



Developing skills for introducing circular business models and digital technologies in olive oil sector

D3.1 Assessment Report on state-of-the-art circular business models

July 2025



Project management



Identification of olive sector



Holistic circular business



VET curricula



Education programmes



Communication strategy

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Contact	: George Vardangalos
Email	: gvardangalos@vakakis.gr
Website	: http://circolive.eu/
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Deliverable Author	: Vakakis and Associates S.A. (Greece)
Contributors	: ASSOCIAÇÃO CHECK-IN - COOPERAÇÃO E DESENVOLVIMENTO (Por CAMARA OFICIAL DE COMERCIO E INDUSTRIA DE LLEIDA (Spain), INSTITUT ZA POLJOPRIVREDU I TURIZAM USTANOVA (Croatia), ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA (Italy)



Contact : George Vardangalos
Email : gvardangalos@vakakis.gr
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Assessment Report on state-of-the-art circular business models

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Deliverable Leader	VAKAKIS		30.07.2025
Work Package Leader	VAKAKIS		30.07.2025
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Executive Summary



1. Executive Summary

This deliverable (D3.1) under the CIRCOLIVE project, identified and assessed Circular Business Models (CBMs) in the olive and agrifood sectors across five EU countries (Greece, Italy, Spain, Portugal, Croatia). By engaging in both desk and field research, it mapped 26 applied CBMs and analysed them through a Circular Business Model Canvas (CBMC) and a Transferability Assessment Matrix (TAM). The deliverable's utter goal is to serve as a guide and support micro and small enterprises (MSEs) in adopting scalable, practical, and sustainable circular models. The findings revealed that low-tech, with local roots models (e.g., composting, regenerative farming) presented the highest transferability, while high-tech and capital-intensive models faced greater adoption barriers.

1.1 Key Findings

Finding	Description
High transferability	Composting, pruning reuse, regenerative farming practices – simple, low-cost, field-tested.
Low transferability	Biotech and energy-intensive models – high capital/technical requirements, complex regulations.
Portugal & Greece	Highest TAM scores due to operational CBMs aligned with MSE capacity.
Barriers	High investment needs, technical complexity, fragmented regulation, weak infrastructure.
Enablers	Local biomass availability, partnerships, policy incentives, public/EU funding access.
Potential for replication	Many CBMs (especially composting/regenerative) can apply to other crops/sectors.

1.2 Recommendations

Recommendation	What to do	...and why?
Small start for a big impact	Composting, mulching, reuse in farm	Lowers the costs, proven success, no or minimal training required
Work with your community	Join local cooperatives or schemes for shared infrastructure (or even machinery)	Costs are shared, risks reduced, capacity strengthened
Access to funds	Apply for rural/EU grants for circular practices	These funds cover capex (and opex sometimes), decouple adoption from the associated risks
Gain knowledge	Receive training in the principles of circular economy, how to apply them, and the governing regulations	It builds confidence and helps to avoid mistakes
Be part of the hive	Outputs to be prioritised based on what the local community needs (not now, but in the long-run, such as compost, eco-oil)	Enhances economic viability
Progress & impact monitoring	Resources used, savings (of any type), reductions (of any type) ought to be monitored	Future investments are justified, as well as to improve self-performance



2

Introduction



2. Introduction

2.1 Objective of the deliverable

The primary objective of this document is to provide the foundations for a strategic transition towards a circular economy in the olive sector via analysing, assessing, and consolidating existing circular business models (CBMs) relevant to the olive sector. Their transferability potential to micro and small enterprises is also evaluated across partner countries in the same sector. It compiles practical insights and best practices in the sector in order for effective and scalable CBMs for small operators to be designed.

Its specific objectives are as follows:

- Map and analyse the existing CBMs in the olive sector across partner countries (field and desk research)
 - Classify and cluster CBMs by:
 - Country
 - Circularity strategy
 - Maturity level
 - Business model type
 - Relevance to the sector
- Assess the transferability of the identified CBMs to micro and small enterprises based on the following parameters:
 - The key factors for success
 - The barriers and the enablers
 - The resources and the capabilities that are required for success
- Identify suitable and of high potentiality CBMs that could be modified and utterly adopted across partner countries
- Support the development of holistic circular business models in the olive sector via foundational analysis of “what works & what does not work” for WP3 next steps, i.e., D3.2, D3.3)

2.2 Scope

Geography

The identification and analysis of the CBMs in the olive sector spans across the 5 partner countries, i.e. (in alphabetical order), Croatia, Greece, Italy, Portugal, Spain.

Sectors

The CBMs collected are focused on:

- Olive trees farming and harvesting
- Olive oil production and processing (mills)
- By-product and waste streams (e.g., pomace, wastewater, olive leaves, pits, residues)

Operations / Business models

All partners put an effort to cover a diverse range of CBMs¹, such as (indicatively):

- Reuse & recycling

¹ CBMs from both large and small enterprises help benchmarking and justification of elements transferability (e.g., an element of a large company's CBM that is considered a barrier, it might be an enabler for a small company and vice versa)



- By-product valorisation
- Industrial symbiosis
- Bio-based innovations
- Eco-design & packaging

Analysis

Both desk and field research are included (literature review, gathering of secondary data, interviews with CBM practitioners and stakeholders of the olive sector).

The examination of each CBM is based on the use of:

- The CBM Canvas (CBMC)
- The transferability assessment matrix (TAM)

While the focus is on identifying: i) each CBM’s key characteristics, ii) its enabling factors, iii) the barriers for replicating or scaling-up, and iv) its transferability to micro and small enterprises (including in other contexts)

Strategy

The D3.1 serves as the foundational input for D3.2 & D3.3, the stakeholder workshops and the holistic circular business models formation respectively). It supports the CIRCOLIVE project’s objectives to enable and foster the transition of the olive sector towards circularity, to build capacity among stakeholders and allow for knowledge transferring among them, as well as to equip policy-makers with valuable insights straight from the directly affected stakeholders (farmers, producers, operators, a.o.) regarding sustainable innovation in the agrifood value chain.

2.3 Target groups

The target groups of D3.1 are segmented into primary and secondary, as follows:

Primary target groups	Description	Role
Micro & small enterprises in the olive sector	<ul style="list-style-type: none"> – Olive farmers – Table olives producers – Olive oil producers – Olive oil mills – Cooperatives – Small operators (sole proprietors or established companies) involved in valorisation processes of the olive waste and by-products – Entrepreneurs or companies interested in circular innovation (e.g., bio-packaging, cosmetics from olive oil or by-products, biogas) 	Adoption & replication of the CBMs
Entrepreneurs & start-ups in the sectors of agrifood & bioeconomy	Frontrunners in exploring business opportunities (locally and regionally) in waste valorisation and circular value chains	Promote and foster business innovation in the sector and scale-up circular ventures
Vocational education and training providers	Vocational education and training institutions in agrifood, sustainability, and entrepreneurship	Utilise CBMs’ insights for the development of the



& the educators and trainers themselves	responsible for the design and delivery of education and training curriculum ²	training programmes under WP4 & WP5
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Secondary target groups	Description	Role
Policy-makers & public authorities	Local/regional/national competent bodies in rural development, business policy, innovation, agricultural support, SME support	Enable policy support and regulatory alignment
Chambers of commerce, business/innovation/r&d clusters in the olive sector, cooperations	Organisations and groups that support businesses and producers to disseminate CBMs, cultivate collaborations, and enable transferability among enterprises	Facilitate dissemination, peer learning, and ecosystem building
Academia & research institutes	Higher education institutions and research institutes focused on circular economy, innovation in the agrifood sector, bioeconomy, technologies and industrial processes for by-product valorisation	Analyse, replicate studies, support technical innovation
Civil society & NGOs	Those involved in (not limited to): <ul style="list-style-type: none"> • Environmental protection • sustainable development • rural development & livelihood • community-based innovation 	Serve as advocates for sustainable rural development and foster the transition towards inclusive business models (within CBMs)

2.4 Relevance to the olive sector and agrifood industries

The D3.1 directly supports the transition of the olive sector and the agrifood industries towards sustainable, resilient and innovative business ecosystems via a strategic approach. It showcases examples of CBMs that valorise olive waste and by-products, hence providing tangible solutions to producers and processors to move from traditional waste management into resource-efficient and regenerative value creation. It also aligns with the EU policies' objectives of the Circular Economy Action Plan³ and the Farm to Fork Strategy⁴.

The identification of high-impact and most-importantly- transferable CBMs provides new income-generating revenue streams for micro and small enterprises, as well as it promotes for product diversification (e.g., biogas, cosmetics based on olive oil, eco-packaging), thus access to new markets via sustainable branding and sustainable innovation. In addition, D3.1 with its components and insights, offers a reduced reliance pathway to volatile olive oil prices via multi-stream business models.

The D3.1 serves as a repository of tested best practices from all partner countries with valuable insights on: i) process optimisation, ii) cross-sector synergies (e.g., energy, cosmetics,

² This specific target group is essential as its representatives will utilise the insights from the CBMs analysis to update or develop training curricula and capacity-building programmes (WP4 & WP5).

³ [Circular economy action plan - European Commission](#)

⁴ [Farm to Fork Strategy - European Commission](#)



nutraceuticals⁵), iii) circularity of resources, and iv) reconfiguration of the olive value chain in its entirety.

Given that the Mediterranean olive-producing regions are facing severe water stress, land degradation due to extended heat waves -even in the winter – which utterly lead to increased regulatory pressure for optimised environmental performance, the CBMs analysed provide strategies and processes that could contribute to:

- Mitigation of the environmental effects (e.g., wastewater & water pollution, GHG emissions)
- Less input of raw materials needs (e.g., water, energy, chemicals)
- Enhanced land and waste efficiency through valorisation

To this end, the D3.1 links in an easy-to-understand way the technical knowledge with its practical application, serving as a basic guide for capacity-building – training – replication (useful for WP4 & WP5), hence offering valuable insights for:

- Olive farmers
- Olive oil producers
- Olive oil mill owners/managers
- Micro & small enterprises keen to transforming the agrifood sector into a sustainable one
- Entrepreneurs exploring scalable circular business opportunities

The D3.1 feeds both directly and indirectly into the policy, investment and educational frameworks via supporting evidence-based policymaking on circular practices in the agrifood system, informs the design of public incentives that could be provided to farmers, producers, and all the main stakeholders, including the design of suitable financing instruments and ESG-aligned investments.

The combination of all the above lead for the D3.1 to be considered as a foundational deliverable for enabling the olive and the relevant actors in its wider sector, as its findings are affecting operations, policy, education & training, and innovation, hence fostering the shift from the linear & extractive models towards a regenerative, resilient, and truly sustainable economy.

2.5 Alignment with circular economy objectives and EU policies

The D3.1 is well-aligned with the relevant objectives and policy frameworks of the EU (e.g., Circular Economy Action Plan), and specifically, it showcases how the systemic transition in the olive and relevant agrifood sector can be supported. The following table presents this alignment.

⁵ „Nutraceuticals are characterized as ‘specially designed preparations’, formulated with the aim of fulfilling specific dietary requirements and/or offer preventive health care. Nutraceuticals are the formulation of nutrient/nutrients which helps in prevention and treatment of some diseases, such as to reduce side effects of cancer chemotherapy and radiotherapy, in addition to a supplement diet.” ([Puri V, Nagpal M, Singh I, Singh M, Dhingra GA, Huanbutta K, Dheer D, Sharma A, Sangnim T. A Comprehensive Review on Nutraceuticals: Therapy Support and Formulation Challenges. *Nutrients*. 2022 Nov 3;14\(21\):4637. doi: 10.3390/nu14214637. PMID: 36364899; PMCID: PMC9654660.](#))



EU policy framework & objectives	Strategic objective	How D3.1 aligns
EU Circular Economy Action Plan (CEAP)	<i>“Transitioning to a circular economy is key to achieving the EU’s 20250 climate neutrality target and halting biodiversity loss”</i>	<ul style="list-style-type: none"> • Identification and evaluation of CBMs that valorise agrifood by-products • Sector-specific circularity support – focus on olive waste streams • Resource efficiency enhancement & preserving value via recovery from bio-based products across countries
European Green Deal	<i>“Decouple economic growth from resource use and reduce environmental degradation”</i>	<ul style="list-style-type: none"> • Greener production and greener processing systems promotion in olive farming and olive oil production • Low carbon & regenerative practices promotion • Decarbonisation of the sector and fostering circular innovation in local (in all countries) micro and small enterprises
Farm to Fork strategy	<i>“Ensure sustainable food systems through circularity, innovation, and reduced environmental impact”</i>	<ul style="list-style-type: none"> • CBMs mapping focusing on waste valorisation at farm and mill level • Creation of circular value chains (reduced losses in the value chain) • Fostering sustainable production and consumption patterns in the olive and the relevant agrifood sector
EU Bioeconomy strategy	<i>“Develop a sustainable and circular bioeconomy in Europe”</i>	<ul style="list-style-type: none"> • CBM assessment where biomass is converted into bio-based products • Promotion of rural bioeconomy development where olive farming is a major activity • Promotion of localised circular bio-innovation for micro and small enterprises
Waste Directive	<i>“Prioritise waste prevention, reuse, and recycling over disposal”</i>	<ul style="list-style-type: none"> • Introduction of a hierarchy system for waste via showcasing best practices for reuse, valorisation, industrial symbiosis • Identification of ways to repurpose olive by-products to avoid landfills and/or incinerators • Guidance to micro and small enterprises how to be compliant to the regulations while at the same time to create value from their own or their sector’s waste streams
EU industrial strategy and strategy for SMEs	<i>“Empower SMEs to adopt sustainable practices and</i>	<ul style="list-style-type: none"> • Focus on CBMs transferability to micro and small enterprises



	<i>integrate into circular value chains”</i>	<ul style="list-style-type: none">• Introduction of a strategic circularity framework for the olive and the relevant agrifood sector• Empowerment of entrepreneurs’ resilience and building capacity on innovation for actors in rural areas
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3

**The Circular Business
Model concept**



3. The Circular Business Model concept

3.1 Definition

The most comprehensive definition for the circular business model could be as follows:

A circular business model is a strategic design of processes and operations through which an organisation creates, delivers, and captures value by decoupling its economic activity from the consumption of finite resources, and by designing and introducing into its operations and processes restoration, regeneration, and retention of value throughout the products' and materials' lifecycle.

The principles of the circular economy are integrated across its value proposition, the value creation and the delivery mechanisms as well as the value capture logic, while it operates within an intertwined system of stakeholders towards closed-loop, slow-loop, narrowed-loop flows of materials, energy and knowledge.

3.2 Key components

3.3.1 Value proposition

Value proposition is for a subject to offer utility to customers, to ecosystems and to society through circular impact.

3.3.2 Value creation & delivery

Value creation & delivery refers to the reliance on renewable inputs, it extends product life, fosters reuse-repair-remanufacturing, and utilises reverse logistics.

3.3.2 Value capture

Value capture is where the circular flows are monetized and the cost savings from resource efficiency are integrated into the business model.

3.3 Importance of Circular Business Models for micro & small enterprises

For micro & small enterprises, the adoption of Circular Business Models (CBMs) offers a unique opportunity for them to enhance their resilience towards climate change effects, reduce exposure to resource volatility in an evolving business environment, and generate new value through the regeneration and retention of materials, energy, and knowledge across the value chain.

By adopting the principles of the circular economy into their core business, micro and small enterprises operating in resource-intensive sectors, such as the agri-food sector in our case, they could reduce input costs and waste generation, while at the same time they could establish additional revenue streams from by-product valorisation, service-based offerings, or reverse logistics. A small operator with a CBM in place is well-positioned to be considered not only as producers but as an integral part of a system of a regenerative, innovation-driven economy.

The micro and small enterprises that adopt CBMs in their process and operations, differentiate themselves from the competition by integrating environmental and social performance into their core value proposition. In an evolving market towards where environmental and social transparency is highly expected by customers, dictated by tight regulations, and enforced by the emergence of green procurement frameworks across the public and private sectors, the



adoption of CBMs could be considered as the new business code of conduct.

