirements defined in Phase 1, the second phase was dedicated to the conceptual design of the toolbox architecture and components.

This phase involved translating user requirements into functional modules, with a strong emphasis on aligning the design with outputs from the PRIMED workpackages. Specific attention is paid to guide users through the analysis, selection, and adaptation of components suitable for circular and bio-based value chains.

Wireframes and mockups for the toolbox and its components will be created, ensuring the conceptual design aligns with user needs and technical feasibility.

### ***Phase 3: Tool Interface Design and Validation (M10–M12)***

The third phase focused on the detailed design of the user interface and its validation through targeted user testing. The goal is to ensure that the toolbox would be intuitive, and aligned with user expectations in terms of usability and content logic.

User interface prototypes are developed and tested with a representative group of stakeholders, covering a range of user profiles and digital literacy levels. Usability testing sessions focus on key criteria including, clarity

of content categorisation and terminology, effectiveness of the navigation system, and other related concerns. Feedback gathered during these sessions is consolidated and used to refine the interface. Key improvements included streamlining of navigation flows, and enhancement of visual hierarchy is expected.

***Phase 4: Development and Population of Data Backend (M12–M15)***

The fourth phase involves developing and populating the data backend to support the toolbox and its tools. This includes comprehensive data on technologies, feasibility analysis templates, biomass/feedstock, business model templates, regulatory landscape, business cases, geographic & socioeconomic context, value chains, operational conditions, stakeholders, bio supply chains, conversion chains, partnerships, living labs, and bioeconomy ecosystems will be collected and integrated. Ensuring data accuracy, consistency, and completeness is critical in this phase. The data population process is carried out in coordination with all PRIMED WPs.

***Phase 5: Implementation of the first version (M15–M18)***

The final phase of the implementation plan focused on the development of the first version of the toolbox, containing the core functionalities identified. This includes the development of the interface core functionalities and the integration of the data components.

### 3. PRIMED-BASED, High-level Models for Bioeconomy Development

At M3 of PRIMED, WP4 has established a preliminary framework that organizes the different concerns in PRIMED to understand the interconnections between different tasks and activities planned in the course of the project. The framework also delimits the different items that can be relevant to the toolbox and can possibly be included, depending on the added value of such item with respect to the overall objectives of the toolbox and its compatibility with other components.

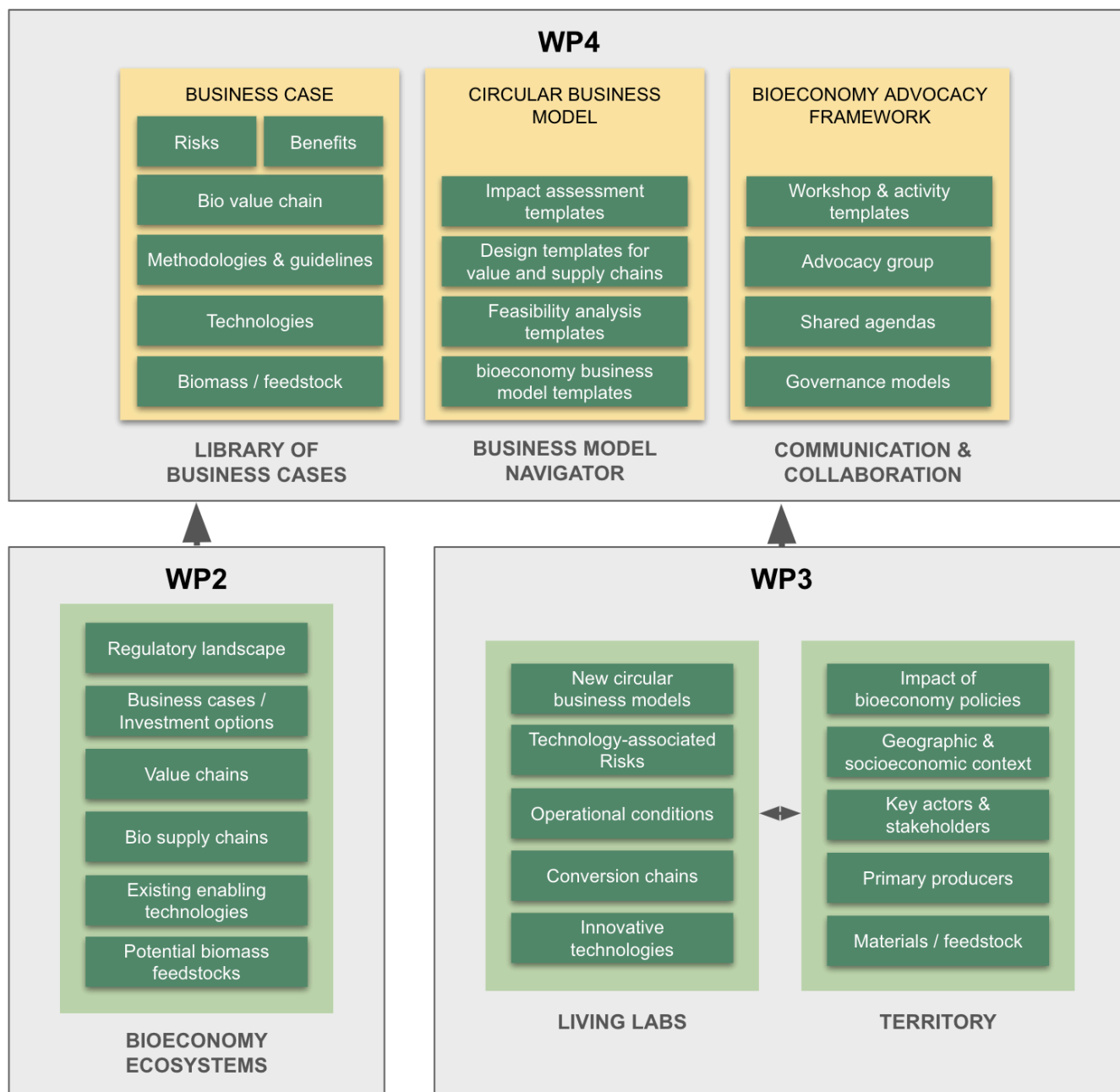


Figure 1. The WP4 Original Framework

This framework serves as the foundation for defining the information architecture of the PRIMED Toolbox. It identifies the key information objects such as resources, technologies, products, stakeholders, territories, and governance models, which together constitute the core data environment of the Toolkit. Understanding these

objects and their interrelations is key to delimit the scope and boundaries of the Toolbox, ensuring that every component included contributes directly to the project's overarching objectives.

## Fundamental data requirements

Based on the WP4 framework, our initial analysis shows that, in order to ensure the PRIMED Toolbox effectively supports the development and implementation of innovative bioeconomy business models, it must encompass various key data requirements, based on the available data, information and knowledge generated in WP2, WP3, and WP4. The following core concepts were analysed and designated of prime interest for the tools, and a process for acquiring relevant data and information on these tools has been established.

**Technologies** are a fundamental aspect, requiring data on both existing enabling technologies and innovative technologies. This includes detailed information on conversion chains, which detail the technologies used to convert biomass into bio-based products.

**Bioresource or Biomass**, feedstock and raw materials available for bio-based production, along with information on potential biomass feedstocks to identify new and sustainable sources.

**Geographic and socioeconomic context parameters**, encompassing regional data on socioeconomic factors influencing the bioeconomy, including demographics, economic activities, and regional biomass availability.

**Value chains and bio supply chains**, covering the stages from primary production to end-users, including supply chain logistics and management for biomass and bio-based products.

**Operational conditions**, including environmental, economic, and operational factors affecting bioeconomy operations, must also be documented.

**Key actors and stakeholders**, such as industry professionals, researchers, and policymakers, are necessary for building a comprehensive stakeholder database.

**Business models**, the toolbox should offer bioeconomy business model templates, providing frameworks for developing sector-specific business models, and new circular business models that focus on sustainability and resource efficiency.

Examples of **successful business cases**/investment options and assessments of technology-associated risks, enabling stakeholders to make informed investment decisions.

**Regulatory landscapes**, data on relevant laws, regulations, and policies affecting the bioeconomy sector, as well as analyses of the impact of these bioeconomy policies.

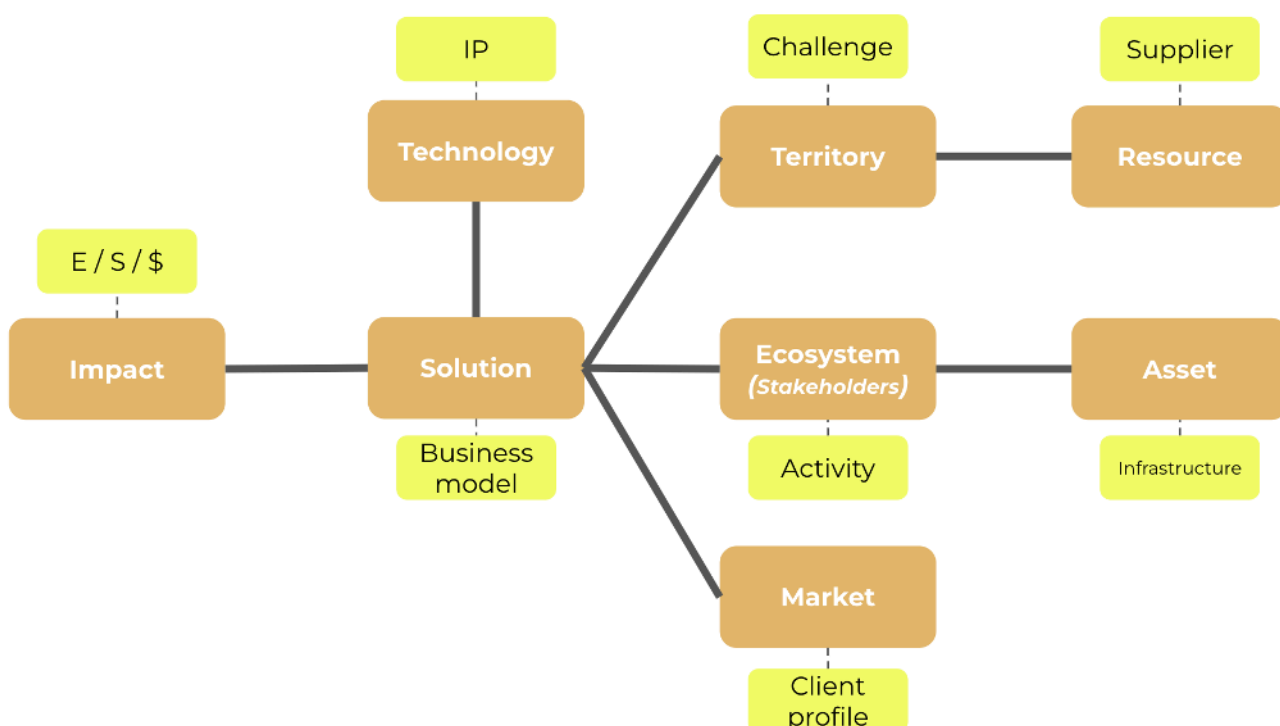
These data components outlined above form the structural backbone of the PRIMED Toolbox and are directly mapped to the context-based conceptual design developed in WP4 (see Chapter 5). Each data category (territories, resources, technologies, stakeholders, products, governance, and business models...) corresponds to one or more interaction contexts that define how users engage with the system. For example, resources and technologies underpin the "Explore Resource" and "Identify Technology" contexts, while stakeholders and governance models enable the "Connect Stakeholders" and "Structure Business" phases. These interconnected data objects create a continuous workflow that mirrors the user journey from territorial scoping to value-chain design and business modelling. In this way, the data architecture organises information logically and also ensures that every dataset supports a specific stage of user interaction and learning within the Toolbox.

## Information Schema for Bioeconomy Solutions

The development of a structured information schema is essential to support the design, replication, and scaling of sustainable bioeconomy value chains. In the context of the PRIMED project, this schema serves as a conceptual and functional backbone for capturing the key elements and interrelations that define a circular and regenerative bioeconomy. It responds directly to the need for a transversal, systems-level approach that overcomes current barriers such as fragmented knowledge, lack of stakeholder coordination, and limited access to investment-ready business cases.

Bioeconomy, by nature, is not a linear sector but a network of interconnected, bio-based value chains where residual streams and by-products are not discarded but revalorised. It is deeply rooted in the principle of maximizing the sustainable use of local natural resources while minimizing environmental externalities—particularly CO<sub>2</sub> emissions. These value chains are typically shorter, territorially embedded, and involve a wide diversity of actors, from raw material suppliers to SMEs, cooperatives, researchers, public administrations, and end-users. Successful bioeconomy initiatives are therefore characterised not only by technological innovation but by multistakeholder collaboration, contextual adaptability, and demonstrable environmental and social impact.

Building on the methodologies developed within PRIMED, the preliminary information schema identifies and organises the core elements required to define and implement a bioeconomy solution. At its centre is the Bioeconomy Solution, conceptualised as an applied, context-specific innovation that integrates technological, ecological, and socio-economic dimensions. This solution is embedded within a Territory that presents specific challenges and opportunities; it draws upon Local Resources, including both primary biomass and secondary by-products; and it is supported by a dynamic Ecosystem of Stakeholders with distinct roles, capabilities, and interests.



*Figure 2. Information Scheme for Bioeconomy Development*

Each Bioeconomy Solution is characterised by a set of Enabling Technologies (e.g. fermentation, anaerobic digestion, biorefining) that make the transformation of resources feasible and viable. The solution exists within a defined Market Context, targeting specific sectors or consumer needs, and must demonstrate clear Environmental, Social, and Economic Impacts to justify investment and policy support. Impact indicators—such as CO<sub>2</sub> reduction, job creation, or circularity metrics—are central to assessing the effectiveness and replicability of each initiative.

Crucially, the solution also integrates an underlying Business Model, which ensures its long-term viability. This business model connects the technological logic of the solution with its operational, financial, and governance components, adapting tools such as circular business model canvases, revenue stream definitions, and stakeholder benefit mappings.

The schema also defines secondary relationships and dependencies between objects. For instance:

- Resources are linked to Suppliers, which may be individual producers, cooperatives, or agro-industrial actors.
- Territories are described not only by geographical boundaries but also by socio-economic conditions, regulatory contexts, and local development strategies.
- Stakeholders are categorised by role (e.g. investor, operator, knowledge provider) and engagement level, often aligned with the hexa-helix model.
- Markets are described in terms of segments, trends, and barriers, helping guide positioning strategies.

## Workshop I: Eliciting Requirements through Collaborative Value Chain Design

This initial workshop organized during the General Assembly at M12 plays a pivotal role in informing the development of the PRIMED Toolbox by providing a structured, hands-on environment for eliciting functional and methodological requirements. It focuses on understanding how territorial bioeconomy value chains are conceived, mapped, and developed collaboratively among diverse stakeholders. The objective is to translate this co-design process into concrete inputs for the Toolbox, ensuring it reflects real-world practices, needs, and barriers encountered by regional actors. The workshop also aimed to observe how different information objects (resources, technologies, products, stakeholders, and governance elements) and systemic concerns (economic, social, and environmental) are defined and interconnected during the co-creation of bioeconomy value chains.

Spanning 2.5 hours, the workshop brings together representatives from the five Living Labs (LLs), grouped by territory, alongside members of WP2, WP3, and WP4. Each group engages in a guided co-creation process to explore how territorial challenges, available bioresources, and future visions can be transformed into actionable bioeconomy solutions. The process is moderated to ensure alignment across work packages and to document the methods, tools, and types of support stakeholders need when building circular and regenerative value chains.

The workshop is structured around the following main activities:

### **1. Introduction and Context Setting**

The session begins with a brief introduction to the workshop's purpose: to understand the process by which territorial actors collaboratively define bioeconomy value chains, and to derive requirements for the Toolbox that will support such processes. Participants are assigned to their Living Lab groups, each comprising local representatives and transversal WP experts.

## **2. Territorial Framing and Vision Sharing**

Each Living Lab presents a structured overview of its territory using a common template, outlining key geographic, socioeconomic, and environmental features, existing challenges, and a preliminary future vision. This segment aims to surface the contextual factors that shape value chain opportunities and constraints. Other group members are encouraged to identify potential gaps, actors to be involved, and system-level challenges, thereby mapping the complexity that the Toolbox will need to accommodate.

## **3. Collaborative Solution Design and Mapping**

In the core exercise, each group works with a printed version of the circular bioeconomy canvas to design a potential value chain aligned with their territory's vision. Participants identify:

- The key regional challenges and enabling resources.
- The types of stakeholders needed to operationalise the solution and their expected roles.
- Market segments and value propositions that reflect circularity and local specificity.
- Expected environmental, social, and economic impacts of the proposed solution.
- Barriers to implementation, such as knowledge gaps, investment needs, or governance limitations.

Throughout the exercise, facilitators document both the content and process: what information actors need at each step, what tools support the discussion, and where bottlenecks or uncertainties arise. These observations will directly inform the functionality, content structure, and user journey of the Toolbox.

## **Outcomes**

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The workshop culminated in the co-creation of five preliminary circular value chain canvases, one for each Living Lab territory. These canvases captured early-stage bioeconomy solutions rooted in the specific challenges, resources, and ambitions of each region. While these templates constituted a tangible output, the workshop's main value lay in its process insights.

As participants progressed through the design exercise, a clearer picture emerged of what users actually need to co-create and validate bioeconomy initiatives. The workshop revealed which types of tools and templates are most helpful at different stages of value-chain development, from stakeholder mapping and role definition to impact articulation and business-model validation. It also provided empirical evidence of how multi-actor collaboration unfolds in practice: how decisions are negotiated, how roles are distributed, and where friction or uncertainty tends to arise.

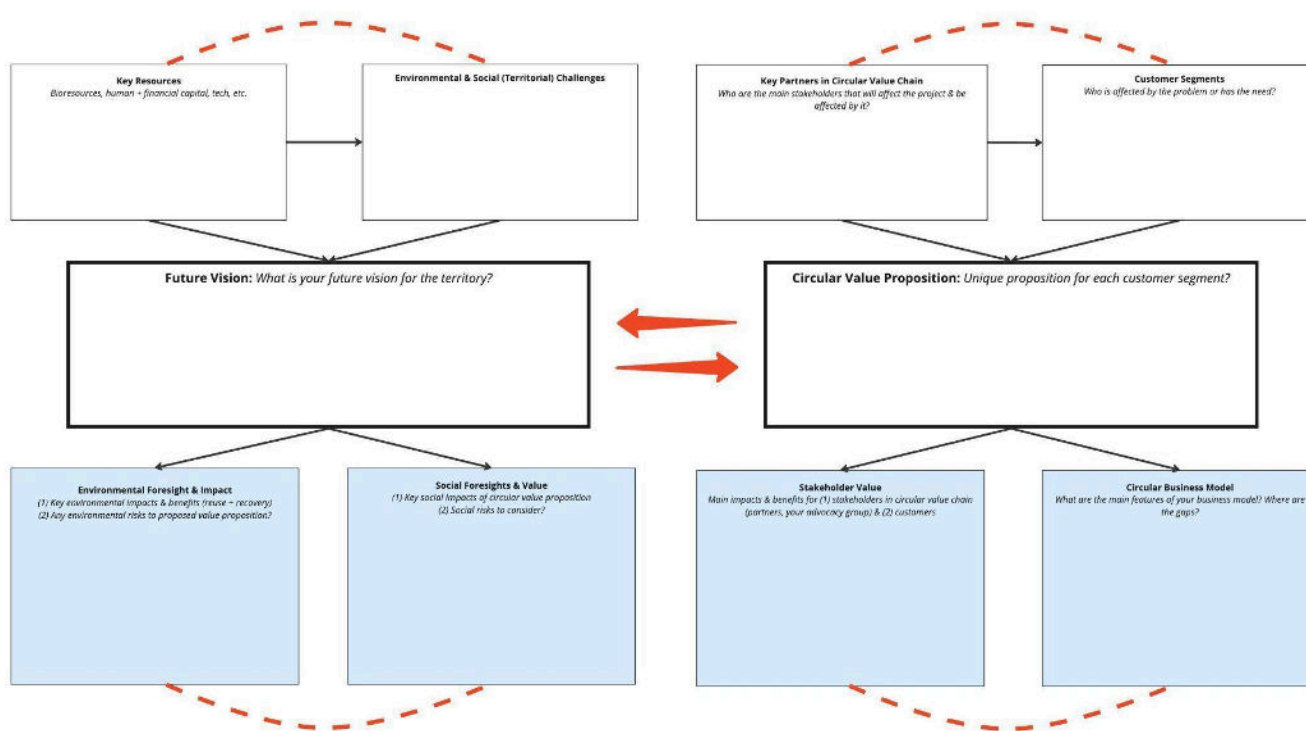


Figure 3. The Future Vision Scenario template designed for the workshop

Crucially, the session illuminated persistent gaps in data availability, knowledge access, and methodological support that hinder the implementation of circular and regenerative models. These findings became a cornerstone for the conceptual design of the PRIMED Toolbox: they helped define the system’s information objects, clarify their interconnections, and prioritise the functionalities required to support real user workflows.