This does not come out of the blue, as by shifting from a linear business model to circular value creation, a micro and small business presents higher opportunities to access new markets, solidify its supplier and customer relationships, and align itself with the emerging EU and national support frameworks and mechanisms (e.g., financing instruments, incentives in tax, technical assistance and infrastructure funding scheme), aiming towards circular transition.

3.4 Role of networks and collaboration approaches

In CBMs, the role of networks and collaboration is foundational. Instead of a company-centric approach, CBMs put the system-centric approach in the center of business conduct. This is due to the fact that CBMs' success relies on multi-actor ecosystems to close, to narrow, and to slow resource loops across the value chains – unlike linear models in which value is created and captured within a single “chain link”.

The networks and collaborations that can practically be utilised and be of value for a micro and small enterprise are outlined – briefly – as follows:

- ➔ Partnerships with suppliers (upstream), with customers (downstream), with technology providers and logistics intermediary companies, along with knowledge institutions and public actors, are essential in order to:
 - Unlock access to secondary materials
 - Share infrastructure
 - Co-develop solutions
 - Manage and implement (collaboratively) strategies for extending products' life and retain value through its lifecycle
- ➔ Benefits for a micro and small enterprise that enters into the ecosystem of CBMs:
 - Reduced transaction costs
 - Building trust through interlinkage of operations
 - Increased access to innovative solutions in circularity
- ➔ Examples of network-enabled circular solutions
 - Industrial symbiosis (in simple terms, “I need what you don't”)
 - Product-service system integration
 - Reverse logistics
 - Shared processing hubs

These examples rely on coordinated action and mutual value alignment. By putting this into the local context, we see that regional alliances in many business sectors, clusters, cooperative initiatives, and cross-sectoral platforms serve as key enablers for communicating, disseminating, scaling, and replicating practices of circular economy. These networks serve also as mechanisms for exchanging knowledge and understanding of what and how circularity works in practice, hence enabling continuous learning, peer-to-peer support and raising awareness on good practices. The formation of collaborative networks strengthens the accountability of stakeholders towards the common good and transform them into stewards for ensuring that environmental and social value is collectively generated and distributed in a fair way.

In essence, networks and collaborations are perceived as the backbone of CBMs; they enable micro and small enterprises to transcend barriers and limitations occurring in linear models and be part of circular value creation while engaging in shared strategies for systemic transformation.



4

Methodology



4. Methodology

4.1 Overview

The methodology followed for this deliverable combined desk-based research with field research, based on structured tools and expert validation processes for consistent and systematic identification, analysis, and assessment of Circular Business Models (CBMs) in the olive sector and related agrifood industries.

This methodology was specifically developed for systematic identification, analysis, and assessment of the state-of-the-art Circular Business Models (CBMs) within the olive sector and related agrifood industries. As a result, it provided a standardised and coherent framework that allowed for:

- i) Comprehensive identification of existing CBMs within the target sectors
- ii) In-depth analysis of these CBMs
- iii) Objective evaluation of the transferability potential of CBMs to micro and small enterprises within the olive sector
- iv) Identification of the benefits and shortcomings or gaps in these business models

Desk-based research initially mapped out and profiled current CBMs, while field research was conducted through structured interviews with subject matter experts. These interviews aimed to enrich the findings from the desk-based research via insights, current practices, and expert endorsements.

The core of this methodological framework was the Circular Business Model Canvas (CBMC), in which elements from both the Circular and Sustainable Business Model Canvas (CSBMC) and the Circular, Collaborative, and Co-Creative Business Model Canvas (C3BMC) were harmonically combined to ensure comprehensive mapping and evaluation of:

- i) Value propositions
- ii) Value creation & delivery mechanisms
- iii) Value capture strategies

The CBMC focused on circularity, efficiency of resources, and minimised environmental and social costs. A Transferability Assessment Matrix (TAM) complemented this framework, serving as an objective Circular Business Model evaluation tool designed to measure the applicability and suitability for adoption by micro & small enterprises, taking into account technical, financial, regulatory, and operational criteria.

The utter goal of this methodology was to promote knowledge exchange, to support cross-sectoral collaboration, and inspire the broad adoption of Circular Business Models among micro & small enterprises, hence leading the olive sector and the related agrifood industries towards a resilient, circular, and resource-efficient business ecosystem.

The engagement of the following target groups through field research (interviews, consultations, workshops) was expected to yield practical and insightful data that were to be used for in-depth analysis and useful outcomes under this methodological framework.

Experts and practitioners of circular economy	Professionals involved in the design-implementation-management of CBMs in the olive and related agrifood sectors
Micro & small enterprises	Owners, managers, key personnel from micro & small enterprises in the olive and related agrifood sectors



Industry stakeholders	Representatives from the olive and agrifood value chain actors
Research institutions & academia	Researchers, academics, scientists (circular economy, sustainability, agriculture, agrifood)
Public & regulatory authorities	Policymakers, regulators, public officials (environment-agricultural, circular economy, sustainable industry)
Business association & Chambers of commerce	Representatives, advisors that may provide insights on barriers, trends, enabling factors for adoption of circular economy practices
Intermediaries & networks	NGOs, clusters, hubs of innovation on circular economy initiatives

4.2 Desk-based research

The 1st phase of the methodology followed for the WP3 included a desk-research stage during which the existing circular business models were systematically identified, collected, categorised and documented across the olive and the related agrifood sector. The objective of the desk-based research was to identify, collect and profile via the tools provided by the current CBMs through literature review and analysis of the data.

The data sources expected to be used were as follows:

- i) Academic and scientific literature
- ii) Reports from the industry and the market
- iii) Repositories of EU projects
- iv) Case studies
- v) Company websites

To ensure consistency and harmonic structure of the gathered data, the data extraction template has been used as the tool for the desk-based research.

The circular business model canvas template has been used to structure and map the identified CBMs, while the transferability assessment matrix has been used to identify their transferability potential and barriers or challenges.

This was the stage prior to any of the next steps (field research and analysis) that utterly led to the findings of this task.

During this phase, a partner from each of the participating countries in this project conducted thorough desk research to identify and record at least three (3) CBMs. The tool provided for this purpose was the “Data Extraction Template / DET”. The main parts of the desk research included:

- Searching and identification of CBMs in each country
- Classification of each CBM based on:
 - Sector (olive, agrifood, biotechnology, a.o.)
 - Type (industrial symbiosis, valorisation of by-products, a.o.)
 - Location
 - Maturity level
 - Mapping of the CBMs’ value proposition, value creation, and value capture
 - Formation of any type of partnership and stakeholder collaboration
 - Technologies & infrastructure
 - Environmental, social, economic impacts
 - Feasibility for micro and small businesses

During this phase, more than 20 CBMs have been identified and documented across the



participating countries, along with the ecosystem they operate within, an element that helped in the comparison among countries and the transferability assessment.

The analytical steps that have been taken from all countries' competent partners to properly conduct Phase 1 are presented in the Annex.

4.2.1 Sources & literature review

The desk-based research includes a blend of primary sources, secondary sources, and insights derived from literature review. In more detail:

- Primary sources
- Websites of related companies across the participating countries and their reports
- Interviews and communicating with entrepreneurs in the olive sector, olive oil mill and plant owners, agronomists
- Technical documentation (filed-specific) of related projects and companies' personnel (those who were kind enough to share with this project's partners publicly available information on their business conduct)
- Secondary sources
- Scientific papers and studies of applied research on the field (either from scientific journals or relevant EU projects' results)
- Articles in the media and from relevant organisations in each country
- Reports from EU-funded relevant projects and regional innovation platforms (e.g., pilot initiatives funded from the ERDF)

To ensure traceability and replicability, the specific literature review is placed in the Annex. In addition, to ensure credibility of the findings and insights during this phase, the competent partner in each country cross-checked the information gathered either via the project/company website or via interviews.

4.3 Field research

The field research is the 2nd phase of the methodology followed for the WP3. It complements the 1st phase (desk research and analysis of the findings and insights gathered) by collecting context-specific and stakeholder driven insights that reveal the practical side of the CBMs, the barriers, the challenges, and of course the enablers for CBM implementation across the olive sector. In more detail, the objective of the field research was to enrich the desk-based findings, to complement them, and to validate them via primary data collection from the target groups.

Interviews have been conducted with the identified target groups as given above, which were specifically designed to captivate insights, practical approaches and methods, details on operational level, as well as the contextual factors affecting the adoption of CBM.

The guide for interviews that has been used for the field research, included specific questions and useful hints for the interviewer on what information or data or insights was to seek from the interviewee.

The circular business model canvas template has been used to validate and enrich the desk-based findings, while the criteria under the transferability assessment matrix have been validated, enriched and detailed by the interviewees.

Its added value was based on:

- Validation and enrichment of the desk research results with insights from people with real hands-on experience on CBMs



- Identification of the success factors and the drawbacks or the barriers that CBM practitioners faced
- Gathering of the perspectives from key actors on feasibility and transferability of the CBMs in the real world

As already mentioned, the field research phase included semi-structured interviews (a template with specific questions to address the interviewees has been used though a level of freedom to weave into the questions based on the discussion status was provided), and direct engagement with key stakeholders in the olive value chain.

4.3.1 Interviews

The interviews followed a standardized interview guide (semi structured) provided to each country’s competent partner in English – this can be found in the Annex –, while the interview itself – for easiness reasons – has been conducted in each partner country national language. To ensure a methodological consistency across the participating countries. Each interview explored the following topics:

Topic	Focus on
Organisation profiling	Type of the interviewee and its role in the olive/agrifood sector, territorial context
Circularity practices	Type and scope of circular practices which are being currently implemented
Prior experience with CBMs	Prior and ongoing efforts to develop – adopt – scale CBMs
Incentives and enablers	Motivation for CBM adoption
Barriers and challenges faced	Economic -technical – legal – cultural
Collaboration with stakeholders	Level and type of cooperation with other actors
Traceability & replicability	Feasibility of their CBM to be adopted by micro & small enterprises in the olive sector
Policy and support	Access to funding – regulations – institutional support
Future prospects	Future plans (expansion), innovative solutions that came into their attention, possible scaling of their operations

Each partner conducted at least 2 interviews, aiming to ensure covering different types of CBMs (e.g., by-product valorisation, industrial symbiosis, bio-packaging, composting, biogas production). The interviewees included:

- Olive mill owners
- Agronomists
- Circular economy entrepreneurs
- Regional innovation facilitators
- R&D representatives
- Public project coordinators

The interviews provided both qualitative depth for the CBM under examination and evidence in their practicality helping to assess their:

- Circular value creation (tangible)
- Ecosystem formation
- Adoption feasibility for micro and small enterprises
- Involved stakeholder willingness to cooperate and engagement level

The analytical steps that have been taken from all country competent partners to properly conduct Phase 2 are presented in the Annex.



4.4 Analytical framework

The analytical framework utilised for this deliverable (D3.1) has been designed with a specific approach in mind; to ensure a i) systematic, ii) standardised, and iii) comparable analysis of the Circular Business Models (CBMs) identified across all partner countries. Its design allows for both qualitative and semi-quantitative assessment of the following elements:

- The business model set-up and the respective logic behind its formation
- The circularity strategies developed and the impact monitoring mechanisms
- The stakeholder mapping and the collaboration ecosystem among them
- The barriers and the enablers for transferability (especially for micro and small businesses)

The analytical framework is based on two (2) specific tools (the templates can be found in the Annex):

1. The Circular Business Model Canvas (CBMC) – for its structural analysis
2. The Transferability Assessment Matrix (TAM) – for its feasibility evaluation

Each partner applied this approach to all CBMs collected during phase 1 & 2 (the desk and field research respectively), thus allowing for a consistent cross-case comparison and aggregation of the findings.

4.4.1 Circular Business Model Canvas

The CBMC is a analytical tool tailored to the needs of this deliverable and is used to capture the value is created, delivered, and captured in a business model under the lenses of the circular economy principles. It is based on the business model canvas designed by Alexander Osterwalder & Yves Pigneur⁶ though it integrates the principles of sustainability and circular economy as its “core” analytical dimensions. The full CBMC can be found in the Annex, while the following table includes the main structural “blocks”.

Structural block	Description ⁷
Identification of the business model	Name, location, sector, and year of establishment
Value proposition	Circular value created for customers, society, and ecosystems
Stakeholder collaboration & co-creation	Identification of key actors and the mechanisms of co-creation and network-based value generation
Circular value creation & delivery	Circular inputs, enabling technologies, and operational strategies
Customer engagement & distribution	How customers participate in circular practices and how products/services are distributed sustainably
Circular revenue streams	Monetisation strategies linked to circular flows
Circular cost structure	Core operational and capital costs associated with implementing and maintaining circularity
Environmental impact reduction	Specific environmental benefits delivered
Social impact	Local employment, community inclusion, stakeholder empowerment

⁶ [BUSINESS MODEL CANVAS : Alexander Osterwalder & Yves Pigneur : Free Download, Borrow, and Streaming : Internet Archive](#)

⁷ Extended description in the CBMC in Annex



Circular risks & resilience	Risks to circularity and strategies enhancing resilience
Metrics & monitoring	Quantitative and qualitative indicators used to assess circular performance

Each of the CBMC was filled with information based on the findings of the Data Extraction Templates, interviews, and additional project or company documentation. This tool provided the foundation for:

- The comparability across cases and across partner countries
- The typology mapping
- The identification of enabling patterns and innovation clusters
- The evidence-based evaluation of the business models' scalability and relevance for micro and small enterprises

4.4.2 Transferability Assessment Matrix (TAM)

In this sub-section the Transferability Assessment Matrix (TAM) is described in its design and structure and covers its rationale and its architecture, its methodological approach, and define the scoring criteria. The TAM was a core component of the analytical framework applied in this deliverable. Its design aimed to explore and evaluate the i) feasibility, ii) scalability, and iii) applicability of the identified CBMCs for micro and small enterprises across different territorial contexts of the olive and agrifood sectors.

It served the following critical roles during the business models analysis:

1. Readiness assessment; evaluating whether a business model can be – realistically – adopted by the micro and small enterprises considering their constraints (financial, human capital, bureaucracy, among others)
2. Comparison across cases; by using a standardised scoring model for each business model, it allows for benchmarking across diverse business models (different countries, different contexts)
3. Identification of high-potential models; the business models that received high scoring and showcase manageable barriers are prioritised for examination in the next WP3 tasks (i.e., validation workshops and holistic circular business models)
4. Guidance for next strategic actions; the outputs from the filled TAMs will be used for policy and training recommendations in order to align the efforts towards circularity with the needed support

This tool complemented the CBMC by introducing a semi-quantitative scoring method (on a 1-5 scale, where 1 = very low, 5 = very high as to the transferability potential and not as to the criteria effect or size to the CBM under examination) that allowed for a structured comparison of different business models across a shared set of criteria as shown below (the full version of the TAM can be found in the Annex). It addressed technical, economic, environmental, social, regulatory, and market factors. The TAM has been populated with data gathered via desk research, via interviews, and via the CBMC analysis. Its results have been used in Chapter 6 and will support the implementation of the workshops under T3.2. The TAMs' findings facilitate the formation of the holistic CBMs (D3.3) and also serve as input for the educational and training deliverables under WP4 and WP5.

The TAM assessed each CBMC across the following dimensions:

Dimension	Definition
Technical complexity	The level of technological sophistication and skills required to operate the business model
Investment requirements	The estimated upfront capital that is needed to implement the business model



Operational feasibility for micro & small enterprises	The ease for business model implementation by micro and small enterprises based on capacity and structure
Scalability potential	The replicability and adaptability of the business model across territories or sectors
Regulatory & legal barriers	The level of compliance complexity and the respective administrative burden/barriers linked to the business model implementation
Supply chain readiness	The availability of the necessary partners, inputs, services needed for the business model to succeed in the regional/national/local ecosystem
Market demand	The current and the anticipated demand for the circular product/service offered by the business model
Environmental impact reduction potential	The potential of the business model to reduce emissions, waste, or to improve resource efficiency (all compared to the linear respective business model)
Social impact potential	The contribution of the business model to local employment, to the inclusion of stakeholders, and to the community's resilience

After scoring each dimension, a summary for each business model under examination was filled where the total score (of maximum 45 points) for each business model reflected is overall transferability, while qualitative notes complemented the scoring focusing on the: i) main barriers for adoption, ii) the key factors for facilitation (the enabling conditions required), iii) the recommendations for adaptation (or replication) and iv) comments from the examiner (context-specific constraints or opportunities identified).