In this sense, Workshop 1 served as a requirement-elicitation exercise and as a conceptual validation of the Toolbox architecture, confirming that its design must mirror the logic of collaborative value-chain construction. The insights gained from this session directly informed the context-based design approach adopted in WP4, ensuring that the Toolbox structure remains grounded in authentic stakeholder processes while maintaining a clear separation of concerns for future interface and data-layer development.

## 4. Use Cases and High-Level Requirements

To ensure that the PRIMED Digital Toolbox addresses the real-world needs of its diverse user base, we have identified eight representative use cases. These scenarios span the entire innovation lifecycle, from initial ideation and co-creation in Living Labs through policy design, project evaluation, and market replication. Together, they illustrate how different actors can leverage the Toolbox to overcome common barriers, accelerate decision-making, and co-design robust, place-based bioeconomy value chains.

### **Use Case 1: Regional Development Agency Designing a New Bioeconomy Cluster**

- **Objective:** Activate a local bioeconomy cluster based on agricultural by-products and SME capabilities.
- **Challenge:** Lacks a systematic method to identify viable value chains, convene stakeholders, and quantify potential impacts.
- **Toolbox Role:**

- Territory mapping and resource identification
- Scenario building and impact-assessment templates
- Governance blueprints for multi-stakeholder steering groups
- **Outcome:** A validated shared innovation agenda and a pilot plan for a circular value chain rooted in regional assets.

#### ***Use Case 2: Cooperative Valorising Agricultural Sidestreams***

- **Objective:** Transform olive-oil pomace and pruning residues into novel value-added products.
- **Challenge:** Limited access to technology partners, market data, and financing sources.
- **Toolbox Role:**
  - Partner matchmaking to identify technology providers and investors
  - Customisable business model templates for agri-sidestream valorisation
  - Case-study library of Mediterranean success stories
- **Outcome:** A feasible, investor-ready business model that engages new partners and secures pilot funding.

#### ***Use Case 3: Research Institution Facilitating a Living Lab Roadmap***

- **Objective:** Co-develop a regional bioeconomy strategy within a Living Lab framework.
- **Challenge:** Must bridge academic research and practical implementation, ensuring active stakeholder buy-in.
- **Toolbox Role:**
  - Interactive facilitation tools and shared canvases
  - Embedded case annotations and decision-support guidance
- **Outcome:** A collaboratively authored roadmap with clear roles, milestones, and impact metrics.

#### ***Use Case 4: Policy-Maker Designing Regional Incentives***

- **Objective:** Craft targeted incentives and policy frameworks aligned with EU Green Deal targets.
- **Challenge:** Requires data-driven insights into on-the-ground barriers and opportunity areas.
- **Toolbox Role:**
  - Aggregated data on resources and gaps
  - Evidence-based case studies to guide policy design
- **Outcome:** A set of place-based policy recommendations calibrated to regional needs.

#### ***Use Case 5: SME Scaling a Bio-Based Product in a New Territory***

- **Objective:** Replicate an existing circular materials business model in a neighboring region.
- **Challenge:** Needs clarity on local feedstock supply, partner networks, and regulatory constraints.
- **Toolbox Role:**
  - Territorial scan for resources, partners, and demand
  - Replication-readiness indicators across geographies
  - Adaptable business model canvases aligned with local specifics
- **Outcome:** A tailored market-entry plan that minimises uncertainty and forges strategic alliances.

#### ***Use Case 6: Funding Body Evaluating Bioeconomy Proposals***

- **Objective:** Improve the rigour and transparency of project appraisal processes.
- **Challenge:** Lacks standardised frameworks to compare systemic impact and feasibility.
- **Toolbox Role:**
  - Standardised evaluation templates integrating business, impact, and risk criteria
  - Benchmark cases and success indicators for reference

- Visualisation tools to map stakeholder networks and resource flows
- **Outcome:** More consistent, evidence-based decisions that prioritise high-impact innovations.

### **Use Case 7: Living Lab Facilitator Structuring Stakeholder Engagement**

- **Objective:** Design and document the process for forming an Initial Advocacy Group (IAG) using the Hexa-Helix model.
- **Challenge:** Must balance representation, influence, and geographic proximity across six stakeholder categories.
- **Toolbox Role:**
  - Guided templates for IAG composition and selection criteria
  - Stakeholder typology modules based on the Hexa-Helix framework
- **Outcome:** A validated IAG charter and engagement plan that ensures inclusive, forward-looking collaboration.

### **Use Case 8: Citizen Representative Co-Creating a Shared Agenda**

- **Objective:** Contribute a community perspective to the Living Lab’s Shared Future Vision.
- **Challenge:** Needs accessible tools to articulate local concerns and link them to bioeconomy opportunities.
- **Toolbox Role:**
  - Simplified canvases for non-technical users
  - Case libraries featuring comparable community-led initiatives
  - Embedded guidance to translate local needs into value propositions
- **Outcome:** An integrated Shared Agenda that reflects both grassroots priorities and technical feasibility.

While each use case addresses unique challenges and stakeholder requirements, common themes emerge. For instance, nearly all scenarios benefit from structured templates and processes that guide multi-actor engagement. Also, across planning, policy, and investment phases, the Toolbox’s data aggregation modules reduce uncertainty and improve decision quality. Finally, interactive navigators and dynamic templates bridge the gap between research and practice, empowering both technical and non-technical users.

Table 1. Summary of the use cases

Use Case	Primary Stakeholder	Phase	Key Toolbox Capability	Expected Benefit
1. Regional Development Agency	Public authority	Planning & Ideation	Territory mapping & impact templates	Evidence-based cluster activation
2. Cooperative Valorisation	Producer cooperative	Design & Partnership	Partner matchmaking & business canvases	Viable sidestream valorisation model
3. Research Institution in LL	RTO / Facilitator	Co-creation & Roadmapping	Interactive facilitation & feedback	Stakeholder-owned strategy
4. Policy-Maker	Policy-maker	Policy Design	Data dashboards & simulation tools	Targeted, data-driven incentives
5. SME Market Replication	SME startup	Replication	Territorial scan & adaptation tools	Rapid, low-risk market entry
6. Funding Body	Funder	Evaluation	Standardised evaluation & benchmarks	Transparent, high-impact funding decisions

7. Living Lab Facilitator	LL Coordinator	Stakeholder Engagement	IAG templates & typology modules	Inclusive, structured multi-actor governance
8. Citizen Representative	Citizen / CSO	Agenda Co-creation	Simplified canvases & embedded guidance	Grassroots-informed shared vision

## High-level Requirements Elicitation

The MoSCoW framework is a prioritisation method widely used in project management and requirements analysis to classify and manage stakeholder demands effectively. The name is an acronym derived from the four priority categories it uses:

**Must Have** – These are critical requirements that are non-negotiable for the system to be functional and deliver its core value. Without them, the project would be considered a failure or not viable.

**Should Have** – These are high-priority features that are important but not essential for immediate delivery. While they add significant value and improve usability or performance, the project can still succeed without them in the short term.

**Could Have** – These represent desirable enhancements or optional features that can improve the user experience but are not essential. They are typically included only if time and resources permit.

**Won't Have (for now)** – These are agreed-upon items that will not be implemented in the current development cycle but may be revisited in the future. Clearly defining these helps manage expectations and prevent scope creep.

In the context of the PRIMED Toolbox, the MoSCoW framework was applied during the requirements identification phase to prioritise features based on their relevance to core user needs, technical feasibility, and alignment with the project's objectives. This approach facilitated focused development efforts, ensured efficient resource allocation, and supported transparent decision-making among consortium partners and stakeholders.

To translate the Toolbox's concept and use cases into a concrete development roadmap, we conducted a high-level requirements elicitation and prioritisation exercise using the MoSCoW framework. Requirements are divided into functional (the features and capabilities the system must deliver) and non-functional (quality attributes and operational constraints). Each requirement is classified as Must, Should, Could, or Won't (this cycle) to guide phased implementation and resource allocation.

## Functional Requirements

Table 2. Prioritized functional requirements

RID	Priority	Requirement description
<b>FR1</b>	<b>Must</b>	Stakeholder Matchmaking: Enable users to discover and connect with collaborators by filtering on expertise, geography, and shared objectives.
<b>FR2</b>	<b>Must</b>	Business Model Navigator: Provide a workflow for designing circular bioeconomy business models, including templates and guidance.

<b>FR3</b>	<b>Must</b>	Impact Calculator: Integrate data (feedstocks, technologies, regulations) and allow users to model environmental, social, and economic impacts.
<b>FR4</b>	<b>Must</b>	User Contribution: Let community members submit new data, cases, and tools via structured forms, subject to moderation workflows.
<b>FR5</b>	<b>Should</b>	Case Library with Replication Guides: Offer a curated repository of validated bioeconomy cases, each accompanied by a playbook for regional adaptation.
<b>FR6</b>	<b>Should</b>	Co-creation Canvas & Facilitation Tools: Supply downloadable and in-platform canvases for workshop use, with embedded instructions and real-time collaboration.
<b>FR7</b>	<b>Should</b>	Policy Simulation Module: Allow policy-makers to explore “what-if” scenarios quantifying the effects of incentive schemes on value-chain outcomes.
<b>FR8</b>	<b>Could</b>	User Contribution Portal: Let community members submit new tools, cases, and datasets via structured forms, subject to moderation workflows.
<b>FR9</b>	<b>Could</b>	Multilingual Interface: Support at least three EU languages for core navigation and templates, based on user demand.
<b>FR10</b>	<b>Won't</b>	Integrated E-Learning Platform: Full SCORM-compliant LMS with advanced tracking and certification.

## Non-Functional Requirements

Table 3. Prioritized non-functional requirements.

RID	Priority	Requirement description
<b>NR1</b>	<b>Must</b>	Usability and Accessibility: Conform to WCAG 2.1 AA standards; ensure intuitive navigation and responsive design across devices.
<b>NR2</b>	<b>Must</b>	Scalability and Performance: Support at least 100 concurrent users without degradation; page load times under 3 seconds for core modules.
<b>NR3</b>	<b>Should</b>	Offline Mode for Templates: Allow users to download and work with key templates offline.
<b>NR4</b>	<b>Should</b>	Interoperability and APIs: Expose RESTful endpoints for data import/export and allow integration with external knowledge bases.
<b>NR5</b>	<b>Should</b>	Security and Data Privacy: Implement role-based access control, data encryption at rest and in transit, and GDPR-compliant policies.
<b>NR6</b>	<b>Could</b>	Analytics and Usage Reporting: Provide administrators with dashboards of user activity, popular tools, and contribution metrics.
<b>NR7</b>	<b>Won't</b>	Mobile-First Native App: Development of native iOS/Android applications (web responsive design will be prioritised initially).

## 5. Context-based Conceptual Design of the Bioeconomy Tool

To ensure that the PRIMED Digital Toolbox is both user-centered and technically coherent, we adopted a Context-Based Design methodology. Rather than beginning with feature lists or technology inventories, this approach organizes the toolbox around a small set of “contexts”. Each context is a self-contained module addressing a particular user concern or thematic objective. By structuring the toolbox in this way, we can tailor functionality, data schemas, and interface elements to the needs and skills of distinct user groups, while still ensuring seamless interoperability across the platform.

The context-based architecture provides the operational logic that translates the high-level functional and non-functional requirements into concrete design domains. Each context acts as a container for one or more requirements, allowing them to be implemented coherently while maintaining modularity and interoperability. In the PRIMED Toolbox, concept design is context-based because each function, dataset, and interface element is grounded in a real operational context (territory, resource, technology, stakeholder, or business configuration). This ensures that users interact not with abstract categories but with the same relational logic that defines real bioeconomy systems.

Building on our Context-Based Design methodology, we have identified six core contexts that together encompass the full bioeconomy value-chain lifecycle. Each context represents a coherent functional domain, with its own digital artifacts, end-to-end processes, elemental functions, and interoperability requirements. Below we describe each context in turn.

- 1. Select Territory:** Define the geographic and socio-economic boundary within which a bioeconomy solution will be developed. Digital Objects: Territory profiles, administrative boundaries, socio-economic indicators, regulatory overlays.
- 2. Explore Resource:** Catalogue and assess local feedstocks, by-products, and sidestreams available within the selected territory. Digital Objects: Resource catalog entries, quality and volume metrics, supplier profiles.
- 3. Identify Technology:** Match available resources to appropriate conversion or processing technologies. Digital Objects: Technology profiles, technology-resource compatibility matrices, TRL (Technology Readiness Level) metadata, cost and performance parameters.
- 4. Connect Stakeholders:** Facilitate the formation of multi-actor consortia and governance structures. Digital Objects: Stakeholder profiles (role, expertise, interests), relationship maps, governance templates.
- 5. Create BioProduct:** Configure the proposed bio-based product or service, linking feedstock, technology, and stakeholder roles into a coherent value proposition. Digital Objects: Circular value-chain canvases, product specifications, impact projections.
- 6. Structure Business:** Develop the financial, legal, and operational framework to implement the bioeconomy solution. Digital Objects: Business-model templates, revenue and cost streams, investment scenarios, risk registers.

These contexts are not isolated modules but operate in a coordinated workflow. Users can initiate their engagement in any context and move iteratively across others, depending on the maturity and specific needs of their initiative. For example, a user may begin by selecting a geographic area and mapping its feedstocks, then identify compatible technologies and relevant actors, and ultimately design a value chain and assess its viability.

This modular and interconnected structure allows the toolbox to accommodate diverse entry points while maintaining consistency and traceability across data and actions. Each context supports a range of elementary

functions, such as creating, editing, tagging, connecting, searching, and filtering objects, that enable users to build, refine, and document their projects systematically.

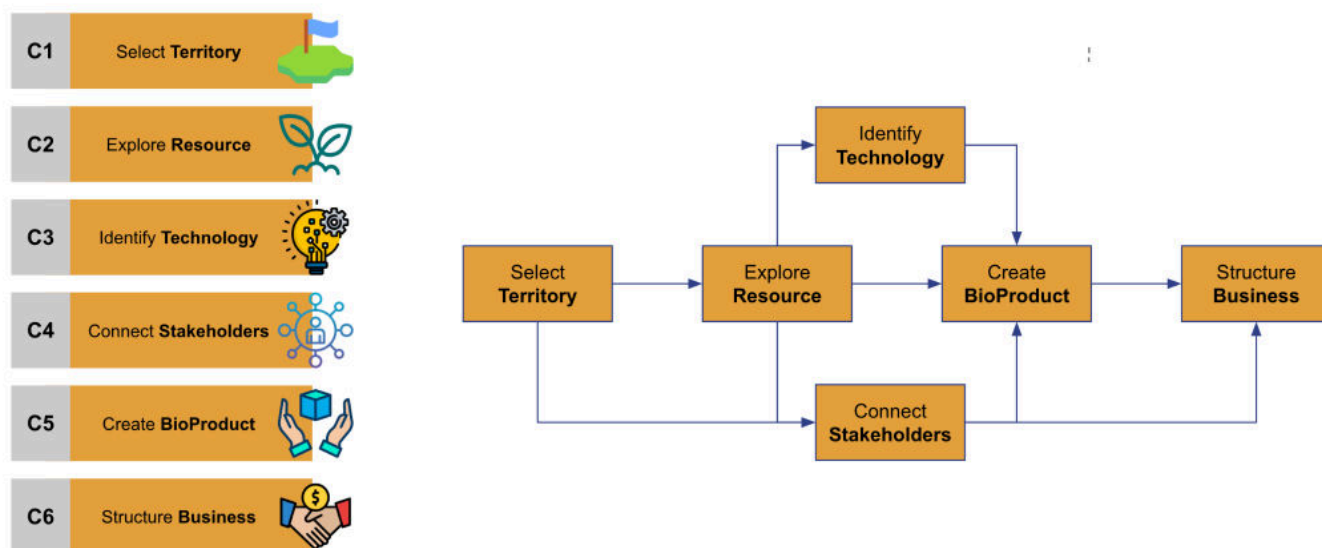


Figure 4. Interaction Contexts for the Toolbox

Table 4. Mapping requirements onto the Interaction Contexts defined.

Context	High-Level Requirements	Primary Functional Focus	Non-Functional Concerns
<b>Select Territory</b>	FR1 (Stakeholder matchmaking), FR3 (Impact calculator)	Define the spatial and regulatory frame for value-chain design; visualise regional data layers.	NR1 (Usability), NR2 (Performance), NR4 (geospatial data).
<b>Explore Resource</b>	FR3 (Impact calculator), FR5 (Case library), FR6 (Co-creation)	Catalogue feedstocks and by-products, assess availability and sustainability.	NR1 (Usability), NR2 (Scalability), NR5 (data integrity).
<b>Identify Technology</b>	FR2 (Business Model), FR3 (Impact calculator), FR7 (Policy inputs)	Match resources with transformation technologies; model conversion efficiency and readiness.	NR4 (tech data), NR2 (Performance).
<b>Connect Stakeholders</b>	FR1 (Stakeholder matchmaking), FR6 (Co-creation)	Facilitate the formation of multi-actor partnerships and governance models; visualise relational maps.	NR1 (Accessibility), NR5 (Security & GDPR).
<b>Create BioProduct</b>	FR2 (Business Models), FR5 (Case library), FR8 (User contribution)	Configure circular value chains, define outputs, and link to markets.	NR1 (Usability), NR3 (Offline templates), NR6 (Analytics).
<b>Structure Business</b>	FR2 (Business Models), FR7 (Policy inputs), FR9 (Multimodal interface)	Develop operational, financial, and governance frameworks for implementation.	NR4 (lexport BM), NR5 (Security), NR7 (Responsive design)

This mapping demonstrates that the functional requirements (FR1–FR9) are not implemented as isolated features but are distributed across six interoperable contexts, each representing a coherent segment of the

bioeconomy innovation process. The non-functional requirements (NR1–NR7), meanwhile, cut across all contexts, defining shared quality attributes (e.g. usability, scalability, and security) that ensure consistency and reliability of user experience.

From a systems-engineering perspective, the context-based design thus provides a “separation of concerns” framework that aligns directly with requirement categories:

- Data concerns (resources, technologies, products) are concentrated in Explore Resource, Identify Technology, and Create BioProduct.
- Process concerns (coordination, governance, business structuring) are managed through Connect Stakeholders and Structure Business.
- Spatial and contextual concerns (territory, regulation, and impact) are handled in Select Territory.

This alignment ensures that requirement implementation is incremental and modular: each context can evolve independently while maintaining data integrity and interoperability across the platform. It also enables phased development, focusing the first prototype on the contexts with the highest functional priority (Explore Resource, Identify Technology, Create BioProduct) while reserving extended governance and business-model layers for later versions.

## Validation and Refinement Through User Journeys

To ensure the robustness and practical relevance of the context-based architecture underpinning the PRIMED Toolbox, a structured validation process was conducted using a comprehensive set of user journeys. These journeys were designed to represent typical scenarios encountered by stakeholders engaged in the development of territorial bioeconomy value chains.

A total of 22 user journeys were defined and analyzed, each illustrating a specific combination of user intent, context navigation, and functional requirements. This exercise served a dual purpose: (1) to confirm the functional adequacy of the six core contexts, and (2) to validate the coherence of transitions and dependencies between them.

Each journey describes a stepwise progression from an initial objective, such as launching a pilot, validating a new feedstock, or assessing technology applications, through to concrete outputs such as bioproduct canvases, stakeholder networks, and business model prototypes. The design of each journey was aligned with the basic functionalities anticipated in the early stages of the Toolbox, including object creation, tagging, editing, linking, and filtering.

This methodology ensured that the platform’s conceptual design was grounded in real-world operational needs and workflows. The analysis also confirmed that the modularity of the contexts allows for non-linear, adaptive navigation, enabling users to initiate their process from any entry point, territory, technology, resource, or stakeholder, depending on the use case.

The following provides a representative subset of these journeys, demonstrating how the PRIMED Toolbox supports diverse processes across the bioeconomy innovation landscape.

### Journey1 - Launch a New Pilot

- 1. Select Territory: Create → draw polygon for pilot area, Edit → name & assign administrative units.
- 2. Explore Resource: Search → query available biomass within polygon, Connect → link new resource entries to territory.

- 3. Identify Technology: Browse → filter technologies compatible with chosen resource; Tag → mark preferred options.
- 4. Connect Stakeholders: Search → find local suppliers & tech providers; Connect → add to pilot.
- 5. Create BioProduct: Create → instantiate canvas, Connect → drag in resources, technologies, stakeholders; Tag → annotate impact assumptions.
- 6. Structure Business: Create → new business model from pilot; Edit → populate cost/revenue; Export → summary PDF for partners.

### **Journey2 - Validate a New Resource**

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- 1. Select Territory: Search → locate existing project area.
- 2. Explore Resource: Create → add new sidestream sample; Tag → annotate quality/volume; Connect → link supplier stakeholder.
- 3. Connect Stakeholders: Browse → find testing labs; Connect → assign quality validation tasks.
- 4. Identify Technology: Search → find pilot-scale trials for resource; Connect → link technology to resource record.

### **Journey3 - Cross-Regional Model Replication**

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- 1. Select Territory: Search → import existing canvas's territory A.
- 2. Explore Resource: Search → scan territory B's feedstocks.
- 3. Identify Technology: Compare → list tech gaps between A & B.
- 4. Create BioProduct: Create → clone canvas for territory B; Edit → update resources & tech.
- 5. Structure Business: Edit → adjust cost structures to reflect new inputs; Export → adaptation report.

### **Journey4 - Find New Applications for a Technology**

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- 1. Identify Technology: Search → open technology profile.
- 2. Explore Resource: Browse → view compatible bioproducts.
- 3. Create BioProduct: Create → instantiate new application canvas; Connect → link to technology.
- 4. Connect Stakeholders: Search → find potential end-users or partners; Connect → add to pilot.

### **Journey5 - Design Value Chain Based on Byproducts**

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- 1. Explore Resource: Search → list byproduct resources.
- 2. Identify Technology: Filter → match resources with conversion technologies.
- 3. Create BioProduct: Create → new circular canvas; Connect → drag in resource-technology pairs.
- 4. Connect Stakeholders: Create → invite relevant producers & tech providers.
- 5. Structure Business: Edit → define cost/revenue streams.

### **Journey6 - Explore Complementarities Between Technologies**

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- 1. Identify Technology: Browse → select multiple tech profiles.
- 2. Identify Technology: Compare → map overlapping process steps and shared feedstocks.
- 3. Connect Stakeholders: Search → identify organizations experienced in both technologies; Connect → create collaboration groups.
- 4. Create BioProduct: Tag → annotate potential co-product synergies.

Accordingly, the context-based design of the toolbox was consolidated into the following model, using only basic functionalities such as create, edit, link, browse, select, and similar, in order to center the exercise on the design of the information structure in its most fundamental forms.

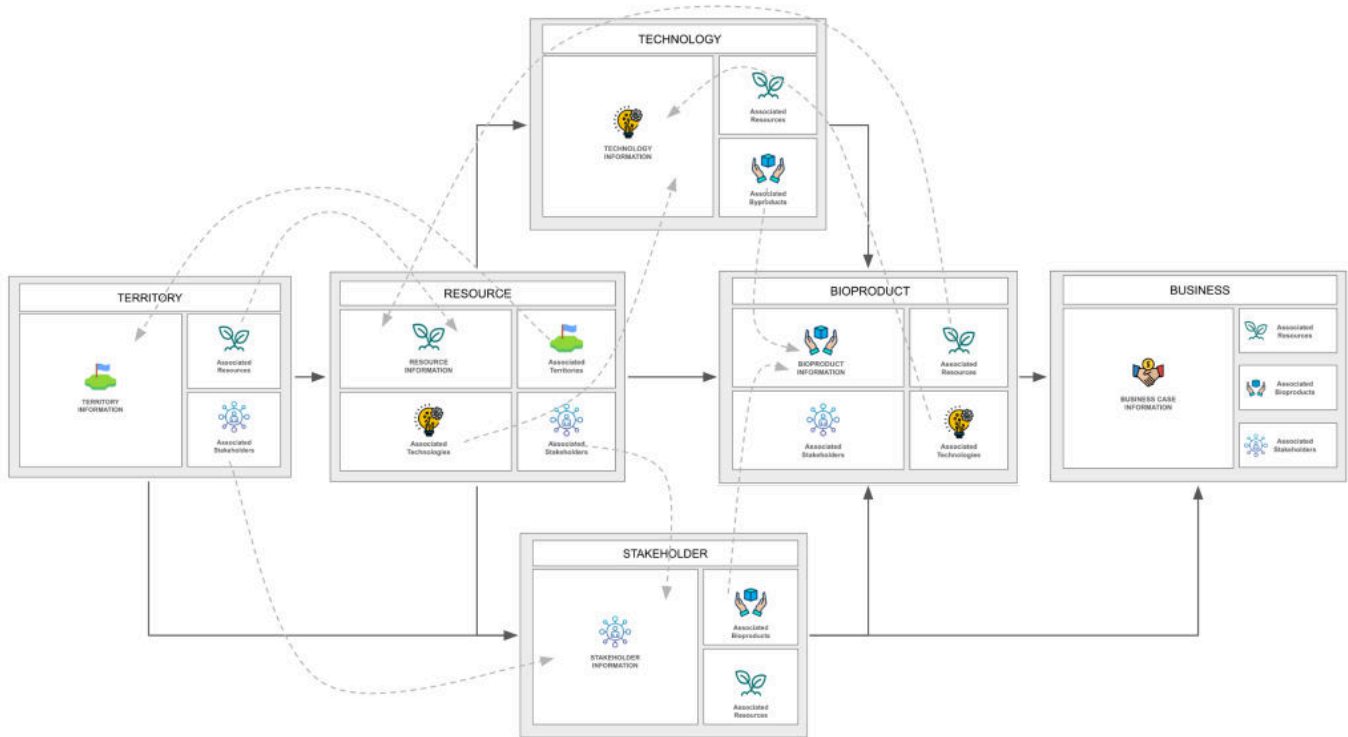


Figure 5. Context-based design of the Toolbox

In addition, several prototypical designs were developed and evaluated to analyze the tradeoff between compartmentalizing information under the six contexts, and the support for comprehensive end-to-end processes.

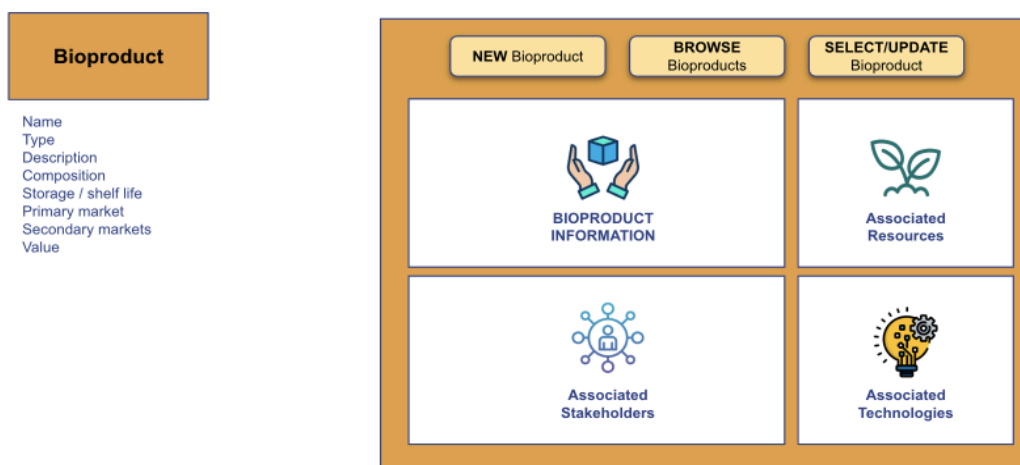


Figure 6. Example of Prototypical Designs Used

## 6. Interface Design and Validation

The first version of the PRIMED Toolbox translates the context-based conceptual design into a fully functional web application, integrating knowledge, data, and tools developed across the project's work packages into a coherent digital environment.

It provides both a system architecture and a user interface that operationalize the conceptual design, ensuring that users can seamlessly navigate between concept creation, knowledge access, and business design.

The first Toolbox focuses mainly on empowering users to design novel bioeconomy value chains. Through earlier conceptual research, we confirmed that this core capability, linking raw materials to transformative technologies, by-products to processing steps, and final products to their end markets, constitutes the Toolbox's distinctive value proposition in the bioeconomy ecosystem.

Consequently, Version1 is built around this essential chaining function. It seamlessly connects resources, technologies, and bioproducts, forming living, data-driven value chains. Peripheral components, such as curated libraries, contextual guidance, and knowledge repositories, are included as complementary support, enriching the user journey, and serving the broader purpose of the Toolkit as described in its concept.

By the end of the project, Version2 can evolve into a comprehensive platform (for example, integrating stakeholder matchmaking, business modelling, deeper territorial data, and co-creation features), while preserving the core value chain engine as its backbone.

## System Architecture, Data Structures and Functional Partitioning

The Toolbox has been developed as a web application with a relational backend database that organises and interlinks the different forms of knowledge required to design, test, and replicate circular bioeconomy value chains. At the core of the system is a data model composed of interrelated objects that capture the main dimensions of bioeconomy innovation. These include:

**Territory** – spatial, socio-economic, and regulatory descriptors that define the context in which bioeconomy solutions are implemented.

**Resources** – data on available biomass, side streams, and by-products.

**Technologies** – conversion and processing methods linking resources to products.

**Bioproducts** – outputs and end-markets emerging from value chains.

**Stakeholders** – actors involved in the design, governance, or implementation of solutions.

**Governance** – institutional structures, roles, and decision-making arrangements.

**Indicators** – environmental, economic, and social metrics for assessing impacts.

**BusinessModels** – structured templates for financial and operational configuration.

**ValueChains** – relational maps connecting resources, technologies, products, and actors.

**SuccessCases** – documented examples of real-world projects and pilots.

**FutureScenarios** – hypothetical or simulated examples used for exploration and learning.

**SupportTools** – templates, canvases, and collaborative resources for bioeconomy.

This structure provides the foundation for interoperability across modules, ensuring that every element created or edited within the interface corresponds to a clearly defined and reusable data object.

The web portal presents a landing page and a navigation menu that partition the Toolbox into six main contexts, providing users with both a creative workspace and a structured repository of knowledge. These contexts are:

**Bioeconomy Value Chains** – the entry point for exploring the logic, typologies, and examples of value chains across regions.

**The Bioeconomy Tool** – the core design environment for “Biopolygons” where users compose their own bioeconomy solutions by linking resources, technologies, and bioproducts.

**Exemplar Bioeconomy Business Models** – a reference collection of validated circular business configurations derived from PRIMED and other European projects.

**Bioeconomy Success Cases** – a library of real pilot and demonstration projects, offering empirical evidence and benchmarking examples.

**Hypothetical Bioeconomy Scenarios** – pre-defined, place-based or thematic scenarios that users can adapt or solve within the Bioeconomy Tool.

**Templates and Collaborative Tools** – communication and facilitation resources that support co-creation, stakeholder engagement, and governance design.

While these six sections collectively form the public interface of the Toolbox, they are differentiated by their function within the overall architecture. The Bioeconomy Tool implements the core logic of the context-based design, directly operationalising the six conceptual contexts (Select Territory, Explore Resource, Identify Technology, Connect Stakeholders, Create BioProduct, Structure Business). Within this environment, users can create, edit, and interlink the main data objects to form value chains, generate business-model drafts, or explore alternative configurations. The other five sections function as support and knowledge-sharing mechanisms, providing the reference information, templates, and exemplars that feed into or complement the design process. They serve as both educational and exploratory environments, ensuring that users have access to tested methodologies, practical examples, and facilitation materials that strengthen their design outcomes in the Bioeconomy Tool.

## Design and Implementation of the Bioeconomy Tool

At M16, an online design workshop was organized with participants from most PRIMED partners, representing diverse stakeholder backgrounds to validate and refine the user interface. The goal was to trace the end-to-end experience of three archetypal users (Technology Providers, Resource Producers, and Living Labs) across each of the conceptual design’s six core contexts. By observing their interactions and eliciting real-time feedback, the workshop generated actionable insights that shaped the prototype’s structure, navigation, and feature set.

During the session, participants received a concise overview of the conceptual framework and the six contexts: Select Territory, Explore Resource, Identify Technology, Connect Stakeholders, Create BioProduct, and Structure Business. Following this, attendees self-organized into profile-specific leads, where they mapped their principal motivations, roles, and workflow steps within each context.

The Technology Providers emphasized the need for clear mechanisms to increase visibility while safeguarding intellectual property. As they navigated the Select Territory context, participants highlighted the importance of a seamless interface for choosing applicable regions and linking those choices to downstream modules. In Explore Resource and Identify Technology, they iterated on profile creation flows that capture technology readiness levels, application domains, and IP metadata. Their feedback underscored the value of a unified action bar that surfaces context-relevant tasks (such as tagging compatible biomass types) without resorting to nested processes. Finally, in Connect Stakeholders and Create BioProduct, the group explored mockups that allow providers to preview sample value-chain canvases.

Resource Producers focused on understanding market demand and establishing fair, sustainable partnerships. In their journey mapping, participants described how they would define operational regions and input critical resource data (type, quality metrics, seasonality, and volume) in the Explore Resource module. They stressed the need for filtering when browsing compatible technologies and a clear interface to signal collaboration preferences, such as price ranges or delivery windows. Their iterations with the Create BioProduct and Structure Business contexts revealed the desirability of a builtin cost–revenue calculator and easy export of preliminary business summaries for partner discussions.

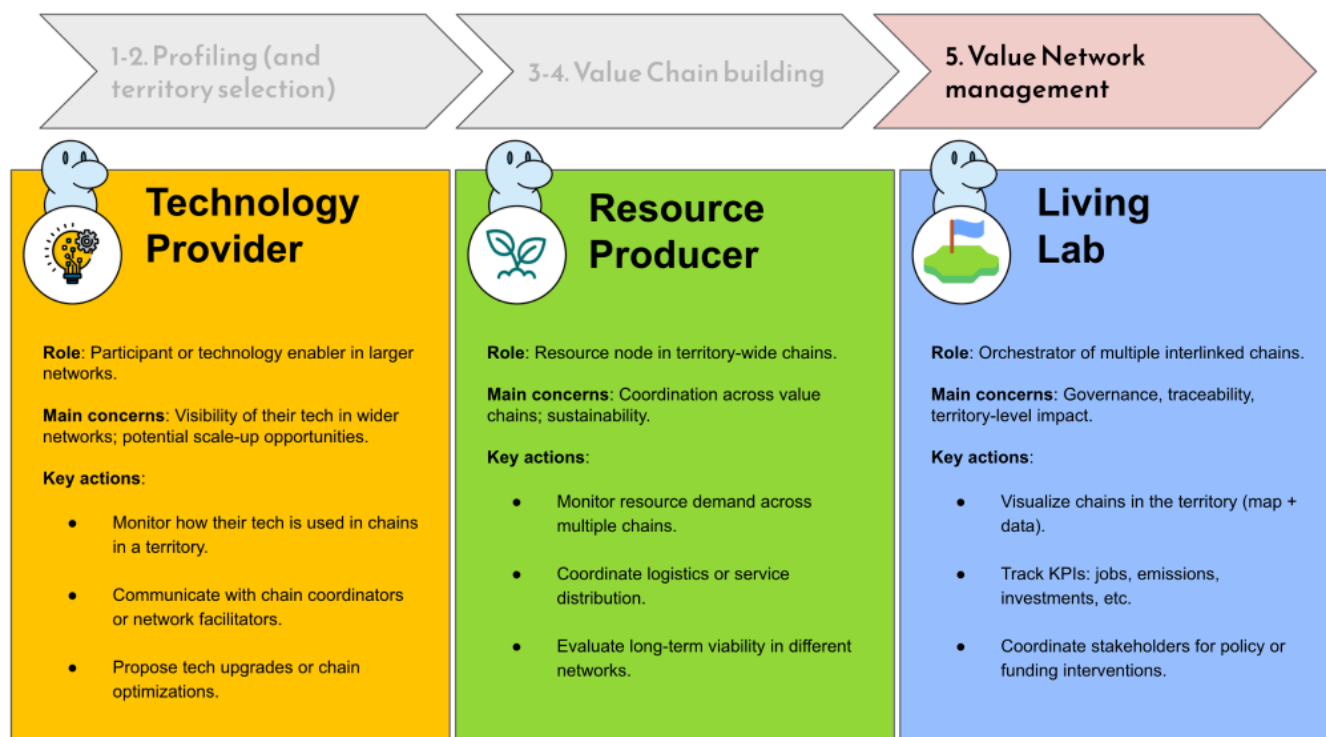


Figure 7. Sample of template used during the workshop

The Living Lab breakout underscored the role of conveners in orchestrating complex multi-actor pilots and tracking impacts. Members demonstrated how they would register territorial boundaries and policy objectives in Select Territory, then inventory local feedstocks in Explore Resource. When curating pilot-ready technologies, they recommended a shortlist function that aligns offerings with regional development goals. Participants valued collaboration protocols embedded directly into the Connect Stakeholders context. Finally, they engaged with the Structure Business context to assign and monitor environmental, social, and economic KPIs.

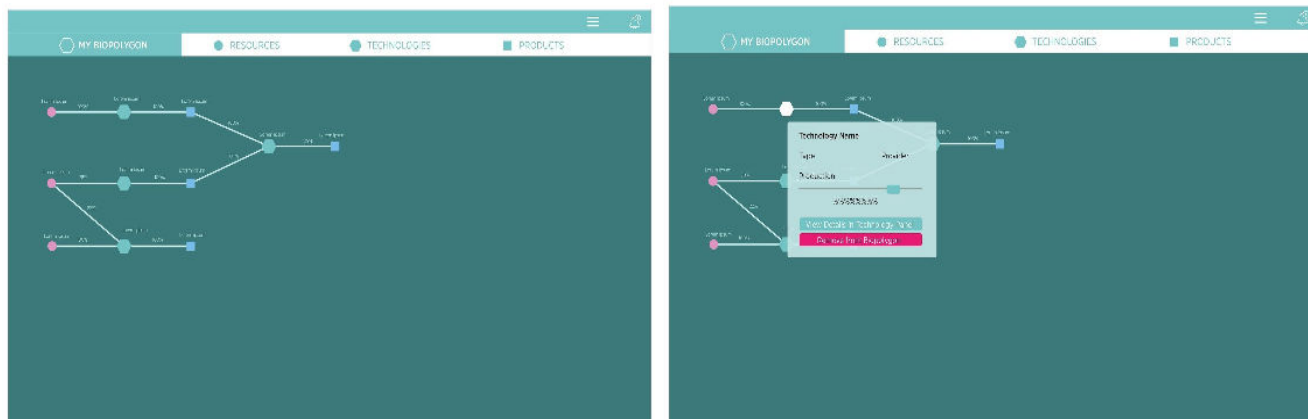
In the post-session analysis, cross-profile comparisons revealed several design imperatives. First, a consistent, context-aware action bar emerged as critical for streamlining workflows. Second, granular visibility controls were deemed essential for both Technology Providers and Resource Producers to manage data sharing preferences. Third, Living Labs advocated for integrated mock datasets that would enable rapid prototyping of pilot scenarios. Lastly, all three groups requested dynamic, embedded guidance, tooltips and contextual help.

Building on the workshop outcomes and supplementary user research, the first public release of the Bioeconomy tool streamlines the design process into four interlinked components:

- **Biopolygon:** A dynamic canvas abstracting the end-to-end value chain. It visualises resources, technologies, and products as connected nodes on a map-like interface.
- **Resources:** A panel for cataloguing available bioresources and managing their supply chains, including supplier capacity and provenance.