4.5 Transferability assessment

While the 4.4.2 described the design and structure of the TAM, this section covers what the TAM revealed when it was applied to the CBMs and what is the added value of the findings. It allows for a clear understanding of how transferability of a CBM was assessed, why some CBMs may be more feasible than others, and what are the insights that emerge from this process to be used in the next phases of the project.

4.5.1 Criteria & indicators

The TAM assessed each CBM on nine (9) core criteria that reflected the parameters affecting their feasibility and adaptability by micro and small enterprises. Namely,

1. Technical complexity
2. Investment requirements
3. Operational feasibility for micro & small enterprises
4. Scalability potential
5. Regulatory & legal barriers
6. Supply chain readiness
7. Market demand
8. Environmental impact reduction potential
9. Social impact potential

4.5.2 Scoring system and evaluation method

For ensuring consistency and comparability among CBMs, a 5-point system has been used for each of the TAM criteria. Namely,



Score	Description
1	Very low
2	Low
3	Medium
4	High
5	Very high

Based on the above, each CBM could score between nine (9) and forty-five (45) points, where the higher the score the higher the transferability potential of a CBM. Each TAM included a narrative section where the examiner could provide a short qualitative summary per CBM, highlight any context-specific enabler(s) and barrier(s), and recommendations for adaptation and replication. This dual-scoring approach aimed to enhance the practical utilisation of the findings per CBM.

4.5.3 Identification of success factors and barriers

The TAM findings revealed the following success factors and barriers:

Success factors	Barriers / constraints / limitations
<u>Public funding</u> <i>Reason → to support innovation</i>	High capital costs for equipment and technologies
<u>Regional coordination frameworks</u> <i>Reason → to allow for multi-stakeholder engagement</i>	Regulatory landscape is too complex and fragmented
<u>Strong market demand</u> <i>Reason → the output of these business models are sustainable/bio-based/zero-waste products while the common perception is that they are of less value and are second choice for consumers</i>	Digital maturity is low among micro and small enterprises
<u>Proximity to academic and research institutions</u> <i>Reason → to facilitate technological co-development</i>	Capacity for innovation is low among micro and small enterprises
<u>Established local supply chains</u> <i>Reason → circular economy requires feedstocks' unconstrained access</i>	Logistics infrastructure is weak and the supply chain actors are scattered
<u>Positive public perception</u> <i>Reason → sustainability-oriented products and practices are still considered as of less value (linked to "strong market demand" factor for success)</i>	Cultural resistance for collaboration on different business model (at least in the traditional sectors)



5

Tools & Templates



5. Tools & templates

In this chapter the tools and templates used throughout the implementation of this deliverable are presented. These tools and templates allowed for standardisation, comparability, and replicability of the identification, analysis, and evaluation of CBMs across the partner countries. Their use ensured that all project partners followed the same approach during the desk-based and the field research, and laid the foundations for an evidence-based and consistent analytical framework.

5.1 Data Extraction Template (DET)

The Data Extraction Template (DET) served as the first analytical lens to use during phase 1 (desk research) for each identified CBM identified by the project partners and preparing them for the next steps (deeper analysis via the CBMC and TAM). It allowed for all necessary data per CBM to be documented in a consistent and structured way. The DET allowed for gathering the following data:

- Information on the CBMs
- Characteristics of the business model
- Core components (value proposition/creation/delivery/capture)
- Partnerships/infrastructure/technologies
- Environmental, social, economic impacts
- Initial assessment of transferability potential
- Success factors / barrier/limitations/constraints identification

5.2 Circular Business Model Canvas (CBMC)

After the DET, it was the turn to use the CBMC serving as the principal tool for analysing each CBM. The CBMC used combined elements from the Circular and Sustainable Business Model Canvas (CSBMC) and the Circular, Collaborative, and Co-creative Business Model Canvas (C3BMC), aiming to provide an integrated perspective on:

- Circular value proposition
- Stakeholder collaboration mechanism(s)
- Operational strategies
- Enabling technologies (for value delivery)
- Customer engagement
- Circular distribution channels
- Circular revenue generation & cost structure
- Environmental and social impacts
- Resilience and risk management
- Monitoring of circularity performance

5.3 Transferability Assessment Matrix (TAM)

The TAM served as a semi-quantitative and comparative evaluation tool for assessing the transferability of each CBM to micro and small enterprises. It was structured on nine criteria, where each criterion was rated on a 1–5 scale. The TAM's purpose was to:

- Establish an evidence-based score for each identified CBM
- Highlight the CBMs with replication, or upscaling, high-potential
- Define the barriers and the enablers for adoption by micro and small enterprises
- Support the CBMs prioritisation
- Provide insights on policy/training recommendations for the project's next phases



Each TAM also included a qualitative section that included the i) main barriers for adoption, ii) the key factors for facilitation (the enabling conditions required), iii) the recommendations for adaptation (or replication) and iv) comments from the examiner (context-specific constraints or opportunities identified), thus enhancing the interpretation of the scoring process.

5.4 Guide for interviews (field research)

The Guide for interviews was used during the field research phase. Its structure contained a set of questions to address to the interviewed practitioners, entrepreneurs, researchers, and other key stakeholders in the olive and agrifood sectors and gather insights. The Guide for interviews was designed as such to ensure the methodological consistency across interviews that were to be conducted in all partner countries and allowed for partners to adjust the conversation according to their needs, while not deviating from the deliverable's and project's objectives.

Specifically, it addressed the following:

- The organisational role and prior/current experience in circular economy practices
- Specific practices that they implement and business model examples
- The mechanisms behind value creation, delivery, and capture
- The incentives, the barriers, and the factors for success
- The feasibility and scalability of the CBM for micro and small enterprises
- The support mechanisms and the necessary frameworks enabling further development



6

Results & findings



6. Results & findings

6.1 Profiles & mapping of state-of-the-art CBMs

A structured overview of the identified CBMs through both desk and field research across the five partner countries of this project is presented below. The objective was to showcase the diversity among the documented circular innovations in the olive and agrifood sectors, review and assess their strategic orientation, and support their further transferability and the respective policy initiatives derived from this assessment.

The following table summarises the CBMs identified in each partner country based on certain core parameters:

- CBM name
- Country / region
- Type (e.g., waste valorisation, industrial symbiosis, etc.)
- Circularity strategy
- Maturity level
- Sector of operation
- Source

	CBM name	Country / region	Type	Circularity strategy	Maturity	Sector	Source
1	Composting of olive mill waste for the production of soil amendments	Greece	By-product valorisation	Waste-to-resource, soil amendment	Operational	Olive	Scientific study
2	Integrated Supply Chain for Compost	Greece	Industrial symbiosis	Logistics optimisation, waste aggregation	Pilot	Olive	Scientific study
3	Water-Energy-Nutrient Recovery from OMWW	Greece	Multi-resource recovery	Biogas, fertigation, water reuse	Pilot	Olive/Agrifood	University pilot
4	KYKLOPAS Bio-Valorisation Model	Greece	Industrial symbiosis	Composting, renewable energy	Scaled	Olive	Company & interview
5	Seven Olea Regenerative Model	Greece	Regenerative agriculture	Biochar, nutrient cycling	Operational	Olive	Company & interview
6	Bioreactor-Based Composting of Olive Pomace	Croatia	By-product valorisation	Composting optimisation	Pilot	Olive	VALOLIVEWASTE project
7	Recycling Plant for Olive By-products	Croatia	Waste valorisation	Pellet production	Operational	Olive	Field interview
8	Olive By-Product Utilization & Valorisation	Croatia	By-product valorisation	Composting, nutrient return	Operational	Olive	Company website
9	Utilizing Pruning Waste for Soil Fertilisation	Croatia	By-product valorisation	Mulching, organic return	Operational	Olive	Field interview
10	Agroenergy Biogas Plant	Italy	Waste valorisation	Anaerobic digestion of pomace	Operational	Olive	Company website, case study & BTS Biogas
11	Bioenutra Polyphenol Extraction	Italy	Industrial symbiosis	OMW valorisation to nutraceuticals	Operational	Olive/Chemical	Company & press
12	Olive Oil Pomace Recovery & Feedstock Integration	Italy	By-product valorisation	Animal feed integration	Operational	Olive/Agri-feed	SME site
13	Casa Alta – Traditional Circular Estate Model	Portugal	Valorisation of olive by-products through composting	Regenerative organic farming	Operational	Olive	Website, tourism platforms, regional development reports
14	Acushla – Circularity in Small-Scale Olive Mill	Portugal	By-product valorisation; Agroecology; Local	Composting	Pilot / early adoption	Olive	Company website

			composting and thermal energy				
15	Herdade do Esporão – Circular Bioeconomy in Olive Oil Production	Portugal	By-product valorisation; Bio-based industrial symbiosis; Renewable energy use	Waste valorisation	Operational and scaled	Olive	Company website, industry reports, news articles, EU project repositories
16	MiOlive3 – Micro-scale Circular Innovation in Olive Byproducts	Portugal	Bio-based innovation; circular biotechnology; by-product valorisation; regenerative agriculture	Valorisation of olive biomass into bio-based inputs	Early adoption	Olive	Company press releases, pilot project documentation, academic support reports
17	Oliveira da Serra – Integrated Circularity in Olive Oil Supply Chain	Portugal	By-product valorisation; Energy recovery; Sustainable branding	Collaborative supply chain Closed loop material flows	Operational and scaled	Olive	Company website, industry reports, press article
18	Herdade da Figueirinha Circular Composting and Regenerative Agriculture Model	Portugal	By-product valorisation; regenerative agriculture; carbon farming; waste valorisation and reuse	Composting; dehydration; biomass valorisation; soil regeneration; reduced chemical input	Operational	Olive & wine	Company website, company report, interview
19	Quinta de S. Braz Circular and Regenerative Olive Oil Production	Portugal	By-product valorisation; regenerative agriculture; resource efficiency; sustainable premium product positioning	Composting of biomass; closed-loop water reuse; renewable energy use; packaging optimisation (recyclable); zero-waste philosophy	Operational and scaled	Olive	Interview, company website
20	Alentejo Circular – Circular Economy Promotion in Alentejo Agrifood Sectors	Portugal	Awareness-raising and capacity-building project; regional public-private partnership; platform for collaborative circular economy initiatives	Sector diagnostics; good practices mapping; stakeholder workshops and forums; online information platform	Pilot	Olive, wine, livestock	Project website, deliverables and publications

21	Valorization of Olive Pomace for Biomass and Energy	Spain	By-product valorisation	Closed-loop composting	Scaled	Olive	Company websites, EU projects, industrial reports
22	Biogas Production from Olive Oil By-products	Spain	By-product valorization Industrial symbiosis	Anaerobic digestion of pomace OMW valorisation	Operational, expanding with EU support	Olive	EU project documentation, company websites, press articles
23	Extraction of Bioactive Compounds from Olive By-products	Spain	By-product valorization, industrial symbiosis	Zero-waste	Operational	Olive	EU projects, company and R&D websites, scientific dissemination
24	Use of Olive By-products for Animal Feed	Spain	By-product valorization	Valorisation of olive residues Zero waste	Operational	Olive	Company websites, R&D projects, agricultural news
25	Reuse of Olive Mill Wastewater for Agricultural Irrigation	Spain	Industrial symbiosis	Wastewater reuse	Pilot / Early adoption	Olive oil	EU projects, research institutions, news media
26	Valorization of Olive Pomace into Activated Carbons for Lithium-Sulfur Batteries	Spain	Industrial symbiosis	High-value bioactives	Operational	Olive/Biotech	EU-funded demo



In the effort to cluster the above based on their typology, five (5) dominant CBM categories have been revealed:

- By-product valorisation
 - These focus on composting, mulching, feed integration, pelletisation
 - This CBM is shown to be the most accessible model for micro and small enterprises
- Industrial symbiosis & ecosystem collaboration
 - These include collaborations with energy plants, extraction platforms, or shared utilities
 - The entailed complexity and the scaling potential range from medium to high levels
- Wastewater and energy recovery
 - These CBMs leverage OMWW (Olive Mill Wastewater) or sludge for energy, water, or nutrient reuse
 - They require specialised infrastructure (leading to lower transferability and adoption by micro and small enterprises)
- Bio-product and biotech innovation
 - These CBMs focus on extraction of high-value elements (e.g., polyphenols)
 - They come with high revenue potential, yet with low transferability due to highly specialised technical support
- Regenerative & low-input farming
 - These CBMs focus on natural cycles, biochar, and agroecology
 - They present high alignment with practices already followed in small farms and implement ecological principles

Each CBM identified and presented in the above table, is accompanied by a filled DET that contains:

- A detailed – as extended as possible – description of the circularity strategy followed
- The inputs, the outputs, and the respective enabling factors
- The challenges towards implementation
- The environmental, social, and economic impacts
- The validation of the source where the CBM itself has been found

All DETs can be found in the Annex organised per country.

Upon assessment of all CBMs from all partner countries, the following findings have been revealed:

Finding	Insight
Predominance of operational models	More than half of the CBMs identified are currently operational, with many having emerged organically in response to local resource management challenges. This highlights a clear readiness for upscaling low-barrier models within existing small and medium enterprises' ecosystems
Greece and Spain – Leaders in typological diversity	Greece and Spain present high diversity due to a combination of “basic” innovations (e.g., regenerative farms) and mid-scale industrial symbiosis projects. Their regulatory flexibility and active agri-innovation communities play a key enabling role.
Portugal and Croatia – High relevant CBMs for adoption by micro & small enterprises	The CBMs from these countries score consistently high in the TAM due to their simplicity, resource-efficiency, and embeddedness in local contexts—making them directly implementable by micro & small enterprises with limited capital and infrastructure.



Regenerative and composting models showcase the highest transferability	Models based on mulching, composting, and nutrient cycling are universally found to be the most transferable. These practices require minimal investment, align with traditional agronomic knowledge, and offer quick returns through soil quality improvements and input cost reduction.
Infrastructure-intensive models (high impact, low accessibility)	Despite the fact that certain CBMs, such as the OMWW valorisation for biogas or polyphenol extraction model, show strong environmental and economic returns, their adoption is constrained by high capital needs, a perplexed regulatory environment, and the need for coordination with multiple stakeholders.
Enhanced role of local ecosystems and networks	For their success and scaling, the CBMs ought to be tightly linked to local innovation ecosystems that provide shared infrastructure, technical support, and policy leverage (e.g., cooperatives, research institutions, and public-private partnerships).
Innovation spectrum – from low-tech to deep-tech	Innovation in the identified CBMs is distributed across a wide range. Specifically, it starts from low-tech composting and results to biotech-driven valorisation (e.g., activated carbon from olive pomace). This broad spectrum of innovative solutions reveals that circularity can be implemented regardless of a company’s digital or technological maturity.
Cross-sectoral replicability beyond olive sector	The CBMs focused on regenerative practices and waste-to-soil solutions are easily adaptable to vineyards, nuts, citrus, and even vegetable sectors. This supports horizontal policy alignment and multi-sector knowledge transfer.
Market-driven value propositions are emerging	Based on the interviews, the literature review, and the “market vibe” the fact that eco-certified olive oil, organic compost, and soil-enhancing amendments are gaining traction as premium products was highlighted, with consumers valuing traceability, sustainability claims, and health benefits; underscoring the commercial viability of circularity.
Key constraints – finance, regulation, culture	Besides capex and tech barriers, cultural resistance to partnering and forming collaborations (a phenomenon noticed especially in dispersed rural ecosystems), low awareness of the benefits of practicing circular economy – let aside the concept of sustainability in general –, and permitting/licensing hurdles were mentioned repeatedly as obstacles towards any level of adoption.

6.2 Analysis of value proposition, value creation & delivery, and value capture

This section analyses the logic of the CBMs using the CBMC framework. The conducted assessment was based on three (3) intertwined domains:

- Value Proposition – the societal and customer needs addressed
- Value Creation & Delivery – the inputs, processes, partnerships, and technologies
- Value Capture – revenue, cost, and savings mechanisms

Five (5) typology clusters based on the CBM strategies have been formed. In a nutshell, the approach used for analysing the value proposition, the value creation & delivery, and value capture in all identified CBMs, groups CBMs into coherent circular strategy clusters. The



respective insights on their business logic across all CBMC dimensions have been also documented.