- **Technologies:** A catalogue of transformation processes, where each technology is defined by its input requirements (raw resources or intermediate bioproducts) and output bioproducts.
- **Products:** A workspace for defining and cataloguing final bioproducts, monitoring current production flows, and identifying potential products enabled by the existing technology set.

## Biopolygon View

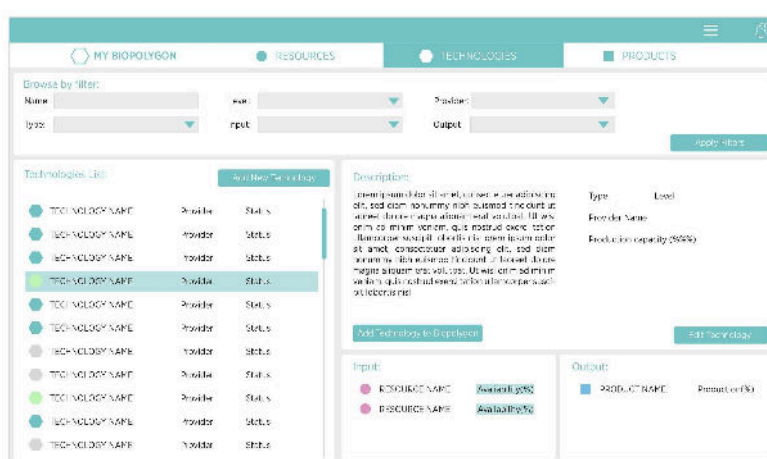


The Biopolygon view serves as the user’s primary workspace, automatically composing a network diagram that connects selected resources to technologies and their resulting products.

Key features include:

- **Automatic Connectivity:** When a technology is added to the Biopolygon, the system links it to compatible resources and products, updating flows in real time.
- **Quick-Action Controls:** Hovering over any node reveals controls to adjust production rates, remove nodes, or open detailed views in the corresponding panel.
- **Strategic Adjustment:** By modifying a technology’s throughput directly on the canvas, users can test alternative configurations and immediately observe downstream effects on product outputs.

## Technologies Panel



The Technologies panel allows users to create and manage process definitions:

- **Creation Workflow:** Users define new technologies by specifying required inputs and expected outputs. Input validation highlights whether the Biopolygon currently holds sufficient resources.

- Interactive Status: Selecting an existing technology displays real-time metrics on resource consumption and product generation. A toggle button adds or removes the technology from the Biopolygon canvas.
- Edit Mode: Technologies can be edited to redefine input-output relationships, triggering automatic updates in the Biopolygon connectivity.

## Resources Panel

In the Resources panel, users oversee the raw materials and intermediates that feed the value chain:

- Resource Cataloguing: Add new resources by entering attributes such as type, quality/density metrics, and supply seasonality.
- Supplier Management: Link multiple suppliers to each resource; the combined production capacities dynamically update the Biopolygon’s available volumes.
- Supply Analytics: Charts indicate resource availability versus current demand across connected technologies.

## Products Panel

The Products panel aggregates the outcomes of configured value chains:

- Product Definition: Create new product entries that can later be selected as outputs for technologies.
- Production Dashboard: Visual summaries show which products are actively produced in the Biopolygon, which technologies contribute to their generation, and current production rates
- Opportunity Explorer: Suggests additional products that could be generated by combining unutilised resources with available technologies.

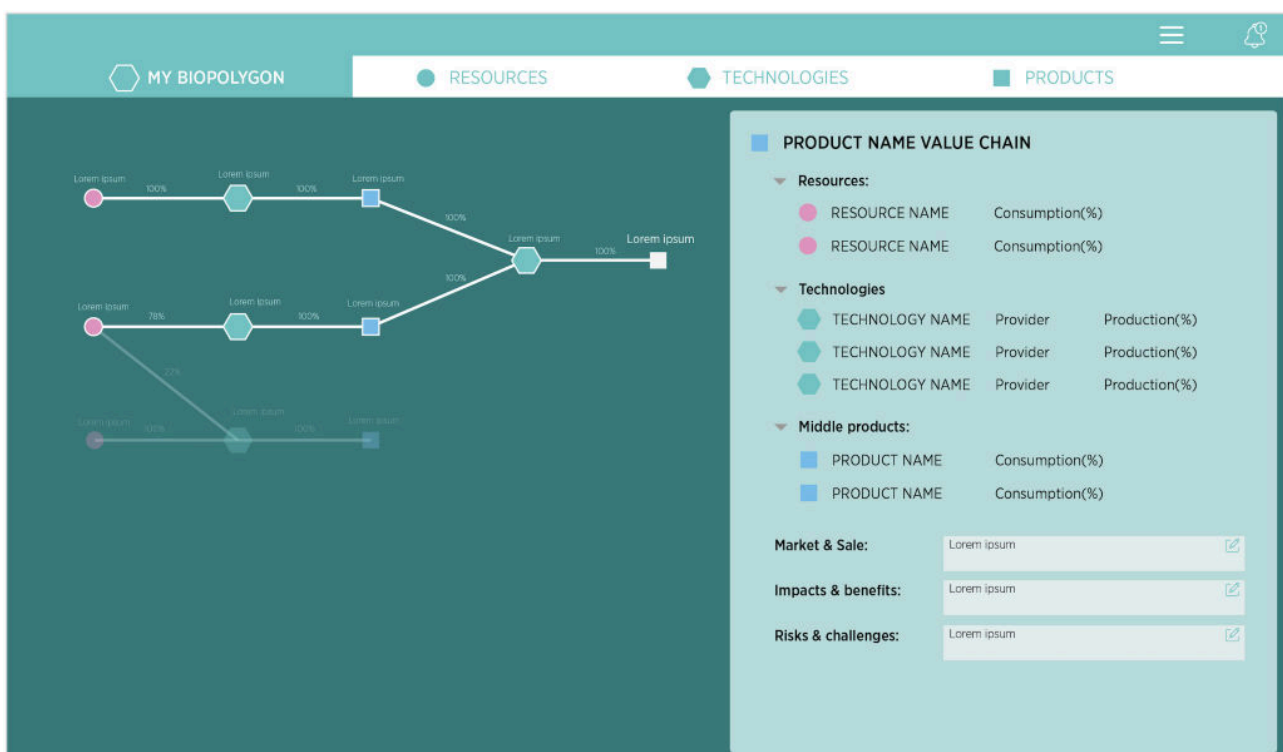


Figure 8. High-fidelity Interface Design

## Data Scheme

Version 1 of the Bioeconomy tool focuses on a core set of entities that underpin the streamlined interface. While additional data types, such as detailed territorial statistics, governance models, and comprehensive stakeholder registers, will be introduced in later phases, the first release centres on four principal objects:

### **Resource**

- Key Fields: ID, Name, Production/Regeneration Rates, Supplier List
- Interface Mapping: Resources are created and managed in the Resources panel. Users define volumetric capacities by aggregating supplier inputs. The panel's analytics visualize current availability against consumption by connected technologies in the Biopolygon view.

### **Technology**

- Key Fields: ID, Name, Type, Description, Maturity Level (TRL), Input Requirements, Output Bioproducts
- Interface Mapping: Process definitions reside in the Technologies panel. When defining a new technology, the system validates input availability from existing Resources. Selected technologies can be toggled onto the Biopolygon canvas, where their inputs and outputs auto-connect to relevant nodes.

### **Bioproduct**

- Key Fields: ID, Name, Category, Market Application Tags
- Interface Mapping: Bioproducts are catalogued in the Products panel. Users can create new product profiles, which then appear as output options when constructing or editing technologies. The panel's Opportunity Explorer leverages the bioproduct list to suggest novel value chains based on unutilized resource-technology combinations.

### **Biopolygon (Value Chain Instances)**

- Key Fields: Canvas Configuration, Active Resources, Active Technologies, Derived Products
- Interface Mapping: The Biopolygon view itself functions as a live data object representing interconnected value chain instances. Additions or adjustments (e.g., altering a technology's throughput) update the underlying model in real time, recalculating resource consumption and product yields.

## **Benchmarking Similar Tools**

A broader ecosystem of digital tools exists to support the design, assessment, and facilitation of bioeconomy value chains.

The Scaler Platform by Synonym Bio is a leading techno-economic and lifecycle assessment (TEA/LCA) tool designed specifically for fermentation-based bioprocesses. It enables users, from startups to large enterprises, to input process parameters, capacity goals, and pricing details to generate detailed reports on CapEx, OpEx, and cradle-to-gate carbon emissions,

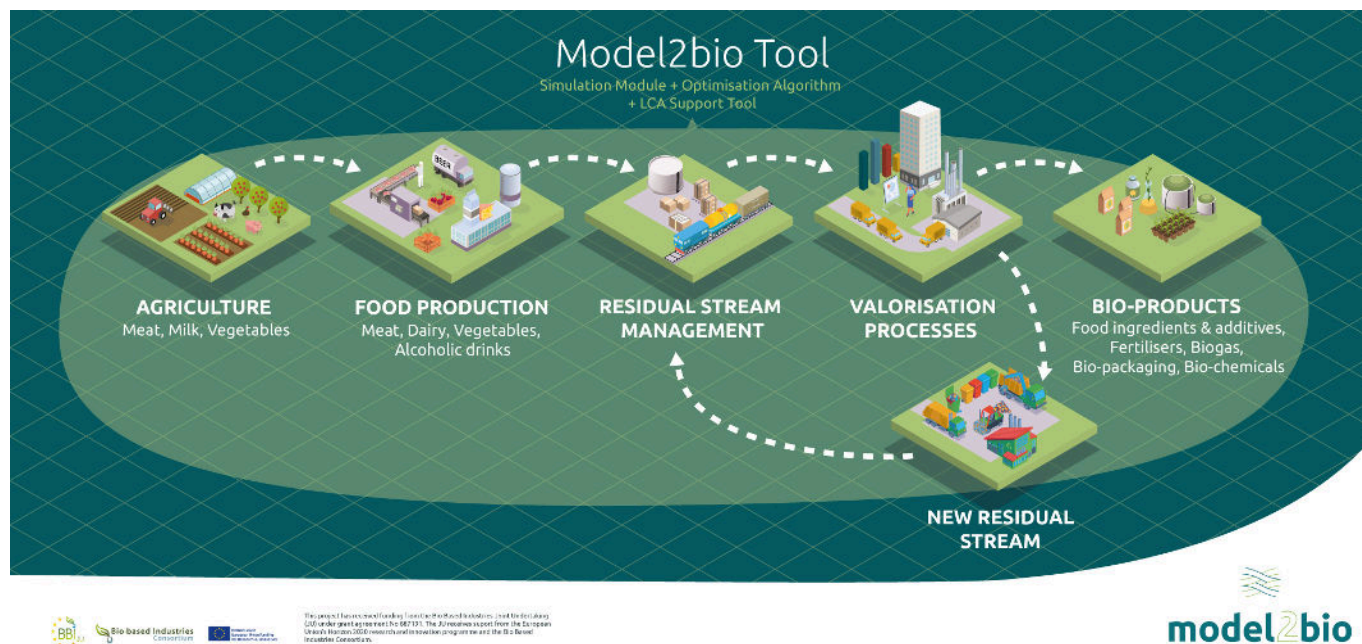


Figure 9. The MODEL2BIO System Concept

The MODEL2BIO<sup>1</sup> Decision-Support System is an EU research tool focused on the valorisation of agri-food residual streams. It combines predictive simulation, optimization algorithms, and LCA modules to assess the technical, economic, environmental, and regulatory viability of processing food-industry by-products. Validated across multiple countries, the tool helps stakeholders determine optimal valorisation pathways by weighing cost, environmental footprint, and social impacts.

The Biobord<sup>2</sup> platform serves as an open co-creation and networking hub for bioeconomy stakeholders in the Baltic Sea region. While not focused on formal value-chain modeling, it excels in matchmaking, knowledge sharing, and supporting regional project development through forums, partnership directories, and interactive collaboration features.

BlueBioClusters’ Visual Value Chain Facilitation Tool<sup>3</sup> uses interactive, workshop-ready interfaces with six biomass-specific boards and stakeholder-led modules to co-create and visualise value chains in the blue bioeconomy, helping participants collaboratively map opportunities during live sessions.

Meanwhile, BIORADAR<sup>4</sup>, a Horizon Europe initiative, provides a digital monitoring suite focused on systemic circularity and environmental and social impact indicators. It incorporates a self-assessment dashboard, benchmarking capabilities, and regulatory tracking tools, targeting sectors like bio-textiles, fertilizers, and packaging.

Table 5. Examples of similar tools.

Tool	Core Focus	Similarities	Differences
Scaler™	Techno-economic + LCA modeling	Matches Toolbox’s future impact calculation ambition	Focuses on fermentation economics only
Model2Bio	Valorisation & optimisation of	Mirrors objectives for	Niche to agri-food residues

<sup>1</sup> [model2bio.eu](http://model2bio.eu)

<sup>2</sup> [biobord.eu](http://biobord.eu)

<sup>3</sup> [bluebioclusters.eu](http://bluebioclusters.eu)

<sup>4</sup> [bioradar.org](http://bioradar.org)

DSS	resource flows	resource-to-product mapping	
Biobord	Networking & stakeholder engagement	Aligns with Connect Stakeholders context	Limited in formal value chain modeling
BlueBioClusters Tool	Workshop facilitation & mapping	Comparable to Biopolygon canvas	Specialized for blue bioeconomy
BIORADAR	KPI assessment & benchmarking	Helpful for impact tracking	Less focused on value chain configuration

## 7. Development and Population of the Toolbox Database

In order to make the tool operational, a data gathering exercise was launched from M12 till M18, recollecting specific data items from the project’s documents and activities in collaboration with WP2, WP3 and WP4. This included data on the resources, terrains, value chains, stakeholders, technologies, projects, success cases, competing solutions, similar European projects, and others.

The data was cleaned and formatted, taking into account the indications for data management included in the projects data management plan, which stipulates that personal data should not be included in the publicly available tools and data.

The task has resulted in an extended database, which encompasses all the information generated around the Living Labs, a database of bioeconomy value chains, a library of success cases, a library of hypothetical bioeconomy scenarios, and tools and templates for supporting Living Labs dynamics.

### Database For Value-Chain Creation

During the course of the project, and in the context of activities pertaining to designing and developing bioeconomy value chains in the PRIMED Living Labs, a total of 14 value chains were designed, using at least 18 different technology stacks, and addressing no less than 8 different types of resources. These value chains generate 15 different products.

This data was extracted and consolidated according to the information scheme defined by the toolbox to create its core database.

The database was complemented with additional research on bioeconomy value chains that tackle identical or similar resources than those addressed in the Living Labs, which increased the number of technologies, resources, products, and value chains in the toolbox library to 44, 16, 25, and 31 respectively.

Table 6. Sample data on value chains.

ID	Region & Case	Input Resources	Tech	Bio products	Market & Scale	Impacts & Benefits	Risks & Challenges
VC1	Liguria & Galicia (EcoeFISHent)	R1	T1 + T2	B1	Food supplements, cosmetics, packaging	70 % protein recovery; 30 % disposal cost reduction	Cold-chain, regulatory compliance
VC11	Northern Greece (CLLD dairy-wine reuse)	R11	T11	B11	Rural beverage & food markets	500 t/yr whey diverted; 30 % carbon reduction	Fermentation consistency; flavour balancing
VC12	Andalusia & Lombardy (AgriMax)	R12	T12	B12	Solvents, bio-oils, feed additives	Scalable valorization; demo-scale validation	Mixed feedstock variability
VC13	Catalonia (GO-Orleans)	R13	T13	B13	Regional beverage markets	70 % whey diversion; € 120 K new sales	Scale, market uptake

VC14	Europe (WHEY cooperatives)	R14	T14	B14	Infant formula, sports nutrition, exports	90 % protein recovery; shared facilities	Quality standardization; coop coordination
VC16	Campania (Naples pilot)	R16	T16	B16	Ceramic feedstock	90 % silica recovery in < 30 min	Pilot integration; process safety
VC17	Catalonia & Lorraine (MesoSi-CO <sub>2</sub> )	R17	T17	B17	Industrial catalysis	40 % CO <sub>2</sub> footprint reduction vs. conventional supports	Energy requirements; retrofitting complexity
VC18	Lombardy (COSMOS-RICE )	R16	T18	B18	Cement & concrete	25 % material cost reduction; 30 % CO <sub>2</sub> savings	Regulatory approval; consistent purity
VC19	Bavaria & Valencia (ECOAEROGEL)	R17	T19	B19	Building retrofit panels; aerospace insulation	20–25 % energy savings; EN ISO 20457 certification	Scale-up costs; market adoption
VC20	Saxony & Bavaria (WaysTUP!)	R15	T20	B20	Wastewater treatment; CHP energy	85–90 % silica yield; 40 % slag reduction	Emissions control; ash handling

## A Set of Bioeconomy Business Models

A Set of Bioeconomy Business Models has been developed in collaboration with WP2 and WP3 as part of this toolkit to support stakeholders in designing, evaluating, and implementing new bio-based value chains.

WP2 established the empirical foundation. Through co-design with the PRIMED Living Labs, researchers mapped local feedstocks, stakeholder constellations, and practical constraints, producing 5 territory-anchored business models that reflected real value chains and governance arrangements (D2.1). WP3 complemented and deepened that empirical work through systematic analysis. Task 3.1 (Grounded Risk Analysis) interrogated each technology-business configuration along four dimensions (Nature, Characteristics, Analysis and Exploitation). This included TRL assessment, IP scans, market and competitive analyses, and stakeholder mapping.

Concurrently, targeted scouting and desk research expanded the candidate pool of business models by identifying additional R&D projects and place-based initiatives across Europe that are developing business models for bioeconomy. 12 further business models and enriched the comparative dataset with alternative technology stacks and governance forms.

Under an iterative consolidation phase, the models were merged where they shared core value-chain logic, technology stacks, governance and financial profiles, producing a compact set of **nine largely generic business model templates** (Appendix A). The consolidation preserved representative value-chain examples to retain place-derived relevance while eliminating location-specific variants.

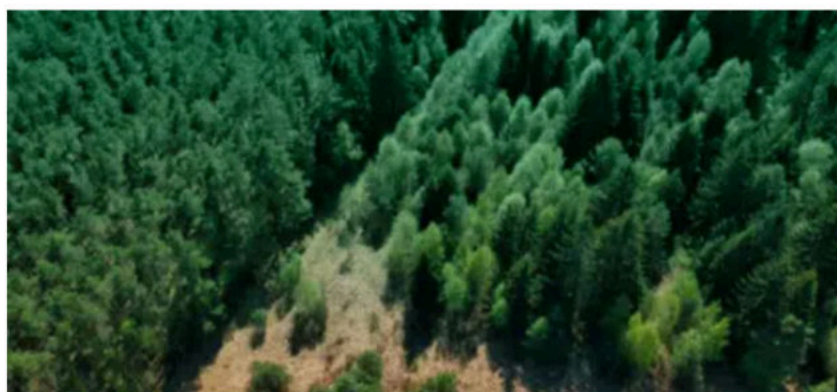
The resulting portfolio is intended for practitioners, a set of reference templates that clarify technical maturity, likely costs, governance options and principal risks. It provides a structured framework for business creation in the bioeconomy sector, offering a range of alternative models tailored to different contexts, feedstocks, and stakeholder constellations. Therefore, It is used as a reference library in V1.

## CIRCULAR BMs Bioeconomy Business Models Set

A Set of Bioeconomy Business Models encompassing 17 different models has been developed as part of this toolkit to support stakeholders in designing, evaluating, and implementing new bio-based value chains. It provides a structured framework for business creation in the bioeconomy sector, offering a range of alternative models tailored to different contexts, feedstocks, and stakeholder constellations. By presenting concrete options, this set helps assess the feasibility of new ventures.

Category:  Tag keywords:  CAPEX:  Search:

9 models shown



### In-house Sidestream Valorization

**Description and Key Aspects:**

Upgrade on-site sidestreams (dairy, brewery, livestock, food processing) into higher-value products—e.g., nutraceuticals, bio-fertiliser, biomethane—by adding compact conversion units to existing plants.

**Tags:** circular-bioeconomy, sidestream-valorization, on-site-biorefineries

**Examples:**

Livestock manure & vegetal residues → compost / AD → biogas → upgraded biomethane / CHP.  
Dairy whey → concentration → fermentation → lactic acid → PLA / nutraceutical ingredients.  
Brewery spent grain → anaerobic digestion → biogas and soil amendments.