Type 1: By-Product Valorisation Models	Value Proposition	<p>These models address key societal and sectoral needs:</p> <ul style="list-style-type: none"> • Elimination of waste disposal burdens on olive mills and farms • Soil health restoration through organic matter return <p>Local availability of low-cost, eco-friendly soil amendments or fuel</p>
	Value Creation & Delivery	<p>Inputs: olive pomace, pruning residues, olive mill sludge</p> <p>Processes: aerobic composting, mulching, pelletising</p> <p>Enabling technologies: shredders, composters, driers, windrow systems</p> <p>Stakeholders: farmers, millers, composting operators, local cooperatives</p> <p>Most are simple, on-site, or small-scale distributed operations</p>
	Value Capture	<p>Revenue: sale of compost/pellets, cost savings from avoided disposal and fertiliser use</p> <p>Cost: moderate (machinery, labour); often shared or minimised via cooperative use</p> <p>Circular savings: soil improvement, reduced emissions, avoided landfill fees</p>
	Innovation & collaboration	<p>Low-tech innovation suitable for MSEs</p> <p>Some models leverage community-based infrastructure (e.g., Portugal, Spain)</p> <p>Knowledge exchange with agronomic institutions is an enabler in Croatia and Greece</p>

Type 2: Industrial Symbiosis & Ecosystem Collaboration Models	Value Proposition	<p>Elimination of OMWW or by-product waste streams</p> <p>Production of value-added products (nutraceuticals, energy)</p> <p>Improved traceability, corporate responsibility, and brand positioning</p>
	Value Creation & Delivery	<p>Inputs: OMWW, olive leaves, sludge, biomass residues</p> <p>Processes: composting + heat generation, biorefinery, high-value compound extraction</p> <p>Technologies: biomass boilers, supercritical extraction units, anaerobic reactors</p> <p>Stakeholders: olive mills, biotech firms, energy partners, public utilities</p>
	Value Capture	<p>Revenue: sale of high-value extracts or energy, cost offsets</p> <p>Costs: high capex and operational complexity</p> <p>Circular savings: synergies with regional actors, integrated material flows</p>
	Innovation & collaboration	<p>Advanced systems require multi-actor collaboration</p> <p>Often operate within circular ecosystems or public-private partnerships</p> <p>Highly innovative but limited transferability to standalone micro and small enterprises</p>



Type 3: Wastewater and Energy Recovery Models	Value Proposition	Reuse of contaminated wastewater and organic sludge. Onsite energy recovery and reduction of water stress in dry regions.
	Value Creation & Delivery	Inputs: OMWW, sludge, biomass Processes: anaerobic digestion, membrane filtration, lagoon bio-treatment Technologies: biogas units, lagoons, nutrient recovery systems Stakeholders: utilities, municipalities, farmers, agri-processors
	Value Capture	Revenue: indirect (cost avoidance, energy savings) Costs: high initial investment; public support often essential Savings: emissions reduction, water circularity, regulatory compliance
	Innovation & collaboration	Require coordination across municipal or utility partners Often supported by EU/national funding or demo grants Scalable in regional clusters but challenging for isolated SMEs

Type 4: Bio-product and Biotech Innovation Models	Value Proposition	Meet emerging market demand for: <ul style="list-style-type: none"> Bio-based, traceable ingredients in food, pharma, or cosmetics Functional reuse of OMW-derived components
	Value Creation & Delivery	Inputs: OMWW, olive leaf extract, polyphenol-rich residues Processes: filtration, drying, compound extraction, formulation Technologies: centrifuges, hydrothermal reactors, cleanrooms Stakeholders: SMEs, startups, R&D centers, investors
	Value Capture	Revenue: high-margin, niche product markets Costs: high development and compliance costs (especially food/pharma) Savings: valorisation of otherwise non-reusable streams
	Innovation & collaboration	High-tech models often stem from R&D spin-offs Commercial scalability depends on regulation, IP, and investor readiness Not directly transferable but can inspire adaptive innovation in the sector

Type 5: Regenerative & Agroecological Farming Models	Value Proposition	Rebuilding soil health and biodiversity. Reducing dependency on external inputs. Meeting rising demand for eco-certified, transparent olive oil
	Value Creation & Delivery	Inputs: own pruning residues, OMWW sludge, biochar Processes: on-site composting, no-till farming, biochar application Technologies: simple tools, small-scale composters, electric harvesters Stakeholders: family farms, R&D, cooperatives
	Value Capture	Revenue: premium-priced olive oil, reduced input cost Costs: low infrastructure, higher labour Savings: long-term resilience, input self-sufficiency
	Innovation & collaboration	Deeply rooted in agroecological philosophy Easily transferable to other small farms Serve as role models for low-barrier entry into circular transition



Insights

- ✓ Circularity is multidimensional, combining environmental, economic, and social value creation across the models
- ✓ Innovation occurs both at the high-tech and low-tech ends, but stakeholder collaboration is a shared success factor
- ✓ Cost-saving mechanisms are often indirect—through avoided inputs or environmental fees—rather than direct revenue generation
- ✓ Transferability depends not just on technology but on network readiness, access to biomass, and institutional support

6.3 Transferability assessment reports

The results of the identified CBMs' TAM have been gathered into the table below. The TAM is a structured framework of nine (9) criteria - where each criterion was rated on a 1–5 scale – to evaluate the feasibility of each CBM's replicability in micro and small enterprises in the olive sector. It has to be noted that the TAM score does not represent the technical complexity or the actual financial needs of a model, but its purpose is to showcase how easy or difficult is for a micro and small enterprises to adopt that model. Regarding scoring, the highest the score, the higher the transferability potential.

The criteria assessed in each CBM are as follows:

1. Technical complexity
2. Investment requirements
3. Operational feasibility for micro & small enterprises
4. Scalability potential
5. Regulatory & legal barriers
6. Supply chain readiness
7. Market demand
8. Environmental impact reduction potential
9. Social impact potential

A selection of the identified CBMs (2 per country) and their Tam scores are included in the following table. The full TAM scores for all identified CBMs are provided in the Annex.

Country	CBM name	Total score	Transferability level	Easiness to adopt by micro & small enterprises	Justification
Greece	Seven Olea regenerative model	38	High	Yes	Low-tech, minimal inputs, farm-level reuse
Greece	Composting of olive mill waste for the production of soil amendments	38	High	Yes	Simple composting practice, easy to find feedstock, low capex
Italy	Bioenutra polyphenol extraction	28	Medium	No	High level technical expertise, sophisticated equipment
Italy	Agroenergy	30	Medium	No	High capex, moderate technology required; micro & small enterprises need adaptation
Croatia	Utilizing the value of waste generated during olive pruning	36	High	Yes	Easy to implement, low tech needs, low capex, no significant regulatory barriers
Croatia	Olive by-Product utilization & valorisation	28	Medium	No	High needs in operational skills, medium capex, high regulatory barriers & limitations
Spain	Valorization of Olive Pomace into Activated Carbons for Lithium-Sulfur Batteries	21	Low	No	Still emerging market, highly site-specific and dependent on high-purity standards and specialised infrastructure, high capex
Spain	Use of Olive By-products for Animal Feed	33	Medium	Yes	Mostly low-tech, moderate investment, no highly tailored adjustments, supply chain actors easy to find
Portugal	Casa Alta – Traditional Circular Estate Model	34	High	Yes	Low capex, low tech, specifically designed for adoption by micro and small enterprises
Portugal	Azeite Acushla – Circularity in Small-Scale Olive Mill	39	Medium	Yes	Limited technical expertise, easy regulatory environment



The aggregated findings per country are shown below:

Country	Avg. score	Most transferable model	Least transferable model
Greece	34.8	Seven Olea Regenerative Model	Integrated Water-Energy-Nutrient Recovery from Olive Mill Wastewater
Croatia	32	Utilizing the value of waste generated during olive pruning	Olive by-products utilization and valorisation
Italy	28.3	Agroenergy	OLI.VA.RE.
Portugal	30	Acushla – Circularity in Small-Scale Olive Mill	Oliveira da Serra – Integrated Circularity in Olive Oil Supply Chain & MiOlive3 – Micro-scale Circular Innovation in Olive Byproducts
Spain	27.5	Use of Olive By-products for Animal Feed	Valorisation of Olive Pomace into Activated Carbons for Lithium-Sulphur Batteries

Croatia and Greece report the highest transferability (on average) potential of their CBMs, mainly due to low tech valorisation practices and models already in place and operational in small farms.

Italy and Spain report the lowest transferability (on average) potential of their CBMs, due to high capital needs or too specialised tech models selected for reporting.

Last but not least, Portugal exhibits a middle score compared to the rest of the countries, with an average score of 30 points on transferability potential of the reported CBMs, focusing on low tech models for achieving circularity.

Main barriers
High capital needs (capex & opex)
High technical complexity
Limited offering for collaborative or shared infrastructure (a main aspect of the circular economy)
Complexity in the regulatory environment (including permissions and licensing)

Main enablers
Simple & low-tech processes
Abundant biomass
Proximity to stakeholders and networks (facilitating collaboration)
Public or EU funding support (for pilot testing & investments in infrastructure- too expensive machinery)

6.4 Recommendations for micro & small enterprises

What	How	Benefit
Low-tech at first	Composting of olive by-products Mulching from pruning waste On-site regenerative practices (e.g., biochar use, nutrient cycling)	Minimal investment Low technical complexity Successfully implemented at small scale
“Exploitation” of local partnerships	Shared infrastructure (e.g., composting facilities, shredders) Technical support and capacity-building	Collaboration strengthens both operational feasibility and financial viability



	Market access for circular outputs (e.g., compost, pellets)	
Resource efficiency and waste valorisation prioritisation	Focus on valorising their existing waste streams (e.g., pomace, pruning residues, olive mill wastewater)	Reduce disposal costs Generate new income streams (e.g., organic fertilisers, biomass) Comply with emerging waste and emissions regulations
Utilising funding opportunities for investments in circular economy	Explore: EU or national rural development grants Green investment schemes or cooperative funding mechanisms Partnerships with tech providers and municipalities	Medium or high investment co-funding
Capacity building	Training on circular economy basics and business model innovation Familiarisation with permitting and regulatory compliance Peer exchange and demonstration visits to existing CBMs	Increased internal readiness and confidence for CBM adoption
Selection of circular models aligned with market demand	(examples of trends in 2025) Organic compost or soil enhancers Eco-certified olive oil Agroecological branding Feedstock for livestock or energy	Improved revenue potential
Performance on circularity monitoring	Introduce simple monitoring practices for: Resource savings (e.g., reduced fertiliser or water use) Environmental benefits (e.g., avoided emissions) Cost savings or revenue generated	Continuous improvement Further investment justification

6.5 Insights for application across EU and beyond

This section includes the key lessons from the analysis of the identified CBMs across all partner countries. These insights can be used by micro and small enterprises, cooperatives, policy makers, and other stakeholders in the wider olive sector – or even from other sectors – to apply similar business models focused on circular economy. The approach is quite simple; *what we learned & what it means*.

Lessons learned	What it means in practice?
CBMs work well in different countries without any limitation in location	Composting, by-products reuse, regenerative farming are the most easily copied practices for any micro and small enterprise no matter its location
Replicability is based on simple practices of circular economy (simplicity is our friend)	Mulching or composting in the farm can be successfully applied in different farm types and of different sectors
Small farmers need also to be supported by regulations	A proportionality in permits and licensing is needed, incentives for composting have to be established, and financial instruments will help uptake for circular practices



These CBMs work well beyond the olive sector!	Due to the many similarities between needs and benefits in crops, these CBMs can be -properly-adapted for wine, fruit, nuts, and vegetable cultivation
Simple tools help small businesses act upon their targets/ambition	A toolkit of simple templates, explanatory guides, and to-the-point training all make it easier for small businesses to follow any circular initiative or practice

Key messages

- Use local materials - raw materials are in abundance around you
- Form a team – join forces with others to share costs or tools (a basic element of circular economy)
- Ask for support from policy makers – policies exist for that exact reason; to promote waste reuse, access to funds, and easier permits and licensing
- Think beyond your own crop – similar issues with waste, soil, water, energy exist in other crops (e.g., vineyards, citrus, nuts, vegetables) and these CBMs can be inspiring
- As it can be seen from the TAM results, a complex yet impactful CBM is not necessarily the most transferable. Simple, local and community-driven solutions (e.g., composting, regenerative practices) can have also big impact in both the environment and the local society with low or none risk.
- Small businesses need financial & technical support – the right tools, the proper knowledge, the solid partnerships are the three (3) key elements for circular economy to become the new norm in agriculture – and beyond.



7

Annexes



7.1 Interview guide

Interview number: (e.g., 1, 2,...)	
Interviewee Full Name	
Organisation/Company	
Position	
Country	
Date	
Consent to record and use responses for research purposes (Yes / No)	
Question 1	
Please describe the core activities of your organisation/company and its role in the olive or agrifood sector <i>Hint for interviewer: we need to clarify the organisation's/company's position in the value chain and type of operations (e.g., production, processing, distribution)</i>	
<u>Response Q1</u>	
Question 2	
Please describe your organisation's/company's experience with circular economy practices or circular economy business models <i>Hint for interviewer: Clarify if the organisation/company has adopted circular economy approaches like reuse, recycling, remanufacturing, recapture value from waste</i>	
<u>Response Q2</u>	
Question 3	
What circular practices are currently being implemented either by your organisation/company or in your sector? <i>Hint for interviewer: we need to explore specific actions related to environmental sustainability and efficiency of resources (e.g., resource optimisation, waste valorisation, eco-design)</i>	
<u>Response Q3</u>	
Question 4	
Can you provide specific examples of circular business models applied within your organization or the olive/agrifood sector? <i>Hint for interviewer: we need to know about concrete cases or initiatives the organisation/company has employed that demonstrate circularity in its operations beyond general practices</i>	
<u>Response Q4</u>	
Question 5:	
Could you tell me what are the main drivers behind adopting these circular business models? For example, regulatory compliance, economic benefits, your organisation's/company's own sustainability goals. <i>Hint for interviewer: we need to determine whether the motivations are internal (cost reduction, innovation) or external (regulations, customer demand) or both.</i>	
<u>Response Q5</u>	
Question 6	
What is the specific value proposition, i.e., added value, offered to your customers or partners in your value chain by these circular initiatives? <i>Hint for interviewer: we need to know how these initiatives create added value, such as improving customer satisfaction, brand image, or reducing the environmental impact of the organisation's/company's operations</i>	
<u>Response Q6</u>	
Question 7	
How does your organisation/company create and deliver value in the framework of circular economy? For example, does this happen through forming strategic partnerships, via adoption of innovative technologies, or by implementation of sustainable supply chain strategies? <i>Hint for interviewer: we need to explore how the organisation/company organise its operations, partnerships, and technology to deliver circular solutions</i>	
<u>Response Q7</u>	
Question 8	
How does your organisation capture value from the adoption of circular practices and/or initiatives? For example, through new revenue streams, via cost savings, or by leveraging the competitive advantage in the market? <i>Hint for interviewer: we need to investigate the financial outcomes, market positioning, and business model innovations</i>	
<u>Response Q8</u>	
Question 9	
What have been the key success factors that allowed for the implementation of circular business models in your organisation/company or in your sector? <i>Hint for interviewer: we are looking for those enabling conditions such as leadership, collaboration, available technologies, or even funding mechanisms, that allow for circular economy to be adopted</i>	
<u>Response Q9</u>	
Question 10	
What are the most significant challenges or barriers encountered towards the adoption of circular business models by your organisation/company? For example, are they technical, financial, regulatory, cultural? <i>Hint for interviewer: we need to identify the specific constraints that hinder the adoption or the scaling-up of circular practices in the organisation's/company's sector</i>	
<u>Response Q10</u>	
Question 11	