**Sources:**

ALC LLab — ALC Bio-Lab (ALC, Alcarràs) — Value Chain: compost & AD (manure, slurry, vegetal residues)  
BioEire LLab — National Bioeconomy Campus Lisheen (IBF) — Value Chain: dairy by-products fermentation (whey → lactic acid → PLA)

**Category:**

Single-Plant

**Key Aspects:**

Leverages existing equipment and footprint  
Modular/incremental upgrades (fast time-to-market)  
Integrated unit operations: pre-treatment, fermentation, AD, separation  
Product diversification with captive feedstock

**CAPEX:**

Low → Moderate (incremental upgrades; digesters/add-ons raise capex)

**OPEX:**

Lower → Moderate (shared logistics, operation & maintenance)

**Key Risks/Challenges:**

Technical adaptation and process integration.  
Developing stable offtake and market channels.  
Regulatory approvals for novel food/feed/fuel products.  
Feedstock variability and seasonality.

Figure 10. The Business Model Navigator integrated in the Toolbox

The first version of the Toolbox comprises a basic collection of relevant and viable business models (figure 10) that allows users to search and browse the collection of business models created and consolidated so far. This collection will be expanded and consolidated in V2. This including expanding the definition of the collected business models to include additional information on the three pillars of value logic: Value Creation: describing

how local resources, technologies, and partnerships jointly generate sustainable products or services; Value Delivery: outlining the mechanisms through which these outputs reach intended markets or users, including logistics, distribution, and stakeholder collaboration; Value Capture: detailing the financial and non-financial returns, from cost recovery and revenue streams to environmental and social value recognition.

## Integrating the Circular Business Model Navigator

The Circular Business Model Navigator (CBMN) is a guided designer for Circular Business Models in the Bioeconomy (CBMBs). It should be used by founders/startups/firms as the first step, when having a business idea for a CBMB. It allows users to evaluate their business model idea mapped to Osterwalder’s BMC and to PRIMED’s value-chain objects (resources, technologies, products). This evaluation should provide information about the feasibility as the outcome. A visualization of the CBMN is shown in D3.1.

The second version of the Toolbox will integrate the CBMN, which will be developed based on the outcomes of WP3 (D3.1) to evaluate circular business model ideas and their feasibility. The CBMN will be developed by RUB as a tool in T6.2 and integrated by NAKED into the Toolbox and hosted on the Toolbox server.

Through this integration, the CBMN will access data on available bioresources and technology stacks, bioproducts on the demand in the market, and the stakeholders and governance model templates in a machine-readable format.

The CBMN will function as a form that guides users in defining and refining the constituents of their business model. The outcome in a CBMB that can be exported in machine-readable format back to the Toolbox and can be integrated into the process of designing and implementing new circular bioeconomy value chains.

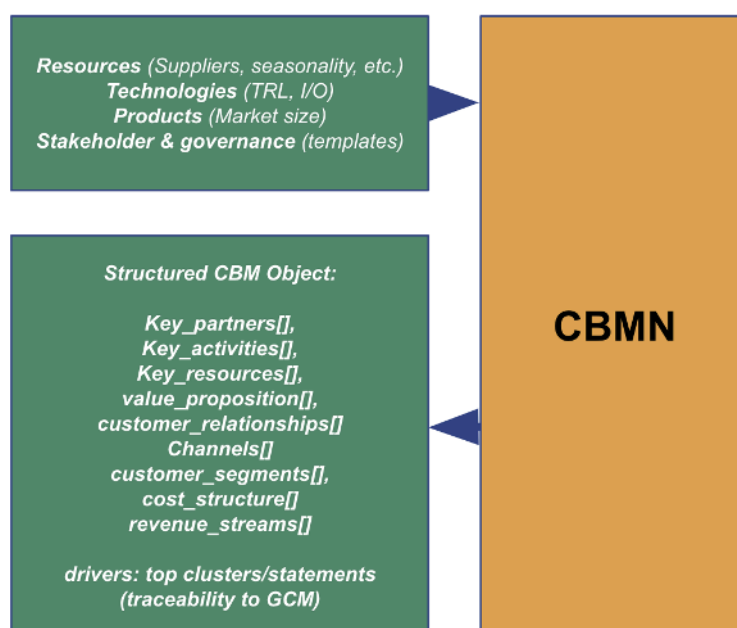


Figure 11. CBMN / Toolbox data integration

This integration is implemented according to the following design:

In the Bioeconomy tool, an additional section will be integrated to accommodate and visualize the business models evaluated in the CBMN tool.

From the Biopolygon view, a “evaluate business model” button appears when a value chain is completed. This button launches the CBMN tool where users can develop and refine business models. The data related to the business model, including the resources yield, costs, and impact indicators is sent to the CBMN from the Bioeconomy tool.

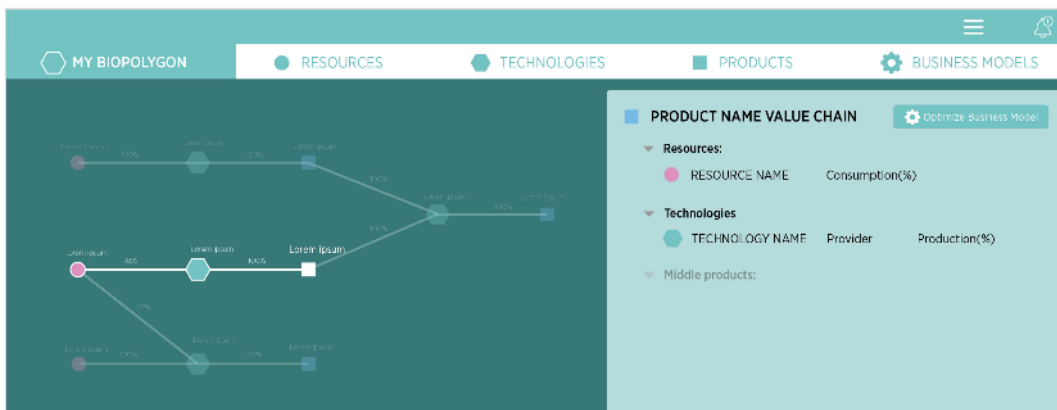


Figure 12. Engaging the CBMN from the Bioeconomy tool

The Bioeconomy tool will also visualize all business models evaluated in the CBMN in a specific section that allows users to manage and refine different models. This is represented in the following interface design. With this design, the user gets an overview about the core components that need to be addressed if pursuing this CBMB idea. Additionally, the estimated costs, revenues, and other information are displayed.

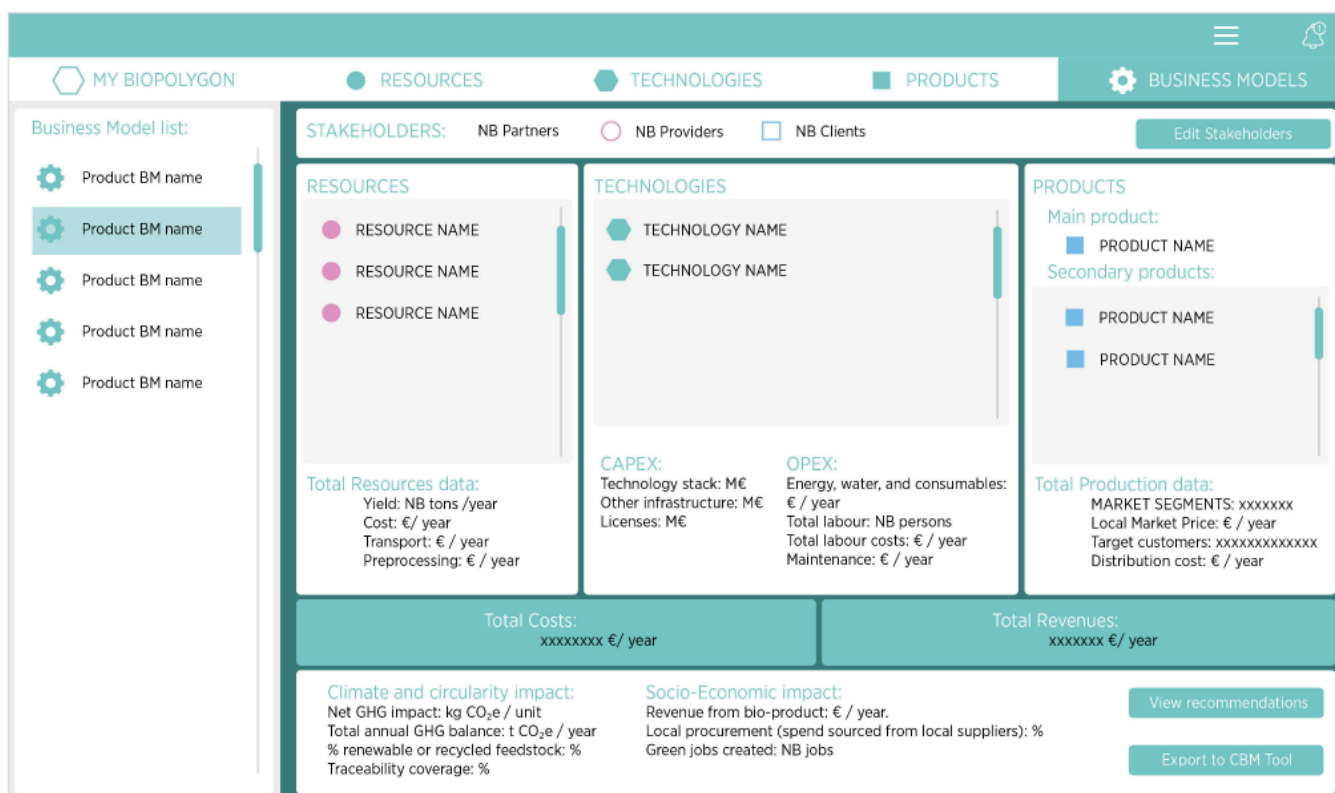


Figure 13. Visualizing business models

## PRIMED's Success Cases Library

Research has been conducted to compile 41 pilot, demonstration, and scaling projects that span diverse processing technologies, feedstocks, and regional contexts. Rather than focusing on individual examples, this consolidated library serves as a rich repository of real-world data objects (resources, technologies, bioproducts, and value chain instances) that inform every aspect of Version 1's design. These cases serve as benchmarks examples for the toolbox users. Their resources, technologies, products, and value chains are integrated in the toolbox's database. The following table describes a sample of these cases.

Table 7. Sample of success stories gathered

#	Case Name	Location	Technology / Process	Throughput / Output	Key Metrics	Partners / Funding	Application / Impact
SC5	Pilot-Scale Continuous Silica Extraction, Naples	Campania, Italy	Continuous alkaline-leaching reactor (1 m <sup>3</sup> /hr)	Industrial-grade silica (90 % recovery)	Residence time <30 min; seamless milling integration	Univ. of Naples Federico II; Italian Ministry of Ecological Transition	Ceramic cluster feedstock; local integration
SC6	MesoSi-CO <sub>2</sub>	Catalonia (ES) & Lorraine (FR)	Continuous alkaline sol-gel extraction + microwave-assisted calcination	Mesoporous silica (>300 m <sup>2</sup> /g surface area)	CO <sub>2</sub> footprint reduction up to 40 % vs. conventional supports	Horizon Europe (Grant 892571)	CO <sub>2</sub> conversion catalysts; decarbonization efforts
SC11	COSMOS-RICE	Lombardy, Italy	Low-temperature (≤400 °C) silica-gel synthesis from rice husk ash and fly ash	Colloidal silica (90 % purity; 50–150 nm)	Raw-material cost –25 %; lifecycle CO <sub>2</sub> emissions –30 %	LIFE (LIFE11-ENV-IT-000256); Univ. of Brescia	Cement/concrete additives; fly-ash stabilization
SC14	ECOAEROGEL	EU-wide (IT, DE, ES, FR)	Ambient-pressure sol-gel + supercritical CO <sub>2</sub> drying	Silica aerogel panels	Thermal conductivity 15–18 mW/m·K; EN ISO 20457 certification	Horizon 2020 (GA 728161)	Building insulation; aerospace applications; energy savings
SC15	WaysTUP!	Saxony & Bavaria, Germany	Fixed-bed combustion for syngas & silica-rich bottom ash	Syngas for CHP; amorphous silica (85–90 wt %)	Slagging –40 %; adsorption >220 mg/g (methylene blue assay)	EERA Bioenergy; German research institutes	Wastewater treatment adsorbent; integrated bioenergy valorisation

The success stories are visualized as a library inside the Toolbox (see Appendix D).

## Hypothetical Scenario Library

To catalyse ideation and stakeholder engagement, we have developed a complementary library of 14 hypothetical scenarios. Each scenario articulates a place-based value chain deployment, ranging from

fermentation-based biorefinery clusters to integrated bio-silica and biogas hubs, grounded in regional feedstock availability, infrastructure, and market potential.

These scenarios serve as starting points within the Toolbox for:

- Template Generation: Prepopulating resource, technology, and product objects in the Biopolygon canvas to accelerate pilot design.
- Stakeholder Engagement: Illustrating tangible opportunities to regional partners, investors, and policymakers, thus soliciting contributions and co-creation.
- Knowledge Sharing: Demonstrating best-practice workflows and value-chain configurations informed by local data and expert insight.

### Example Scenarios

- Fermentation-based Biorefinery in Thessaly: Converts 55 000 t/year of dairy whey into lactic acid, prebiotics, and biopolymers, unlocking €40–50 M in revenue and abating 28 000 tCO<sub>2</sub>e/yr.
- Ebro Delta Integrated Bio-Silica and Biogas Hub: Valorises 27 000 t/year of rice husks and 65 000 t/year of organic residues through modular sol-gel silica extraction and a 5 000 m<sup>3</sup> AD digester, achieving €6.5 M annual turnover and 25 000 tCO<sub>2</sub>e/yr emission reduction.
- Po Valley Bio-Silica for Construction: Processes 260 000 t/year of rice husk ash into precipitated silica and aerogels for low-carbon concrete and insulation, generating €8 M in annual revenue and cutting 40 000 tCO<sub>2</sub>e/yr.

Integrating these hypothetical scenarios into Version 1 empowers users to rapidly prototype and adapt value chains to their territories of interest. By inviting real-world stakeholders to refine and extend these templates, the Toolbox fosters a vibrant co-creation ecosystem, laying the groundwork for a fully-fledged scenario management module in Version 2.

## Living Labs communication and collaboration tools

A core component of the PRIMED Toolbox is the set of collaborative templates, developed to structure communication, co-design, and decision-making processes within the Living Labs and Shared Agendas (**Appendix B**). These templates translate complex collaborative dynamics into accessible visual frameworks that help stakeholders think together, negotiate priorities, and document shared outcomes in a transparent way.

Each template is a collaboration tool that enables co-creation, reflection, and consensus-building, and also a communication tool, serving as a shared language for diverse actors across regions, sectors, and disciplines. Together, they operationalise PRIMED’s participatory approach to innovation governance, providing adaptable resources that can be used in workshops, online platforms, or strategic planning sessions.

The table below summarises the relevance and use of each template included in the Toolbox:

*Table 8. Communication and collaboration tools*

No.	Template	Purpose and Use as Communication & Collaboration Tool
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<b>1</b>	<b>Shared Agenda Canvas</b>	Provides the overarching structure for territorial collaboration, integrating seven dimensions (challenges, assets, alliances, opportunities, purpose, governance, and vision). It serves as a visual framework to design and communicate the shared agenda of a Living Lab.
<b>2</b>	<b>Future Vision</b>	Facilitates a creative, participatory process to articulate the desired long-term outcomes of the shared agenda. It aligns diverse actors around a common vision and narrative for regenerative territorial futures.
<b>3</b>	<b>Challenges Canvas</b>	Helps stakeholders collectively identify and prioritise key barriers hindering the development of circular and bio-based value chains. Enhances transparency and mutual understanding of systemic challenges.
<b>4</b>	<b>Soft Analysis</b>	Encourages participatory diagnosis of the territorial context by integrating qualitative knowledge—strengths, weaknesses, opportunities, and threats—into collective strategy formulation.
<b>5</b>	<b>Roadmap Template</b>	Transforms visions and challenges into an actionable sequence of steps, milestones, and responsibilities. Enhances coordination, transparency, and accountability within shared agenda implementation.
<b>6</b>	<b>Governance Model</b>	Defines the organisational and decision-making structure of collaboration, clarifying roles (Steering Committee, Technical Office, Working Groups, etc.) and ensuring inclusiveness and legitimacy.
<b>7</b>	<b>Key Assets &amp; Purpose</b>	Helps map the tangible and intangible resources, competencies, and shared motivations underpinning a territorial bioeconomy strategy. Strengthens the narrative of collective identity and value creation.
<b>8</b>	<b>Impact-Effort Matrix</b>	Supports joint prioritisation of actions by plotting potential impact against implementation effort, helping stakeholders focus on high-leverage or “quick win” interventions.
<b>9</b>	<b>Likelihood-Severity Matrix</b>	Provides a simple framework for participatory risk assessment, facilitating collective understanding of uncertainties and agreement on mitigation strategies.
<b>10</b>	<b>Support Demand</b>	Structures the articulation of technical, financial, and institutional support needs, aligning local priorities with potential regional or EU programmes and investment opportunities.
<b>11</b>	<b>Feedstock-Origin Committee Canvas</b>	Maps the origins, governance, and sustainability of biomass resources within local value chains, promoting transparency, traceability, and responsible sourcing practices.
<b>12</b>	<b>Hexa-Helix Cohorts</b>	Guides the identification of stakeholders across six domains—academia, industry, government, civil society, environment, and culture—to ensure diversity and systemic collaboration.
<b>13</b>	<b>Power-Interest Matrix</b>	Categorises stakeholders by their level of influence and interest, supporting strategic engagement planning and communication management within the shared agenda.

14	<b>The Onion Canvas</b>	Visualises stakeholder proximity and involvement around the project core, helping design tailored engagement and communication strategies based on influence and role.
15	<b>Future Scenario Template</b>	Facilitates collective foresight and systems thinking by combining challenge identification, visioning, and co-design of circular bioeconomy value chains. Used in PRIMED workshops to elicit user needs for the Toolbox.

## Governance Models

Governance models are intrinsic to the development and implementation of Shared Agendas. They structure how territorial actors collaborate, deliberate, and make decisions, ensuring that processes remain coherent, legitimate, and adaptive to evolving contexts. Within PRIMED, governance is a central element of the methodology, supporting the operationalisation of Living Labs and the long-term sustainability of the value chains they co-create.

Because governance models are primarily addressed in the second half of the project, following the maturation of the Shared Agendas and the pilot value chains, they are not yet fully integrated in the current version of the Toolbox. Their inclusion is foreseen in Version 2, when the models developed through the Living Labs and shared agenda processes can be validated, harmonised, and digitised.

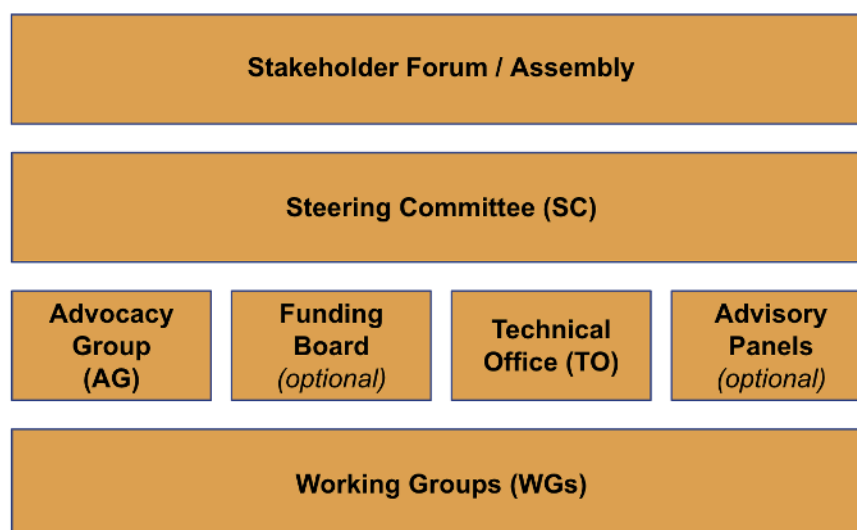


Figure 14. Constituents of the Shared Agenda's governance model

To prepare for this integration, an early prototype of a **Governance Model Design Form** (Appendix C) has been developed as a tool. It builds on the Shared Agenda framework and is inspired by the governance structure emerging from the Lleida Shared Agenda. The form provides a structured template for defining the main governance components of circular and bioeconomy value chains, supporting transparency and comparability across regions. The current version of the Governance Model Form comprises seven sections, each corresponding to a key dimension of governance in shared agendas:

- **Steering Committee (SC)**: Defines the strategic leadership body that ensures legitimacy, sets priorities, and mobilises resources. It specifies the number of seats, representation logic, and decision-making rules (e.g., consensus, quorum).