In your opinion, are these circular business models suitable for micro and small enterprises in the olive or agrifood sector? (if yes, then why / if not, then why?) <i>Hint for interviewer: we need to assess whether these circular business models can be effectively employed by smaller organisations and the reasons behind their suitability or limitations</i>
<u>Response Q11</u>
Question 12
What would be the necessary and specific adaptations to ensure the successful adoption of these circular business models by micro and small enterprises in the olive or agrifood sector? <i>Hint for interviewer: we need to identify any necessary simplifications, adaptation cost-reductions, or even capacity-building needed.</i>
<u>Response Q12</u>
Question 13
What would be the enabling factors that could facilitate the transfer of circular business models to micro and small enterprises? For example, would those be financial incentives, or support from relevant policies, or targeted capacity-building? <i>Hint for interviewer: we need to explore and discuss with the interviewee the potential external support mechanisms or partnerships that could facilitate transferability</i>
<u>Response Q13</u>
Question 14
Could you describe how external actors, such as research institutes, public agencies, or even intermediaries contribute to the successful adoption of circular business models in your sector? <i>Hint for interviewer: we need to explore the role of supporting institutions in knowledge transfer, funding, or capacity-building</i>
<u>Response Q14</u>
Question 15
Can you share any exemplary case studies or best practices of circular business models within your region or sector? <i>Hint for interviewer: we need to know about success stories that can be used as an inspiration or network & business opportunities for other actors.</i>
<u>Response Q15</u>
Question 16
What recommendations would you give to those responsible on forming the policies in your sector, or business associations, or other stakeholders in order to strengthen the uptake of circular business model from micro and small enterprises? <i>Hint for interviewer: we need to seek for actionable suggestions and recommendations on how to improve the circular economy business environment</i>
<u>Response Q16</u>

7.2 Interviews per country

Croatia

Interview number: (e.g., 1, 2,...)	1
Interviewee Full Name	Sandi Chiavalon
Organisation/Company	OPD Chiavalon Sandi
Position	Owner
Country	Croatia
Date	10.6.2025.
Consent to record and use responses for research purposes (Yes / No)	Yes
Question 1	
Please describe the core activities of your organisation/company and its role in the olive or agrifood sector	
<u>Response Q1</u>	
It is a family farm. In addition to a little over 35 hectares of olive groves, we also have 185 hectares of arable land. We also produce vegetables for processing. We process between 800,000 and a million kg of olives annually, working both for ourselves and for clients. We also have an oil mill with a capacity of 2 tons per hour.	
Question 2	
Please describe your organisation's/company's experience with circular economy practices or circular economy business models	
<u>Response Q2</u>	
We try to reuse and reuse everything we can in the olive grove or in other ways, so that it does not become waste. We have adopted practices such as reuse, recycling and recovering the value of waste.	
Question 3	
What circular practices are currently being implemented either by your organisation/company or in your sector?	
<u>Response Q3</u>	
We extract the pit from the pomace, the pit is packed in jumbo bags. It can be used on agricultural land as mulch, mainly as an auxiliary material in production. It can also be used for heating the house. The rest of the pomace, we take a part to our	



own land, compost it and after about 12 to 15 months it is returned to the olive grove, mixed with manure and applied to a third of the land area every year. For the pruning residues, we have a machine that collects branches and mulches them. Then we put them aside and together with the olive compost, we compost them and then return them to the olive grove. We do not generate any wastewater, except for washing floors, which goes to a grease and oil purifier, and then the water goes into a tank from which it can be used for irrigation.

Question 4

Can you provide specific examples of circular business models applied within your organization or the olive/agrifood sector?

Response Q4

Currently, in our plant, we are working to maximize the use of everything that is currently technologically possible. We compost the pomace and return it to the olive grove, mulch the pruning residues, purify the wastewater and reuse it for irrigation. We also separate the pit from the pomace, but we are not allowed to sell it, so we use some and give the rest to other olive growers who can use it.

Question 5:

Could you tell me what are the main drivers behind adopting these circular business models? For example, regulatory compliance, economic benefits, your organisation's/company's own sustainability goals.

Response Q5

We have always tried to use such practices because the soil is poor in humus and we need to return as much humus as possible to the soil and that is the main driver in organic farming so we have been using every residue that we can use in the production of humus and returning it to the soil since the beginning of our production. The problem here is again the law, the regulations that determine how we compost it, where we compost it, why we compost it, reports from other people. But in general, we are probably currently using it the best, as it is currently possible in Croatia. Also, economic reasons are one of the drivers, as well as social ones because we help people, for example, by giving away pits with which they can warm themselves in the winter.

Question 6

What is the specific value proposition, i.e., added value, offered to your customers or partners in your value chain by these circular initiatives?

Response Q6

Spreading awareness of sustainable development and reducing environmental impact in organic olive growing, and certainly a note of solidarity.

Question 7

How does your organisation/company create and deliver value in the framework of circular economy? For example, does this happen through forming strategic partnerships, via adoption of innovative technologies, or by implementation of sustainable supply chain strategies?

Response Q7

Primarily by adopting innovative technologies, certainly by strengthening certain partnerships that, unlike us, are better in certain business segments.

Question 8

How does your organisation capture value from the adoption of circular practices and/or initiatives? For example, through new revenue streams, via cost savings, or by leveraging the competitive advantage in the market?

Response Q8

Given that business costs are rising in all sectors, including agriculture, we want to save costs on a targeted basis, but we believe that circular practices definitely make us stand out on the market because we are one of the pioneers of circular business in the organic olive growing and olive oil production sector in the Istrian region.

Question 9

What have been the key success factors that allowed for the implementation of circular business models in your organisation/company or in your sector?

Response Q9

Hard work, perseverance, market analysis, years of work and extensive experience in the field, establishing partnerships and using new technologies in production.

Question 10

What are the most significant challenges or barriers encountered towards the adoption of circular business models by your organisation/company? For example, are they technical, financial, regulatory, cultural?

Response Q10

Mostly regulatory, then technical and sometimes financial.

Question 11

In your opinion, are these circular business models suitable for micro and small enterprises in the olive or agrifood sector? (if



yes, then why / if not, then why?)
<u>Response Q11</u>
I believe that they are, but perhaps it would be more practical and profitable if, at the regional level, we have centers that collect by-products and continue to deal with closing the circular business model, and not every micro and small entrepreneur making large investments to recycle their own by-products.
Question 12
What would be the necessary and specific adaptations to ensure the successful adoption of these circular business models by micro and small enterprises in the olive or agrifood sector?
<u>Response Q12</u>
The above-mentioned centers for the collection, disposal and composting of by-products from the olive sector or associations of several micro and small entrepreneurs.
Question 13
What would be the enabling factors that could facilitate the transfer of circular business models to micro and small enterprises? For example, would those be financial incentives, or support from relevant policies, or targeted capacity-building?
<u>Response Q13</u>
Targeted capacity-building.
Question 14
Could you describe how external actors, such as research institutes, public agencies, or even intermediaries contribute to the successful adoption of circular business models in your sector?
<u>Response Q14</u>
Research work, dissemination of knowledge and transfer of information, i.e. results of research projects on the topic of circular business models. We hope for more funding and capacity building ideas and implementation.
Question 15
Can you share any exemplary case studies or best practices of circular business models within your region or sector
<u>Response Q15</u>
Certainly the company J.T. Energy, in the area of our region that has been trying for years to create innovative technology in olive processing. From wet pomace they manage to get dry pellets which are again a source of energy, can be fertilizer or feed for livestock.
Question 16
What recommendations would you give to those responsible on forming the policies in your sector, or business associations, or other stakeholders in order to strengthen the uptake of circular business model from micro and small enterprises?
<u>Response Q16</u>
Possibility of funding to encourage the implementation of a circular business model in olive growing.

Interview number: (e.g., 1, 2,..)	2
Interviewee Full Name	Ines Štifanić
Organisation/Company	O.P.G. Oliveri
Position	Co-owner
Country	Croatia
Date	12.6.2025.
Consent to record and use responses for research purposes (Yes / No)	Yes
Question 1	
Please describe the core activities of your organisation/company and its role in the olive or agrifood sector	
<u>Response Q1</u>	
Production and distribution of olive oil.	
Question 2	
Please describe your organisation's/company's experience with circular economy practices or circular economy business models	



<u>Response Q2</u>
The company has an organic concept where chemicals and pesticides are not used, old tools are renovated and reused, waste is utilized as much as possible, and inter-row weeding is used.
Question 3
What circular practices are currently being implemented either by your organisation/company or in your sector?
<u>Response Q3</u>
Waste valorization, sustainable land cultivation (mulching), plowing of mulched pruning residues, mowing grass, use of organic fertilizers.
Question 4
Can you provide specific examples of circular business models applied within your organization or the olive/agrifood sector?
<u>Response Q4</u>
Using of pruning residues as organic cover (mulching), separating larger pruning residues to be used as firewood.
Question 5:
Could you tell me what are the main drivers behind adopting these circular business models? For example, regulatory compliance, economic benefits, your organisation's/company's own sustainability goals.
<u>Response Q5</u>
The main drivers for adopting circular business models are both internal and external. Internal - cost reduction (the cost of a machine operation is cheaper than the cost of human work) External - regulations (only diseased material can be thrown away)
Question 6
What is the specific value proposition, i.e., added value, offered to your customers or partners in your value chain by these circular initiatives?
<u>Response Q6</u>
The organic concept gives added value to the product for the customer, and also reduces the impact on the environment. Waste valorization also reduces the price of the product, which makes it more accessible to customers.
Question 7
How does your organisation/company create and deliver value in the framework of circular economy? For example, does this happen through forming strategic partnerships, via adoption of innovative technologies, or by implementation of sustainable supply chain strategies?
<u>Response Q7</u>
It creates value through forming strategic partnerships.
Question 8
How does your organisation capture value from the adoption of circular practices and/or initiatives? For example, through new revenue streams, via cost savings, or by leveraging the competitive advantage in the market?
<u>Response Q8</u>
It captures value through competitiveness on the market with organic products, reduction of irrigation costs with inter-row weeding (low soil evapotranspiration), lower cost of organic fertilizer due to plowing of mulched residues.
Question 9
What have been the key success factors that allowed for the implementation of circular business models in your organisation/company or in your sector
<u>Response Q9</u>
Additional funding through IACS (integrated administrative and control system) measures for organic production, annual education through advisory services, education through various published research such as Innovative Circular Business Models in the Olive Oil Sector for Sustainable Mediterranean Agrifood Systems.
Question 10
What are the most significant challenges or barriers encountered towards the adoption of circular business models by your organisation/company? For example, are they technical, financial, regulatory, cultural?
<u>Response Q10</u>
The main obstacle towards the adoption of multiple different circular business models is financial.
Question 11
In your opinion, are these circular business models suitable for micro and small enterprises in the olive or agrifood sector? (if yes, then why / if not, then why?)



<p style="text-align: center;"><u>Response Q11</u></p> <p>Yes, they are suitable for micro and small enterprises if they have the financial means to buy the necessary equipment.</p>
<p style="text-align: center;">Question 12</p> <p>What would be the necessary and specific adaptations to ensure the successful adoption of these circular business models by micro and small enterprises in the olive or agrifood sector?</p>
<p style="text-align: center;"><u>Response Q12</u></p> <p>Additional measures and help from the Paying Agency for Agriculture, Fisheries and Rural Development (PAAFRD) that would encourage micro and small enterprises in the olive oil sector to adopt circular business models.</p>
<p style="text-align: center;">Question 13</p> <p>What would be the enabling factors that could facilitate the transfer of circular business models to micro and small enterprises? For example, would those be financial incentives, or support from relevant policies, or targeted capacity-building?</p>
<p style="text-align: center;"><u>Response Q13</u></p> <p>Enabling factor that could facilitate the transfer of circular business models to micro and small enterprises would be relevant policy support and financial incentives.</p>
<p style="text-align: center;">Question 14</p> <p>Could you describe how external actors, such as research institutes, public agencies, or even intermediaries contribute to the successful adoption of circular business models in your sector?</p>
<p style="text-align: center;"><u>Response Q14</u></p> <p>They can contribute to the successful adoption through various manifestations in which they publicly inform producers about new models and ways of applying the circular economy models and help their successful adoption.</p>
<p style="text-align: center;">Question 15</p> <p>Can you share any exemplary case studies or best practices of circular business models within your region or sector?</p>
<p style="text-align: center;"><u>Response Q15</u></p> <p>In our region, there are many examples of producers who are striving to implement circular business practices in their business, especially those producing organic olive oil. Organically oriented producers are investing in technologies, knowledge and collaboration to introduce concrete circular processes – from the use of bio-waste to local distribution and soil regeneration – while simultaneously increasing the value of their products and positively impacting the community.</p>
<p style="text-align: center;">Question 16</p> <p>What recommendations would you give to those responsible on forming the policies in your sector, or business associations, or other stakeholders in order to strengthen the uptake of circular business model from micro and small enterprises?</p>
<p style="text-align: center;"><u>Response Q16</u></p> <p>Encouraging olive growers with financial support. This is the only way for a Croatian olive grower in a land with scarce resources and great challenges in production to incorporate any sustainable circular economy model.</p>



Greece

Interview number: (e.g., 1, 2,...)	1
Interviewee Full Name	Evangelia Kelidou
Organisation/Company	KYKLOPAS S.A.
Position	Director of Communication & Marketing
Country	Greece
Date	01/07/2025
Consent to record and use responses for research purposes (Yes / No)	Yes
Question 1	
What exactly does your company/organization do? What is its role in the olive oil or food sector?	
<u>Response Q1</u>	
<p>KYKLOPAS is a vertically integrated, family-owned business operating in the olive oil sector. Our unit combines the cultivation, production, standardization and export of olive oil, ensuring full quality control at all stages.</p> <p>Our role is multidimensional and focuses on:</p> <ul style="list-style-type: none"> - In primary production, with the cultivation of 12,000 olive trees of the Makri variety, which are PDO. - The production of extra virgin olive oil in our privately owned, modern olive mill, with emphasis on cold pressing and minimizing the time from harvest to pressing. - Standardization and packaging in our own standardization plant, with strict quality standards (ISO, HACCP). - In exports, with a presence in foreign markets, mainly in Europe, promoting quality Greek olive oil. - To promote olive tourism, through organized Olive Oil Tours and tastings at our site, giving visitors the opportunity to get to know the production process and the quality characteristics of olive oil. 	
Question 2	
Have you implemented circular economy practices? Such as, for example, reuse, recycling, waste recovery?	
<u>Response Q2</u>	
<p>KYKLOPAS S.A. It implements circular economy practices, focusing on sustainable management of natural resources and minimizing the environmental footprint of production. As a family business with a strong ecological conscience, we maintain a gender-environmental policy in both cultivation and processing.</p> <p>Specifically:</p> <p>Recycling of pruning derivatives: The residues from the pruning of olive trees are not burned, but reused. Together with the leaves, they are composted and the produced natural fertilizer returns to the soil of our olive groves.</p> <p>Maintenance of natural turf on the estates, which contributes to the maintenance of natural balance, biodiversity and soil quality.</p> <p>Soil improvement based on analysis: We perform soil and foliar diagnostic analyses for targeted interventions, avoiding the reckless use of fertilizers and enhancing the sustainability of the crop.</p> <p>Utilization of liquid waste: The liquid residues from the oiling process are transported daily to an adjacent biogas production plant, where they are used for the production of electricity, giving new value to the "waste".</p>	
Question 3	
What circular practices do you implement or see in your field today?	
<u>Response Q3</u>	
Question 4	
Can you give us one or two examples of circular business models that you implemented?	
<u>Response Q4</u>	
<p>1. Composting of agricultural residues and returning to the soil Our company implements a fully circular agrobiological residue management system: Pruning residues and olive leaves (derivatives of olive oiling) are not discarded or burned. Instead, they are combined and composted in-house. The produced natural fertilizer (compost) returns back to the olive groves, enriching the soil with organic matter. Circularity: waste → processing → new product → use in the same production.</p> <p>2. Utilization of wastewater through cooperation with a biogas plant During the oiling process, liquid waste (goat) is produced, which in many cases is treated as a problem for the environment. In our case: We have entered into a cooperation with an adjacent biogas plant, to which the liquid waste is transported daily. There, they are used as a raw material for the production of renewable energy (electricity).</p>	