- **Advocacy Group (AG):** Captures how the initiative engages with policy processes, formulates positions, and channels territorial needs into broader governance frameworks.
- **Technical Office (TO):** Describes the neutral facilitation and coordination entity responsible for daily operations, communication, and monitoring, evaluation, and learning (MEL).
- **Working Groups (WGs):** Outlines task-oriented, autonomous teams focusing on specific challenges or opportunities (e.g., feedstock valorisation, digitalisation, local markets).
- **Advisory Panels and Funding Board:** Details expert groups or pooled financing structures that provide technical guidance and manage joint resources or seed funds.
- **Stakeholder Forum / Assembly:** Defines the open, participatory space where the wider community is engaged for validation, co-learning, and accountability.
- **Monitoring, Evaluation, and Learning (MEL) and Legal Framework:** Specifies reporting mechanisms, KPIs, data-sharing rules, and the legal form of collaboration (e.g., MoU, consortium agreement).

Each section of the form includes short guidance notes and examples drawn from the Lleida case and the original Shared Agenda methodology. The tool will allow users to generate structured governance profiles in machine-readable formats (JSON or PDF), which can then feed into project design documents, shared agenda charters, or Terms of Reference for Living Lab operations.

## 8. Phased deployment of the PRIMED

The first version of the toolbox will be made available to the Living Labs, the PRIMED partners, and collaborating entities throughout the second phase of the project, in order to support engagement with bioeconomy stakeholders at local level. This will allow us to gather feedback and additional data for the second version, which will be a fully-functional publicly available portal published under the PRIMED domain name.

### System Architecture of the Toolbox

The toolbox will be deployed as a web application hosted on its own cloud server infrastructure. The backend architecture consists of a relational database that stores all data collected by the PRIMED consortium, as well as data generated by users, including user profiles and the value chains they design. All user-uploaded data will be public and accessible to any other user within the system.

A RESTful API layer is implemented in the backend to enable secure data exchange between the toolbox and potential third-party platforms or services in the future. The backend also includes a web server responsible for hosting and serving associated documents, such as reports and generated outputs.

The front-end is built with standard HTML, CSS, and JavaScript libraries, providing a responsive and accessible user interface. It includes an authentication module to manage user registration, login, and secure access to user-specific functionalities.

The system architecture follows a simple, scalable cloud-based design, leveraging modern cloud technologies. The relational database, API, and web server run within containerized services ( Docker), orchestrated with a lightweight orchestration layer to ensure updates and scaling. The cloud environment is managed through standard infrastructure-as-a-service (IaaS) offerings (AWS), enabling future extension with minimal overhead. Security measures include secure user credential storage, and role-based access control.

### Version 1 and Version 2 of the Toolbox

The first version (V1) of the PRIMED toolbox represents a solid foundation upon which the project will continue to build towards full realization of its objectives in Version 2 (V2). V1 has prioritized the core functionalities and concerns most critical to launching a useful, stable platform that can actively support stakeholders in real contexts, while acknowledging that certain capabilities will mature or expand in subsequent iterations.

Supporting Living Labs Dynamics is already strongly addressed in V1, achieving roughly 75% of the envisioned capabilities. This includes facilitating actor engagement, coordination protocols, and basic collaboration dynamics. V2 will provide a comprehensive process facilitation to achieve 100% coverage.

Designing Bioeconomy Value Chains is at the heart of the toolbox. V1 delivers around 60% of the ultimate envisioned functionality, enabling users to map resources, technologies, and products into coherent chain structures. V2 will finalize this component by integrating advanced optimization tools, scenario simulations, and pilot-tested configurations refined with feedback.

Developing Sustainable and Scalable Business Models is in its early stages in V1, at approximately 20%. While basic placeholders and templates exist, the full suite of modelling tools, financial calculators, and risk assessment features will be completed in V2 to reach 100% maturity.

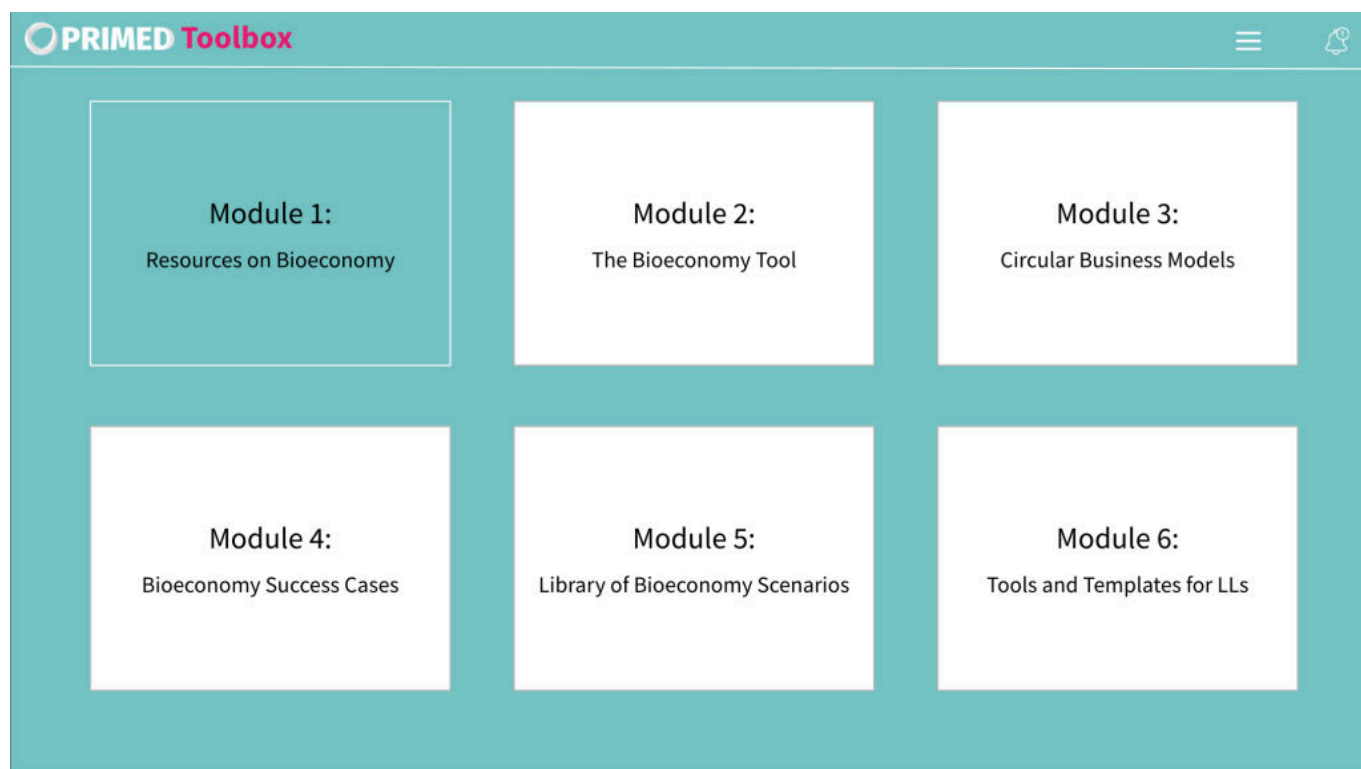


Figure 15. Components of V1

Discovering New Bioeconomy Applications is partly implemented in V1, achieving roughly 60% of the goal. The toolbox includes a searchable library of technologies, products, and example value chains that guide users in finding and conceptualizing new applications. V2 will expand this with semantic search, recommendation algorithms, and integrated best practice guides.

Conducting Comprehensive Impact Assessment is not included in V1. V2 will introduce modules for environmental, economic, and social impact tracking, enabling value chains designed within the toolbox to be assessed across sustainability metrics.

Table 9. Overall maturity of V1 with respect to V2

Concern	V1	V2
Supporting Living Labs Dynamics	75%	100%
Designing Bioeconomy Value Chains	60%	100%
Developing a Sustainable and Scalable Business Models	20%	100%
Discovering New Bioeconomy Applications	60%	100%
Conducting Comprehensive Impact Assessment	0%	100%

## APPENDIX A: Initial Library of Business Models

Business models included in the first version of the ToolBox.

Name	Category	Description	Key aspects	Financials (CAPEX / OPEX)	Risks & challenges	Examples (value chains)	Sources
In-house Sidestream Valorization	Single-Plant	Upgrade on-site sidestreams (dairy, brewery, livestock, food processing) into higher-value products (nutraceuticals, bio-fertiliser, biomethane) by adding compact conversion units to existing plants.	<ul style="list-style-type: none"> <li>• Leverages existing equipment and footprint</li> <li>• Modular / incremental upgrades (fast time-to-market)</li> <li>• Integrated unit operations: pre-treatment, fermentation, AD, separation</li> <li>• Product diversification with captive feedstock</li> </ul>	<p><b>CAPEX:</b> Low → Moderate (incremental upgrades; digesters/add-ons raise capex)</p> <p><b>OPEX:</b> Lower → Moderate (shared logistics; O&amp;M)</p>	<ul style="list-style-type: none"> <li>• Technical adaptation &amp; process integration</li> <li>• Developing stable offtake and market channels</li> <li>• Regulatory approvals for novel food/feed/fuel products</li> <li>• Feedstock variability / seasonality</li> </ul>	<ul style="list-style-type: none"> <li>• Livestock manure &amp; vegetal residues → compost / AD → biogas → upgraded biomethane / CHP</li> <li>• Dairy whey → concentration → fermentation → lactic acid → PLA / nutraceuticals</li> <li>• Brewery spent grain → AD → biogas + soil amendments</li> </ul>	PRIMED — ALC Living Lab (ALC Bio-Lab): composting & AD value chains; PRIMED — BioEire (Lisheen) — dairy fermentation VC; internal PRIMED examples in D2.1
Specialized Conversion & Extraction Facilities	Dedicated Facility	Dedicated facilities focused on a single conversion/extraction pathway (e.g., bio-silica extraction, pyrolysis, catalytic upgrading) producing high-value intermediates or specialty chemicals at pilot → demo → commercial scale.	<ul style="list-style-type: none"> <li>• Technology-focused pilot / demo / commercial units</li> <li>• High process specificity and downstream conditioning</li> <li>• Modular units to de-risk scale-up</li> <li>• Targets niche industrial markets (additives, fillers, specialty chemicals)</li> </ul>	<p><b>CAPEX:</b> Moderate → High (reactors, calcination ovens, downstream units)</p> <p><b>OPEX:</b> Moderate → High (energy-intensive steps, reagents, maintenance)</p>	<ul style="list-style-type: none"> <li>• Scale-up bottlenecks (energy, drying/separation limits)</li> <li>• High energy intensity (calcination, pyrolysis)</li> <li>• Market validation and substitution performance risk</li> <li>• Waste streams and lifecycle footprint</li> </ul>	<ul style="list-style-type: none"> <li>• Rice husk → alkaline sol-gel extraction → bio-silica for fillers/coatings/filters</li> <li>• Forestry residues → pyrolysis → biochar, bio-oil, syngas</li> <li>• Insect oil extraction → biodiesel + fertilizer co-products</li> </ul>	PRIMED — CeNTI Bio-Silica Living Lab (bio-silica extraction & modified silica); PRIMED — BioEire (pyrolysis VC); internal PRIMED cases in D2.1
Cooperative-owned Biorefineries	Cooperative	Producer-owned cooperative biorefineries that extend existing co-op infrastructure (mills, slaughterhouses) to process regional biomass into fuels, chemicals and materials; ownership and	<ul style="list-style-type: none"> <li>• Member-owned governance &amp; profit sharing</li> <li>• Aggregated regional feedstock logistics</li> <li>• Leverages existing cooperative facilities and trust</li> <li>• Aligns local socio-economic benefits with circular production</li> </ul>	<p><b>CAPEX:</b> Moderate (jointly funded upgrades or modest new facility)</p> <p><b>OPEX:</b> Shared (economies of scale; shared transport &amp; operations)</p>	<ul style="list-style-type: none"> <li>• Governance complexity and aligning member incentives</li> <li>• Maintaining consistent feedstock quality and volumes</li> <li>• Demand variability for diversified outputs</li> </ul>	<ul style="list-style-type: none"> <li>• Farmer co-ops → integrated plants producing bioethanol, succinic acid, cosmetic precursors</li> <li>• Co-op aggregation of livestock/agri residues → multi-output biorefineries</li> </ul>	PRIMED — ALC Living Lab examples (cooperative aggregation & compost/AD); external example: Pomacle-Bazancourt cooperative biorefinery (literature reference)

		returns shared among members.					
Consortium-owned Biorefineries	Consortium	Consortiums of public & private stakeholders co-invest in new regional biorefineries to process aggregated biomass into multiple products, sharing CAPEX/OPEX and revenues via formal contracts and offtake agreements.	<ul style="list-style-type: none"> <li>Formal consortium governance with diverse stakeholders</li> <li>Regional sourcing &amp; logistics coordination</li> <li>Combines public support and private investment</li> <li>Joint offtake and revenue-sharing arrangements</li> </ul>	<p><b>CAPEX:</b> High (new facility via joint investment)</p> <p><b>OPEX:</b> Shared (costs and outputs divided among members)</p>	<ul style="list-style-type: none"> <li>Securing stable feedstock and offtake commitments</li> <li>Complex contractual and management arrangements</li> <li>Balancing commercial goals across partners</li> </ul>	<ul style="list-style-type: none"> <li>Consortium plants converting urban organic waste → biopolymers &amp; biofertilisers</li> <li>Regional consortium biorefineries converting agri residues → chemicals/materials</li> </ul>	PRIMED — BioEire / regional pilot campus references (consortium & governance); external example: Circular Biocarbon / Zaragoza consortium case
Industrial Symbiosis & Eco-Industrial Clusters	Cluster / Hybrid	Networks of firms in eco-industrial parks that exchange by-products, heat and materials so one site's outputs serve as inputs for another — enabling closed-loop resource use and shared utilities.	<ul style="list-style-type: none"> <li>Cross-industry material &amp; energy exchange</li> <li>Shared utilities and infrastructure (energy, water, logistics)</li> <li>Cluster-level planning and matchmaking services</li> <li>Can combine with cooperative or consortium ownership</li> </ul>	<p><b>CAPEX:</b> Variable (often uses existing assets; some shared infra investment may be required)</p> <p><b>OPEX:</b> Reduced across participants (waste reused as feedstock; shared utility costs)</p>	<ul style="list-style-type: none"> <li>Coordination complexity across firms and sectors</li> <li>Supply-chain interdependencies and single-point failures</li> <li>Regulatory/permitting hurdles for material exchanges</li> </ul>	<ul style="list-style-type: none"> <li>Kalundborg-style industrial symbiosis examples (waste heat &amp; material streams reused locally)</li> <li>Regional clusters where co-op biorefineries supply energy/materials to nearby firms</li> </ul>	PRIMED — Liguria (FILSE) territorial cluster mentions; PRIMED — ALC cluster/polygon references; external examples in literature
Waste Valorization Service Provider	Service	Third-party operators providing collection and conversion services (centralized or mobile) that transform agricultural & food industry residues into bioenergy, compost, biofertilisers and other marketable products under contract.	<ul style="list-style-type: none"> <li>Contract-based feedstock collection &amp; processing</li> <li>Flexible mobile and centralized conversion units</li> <li>Multi-output value recovery (AD, composting, pelletizing)</li> <li>Revenue: service fees + product sales</li> </ul>	<p><b>CAPEX:</b> Moderate (digesters, mobile units, pelletisers)</p> <p><b>OPEX:</b> Moderate (transport, energy, labor, maintenance)</p>	<ul style="list-style-type: none"> <li>Fluctuating &amp; seasonal feedstock supply</li> <li>Competitive pricing &amp; margin pressure</li> <li>Regulatory compliance for waste handling &amp; product quality</li> </ul>	<ul style="list-style-type: none"> <li>Mobile units converting food/manure → biogas, compost, heat</li> <li>Municipal/industrial contracts for organic waste valorization</li> </ul>	PRIMED — ALC Living Lab (composting & planned AD services); PRIMED — Liguria (EcoeFISHent) service models
Pilot & Technology Platforms / Living Labs	Platform / Living Lab	Shared pilot campuses & living labs that host modular pilot plants, provide technical services (LCA,	<ul style="list-style-type: none"> <li>Pilot rental and shared infrastructure (fermentation, pyrolysis, pre-treatment)</li> </ul>	<p><b>CAPEX:</b> Low → High (coordination platforms low; pilot infrastructure high)</p>	<ul style="list-style-type: none"> <li>Translating pilot demos into commercial outcomes</li> <li>Long-term funding &amp; sustainability of platforms</li> </ul>	<ul style="list-style-type: none"> <li>Territorial LLab: fishery &amp; agro side-streams → bioplastics, bio-actives, recycled materials</li> </ul>	PRIMED — BioEire (Lisheen pilot campus & services); PRIMED — VTT CellFactory lab (plant cell culture pilots);

		prototyping) and connect research, industry and public actors to de-risk innovation and accelerate scale-up.	<ul style="list-style-type: none"> <li>• Multi-stakeholder governance &amp; matchmaking</li> <li>• Services: testing, LCA, prototyping, market validation</li> <li>• Links to investors and scale-up support</li> </ul>	<b>OPEX:</b> Moderate (staffing, pilot ops; often grant-subsidized)	<ul style="list-style-type: none"> <li>• Regulatory/permitting for pilot operations</li> </ul>	<ul style="list-style-type: none"> <li>• Pilot campus: whey → fermentation → lactic acid → PLA; plant-cell culture pilots for novel ingredients</li> </ul>	PRIMED — CeNTI pilot reactors
Certification, Compliance & Advisory Services	Service (Knowledge)	Providers of certification, auditing and advisory services that help bio-based companies meet evolving regulatory standards, demonstrate sustainability claims and increase market trust.	<ul style="list-style-type: none"> <li>• Standards development, auditing &amp; compliance services</li> <li>• Testing &amp; verification (LCA; supply chain audits)</li> <li>• Market trust and labelling support for bio-based products</li> </ul>	<b>CAPEX:</b> Low (knowledge driven) <b>OPEX:</b> Moderate (staff; testing/equipment; audit operations)	<ul style="list-style-type: none"> <li>• Rapidly evolving regulation &amp; standards</li> <li>• Maintaining credibility and independence</li> <li>• Ensuring uptake among SMEs</li> </ul>	<ul style="list-style-type: none"> <li>• Third-party certification schemes for biomass &amp; biofuels compliance</li> <li>• Advisory services supporting RED III / GHG compliance and product claims</li> </ul>	PRIMED — BioEire LLab links to LCA & advisory services; External: REDcert; ISCC EU
Collaborative Innovation Networks	Platform / Network	Distributed networks (Living Labs, MIPs, EU networks) that connect projects, SMEs, research centres and public bodies to share best practices, match pilots with buyers/investors and replicate value chains across regions.	<ul style="list-style-type: none"> <li>• Networked living labs &amp; project platforms</li> <li>• Knowledge sharing, capacity building &amp; matchmaking</li> <li>• Digital coordination platforms for replication</li> <li>• Often grant-funded coordination with regional rollout</li> </ul>	<b>CAPEX:</b> Low (digital tools & coordination) <b>OPEX:</b> Moderate (coordination staff, events; often subsidy-supported)	<ul style="list-style-type: none"> <li>• Sustaining funding &amp; stakeholder engagement across regions</li> <li>• Translating network outputs into tangible industrial projects</li> <li>• IP and benefit-sharing across partners</li> </ul>	<ul style="list-style-type: none"> <li>• EuBioNet — network of EU bioeconomy projects and living labs</li> <li>• BIS — Baltic Industrial Symbiosis platform linking companies for resource exchange</li> </ul>	PRIMED — Liguria (FILSE) network replication examples; External: EuBioNet; BIS (Baltic Industrial Symbiosis)

# APPENDIX B: Collaboration and Communication tools

Collaboration and communication tools included in the first version of the toolbox.

## Living Labs support Tools & Templates

The PRIMED Toolbox includes a series of collaborative templates designed to guide co-creation, dialogue, and decision-making within Living Labs and Shared Agendas. Each template provides a visual and participatory framework to help territorial actors work together—identifying challenges, mapping assets, defining visions, and planning actions toward regenerative and circular bioeconomy transitions.

Explore the templates below to download, test, and integrate them into your own shared agenda process.

**Template #01**  
**Shared Agenda Canvas**

The Shared Agenda framework evolved from five initial components (Challenges, Opportunities, Assets, Alliances, and Future Vision) into seven interconnected elements that better reflect a comprehensive Living Lab approach.

PRIMED 2025 | [DOWNLOAD](#)

**Template #02**  
**Future Vision**

The Future Vision template facilitates a shared and creative exploration of desired long-term outcomes among stakeholders. It helps participants articulate a collective vision of how their territory could evolve under a regenerative bioeconomy scenario.

PRIMED 2025 | [DOWNLOAD](#)

**Template #03**  
**Challenges Canvas**

The Challenges template structures a participatory process to identify and prioritise the key barriers hindering the development of circular and bio-based value chains in a given territory. It captures both systemic and operational challenges and enables different voices to be heard and compared transparently.

PRIMED 2025 | [DOWNLOAD](#)

**Template #04**  
**Soft Analysis**

The Soft Analysis template supports qualitative diagnosis of the territorial context by mapping strengths, weaknesses, opportunities, and threats in a collaborative setting. It encourages stakeholders to integrate local knowledge, perceptions, and values—often overlooked in quantitative analyses—into strategic decision-making.

PRIMED 2025 | [DOWNLOAD](#)

**Template #05**  
**Roadmap Template**

The Roadmap template transforms visions and challenges into a sequenced plan of action. It allows stakeholders to define milestones, assign responsibilities, and coordinate short-, medium-, and long-term activities across organisations. As a collaborative tool, it promotes transparency and accountability in shared agenda implementation.

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**Template #06**  
**Governance Model**

The Governance Model template defines how collaboration is organised within a shared agenda or circular bioeconomy value chain. It clarifies roles, decision-making mechanisms, and coordination structures—such as steering committees, technical offices, working groups, and stakeholder forums—ensuring legitimacy, inclusiveness, and efficiency.

PRIMED 2025 | [DOWNLOAD](#)

**KEY ASSETS & PURPOSE CANVAS**

**Template #07**  
**Key Assets & Purpose**

The Key Assets & Purpose template helps territories identify their distinctive resources, capabilities, and strategic intent in relation to the shared agenda. It combines an inventory of tangible and intangible assets—such as local bioresources, infrastructures, networks, and know-how—with a reflection on collective purpose and added value.

PRIMED 2025 | [DOWNLOAD](#)

**IMPACT / EFFORT MATRIX**

**Template #08**  
**Impact-Effort**

The Impact-Effort template provides a visual and participatory framework to prioritise actions based on their potential benefits and the resources required for implementation. By plotting activities along two axes (expected impact and required effort) it enables multi-actor groups to focus on quick wins while keeping long-term transformative actions in view.

PRIMED 2025 | [DOWNLOAD](#)

**LIKELIHOOD / SEVERITY MATRIX**

**Template #09**  
**Likelihood-Severity**

The Likelihood-Severity template supports risk assessment within shared agenda implementation. It guides stakeholders to evaluate potential risks by estimating both their probability of occurrence and their possible impact. The visual matrix makes risk management accessible and participatory, turning abstract uncertainties into structured dialogue.

PRIMED 2025 | [DOWNLOAD](#)

**SUPPORT DEMAND MATRIX**

**Template #10**  
**Support Demand**

The Support Demand template helps articulate the types of external support—technical, financial, institutional, or policy-related that a territory or initiative requires to advance its shared agenda. It translates local needs into structured requests that can be aligned with regional, national, or EU-level programmes.

PRIMED 2025 | [DOWNLOAD](#)

**FEEDSTOCK-ORIGIN COMMITTEE CANVAS**

**Template #11**  
**Feedstock-Origin Committee Canvas**

The Feedstock-Origin Committee Canvas is a tool for mapping the sources, governance, and sustainability of biomass inputs within territorial value chains. It helps stakeholders identify feedstock origins, trace responsibilities, and align resource use with environmental and social criteria.

PRIMED 2025 | [DOWNLOAD](#)

**HEXA HELIX CANVAS**

**Template #12**  
**Hexa-Helix Cohorts**

The template for defining hexa-helix cohorts provides a structured approach to identify and group stakeholders from six key spheres: academia, industry, government, civil society, environment, and culture. It guides users in mapping roles, interests, and potential contributions, ensuring balanced representation and collaboration. This framework helps build diverse, context-sensitive cohorts that can effectively drive systemic innovation and territorial transformation.

PRIMED 2025 | [DOWNLOAD](#)

**Template #13**  
**Power-Interest Matrix.**

A stakeholder analysis tool that helps categorize actors based on their level of influence and degree of interest in a project or initiative. It supports strategic engagement by clarifying who to monitor, inform, consult, or actively involve.

PRIMED 2025 | [DOWNLOAD](#)

**Template #14**  
**The Onion Canvas.**

The Onion Canvas for engagement planning visualizes stakeholders in concentric layers around the core project team, reflecting their proximity, involvement, and influence. It supports the design of tailored engagement strategies by clarifying who should be closely involved, consulted, or kept informed...

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**Template #15**  
**Future Scenario Template.**

Designed to co-create territorial bioeconomy value chains while eliciting practical requirements for the PRIMED Toolbox. Over 2.5 hours, Living Lab representatives and project partners work in territorial groups to frame challenges, share visions, and collaboratively design circular bioeconomy solutions using a structured canvas. The process captures both content and methodology, ensuring the Toolbox reflects real-world needs, barriers, and collaborative practices.

PRIMED 2025 | [DOWNLOAD](#)

PRIMED TOOLBOX is a platform by the PRIMED Consortium & the PRIMED EU Project: Redesigning the primary sector for maximizing bioeconomy development.

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## APPENDIX C: Governance Designer Prototype

Early version of the Governance Design Form.

### ● Governance Design Form — Circular Bioeconomy Value Chain

#### ● Filling instructions — quick guidance

Use the guidance below while you fill the form. Each section includes what to enter, why it matters, and a short example. Keep entries concise — the form is designed to export a structured JSON for project tools.

##### Project & contact

- **Project / Shared Agenda name:** short, unique name (e.g. *Regenerative Olive Biohub*).
- **Territory:** administrative region or description (e.g. *Andalusia — Guadalquivir Valley* or NUTS3 code).
- **Contact person / email:** operational lead for follow-up; use an organisational address if possible.

##### Steering Committee (SC)

- Set a realistic seat count (6–12 recommended). Ensure the four voices (Intention, Experience, Design, Capacity) are represented.
- **Decision rule:** choose *Consensus-first* where possible; add fallback rule to avoid paralysis.
- For each SC member add: name, organisation, primary voice, email, term (years), and short selection reason.

##### Advocacy Group (AG)

- Enable the AG if you plan policy outreach, consultations or formal position papers. Indicate one lead organisation and 1–3 primary policy targets (e.g. CAP reform, regional procurement).
- Specify expected outputs and cadence (e.g. "2 policy briefs / year").

##### Technical Office (TO)

- Choose a neutral host with administrative capacity (university, NGO or municipal incubator). Enter team size as FTEs; include main responsibilities (facilitation, MEL, fundraising, comms).
- Set meeting cadence with the SC (Quarterly is a good default) and how secretariat/admin support is provided.

##### Funding Board / Finance WG

- Enable this if you plan a pooled seed fund or joint grant-making. Enter a realistic seed amount or range and a short eligibility rule (e.g. local partners + 20% match).
- Choose a disbursement cadence aligned with your project rhythm (rolling, quarterly or annual calls).

##### Advisory Panels

- List the thematic panels you expect (LCA, legal, finance). Prefer named institutes or 2–3 experts if already identified.

##### Working Groups (WGs)

- Create WGs around clear challenges or opportunities (e.g. "Olive pomace valorisation" or "Local compost market"). Each WG needs a one-line mandate, a coordinator (name/org), planned budget and one primary KPI.
- Limit WG size to 6–12 core members and ensure at least one representative per core voice (Intention/Experience/Design/Capacity).

##### Stakeholder Forum / Assembly

- Use the Forum for legitimacy & public validation. Choose an accessibility package (stipends, translation, online access) so marginalised voices can attend.
- Decide cadence (Annual/Biannual) and primary purpose (validation, learning, procurement).

##### MEL, Data & Legal

- Write a 1–3 line Theory of Change that links pilots to outcomes (e.g. "By valorising olive residues we reduce landfill GHG and create local high-value products, increasing farm incomes").
- Pick one primary KPI (simple & measurable) and a reporting cadence. Default data sharing = "Partners-only" unless you plan public dashboards.
- Start with an MoU; escalate to Consortium Agreement or formal legal entity only when the agenda requires contracting or asset ownership.

##### Inclusion, Resources & Timeline

- Set a minimum % of WG seats for local/community actors (25% recommended) and list inclusion measures (stipends, childcare, travel support).
- Provide a short activation timeline (0–18 months) with clear milestones for MoU, seed fund, WG pilots and first evaluation.

##### Export & next steps

- Use **Export JSON** to produce a machine-readable governance profile; this can be used to populate ToR templates or project proposals.
- After export, prepare a 1-page public summary (vision, SC list, TO host, 3 WGs, seed fund size, primary KPI) to share with stakeholders.

<b>Project / Shared Agenda name</b> <input type="text" value="e.g. Regenerative Olive Biohub"/>	<b>Territory / Region</b> <input type="text" value="Region, NUTS3, or description"/>
<b>Contact person</b> <input type="text" value="Name"/>	<b>Contact email</b> <input type="text" value="email@example.org"/>

**Steering Committee (SC)** Strategic leadership & legitimacy

Define composition, decision rules and meeting cadence.

<b>Number of seats (recommended 6–15)</b> <input type="text" value="9"/>	<b>Co-chairs (select how many)</b> <input type="text" value="2"/>
<b>Decision rule</b> <input type="text" value="Consensus-first"/>	<b>Quorum</b> <input type="text" value="50% + 1"/>

**Steering Committee members**

**Advocacy Group (AG)** Policy influence & external alliances

Enable Advocacy Group

<b>Lead organisation</b> <input type="text" value="Organisation leading advocacy"/>	<b>Primary policy targets</b> <input type="text" value="e.g. CAP, regional incentives"/>
--	---

**Key outputs (position papers, consultations)**

**Technical Office (TO)** Facilitation, M&E, fundraising

<b>Host organisation</b> <input type="text" value="Neutral host (university, NGO, municipality)"/>	<b>Core team size (FTE)</b> <input type="text" value="3"/>
---	---

**Core TO responsibilities (comma separated)**

<b>Meeting cadence with SC</b> <input type="text" value="Quarterly"/>	<b>Secretariat &amp; admin support?</b> <input type="text" value="Host provides"/>
--	---

**Funding Board / Finance WG** Optional: pooled funds & grant rules

Enable Funding Board

<b>Seed pooled fund size (€)</b> <input type="text" value="e.g. 100000"/>	<b>Eligibility rule (short)</b> <input type="text" value="e.g. local partners + match funding"/>
--	---

**Disbursement cadence**

### Advisory Panels

Optional expert advice (LCA, legal, finance)

Enable Advisory Panels

#### Panel topics (comma separated)

e.g. LCA, legal, investm

#### Preferred experts / institutes

List organisations or nai

### Working Groups (WGs)

Autonomous, task-focused teams

Create one or more WGs. Provide a short mandate, coordinator and KPI for each.

#### WG name

e.g. Biorefinery pilots

#### Mandate / challenge (short)

Short mandate

#### Coordinator (name / org)

Coordinator

#### Planned budget (€)

e.g. 25000

#### Primary KPI (one)

e.g. % residues used or tCO2e avoided

#### WG members (add)

+ Add member

Remove WG

+ Add Working Group

Clear

### Stakeholder Forum / Assembly

Open deliberative space

#### Cadence

Annual

#### Primary purpose

e.g. validation, public er

#### Accessibility & inclusiveness measures

e.g. stipends, translator

### MEL, Data & Legal

Theory of Change, KPIs, MoU, IP and data rules

#### Short Theory of Change (1–3 lines)

How do your actions lead to impact?

#### Primary KPI (one)

e.g. % feedstock residu

#### Reporting cadence

Annual

#### Data sharing (default)

Partners-only

#### GDPR compliance & data owner

Who owns the project d

#### Legal instrument (start)

MoU

#### IP default rule

e.g. shared non-exclusi

● **Actions & Export**

Save or export governance definition

Notes: the exported JSON contains the full structure of the governance model. Use it to pre-populate tools, generate ToRs, or feed proposal templates.

**Export JSON**

**Save locally**

**Load last**

**Import JSON**

Built for quick governance design. Edit fields, add members and WGs, then export the JSON to integrate with your project tools.

# APPENDIX D: Current Version of the Toolbox

The landing page:

**PRIMED TOOLBOX**

Home BE Chains Bioeconomy Tool Circular BMs BE Success Cases BE Scenarios Library Templates for LLS

## A set of tools for Bioeconomy Business Models

A digital toolbox aimed at facilitating, supporting, and accelerating collaboration between diverse stakeholders in social, technological, and business innovation within the bioeconomy.

**PRIMED Toolbox**

### Redesigning the Primary Sector for Maximizing Bioeconomy Development.

**“Empowering primary producers to turn local resources into resilient livelihoods and circular value chains.”**

The PRIMED Toolbox accelerates the transformation of the primary sector into a regenerative, circular bioeconomy by offering practical tools, templates and matchmaking to convert local biomass into viable, regionally anchored value chains. It bridges the research-to-practice gap with user-centred guidance, capacity building and impact measurement so producers, businesses and policymakers can co-design scalable, transparent business models.

**50** Successful Use Cases    **350** Scenarios Library    **550** Bioeconomy Resources

nt technology networks    INIA    Naked Innovations    ALCARRAS    BIO-HUBCAT    PRIMED    RURE UNIVERSITAT SOCIA M

## The Value Chains section:

# RESOURCES

## For Value-Chain Creation

During the course of the project, and in the context of activities pertaining to designing and developing bioeconomy value chains in the PRIMED Living Labs, a total of 14 value chains were designed, using at least 18 different technology stacks, and addressing no less than 8 different types of resources. These value chains generate 15 different products.

ID: VC1

### Direct aerobic composting

**Feedstock Flow & Capacity:** solid manure: 22,500 t/y, pig slurry solids: 4,500 t/y, pruning wood: 2,000 t/y, additional woody biomass: 50,000 t/y | Throughput: Current: ~27,000 t/y

**Technological Feasibility:** Low-tech, scalable; moisture/nutrient imbalances may reduce microbial efficiency; inadequate monitoring may affect pathogen inactivation

**Competitive Landscape:**

Decentralized composting on farms | Direct land-spreading under nutrient regulation | Alcarràs model is collective, centralized, and quality-focused

**Value Proposition:**

Centralizes slurry solids processing, supports nitrate regulation compliance, produces high-value organic compost, interest from multinational buyers

**Market Applications:**

Local farms (soil health improvement)  
International buyers (e.g., French farmers)  
Municipalities, gardening retailers, ornamental horticulture

**Stakeholders & Value Chain:**

150 local farm families supply feedstock  
Centrally managed composting  
Supported by BioHubCAT and local/regional government  
Export interest and market development in progress

**Market Dynamics:**

EU demand for organic soil inputs rising  
Premium compost commands higher pricing  
Market sensitive to input costs and competition from chemical fertilisers

**Known Risks:**

Operational: Expansion logistics, compost quality monitoring  
Regulatory: Compliance with organic and health standards  
Environmental: Risk of leachate, odor if mismanaged  
Economic: ~€1.5M investment depends on market uptake  
Social: Trust-building and community engagement essential

ID: VC2

### Anaerobic digestion

**Feedstock Flow & Capacity:** pruning wood: 2,000 t/y, regional forest agro residues: up to 10,000 t/y initially, scalable |

Throughput: Small-scale pilot (~2,000–5,000 t/y), expandable

**Technological Feasibility:** Moderate to high-tech; requires consistent biomass quality and drying; output: biogas, digestate; risk of inhibition from ammonia/toxic compounds

**Competitive Landscape:**

Emerging regional startups and EU-funded demo projects | Competes with biomass combustion and CHP | Few biochar producers in Catalonia; early-mover advantage possible

**Value Proposition:**

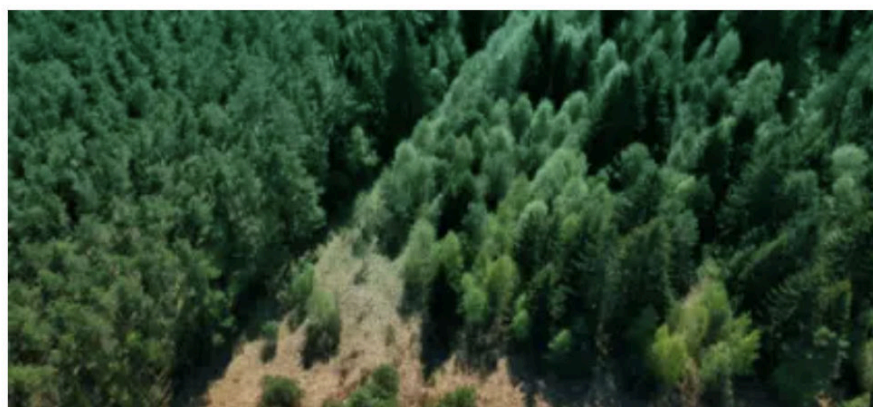
Decentralized valorization of woody biomass; aligns with fire prevention and forest management; circular use of prunings/waste; potential carbon credit revenue

## CIRCULAR BMS Bioeconomy Business Models Set

A Set of Bioeconomy Business Models encompassing 17 different models has been developed as part of this toolkit to support stakeholders in designing, evaluating, and implementing new bio-based value chains. It provides a structured framework for business creation in the bioeconomy sector, offering a range of alternative models tailored to different contexts, feedstocks, and stakeholder constellations. By presenting concrete options, this set helps assess the feasibility of new ventures.

Category:  Tag keywords:  CAPEX:  Search:

9 models shown



### In-house Sidestream Valorization

**Description and Key Aspects:**

Upgrade on-site sidestreams (dairy, brewery, livestock, food processing) into higher-value products—e.g., nutraceuticals, bio-fertiliser, biomethane—by adding compact conversion units to existing plants.

**Tags:** circular-bioeconomy, sidestream-valorization, on-site-biorefineries

**Examples:**

Livestock manure & vegetal residues → compost / AD → biogas → upgraded biomethane / CHP.  
Dairy whey → concentration → fermentation → lactic acid → PLA / nutraceutical ingredients.  
Brewery spent grain → anaerobic digestion → biogas and soil amendments.

**Sources:**

[ALC LLab — ALC Bio-Lab \(ALC, Alcarràs\) — Value Chain: compost & AD \(manure, slurry, vegetal residues\)](#)  
[BioEire LLab — National Bioeconomy Campus Lisheen \(IBF\) — Value Chain: dairy by-products fermentation \(whey → lactic acid → PLA\)](#)

**Category:**

Single-Plant

**Key Aspects:**

Leverages existing equipment and footprint  
Modular/incremental upgrades (fast time-to-market)  
Integrated unit operations: pre-treatment, fermentation, AD, separation  
Product diversification with captive feedstock

**CAPEX:**

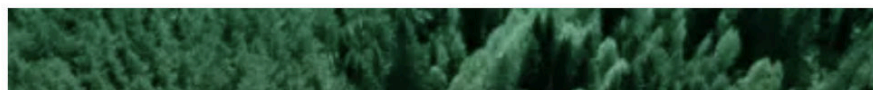
Low → Moderate (incremental upgrades; digesters/add-ons raise capex)

**OPEX:**

Lower → Moderate (shared logistics, operation & maintenance)

**Key Risks/Challenges:**

Technical adaptation and process integration.  
Developing stable offtake and market channels.  
Regulatory approvals for novel food/feed/fuel products.  
Feedstock variability and seasonality.