<p>Circularity: organic waste → energy → zero waste → energy utilization.</p>
<p style="text-align: center;">Question 5:</p> <p>Why did you decide to implement circular practices? What prompted you to do this?</p>
<p style="text-align: center;"><u>Response Q5</u></p> <p>Our decision to implement circular practices was not just a strategic choice, but the result of a conscious ecological attitude, a long-term vision and respect for the place and the land that nourishes us.</p>
<p style="text-align: center;">Question 6</p> <p>What benefit do these practices offer to your customers or partners?</p>
<p style="text-align: center;"><u>Response Q6</u></p> <p>Our practices offer substantial benefit to our customers and partners, as they enhance the efficiency, transparency and sustainability of our partnerships. Thanks to the value they produce in practice, we have been invited to nationwide conferences to present our work and share our experience with professionals from all over the country. This recognition confirms the innovation and positive impact of our practices on the industry.</p>
<p style="text-align: center;">Question 7</p> <p>How do you put circular solutions into practice? Through collaborations, new technologies, different organization?</p>
<p style="text-align: center;"><u>Response Q7</u></p> <p>Composting: Organic residues, such as leaves, prunings and olive residues, are converted through composting into valuable natural fertiliser. This compost returns to the field, enhancing soil fertility and reducing the need for chemical fertilisers. In this way, we close the nutrient cycle in a completely natural way.</p> <p>Utilization of pit wood: Pitted wood, i.e. the woody residue of the olive tree after the oil has been extracted, is not wasted. On the contrary, it is used as a biofuel. We burn it in specially designed high-efficiency cauldrons to heat the mill during the winter months. It is a renewable energy source that reduces our dependence on conventional fuels and enhances our energy self-sufficiency.</p>
<p style="text-align: center;">Question 8</p> <p>What does your company gain from circular practices? Savings, additional revenues, competitive advantage?</p>
<p style="text-align: center;"><u>Response Q8</u></p> <p>For us, circular practices are not just a strategy – they are part of our philosophy. Our vision begins first as a family: to respect the land that nourishes us, to waste nothing and to find value where others see only "garbage".</p> <p>From this attitude to life, a business direction was born that offers us significant benefits:</p> <ul style="list-style-type: none"> – Cost savings: By utilizing by-products such as stone wood and organic waste, we reduce costs in energy, raw materials and waste management. – Extra revenue: Materials that were once considered useless, are now gaining value. For example, compost is our own natural fertilizer. – Competitive advantage: Circular practices differentiate us in the market, strengthening our brand as responsible, innovative and conscious. Customers and partners recognize and choose this approach. – In the end, what others reject, we turn into an opportunity – not only for the business, but also for the place, the environment and future generations.
<p style="text-align: center;">Question 9</p> <p>What has helped the most to implement these practices? Partnerships, support, technology, other factor?</p>
<p style="text-align: center;"><u>Response Q9</u></p> <p>The implementation of these circular practices did not happen overnight—it was the result of a combined effort and belief in a different way of working.</p> <p>What helped the most was:</p> <ol style="list-style-type: none"> 1. The family mentality: Above all, our common perception as a family that nothing should go to waste. This deep-rooted value gave us the perseverance and motivation to try alternatives, even when they seemed difficult or "out of the system". 2. The right partnerships: We found people and institutions who shared the same vision as us. Thanks to them, we were able to test and evolve our practices with safety and expertise.
<p style="text-align: center;">Question 10</p> <p>What obstacles or difficulties did you encounter? Or which ones do you think exist in your field?</p>
<p style="text-align: center;"><u>Response Q10</u></p> <p>Before the installation of the biogas plant, we had a major problem with waste management. The lack of adequate infrastructure made it difficult to manage them safely and environmentally responsibly.</p> <p>To limit the impact, we had created special oil tanks with reinforced special cloth on the bottom, in order to prevent the leakage of pollutants into the aquifer. Although this practice was quite costly and did not constitute a form of recycling, it respected the environment and was a temporary solution until the most comprehensive and sustainable solution of the biogas plant was implemented.</p>



Question 11
Do you think that such circular models can be implemented by small or very small businesses? Why yes or why not?
<u>Response Q11</u>
Yes, we believe that circular models can also be applied by small or very small businesses. We ourselves are a small family business that started with this concept – that nothing should go to waste and that every resource has value.
What made the difference was our insistence on looking for solutions, being informed and working with the right people and institutions. With the right partnerships, support and adaptation to our own needs and capabilities, we have been able to implement circular practices that make a difference – environmentally and economically.
Size is not a barrier, but a factor that requires flexibility and creativity. Small businesses have the advantage of adapting quickly and having a closer relationship with their community, which can help them implement sustainable and innovative solutions effectively.
Question 12
What changes are needed to enable small businesses to implement these models?
<u>Response Q12</u>
We have said it beforehand
Question 13
What support would help these small businesses? E.g., funding, training, policies;
<u>Response Q13</u>
Training and education: Although there is a plethora of information conferences and seminars – which we have also participated in as speakers – we notice that the participation of small businesses is not always as expected, which is a real shame. Perhaps more targeted, practical and accessible training is needed that suits their needs and time.
Question 14
How do other bodies, such as universities, public authorities, chambers, help in the adoption of these models?
<u>Response Q14</u>
Question 15
Do you know of any successful examples of circular economy in your area or sector?
<u>Response Q15</u>
Us only here in the area in our field
Question 16
What do you suggest to policymakers or small businesses to strengthen the circular economy?
<u>Response Q16</u>
Simplification of procedures and bureaucracy Reduce administrative burdens and simplify regulations so that small businesses can easily and quickly integrate circular practices.
Strengthen partnerships and networking Support initiatives that bring small businesses together with technical advisors, research centres, and other bodies, promoting cooperation and know-how transfer.
Awareness and information Strengthen information and awareness-raising actions to highlight the benefits of the circular economy and mobilise more businesses.

Interview number: (e.g., 1, 2,...)	2
Interviewee Full Name	Manos Kokkinelis
Organisation/Company	Seven Olea
Position	Olive oil producer
Country	Greece
Date	02/07/2025
Consent to record and use responses for research purposes (Yes / No)	Yes

Question 1
What exactly does your company/organization do? What is its role in the olive oil or food sector?
<u>Response Q1</u>
Seven Olea is the company's brand name and the brand name of olive oil. The company is essentially a producer, as it owns privately owned olive groves in Arkalochori, Heraklion, Crete. The product has been awarded gold in 2022 with the health claim by the World Olive Center for Health. The aim is to maintain the health of the trees, to minimize nuisance to the olive grove (inputs and machinery) and to produce quality fruit and consequently olive oil. Whenever we participate in an international competition, we have always been distinguished.



www.sevenolea.com

sevenolea.crete@gmail.com

6981358800

Question 2

Have you implemented circular economy practices? Such as, for example, reuse, recycling, waste recovery?

Response Q2

Crush the pruning residues and scatter them around the crown up to 2 meters outside it. At the same time, just before the weeds bloom, they are mowed, resulting in the return of the biomass to the soil through decomposition and the microbiome of the rhizosphere is strengthened, since the soil is enriched. We also use electric rods for fruit harvesting, reducing the carbon footprint. Olive groves are not ploughed.

Our company participates in the "Eleonas" program as a partner together with the Hellenic Mediterranean University, Pan. Aegean, the Agricultural Cooperative of Petra and the Association of Graduate Environmentalists of Greece.

The aim is:

- The liquid waste from the oil mills after sedimentation should be used to regulate the moisture in the composting piles.
- The sludge from the sedimentation tank in the mill will be co-composted with the olive leaves, to produce excellent quality compost that will also be available to the crops.
- Biochar, the residue of the charcoal production process from the coarse wood of the olive tree, will be used as a soil conditioner and will enhance soil fertility.

Question 3

What circular practices do you implement or see in your field today?

Response Q3

Crushing pruning residues and mowing weeds.

Question 4

Can you give us one or two examples of circular business models that you implemented?

Response Q4

Elaionas Project <https://elaionasproject.gr/> has information on the circular economy model.

Question 5:

Why did you decide to implement circular practices? What prompted you to do this?

Response Q5

It is the philosophy of the producer. It is extremely important to return to the olive grove a place that belongs to it. What I'm saying is that nature knows best, and if we let it go, it will give us more than we expect. Fewer interventions, gentle pruning, pruning in the summer and the addition of soil conditioners and manure for the growth of beneficial microorganisms.

So, I seek a living soil without chemicals.

Just the feeling that you are following nature and keeping up with it, gives you tangible results since the

trees have vivid foliage, bright color, well-formed fruit and manageable pareniautophoria.

Question 6

What benefit do these practices offer to your customers or partners?

Response Q6

You know that it offers quality olive oil. With excellent aroma and taste. Clients understand if the producer loves their job and feel that what they are telling is true. It is important to offer the market a special product. It is necessary to be consistent in what we say and promise. The people who trust us know that seven olea olive oil has quality characteristics that satisfy their taste and nutritional requirements.

Question 7

How do you put circular solutions into practice? Through collaborations, new technologies, different organization?

Response Q7

Those programs that require university research and pilot implementation, then our olive groves participate as experimental. Our company participates as a partner. However, using the potential of technology with a limited impact on the environment is paramount. For example, lawn mowing is not carried out with an agricultural tractor, but with a lawn mower that does not exceed 80 kg. The incorporation of manure around the trees is carried out manually, without the use of mechanical means. The transport of the 25 liter crates from the olive grove to the transport vehicle is carried out by hand or with a low-polluting transport vehicle.

Question 8

What does your company gain from circular practices? Savings, additional revenues, competitive advantage?



<u>Response Q8</u>
Profit is the difference in product quality. In its taste and its aroma. From a financial point of view, the company saves time and resources from limited interventions. The absolutely necessary. Nature reacts positively to them. The trees want their peace. We are interested in long-term production maintenance and not in maximum annual yield.
Question 9
What has helped the most to implement these practices? Partnerships, support, technology, other factor?
<u>Response Q9</u>
And the collaborations, but more the philosophy of the producer. Without the logic of a serious approach, of the perception that resources are finite, it creates the conditions for the implementation of cultivation practices that do not disturb the natural environment of the olive grove.
Question 10
What obstacles or difficulties did you encounter? Or which ones do you think exist in your field?
<u>Response Q10</u>
<ul style="list-style-type: none"> - Unfair competition, adulteration of olive oil and consequently defamation of the product and the country of origin. - Absence of a strategic plan for agricultural production. - Elected executives who have no idea or are not interested in the primary sector. - Difficulties in finding an export distribution channel. - The lack of education and perception of the future of production. - The reduced rainfall. - Non-application of basic methods of olive oil extraction by the olive mills for the production of quality olive oil. - Non-targeted funding. - Illegal grazing and damage by animals. - Spraying by mechanical means (turbines) from other producers.
Question 11
Do you think that such circular models can be implemented by small or very small businesses? Why yes or why not?
<u>Response Q11</u>
Circular economy models can be implemented by small businesses, as long as the producer wants it. Also, the available funding boosts investment and the uptake of such models. Besides, in addition to protecting the environment, the olive grove, the market wants to know that the producer cares about sustainability. It is a differentiating advantage for those who are seriously involved in the primary sector.
Question 12
What changes are needed to enable small businesses to implement these models?
<u>Response Q12</u>
It needs funding. Not in the form of subsidies. But by standardizing the product and promoting it abroad. Thus, the producer will have direct inputs and will be willing to invest additional funds.
I believe that it is necessary to reduce taxes (22%) for a newly established company, which after a period of time (5 years) will pay a business tax and the producer who pays insurance contributions, upon the establishment of the company, will pay additional money as an administrator. The employment of an accountant costs at least 600 euros on an annual basis.
A small business cannot bear these financial burdens.
Training of producers and linking funding to their attendance at university programs. A producer with a degree is prestigious, negotiates better, intervenes directly in his cultivation, makes the right decisions at the right time.
Question 13
What support would help these small businesses? E.g., funding, training, policies;
<u>Response Q13</u>
There is no strategic planning. Subsidies train producers from an early age to inactivity.
We need training, training of producers, then funding, and obviously policies come first. But policies require the choice of persons. And what I always say is that we must be careful in our social, professional and political choices. Among us are worthy people. Let society find them and promote them. They're easy to spot. What they say touches you.



I'm not optimistic. I believe that the situation is irreversible. But the effort on my part continues. I cannot accept those who talk about development. Containment must first come first, recovery and then development. And for this, serious political figures are needed.

Question 14

How do other bodies, such as universities, public authorities, chambers, help in the adoption of these models?

Response Q14

I will give you an example of chambers. Every year there is a forum where producers are invited to meet with businesses.

This year there were about 20 entrepreneurs in the olive oil sector, of which 18 were hotels and 2 distribution channels. Of the 3 that I was interested in, one did not come and the other two wanted olive oil in bulk or had their own production. We want to promote the standardized product and in

practice there is no result. Just to take a photo to make it look like something happened.

University programs are dominated by funding and it is not examined whether it is applied to the market. If it is communicated and has tangible results.

In a seminar for olive oil tasting, an executive of the Region of Crete was also present. What he had told me was not to expect anything from the State. That I can do it myself.

Question 15

Do you know of any successful examples of circular economy in your area or sector?

Response Q15

In my area, there is crushing and everything that our company implements through its partners.

Question 16

What do you suggest to policymakers or small businesses to strengthen the circular economy?

Response Q16

The citizens must first change their mentality. Because they choose. Unfortunately, most people do not have the ability to make the right judgment. The faces must change. And this is done by strengthening and supporting people who are serious role models for every local community. If people who permanently use underground routes are supported, then there will be no room for the deserving. That is why today, wherever we look, there is sadness and events appear that confirm the absolute decline.

So, a change of mentality, the choice of persons and the implementation of policies.

Policies: Reduced taxation, subsidy to production, punishment of those who move illegally in the olive oil industry, incentives for university education, financing on favorable terms for equipment, strict rules for the operation of olive mills.

Imposition of a difference in the price of organic from the conventional one. For example, if the conventional one sells for 6 euros, the organic one has 9 euros.

Abolition of the subsidy to livestock farmers who cause damage to olive groves.

Promotion of our products at airports. They do not accept us. We need to have acquaintances in order for our olive oil to enter the country's airports.

Subsidy for our participation in exhibitions both in Greece and abroad. The amount given is low.

Interview number: (e.g., 1, 2,..)	3
Interviewee Full Name	Androutsou Vasilaki Panagiota
Organisation/Company	ABEA-BIOXYM "ANATOLI"
Position	Quality Control and Quality Assurance Manager
Country	Greece
Date	03/07/2025
Consent to record and use responses for research purposes (Yes / No)	Yes

Question 1

What exactly does your company/organization do? What is its role in the olive oil or food sector?

Response Q1

The establishment of ABEA at the end of the 19th century (1889) was a milestone for the modernization of the economic life of the country, as it was the first olive oil industry in Greece and one of the largest in the Mediterranean. Its activity currently includes a wide range of production units.

More specifically:

- Standardization of Olive Oils: We standardize excellent quality olive oils, ensuring strict quality controls and ensuring the authenticity and purity of the product until it reaches the consumer.



- Operation of the Pomace Oil Mill: We have a fully equipped pomace oil mill where the extraction of pomace oil from the olive pomace takes place.
- Refinery: We have a fully equipped refinery that allows the processing of either olive oils or pomace oils.
- Soap Factory: We produce olive oil soap

Question 2

Have you implemented circular economy practices? Such as, for example, reuse, recycling, waste recovery?

Response Q2

Yes, our company implements essential circular economy practices and more specifically

- Utilization of by-products and waste:

In the pomace oil mill, the olive pomace (the residue of the olive tree after pressing) is fully utilized for the production of pomace oil and biomass.

In the standardization plant, the so-called mourses and olive oils that clean the standardization machines (when the category of oil that will be standardized changes, a quantity that is not packaged "passes") are collected and become the raw material for the soap factory.

- Use of energy produced:

Entirely the thermal energy required in our pomace oil mill facilities is covered by the combustion of by-products, reducing the need for external fuels.

On the roof of the standardization plant we have installed photovoltaic systems, covering part of our energy needs with clean, renewable energy and enhancing self-sufficiency

Question 3

What circular practices do you implement or see in your field today?

Response Q3

The Circular practices we apply are

- Utilization of olive pomace and by-products
- Soap production from olive oil residues
- Use of renewable energy sources
- Recycling of packaging materials

Other circular practices we see in our field today are

- Recycling of vegetable water (goat)
- Solid waste composting
- Use of residual glycerin

Question 4

Can you give us one or two examples of circular business models that you implemented?

Response Q4

Utilization of olive pomace

We transform the olive pomace – a by-product of the pressing of the olive – into pomace oil and pomace wood.

How it works circularly:

- The olive pomace, which under other circumstances would be considered waste, is transported to our pomace mill.
- Pomace oil is extracted there, which is either refined or sold as a raw material.
- The remaining solid residue (stone mackerel-olive flour) is dried and utilized as biofuel, both for its own energy needs and for commercial use.

Production of traditional soap from olive oil by-products

How it works circularly:

- Fats that do not meet food standards (e.g. acids, soap paste) are not discarded, but are discharged into our soap factory. We use secondary raw materials from the refinery, the pomace oil mill and the standardization plant for the production of traditional soap.

Question 5:

Why did you decide to implement circular practices? What prompted you to do this?

Response Q5

Our decision to implement circular economy practices was not just an environmental choice, but a strategic decision with multiple benefits for the company, the environment and society.

Respect for raw material and tradition:

As one of the oldest olive oil companies in the country, we have learned to respect the olive tree in all its form. The cyclical utilization of all its by-products (olive kernels, fatty residues) is for us a natural continuation of our traditional philosophy.

Need for sustainable operation:

Our industry, as well as the agri-food sector as a whole, produces significant organic waste. Implementing circular practices has allowed us to convert them from cost to resource, reducing pollution and operating costs.

Energy self-sufficiency and efficiency:

By utilizing biomass and installing photovoltaics, we have reduced our dependence on external energy sources, making production more self-sufficient and efficient.

Responding to market and societal demands:

Modern consumers, as well as foreign markets, demand products with a low environmental footprint and transparency in their life cycle. The circular economy has given us the tool to strengthen our position in the market.

Question 6

What benefit do these practices offer to your customers or partners?



<u>Response Q6</u>
Our circular practices add commercial, qualitative and ethical value to our products and partnerships, something that modern consumers and business partners value and seek
Question 7
How do you put circular solutions into practice? Through collaborations, new technologies, different organization?
<u>Response Q7</u>
The implementation of circular solutions requires a combination of know-how, investment and cooperation. At ABEA-VIOCHYM we implement them through: Technological upgrade of the facilities. Organization of production with a circular logic. In-house training and awareness-raising.
Question 8
What does your company gain from circular practices? Savings, additional revenues, competitive advantage?
<u>Response Q8</u>
The adoption of circular models offers us concrete and tangible benefits, both at an economic and strategic level <ul style="list-style-type: none"> • Reduction of energy costs thanks to the utilization of the produced biomass (core wood) and photovoltaics. • We produce secondary products with commercial value (soap, pomace oil, biofuel), utilizing materials that would otherwise be discarded
Question 9
What has helped the most to implement these practices? Partnerships, support, technology, other factor?
<u>Response Q9</u>
Stable collaborations with olive mills helped to ensure a steady flow of raw materials. Investment in technological equipment such as photovoltaics The in-house knowledge, experience and culture with the deep knowledge of the production process and material flows thanks to our many years of experience. Monitoring trends and environmental policy
Question 10
What obstacles or difficulties did you encounter? Or which ones do you think exist in your field?
<u>Response Q10</u>
High cost of investment in circular economy equipment and technology. Lack of solid incentives or support from the State. Resistance to a change of mentality and the need for continuous education. Technical difficulties in the utilization of some by-products (e.g. liquid waste).
Question 11
Do you think that such circular models can be implemented by small or very small businesses? Why yes or why not?
<u>Response Q11</u>
Yes, circular models can also be implemented by small businesses, especially when there is cooperation, good organization and access to basic know-how. They do not always require large costs (e.g. composting, recycling, reuse of materials). They can be applied more flexibly due to small scale
Question 12
What changes are needed to enable small businesses to implement these models?
<u>Response Q12</u>
Information and training Financial incentives & subsidies Local partnerships Reduction of bureaucracy
Question 13
What support would help these small businesses? E.g., funding, training, policies;
<u>Response Q13</u>
Financing & subsidies for equipment and green investments Training & technical support in circular economy practices Simple and stable policies for environmental measures Cooperation networks between small enterprises and institutions
Question 14
How do other bodies, such as universities, public authorities, chambers, help in the adoption of these models?
<u>Response Q14</u>
Universities: provide knowledge, research and expertise in sustainable practices. Public authorities: create policies, motivate and support through programmes. Chambers: inform, educate and facilitate collaborations between businesses.
Question 15



Do you know of any successful examples of circular economy in your area or sector?

Response Q15

Biolea (Kolymbari, Chania)

A family business that produces organic olive oil using traditional methods and:

It reuses olive residues for composting.

It applies agroecological practices in the olive grove.

Cheese Factories – Breweries in Crete

They use the leftovers of curd milk for animal feed or fertilizers.

Breweries give the malt residues to local farmers.

Question 16

What do you suggest to policymakers or small businesses to strengthen the circular economy?

Response Q16

Simple, targeted subsidies for circular applications in small businesses.

Training and counselling programmes, especially at a practical level and for traditional sectors.

Supporting synergies between small businesses (e.g. joint waste or energy management).

Reduction of bureaucracy for circular investments and rapid approval of environmental projects.

Incentives for products with a circular footprint.



Italy

Interview number: (e.g., 1, 2,...)	1
Interviewee Full Name	Franco Spada
Organisation/Company	AZIENDA AGRICOLA SPADA FRANCO
Position	Agronomist – honorary president
Country	Italy
Date	13/06/2025
Consent to record and use responses for research purposes (Yes / No)	Yes
Question 1	
Please describe the core activities of your organisation/company and its role in the olive or agrifood sector	
<u>Response Q1</u>	
The agricultural cooperative (with social olive mill) operates in the olive-growing and olive-oil sector. It is responsible for coordinating the member farmers' companies that produce according to the directives of the cooperative itself. The cooperative is made up of 300 farms and the social olive mill has a capacity of 20,000 quintals of olives per harvest season. The olive mill includes five people in production and three people in the administrative sector. The role of the interviewee is that of honorary president of the cooperative, and he is responsible for assisting the young.	
Question 2	
Please describe your organisation's/company's experience with circular economy practices or circular economy business models	
<u>Response Q2</u>	
The company is committed to recovering value from waste through the valorisation of by-products and makes use of renewable energy (solar panels)	
Question 3	
What circular practices are currently being implemented either by your organisation/company or in your sector?	
<u>Response Q3</u>	
The company is committed to the valorisation of by-products (pruning waste used by third parties as animal feed, vegetation water and pomace used as biomass for the biodigester, and olive stone used for energy production); planned: extraction of polyphenols from by-products (mill already set up to start this process); use of renewable energy (solar panels).	
Question 4	
Can you provide specific examples of circular business models applied within your organization or the olive/agrifood sector?	
<u>Response Q4</u>	
The pulp and vegetation water are sent to a biodigester for energy production at zero cost (no compensation, but also no disposal fees). The olive stone, which has been separated, is marketed for energy production, and a model (currently in the testing phase) for cleaning the stones is planned. The olive stone is sold directly (in 10-quintal bags) for use in artisanal and/or industrial boilers, not at the household level because the moisture content is too high and would require further drying (mixtures with pellets and olive stone would have an ideal calorific yield, but further moisture removal would be needed). All the roofs and coverings of the company are equipped with solar panels	
Question 5:	
Could you tell me what are the main drivers behind adopting these circular business models? For example, regulatory compliance, economic benefits, your organisation's/company's own sustainability goals.	
<u>Response Q5</u>	
Main drivers behind the adoption of circular practices and business models: social (sustainability, social benefits), economic (cost reduction, consumer demand for sustainable products, higher profits), political/legal (environmental regulations and policies, certification systems: this way the company becomes a sustainable company), environmental (resource scarcity, waste management needs), technological (development of new technologies and innovation).	
The value of olive pomace has decreased over time (since the 2000s), and as a result, pomace processing plants are also declining: it's no longer convenient to bring pomace there. Today, pomace processors raise their prices because raw pomace is in short supply; therefore, it might now be convenient to deliver pomace to them as they currently pay well for these by-products. However, in the future, pomace will likely no longer be taken to these facilities for disposal. Currently, pomace and olive mill wastewater are sent to a biodigester for energy production: stored in an external tank outside the mill and collected by third-party vehicles (this results in savings on management and storage: previously €2.5 per quintal for disposal, now a final return of €5 per quintal of milled olives). In the future, the pulp will likely be used as animal feed, and the olive mill wastewater will be used for polyphenol extraction.	
Question 6	
What is the specific value proposition, i.e., added value, offered to your customers or partners in your value chain by these circular initiatives?	
<u>Response Q6</u>	
Increase in customer satisfaction and improvement of the cooperative's image thanks to the circular economy practices implemented; since the work is carried out in a "clean" and sustainable way, the raw material and the final product are perceived as being of good quality (consumer awareness). The company is also working on the use of carbon credits: energy savings and lower costs for by-product disposal.	



Question 7
How does your organisation/company create and deliver value in the framework of circular economy? For example, does this happen through forming strategic partnerships, via adoption of innovative technologies, or by implementation of sustainable supply chain strategies?
<u>Response Q7</u>
Collaborations with institutions such as universities make it possible to work together to understand how to enhance by-products (ongoing development of technologies, machines, mechanics, research); after a period of stagnation, in the last ten years there has been continuous research (e.g. ultrasounds, cooling of extraction lines) in order to bring valuable compounds into the oil and to improve the healthiness of the products.
Question 8
How does your organisation capture value from the adoption of circular practices and/or initiatives? For example, through new revenue streams, via cost savings, or by leveraging the competitive advantage in the market?
<u>Response Q8</u>
Cost reduction: savings in by-product disposal. In the past: 2.5 euros spent to dispose of by-products; today: 2.5 euros earned from the sale of olive stones and from giving away the pomace and vegetation water.
Question 9
What have been the key success factors that allowed for the implementation of circular business models in your organisation/company or in your sector?
<u>Response Q9</u>
Cost reduction and collaborations with universities
Question 10
What are the most significant challenges or barriers encountered towards the adoption of circular business models by your organisation/company? For example, are they technical, financial, regulatory, cultural?
<u>Response Q10</u>
Challenges or barriers faced by the company in adopting circular practices and business models (in this case: extraction of polyphenols from olive oil production by-products): economic (difficulty in finding buyers, they need to be sold to those who use them industrially; currently, it is more convenient to use chemical additives, but there is hope in future consumer trends that value health and seek natural ingredients), political/legal (from a legal perspective, some obstacles in the use of exclusively natural substances in food), technical (the issue is the industrialization of polyphenol extraction).
Question 11
In your opinion, are these circular business models suitable for micro and small enterprises in the olive or agrifood sector? (if yes, then why / if not, then why?)
<u>Response Q11</u>
Possible, but less feasible to use advanced technologies for mills processing less than 3000 quintals of olives. It might be doable for by-products and solar panels, but for machinery and technologies related to oil extraction and preservation, it is difficult (less technology means less opportunity to valorize by-products and lower product quality). For micro and small businesses, it is more convenient to rely on a larger mill for the valorization of by-products.
Question 12
What would be the necessary and specific adaptations to ensure the successful adoption of these circular business models by micro and small enterprises in the olive or agrifood sector?
<u>Response Q12</u>
Better technologies, larger scales.
Question 13
What would be the enabling factors that could facilitate the transfer of circular business models to micro and small enterprises? For example, would those be financial incentives, or support from relevant policies, or targeted capacity-building?
<u>Response Q13</u>
Funding and great attention to the training.
Question 14
Could you describe how external actors, such as research institutes, public agencies, or even intermediaries contribute to the successful adoption of circular business models in your sector?
<u>Response Q14</u>
Funding through producer organizations; to grow, funding is necessary; the cooperative must support individual producers, and associations that provide assistance are needed.
Question 15
Can you share any exemplary case studies or best practices of circular business models within your region or sector?
<u>Response Q15</u>
Carbon credit trading: the olive tree is a "positive" plant for generating carbon credits, which can be sold to industries that need them (carbon credits have commercial value). Funding related to environmental restoration: conservation and



environmental recovery of olive trees, which today are difficult to maintain because historic-landscape olive growing has low yield, but from the carbon credit perspective it is more useful.

Question 16

What recommendations would you give to those responsible on forming the policies in your sector, or business associations, or other stakeholders in order to strengthen the uptake of circular business model from micro and small enterprises?

Response Q16

Funding and a lot of focus on training, which is currently very lacking. In micro and small businesses, trained personnel are often absent, which can lead to mistakes that compromise the final outputs. Training must be serious and at all levels (both young farmers and older farmers). Mandatory training is needed to prevent untrained people from making errors that damage plants and products (e.g., improper use of pesticides, water waste). If training is not possible, it is necessary to consult experts. The government and regional authorities should provide funds for training (serious and continuously updated training, competent and experienced instructors, and compensation for those attending training courses).

Interview number: (e.g., 1, 2,...)	2
Interviewee Full Name	Valter Marcolini
Organisation/Company	Frantoio Valsanterno (Imola)
Position	President of the olive mill
Country	Italy
Date	17/06/2025
Consent to record and use responses for research purposes (Yes / No)	yes
Question 1	
Please describe the core activities of your organisation/company and its role in the olive or agrifood sector	
<u>Response Q1</u>	
Three main activities: agricultural activity with an olive grove of 4,000 trees of various cultivars; oil mill (milling of its own olives and the majority of olives from olive growers in the Bologna, Modena, and Reggio Emilia areas); oil production, bottling, packaging, and sales. Company with 5 employees.	
Question 2	
Please describe your organisation's/company's experience with circular economy practices or circular economy business models	
<u>Response Q2</u>	
The company's own production is organic (no use of fungicides, pesticides, etc.). ARPAE enforces strict and thorough controls: no release of by-products into the environment is allowed. Cleaning, processing, and production waters are directed to a disposal plant, together with olive processing waste. Oil mill: two-phase processing system, with oil produced on one side and pomace with olive pits on the other. The wet pomace is recovered and transported to by-product handlers for biomass production: no product is dispersed into the environment. Everything is managed in a controlled manner.	
Question 3	
What circular practices are currently being implemented either by your organisation/company or in your sector?	
<u>Response Q3</u>	
Organic methods for olive cultivation, environmentally friendly practices. Valorization of by-products: wet pomace is sold to biomass production plants.	
Question 4	
Can you provide specific examples of circular business models applied within your organization or the olive/agrifood sector?	
<u>Response Q4</u>	
Organic production. In a given year, the pomace is sold, but the transport cost is high. Therefore, there is no profit (revenue and cost are equal).	
Question 5:	
Could you tell me what are the main drivers behind adopting these circular business models? For example, regulatory compliance, economic benefits, your organisation's/company's own sustainability goals.	
<u>Response Q5</u>	
Reduction of costs related to waste disposal (wet pomace sold to biomass production plants). Regulatory compliance (legislation and strict and meticulous controls by ARPAE). Customer demand (growing interest in organic products).	
Question 6	
What is the specific value proposition, i.e., added value, offered to your customers or partners in your value chain by these circular initiatives?	