# SUCCESS CASES

## Bioeconomy Success Cases Library

Research has been conducted to compile 41 pilot, demonstration, and scaling projects that span diverse processing technologies, feedstocks, and regional contexts. Rather than focusing on individual examples, this consolidated library serves as a rich repository of real-world data objects (resources, technologies, bioproducts, and value chain instances). These cases serve as benchmark examples for the toolbox users.

<p> ID: pl001 <b>BBEPP - Bio Base Europe Pilot Plant (AgriSidestreams platform)</b></p> <p><b>Bioresources:</b> pressed-fruit-juice, press-fractions, plant-food-juices (PFJ)</p> <p><b>Technology / Process:</b> bench-to-pilot bioreactors, perfusion reactors, DSP trains, media optimization, GMP-like pilot operations</p> <p><b>Bioproducts / Output:</b> plant-cell-derived metabolites, nutraceuticals, speciality-ingredients</p> <p><b>Success Factors:</b> Open, modular pilot infrastructure; hands-on process engineering and downstream capabilities that bridge lab protocols to industrially-relevant conditions; strong SME access model.</p> <p><b>Partners:</b> Bio Base Europe Pilot Plant (Ghent), BBEPP network partners / SME clients</p> <p>Bio Base Europe Pilot Plant (BBEPP, Ghent) is an open-access pilot facility offering turnkey process development and scale-up from lab to multi-ton capacity. Its AgriSidestreams platform provides SMEs access to 50 L bioreactors and downstream processing trains to prototype PFJ-based media and PFJ-PCC workflows under near-GMP conditions, accelerating media optimization and de-risking scale-up.</p> <p><b>pilot-plant, process-scaleup, fermentation, downstream processing, circular-bioeconomy</b></p>	<p> ID: pl004 <b>EcoFISHent</b></p> <p><b>Bioresources:</b> fish-processing-side-streams, tuna-residues, crustacean-shells</p> <p><b>Technology / Process:</b> dehydration (Themis), enzymatic hydrolysis, extraction &amp; fractionation, film-casting lines</p> <p><b>Bioproducts / Output:</b> gelatine, bio-actives (peptides), biodegradable barrier coatings, Eco-FISH powder</p> <p><b>Success Factors:</b> Cluster approach that integrates fishing cooperatives, regional authorities and SMEs; modular pretreatment and enzymatic extraction enabling food-grade outputs; demonstrated pilot throughput and protein-recovery rates.</p> <p><b>Partners:</b> EcoFISHent consortium (regional authorities, AIMPLAS, FILSE, local cooperatives, biotech SMEs)</p> <p>EcoFISHent is an EU-funded project developing a territorial cluster and modular pre-treatment/extraction technologies to valorise fish-processing side-streams into high-value ingredients (food supplements, skin-care gelatin) and biodegradable barrier films for packaging. Pilot clusters in coastal regions have demonstrated significant protein recovery and disposal-cost reductions for local processors.</p> <p><b>fish-waste, marine-biorefinery, protein-recovery, biopolymer, food-grade-extracts</b></p>
<p> ID: pl005 <b>n-CHITOPACK (n-CHITOPAC)</b></p> <p><b>Bioresources:</b> crustacean-shells, fish-scales</p> <p><b>Technology / Process:</b> acid demineralisation, nano-fibrillation (ultrasonication), film-casting</p> <p><b>Bioproducts / Output:</b> chitin-nanofibril-based films, bacteriostatic packaging films</p> <p><b>Success Factors:</b> High-barrier, compostable alternative to petro films; pilot validation of nano-processing; strong alignment with packaging SMEs seeking sustainable barrier layers.</p> <p><b>Partners:</b> academic groups (chitin chemistry), packaging SMEs, waste-collector networks</p> <p>n-CHITOPACK leverages chitin nano-fibrils from crustacean shells and fish scales to produce 100% biodegradable, bacteriostatic food-packaging films with mechanical and barrier performance comparable to conventional multilayers. The project validated pilot-scale extraction and nano-fibrillation and demonstrated industrial compostability.</p> <p><b>chitin, biodegradable-packaging, nanofibrils, food-packaging, compostable-materials</b></p>	<p> ID: pl006 <b>DAFIA</b></p> <p><b>Bioresources:</b> fish-byproducts, municipal-organic-waste</p> <p><b>Technology / Process:</b> enzymatic hydrolysis of collagen, crosslinking chemistries, extrusion for films</p> <p><b>Bioproducts / Output:</b> fish-gelatin oxygen-barrier coatings, bioplastic formulations, flame-retardant additives</p> <p><b>Success Factors:</b> Integration of mixed organic streams into value-added packaging chemistries and demonstration of barrier/flame-retardant performance.</p> <p><b>Partners:</b> waste-management firms, packaging converters, chemical formulators</p> <p>DAFIA develops routes to convert fish industry by-products and organic municipal waste into bioplastic materials, focusing on gelatin-based oxygen barrier coatings and flame-retardant additives. Pilot trials demonstrated barrier and flame-retardant functionality comparable to fossil-based alternatives.</p>

## Library of hypothetical scenarios:

# SCENARIOS

## Hypothetical Bioeconomy Scenarios Library

We created a library of place-based scenarios that map realistic value-chain deployments, grounded in local feedstock, infrastructure and market potential. Each scenario is a compact, actionable blueprint designed to jumpstart pilot design by prepopulating resources, technologies and product objects in the Biopolygon canvas. They communicate concrete opportunities to regional partners, investors and policymakers and stimulate co-creation around shared innovation agendas. They also capture best-practice workflows and value-chain configurations, synthesising local data and expert insight for rapid learning and replication.



### Whey Valley — Asturias Dairy Biorefineries

**Description:**

Asturias processes large seasonal volumes of cow's milk that produce substantial whey streams from c...



### Thessaly Whey Biorefinery Cluster

**Description:**

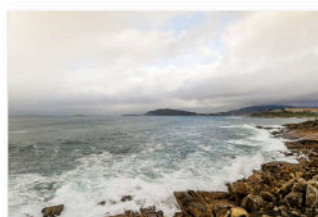
Thessaly's concentrated dairying and cooperative structures create an abundant, underutilized whey s...



### Shellfish Valorization Hub — Atlantic Ireland (Crab-Shell Biorefinery)

**Description:**

Crab and shellfish processors on Ireland's west coast generate thousands of tonnes of shell residues...



### LIFE REFISH — Rías Baixas Demo Biorefinery

**Description:**

The LIFE REFISH demo plant in Galicia showcases modular valorization of large volumes of seafood pro...



### Adriatic Cascade Valorization

**Description:**

Along the Adriatic coast, this project applies cascade valorization to large fishery by-product stre...



### County Cork — Pasture to Biogas Hub

**Description:**

County Cork's abundant cattle slurry and grass residues can be aggregated via a network of mid-scale...



### Osona Bio-Refinery Hubs for Circular Fertilisers

**Description:**



### Foggia Polycentric Agro-Energy Network



### Ebro Delta — Integrated Bio-Silica & Biogas Hub

## Collaboration and communication tools:

# TEMPLATES

## Living Labs support Tools & Templates

The PRIMED Toolbox includes a series of collaborative templates designed to guide co-creation, dialogue, and decision-making within Living Labs and Shared Agendas. Each template provides a visual and participatory framework to help territorial actors work together—identifying challenges, mapping assets, defining visions, and planning actions toward regenerative and circular bioeconomy transitions.

Explore the templates below to download, test, and integrate them into your own shared agenda process.

**Template #01**  
**Shared Agenda Canvas**

The Shared Agenda framework evolved from five initial components (Challenges, Opportunities, Assets, Alliances, and Future Vision) into seven interconnected elements that better reflect a comprehensive Living Lab approach.

PRIMED 2025 | [DOWNLOAD](#)

**Template #02**  
**Future Vision**

The Future Vision template facilitates a shared and creative exploration of desired long-term outcomes among stakeholders. It helps participants articulate a collective vision of how their territory could evolve under a regenerative bioeconomy scenario.

PRIMED 2025 | [DOWNLOAD](#)

**Template #03**  
**Challenges Canvas**

The Challenges template structures a participatory process to identify and prioritise the key barriers hindering the development of circular and bio-based value chains in a given territory. It captures both systemic and operational challenges and enables different voices to be heard and compared transparently.

PRIMED 2025 | [DOWNLOAD](#)

**Template #04**  
**Soft Analysis**

The Soft Analysis template supports qualitative diagnosis of the territorial context by mapping strengths, weaknesses, opportunities, and threats in a collaborative setting. It encourages stakeholders to integrate local knowledge, perceptions, and values—often overlooked in quantitative analyses—into strategic decision-making.

PRIMED 2025 | [DOWNLOAD](#)

**Template #05**  
**Roadmap Template**

The Roadmap template transforms visions and challenges into a sequenced plan of action. It allows stakeholders to define milestones, assign responsibilities, and coordinate short-, medium-, and long-term activities across organisations. As a collaborative tool, it promotes transparency and accountability in shared agenda implementation.

PRIMED 2025 | [DOWNLOAD](#)

**Template #06**  
**Governance Model**

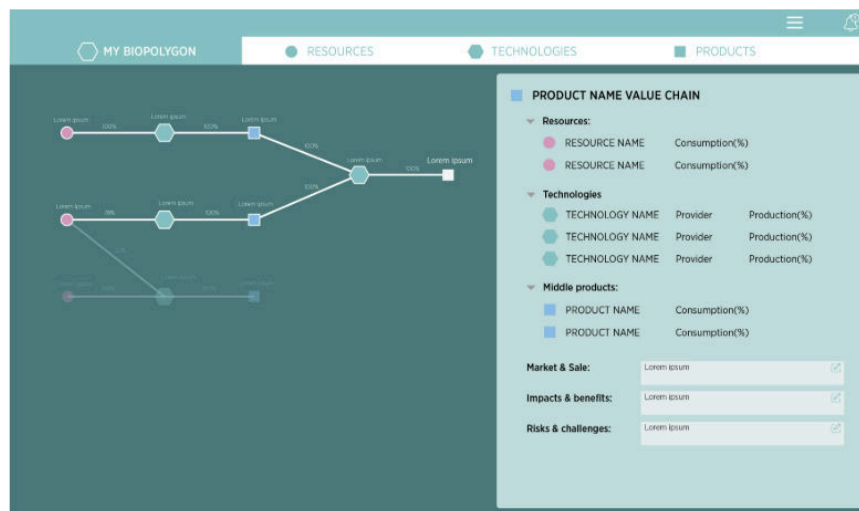
The Governance Model template defines how collaboration is organised within a shared agenda or circular bioeconomy value chain. It clarifies roles, decision-making mechanisms, and coordination structures—such as steering committees, technical offices, working groups, and stakeholder forums—ensuring legitimacy, inclusiveness, and efficiency.

PRIMED 2025 | [DOWNLOAD](#)

## Landing of the Bioeconomy tool:

### PRIMED Bioeconomy Tool

Conceived as a collaborative, open-access knowledge and resource hub designed to facilitate systemic innovation in the European bioeconomy. It targets a wide range of actors across sectors and value chains, promoting knowledge exchange, coordination, co-creation, and long-term cooperation to unlock the full potential of regenerative and circular bio-based solutions. It visualises resources, technologies, and products as connected nodes on a map-like interface.



The PRIMED Digital Toolbox is conceived as a collaborative, open-access knowledge and resource hub designed to facilitate systemic innovation in the European bioeconomy. It targets a wide range of actors across sectors and value chains, promoting knowledge exchange, coordination, co-creation, and long-term cooperation to unlock the full potential of regenerative and circular bio-based solutions.

Building on the workshop outcomes and supplementary user research, the first public release of the PRIMED Digital Toolbox streamlined the original six contexts into four interlinked domains. This simplification centers the interface on its core mission: designing feasible and impactful bioeconomy value chains. Territorial management functions are now implicit within each domain rather than presented as a standalone context.

**Biopolygon:** A dynamic canvas abstracting the end-to-end value chain. It visualises resources, technologies, and products as connected nodes on a map-like interface.

**Resources:** A panel for cataloguing available bioresources and managing their supply chains, including supplier capacity and provenance.

**Technologies:** A catalogue of transformation processes, where each technology is defined by its input requirements (raw resources or intermediate bioproducts) and output bioproducts.

**Products:** A workspace for defining and cataloguing final bioproducts, monitoring current production flows, and identifying potential products enabled by the existing technology set.

LAUNCH TOOL



PRIMED TOOLBOX is a platform by the PRIMED Consortium & the PRIMED EU Project: Redesigning the primary sector for maximizing bioeconomy development.

Contact Us

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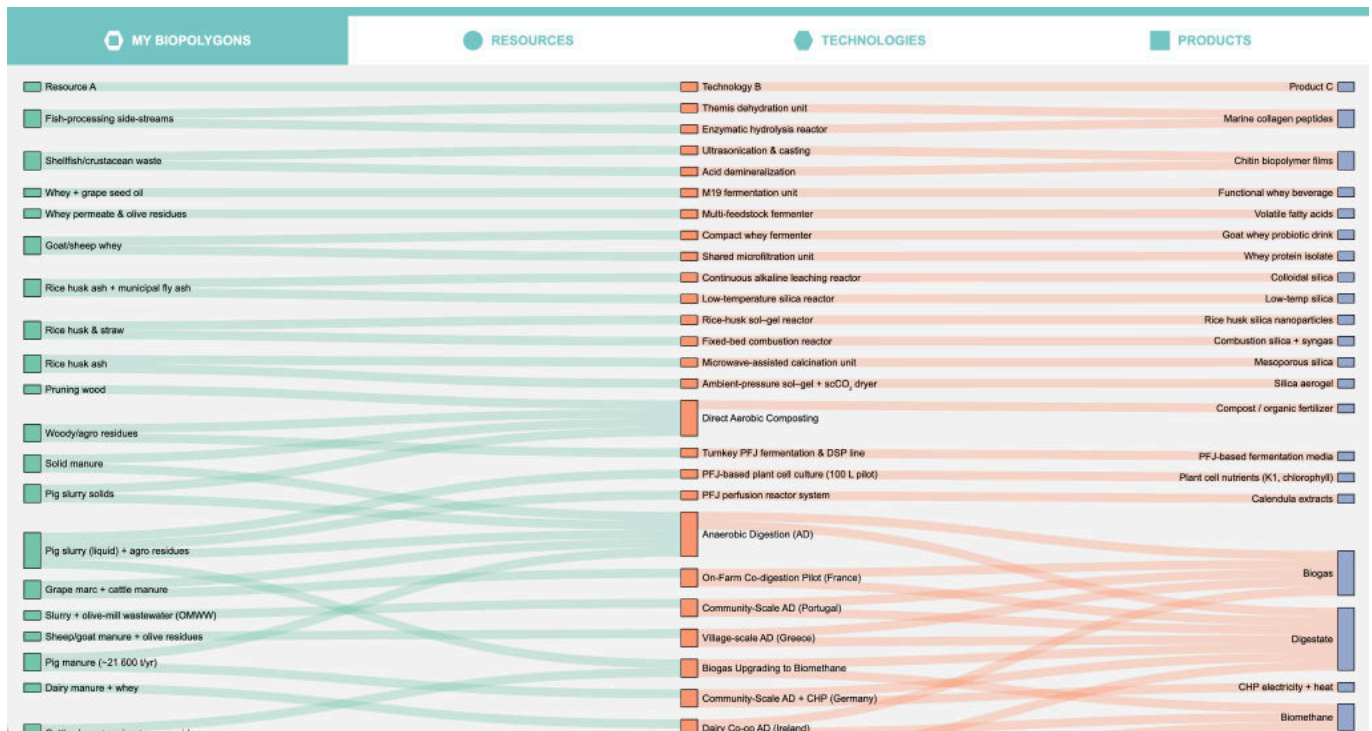
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## Value chains currently implemented in the Bioeconomy Tool:



## Resource Management Section:

**MY BIOPOLYGONS** | **RESOURCES** | **TECHNOLOGIES** | **PRODUCTS**

Name:  Category:

**Resources List:**

- Fish-processing side-streams
- Shellfish/crustacean waste
- Whey + grape seed oil
- Whey permeate & olive residues
- Goat/sheep whey**
- Rice husk & straw
- Rice husk ash + municipal fly ash
- Rice husk ash
- Solid manure
- Pig slurry solids
- Pruning wood
- Woody/agro residues
- Pig slurry (liquid) + agro residues
- Pig manure (~21 600 t/yr)
- Cattle slurry + maize + agro residues
- Grape marc + cattle manure
- Slurry + olive-mill wastewater (OMWW)
- Sheep/goat manure + olive residues
- Dairy manure + whey

**Goat/sheep whey**

Goat and sheep whey is commonly generated on small dairy farms and has a different protein/fat profile compared with cow whey, often commanding specialty food markets. On-farm aggregation and small fermenters enable regionally branded beverages (kefir, sports drinks) or starter cultures. Technical barriers are logistics, microbial control and shelf-stability, but niche product premiums can justify cooperative micro-processing. Projects show that local branding and short supply chains improve farmer incomes and circularity. Aggregated whey from multiple cooperatives smooths seasonal variability and enables cost-effective shared processing infrastructure (micro-filtration, fermentation). Aggregation supports higher-value product streams such as whey protein concentrates and nutraceuticals, increasing export potential. Coordination, standardization and cold-chain logistics are crucial to maintain consistent quality across member producers. Cooperative models reduce per-farm CAPEX while increasing bargaining power for offtake and certification.

**Suppliers List:**

- Goat/sheep cheese producers and agricultural cooperatives

Moianès in Catalonia (ES), France, Italy, Romania

### Technology Management Section:

MY BIOPOLYGONS   RESOURCES   **TECHNOLOGIES**   PRODUCTS

Type: -- Select --   
 Level: -- Select --   
 Input: -- Select --   
 Output: -- Select --   
 Apply Filters

**Technologies List:** Add New Technology

- Themis dehydration unit
- Enzymatic hydrolysis reactor
- Ultrasonication & casting
- Acid demineralization
- M19 fermentation unit
- Multi-feedstock fermenter
- Compact whey fermenter
- Shared microfiltration unit
- Rice-husk sol-gel reactor
- Continuous alkaline leaching reactor
- Microwave-assisted calcination unit
- Low-temperature silica reactor
- Ambient-pressure sol-gel + scCO<sub>2</sub> dryer
- Fixed-bed combustion reactor
- Turnkey PFJ fermentation & DSP line
- PFJ-based plant cell culture (100 L pilot)
- PFJ perfusion reactor system
- Direct Aerobic Composting
- Anaerobic Digestion (AD)
- Biogas Upgrading to Biomethane
- Community-Scale AD + CHP (Germany)
- Cooperative Biomethane Plant (Italy)

**Multi-feedstock fermenter**

Fermentation of whey permeate + olive residues to VFAs

**Type:** Biochemical

**Providers:** AgriMax consortium

**Maturity:** Demo

**Risks:** Feedstock mix variability

Edit Technology

View in Biopolygon

**Input:**

- Whey permeate & olive residues

**Output:**

- Volatile fatty acids

### Bioproduct Management Section:

MY BIOPOLYGONS   RESOURCES   TECHNOLOGIES   **PRODUCTS**

Category: -- Select --   
 Apply Filters

**Products list** Add New Product

- Marine collagen peptides
- Chitin biopolymer films
- Functional whey beverage
- Volatile fatty acids
- Goat whey probiotic drink
- Whey protein isolate
- Rice husk silica nanoparticles
- Colloidal silica
- Mesoporous silica
- Low-temp silica
- Silica aerogel
- Combustion silica + syngas
- PFJ-based fermentation media
- Plant cell nutrients (K1, chlorophyll)
- Calendula extracts
- Compost / organic fertilizer
- Biogas
- Digestate
- Biomethane
- CHP electricity + heat
- Grape marc-derived gas
- OMWW-derived gas

**Volatile fatty acids**

Volatile fatty acids (VFAs) are key intermediates in anaerobic digestion. They serve as building blocks for bioplastics, biofuels, and chemicals. Production from organic waste offers a sustainable alternative to petrochemicals. They are gaining attention in industrial biotechnology for circular economy models. Pilot projects focus on process optimization and cost reduction.

**Status**  
Demo

**Markets**  
Platform biochemicals

Edit Product

View in Biopolygon