<u>Response Q6</u>
<p>Mill acquisition: 4 years ago. The mill had basic products and was not organic, and treatments were not organic. Operating in an area close to the city and with several regulations to comply with does not allow or encourage actions outside the law. It is a duty to follow the rules in order to obtain an excellent product and to respect the environment in general.</p> <p>A 3-year process was needed to become organic (also to offer a better image of the company to consumers). Our production is 25% organic (oil that comes directly from our own olive groves), while the remaining 75% is not organic, since it comes from the milling of olives purchased from other olive growers. In recent times (the past year/year and a half): strong attention and interest from consumers in organic products.</p>
Question 7
<p>How does your organisation/company create and deliver value in the framework of circular economy? For example, does this happen through forming strategic partnerships, via adoption of innovative technologies, or by implementation of sustainable supply chain strategies?</p>
<u>Response Q7</u>
<p>Cold pressing process and within a very short time (24–36 hours) to obtain excellent quality.</p> <p>Storage: oil is stored in clean environments, at a controlled temperature, under nitrogen to prevent oxidation.</p> <p>No particular aspects regarding technology.</p> <p>There is excellent cleanliness.</p>
Question 8
<p>How does your organisation capture value from the adoption of circular practices and/or initiatives? For example, through new revenue streams, via cost savings, or by leveraging the competitive advantage in the market?</p>
<u>Response Q8</u>
<p>Cost savings related to waste disposal (the pomace is sold to biomass production plants, no waste disposal costs).</p> <p>Competitive advantages on the market (sale of higher quality organic products).</p>
Question 9
<p>What have been the key success factors that allowed for the implementation of circular business models in your organisation/company or in your sector?</p>
<u>Response Q9</u>
<p>Cost reduction and improvement of the company's image on the market (sale of organic products, environmentally friendly cultivation methods, and high quality of the final product).</p>
Question 10
<p>What are the most significant challenges or barriers encountered towards the adoption of circular business models by your organisation/company? For example, are they technical, financial, regulatory, cultural?</p>
<u>Response Q10</u>
<p>The bureaucratic and administrative aspects are the main barriers; bureaucracy takes a very long time to implement works and actions that could lead to innovations or other positive aspects for the activity and the organization.</p> <p>Example: I need to make a modification to the plant and I have to obtain a whole series of certifications for water discharge (in Imola this is a highly problematic issue). It is also very complex to obtain the necessary permits.</p>
Question 11
<p>In your opinion, are these circular business models suitable for micro and small enterprises in the olive or agrifood sector? (if yes, then why / if not, then why?)</p>
<u>Response Q11</u>
<p>Example: reuse of wet pomace as biomass.</p> <p>Until two years ago, we had a plant to separate the olive pits from the pomace, which was then sold de-pitted to the biomass producer; since last year this is no longer done: the de-pitting plant has significant costs and the revenue from selling the pits is limited. Pomace, with or without pits, is an excellent product for energy production, but this (energy production from pomace used as biomass) cannot be done at a micro-production scale; only very large plants can afford it. Processing 20,000 quintals of olives, producing about 80% wet pomace, does not justify building micro energy production plants. To generate energy from pomace, a large plant is needed.</p>
Question 12
<p>What would be the necessary and specific adaptations to ensure the successful adoption of these circular business models by micro and small enterprises in the olive or agrifood sector?</p>
<u>Response Q12</u>
<p>Create a consortium of entrepreneurs to build facilities to collect wet pomace from various mills and use it as biomass for energy production. This is an important aspect both for the disposal of by-products/waste and for energy production. Even if a single mill has a very high capacity, it cannot manage alone, but a consortium of entrepreneurs can.</p>
Question 13
<p>What would be the enabling factors that could facilitate the transfer of circular business models to micro and small enterprises? For example, would those be financial incentives, or support from relevant policies, or targeted capacity-building?</p>



Response Q13

In Emilia Romagna, olive production has been increasing in recent years, with new olive plantations (special attention to the olive-oil sector). Institutions should be more present, especially regarding funding. For example, a recent Emilia Romagna call for proposals of 60 million euros allocated 57 million to livestock and orchards, and only 3 million to the olive sector and other sectors. These amounts are negligible and absolutely insufficient to develop circular economy practices and techniques in the olive-oil field. To create facilities for the collection and valorization of olive by-products, greater attention to this sector is needed, especially at the institutional level.

Question 14

Could you describe how external actors, such as research institutes, public agencies, or even intermediaries contribute to the successful adoption of circular business models in your sector?

Response Q14

More attention and increased funding from institutions.

Question 15

Can you share any exemplary case studies or best practices of circular business models within your region or sector?

Response Q15

A fairly new reality, with no deep knowledge yet in the field of circular business models to take examples from. The qualitative aspect is important: great importance must be given to all innovations that allow maintaining very high quality.

Question 16

What recommendations would you give to those responsible on forming the policies in your sector, or business associations, or other stakeholders in order to strengthen the uptake of circular business model from micro and small enterprises?

Response Q16

Give importance to product quality (from olive production using organic methods to technologies that achieve a superior quality product). Institutions must increase attention and funding dedicated to the olive-oil sector.



Portugal

***(The following interview documentation has been filled based on the contents from the respective
DET, CBMC, TAM of each study case)***

Interview number: (e.g., 1, 2,...)	1
Interviewee Full Name	Quinta de S. Braz
Organisation/Company	Quinta de S. Braz
Position	management
Country	Portugal
Date	12.06.2025
Consent to record and use responses for research purposes (Yes / No)	yes
Question 1	
Please describe the core activities of your organisation/company and its role in the olive or agrifood sector	
<u>Response Q1</u>	
Artisanal DOP/BIO olive oil production with on-site processing.	
Question 2	
Please describe your organisation's/company's experience with circular economy practices or circular economy business model	
<u>Response Q2</u>	
Integrated regenerative and circular model since 2015.	
Question 3	
What circular practices are currently being implemented either by your organisation/company or in your sector?	
<u>Response Q3</u>	
Closed-loop water reuse, biomass composting, solar energy use.	
Question 4	
Can you provide specific examples of circular business models applied within your organization or the olive/agrifood sector?	
<u>Response Q4</u>	
Regenerative olive oil production, DOP/BIO certifications, consumer education.	
Question 5:	
Could you tell me what are the main drivers behind adopting these circular business models? For example, regulatory compliance, economic benefits, your organisation's/company's own sustainability goals.	
<u>Response Q5</u>	
Consumer demand for sustainability, EU alignment, internal innovation drive.	
Question 6	
What is the specific value proposition, i.e., added value, offered to your customers or partners in your value chain by these circular initiatives?	
<u>Response Q6</u>	
High-quality DOP/BIO oil with traceable, regenerative practices.	
Question 7	
How does your organisation/company create and deliver value in the framework of circular economy? For example, does this happen through forming strategic partnerships, via adoption of innovative technologies, or by implementation of sustainable supply chain strategies?	
<u>Response Q7</u>	
Through small-batch production, renewable energy, compost reuse, packaging choices.	
Question 8	
How does your organisation capture value from the adoption of circular practices and/or initiatives? For example, through new revenue streams, via cost savings, or by leveraging the competitive advantage in the market	
<u>Response Q8</u>	
Cost savings on fertiliser, water, energy; strong market position.	
Question 9	
What have been the key success factors that allowed for the implementation of circular business models in your organisation/company or in your sector?	
<u>Response Q9</u>	
Leadership, technical know-how, EU demand, institutional partnerships.	
Question 10	
What are the most significant challenges or barriers encountered towards the adoption of circular business models by your organisation/company? For example, are they technical, financial, regulatory, cultural?	
<u>Response Q10</u>	



High CAPEX, resistance to change, niche market limits.
Question 11
In your opinion, are these circular business models suitable for micro and small enterprises in the olive or agrifood sector? (if yes, then why / if not, then why?)
<u>Response Q11</u>
Yes – feasible with proper training and investment.
Question 12
What would be the necessary and specific adaptations to ensure the successful adoption of these circular business models by micro and small enterprises in the olive or agrifood sector?
<u>Response Q12</u>
Tech support, storytelling, regional financial schemes.
Question 13
What would be the enabling factors that could facilitate the transfer of circular business models to micro and small enterprises? For example, would those be financial incentives, or support from relevant policies, or targeted capacity-building?
<u>Response Q13</u>
Training, tailored funding, knowledge sharing via producer networks.
Question 14
Could you describe how external actors, such as research institutes, public agencies, or even intermediaries contribute to the successful adoption of circular business models in your sector?
<u>Response Q14</u>
Polytechnic institutes, APPITAD, EVOO networks.
Question 15
Can you share any exemplary case studies or best practices of circular business models within your region or sector?
<u>Response Q15</u>
Own model; transferable to PDO/BIO regions with similar conditions.
Question 16
What recommendations would you give to those responsible on forming the policies in your sector, or business associations, or other stakeholders in order to strengthen the uptake of circular business model from micro and small enterprises?
<u>Response Q16</u>
Support outreach, fund training, reward sustainable innovation.

Interview number: (e.g., 1, 2,...)	2
Interviewee Full Name	Herdade da Figueirinha
Organisation/Company	Herdade da Figueirinha
Position	management
Country	Portugal
Date	16.06.2025
Consent to record and use responses for research purposes (Yes / No)	yes
Question 1	
Please describe the core activities of your organisation/company and its role in the olive or agrifood sector	
<u>Response Q1</u>	
Production of olive oil and wine, on-farm composting, regenerative agriculture.	
Question 2	
Please describe your organisation's/company's experience with circular economy practices or circular economy business models	
<u>Response Q2</u>	
Adopted a full-scale circular composting model reusing all by-products.	
Question 3	
What circular practices are currently being implemented either by your organisation/company or in your sector?	
<u>Response Q3</u>	
Organic waste composting, dehydration, water-saving irrigation, traceability systems.	
Question 4	
Can you provide specific examples of circular business models applied within your organization or the olive/agrifood sector?	
<u>Response Q4</u>	
Composting unit producing 4,000t/year; 'soil-to-soil' carbon farming model.	
Question 5:	



<p>Could you tell me what are the main drivers behind adopting these circular business models? For example, regulatory compliance, economic benefits, your organisation's/company's own sustainability goals.</p>
<p><u>Response Q5</u></p>
<p>Environmental benefits, brand positioning, EU policies, demand from Continente.</p>
<p>Question 6</p>
<p>What is the specific value proposition, i.e., added value, offered to your customers or partners in your value chain by these circular initiatives?</p>
<p><u>Response Q6</u></p>
<p>Reduced fertiliser use, enhanced soil, environmental impact reduction.</p>
<p>Question 7</p>
<p>How does your organisation/company create and deliver value in the framework of circular economy? For example, does this happen through forming strategic partnerships, via adoption of innovative technologies, or by implementation of sustainable supply chain strategies?</p>
<p><u>Response Q7</u></p>
<p>Via tech (composting, irrigation), partnerships (academia, retail), and traceability.</p>
<p>Question 8</p>
<p>How does your organisation capture value from the adoption of circular practices and/or initiatives? For example, through new revenue streams, via cost savings, or by leveraging the competitive advantage in the market?</p>
<p><u>Response Q8</u></p>
<p>Lower input costs, brand premium, future sales of compost and carbon credits.</p>
<p>Question 9</p>
<p>What have been the key success factors that allowed for the implementation of circular business models in your organisation/company or in your sector?</p>
<p><u>Response Q9</u></p>
<p>Partnerships, access to CAP/PEPAC, strong retail links, quantified KPIs.</p>
<p>Question 10</p>
<p>What are the most significant challenges or barriers encountered towards the adoption of circular business models by your organisation/company? For example, are they technical, financial, regulatory, cultural?</p>
<p><u>Response Q10</u></p>
<p>Regulatory complexity, licensing delays, lack of public funding access.</p>
<p>Question 11</p>
<p>In your opinion, are these circular business models suitable for micro and small enterprises in the olive or agrifood sector? (if yes, then why / if not, then why?)</p>
<p><u>Response Q11</u></p>
<p>Yes – high suitability for on-farm composting, especially for internal use.</p>
<p>Question 12</p>
<p>What would be the necessary and specific adaptations to ensure the successful adoption of these circular business models by micro and small enterprises in the olive or agrifood sector?</p>
<p><u>Response Q12</u></p>
<p>Simplify licensing, offer fiscal support, provide tech training.</p>
<p>Question 13</p>
<p>What would be the enabling factors that could facilitate the transfer of circular business models to micro and small enterprises? For example, would those be financial incentives, or support from relevant policies, or targeted capacity-building?</p>
<p><u>Response Q13</u></p>
<p>Funding programmes, clear regulation, academic and retail support.</p>
<p>Question 14</p>
<p>Could you describe how external actors, such as research institutes, public agencies, or even intermediaries contribute to the successful adoption of circular business models in your sector?</p>
<p><u>Response Q14</u></p>
<p>Universities (Évora, IP Beja), EDIA, Continente, public-private cooperation.</p>
<p>Question 15</p>
<p>Can you share any exemplary case studies or best practices of circular business models within your region or sector?</p>
<p><u>Response Q15</u></p>
<p>This model itself; scalable in Alentejo and other olive regions.</p>
<p>Question 16</p>
<p>What recommendations would you give to those responsible on forming the policies in your sector, or business associations, or other stakeholders in order to strengthen the uptake of circular business model from micro and small enterprises?</p>
<p><u>Response Q16</u></p>



Clarify legislation, simplify procedures, support small-scale pilots.



Spain

The Spain partners proceeded with a different approach for the interviews rather than following the interview guide provided and the results were as follows:

A total of three in-depth interviews were conducted with actors positioned at different points of the olive oil value chain. These interviews provided first-hand, practice-based knowledge that enriched both the Circular Business Model Canvases (CBMCs) and the Transferability Assessment Matrices (TAMs) developed for the identified circular business models (CBMs).

Each stakeholder offered a unique yet complementary perspective on the implementation of circular strategies in the sector, covering technical feasibility, organizational dynamics, and governance challenges. Thematic convergence across interviews revealed key factors that condition the uptake of circular models by SMEs, as well as structural features that influence the replicability of existing cases.

Cuadrat Valley – Technical Innovation and Local Experimentation

The Technical Director of Cuadrat Valley, olives's producers and an olive oil mill, provided a comprehensive view of the types of circular practices currently applied or under consideration within small and medium-scale olive oil operations. These included the use of pruning residues for compost production, deployment of olive pits for *mulching* and water retention in olive groves, and transformation of olive paste and wastewater into compostable materials and ecological cleaning products.

A central theme of the interview was the importance of practical experimentation at local scale, driven by trial-and-error and iterative learning processes. The interviewee noted that many solutions were technically viable but faced non-technological barriers, especially in the form of legal ambiguity, access to financing, and a lack of understanding of by-product potential among SMEs.

"It's not that SMEs can't do it—it's that they often don't know what to do with their by-products."

This quote encapsulates a broader issue of cognitive and informational gaps that prevent circular strategies from being activated, even when the infrastructure and raw materials are already present. Another recurring point was the need for shared services and cooperative structures, particularly for costly or specialized operations like drying, extraction, or waste treatment.

As a result, the CBMCs for models involving by-product reuse and decentralized valorization were adjusted to emphasize the role of external enablers, such as advisory platforms, legal facilitators, and shared logistics. In parallel, the TAMs incorporated soft barriers—including cultural inertia and lack of guidance—as critical factors affecting model transferability, especially among isolated small producers.

Olea Drinks – Product Innovation and Market Readiness

Olea Drinks, a small olive mill integrating circular innovation into consumer product development, echoed many of the technical and organizational themes raised by Cuadrat Valley, while adding a stronger focus on market viability and commercial scalability. Their approach involves extracting polyphenols and other bioactive compounds from olive by-products and integrating them into functional food and beverage formulations.



One of the most salient points raised in the interview was the disconnect between circular innovation and regulatory frameworks, particularly when transitioning from raw materials to marketable products. The company encountered substantial hurdles related to food safety approvals, product registration, and ingredient labeling. Despite the strong sustainability narrative, circular products often require more time and investment to reach consumer acceptance due to unfamiliarity or lack of perceived value.

“The main challenge is not in developing the product, but in convincing the market that a circular ingredient is trustworthy and valuable.”

From a CBMC perspective, this insight led to a reassessment of value proposition elements for high-value valorization models, highlighting the need for consumer education, certification schemes, and transparent storytelling as core activities, not auxiliary ones. The TAM also incorporated market maturity and regulatory complexity as essential dimensions when evaluating transferability, with lower feasibility for firms lacking dedicated commercial or legal teams.

Federació de Cooperatives Agràries de Catalunya – Territorial Strategy and Governance

The Director of the FCAC provided a high-level view of circular initiatives implemented through cooperative structures. He described how member cooperatives are already engaged in valorizing *sansa* (olive pomace) via integrated plants that produce orujo oil, fuel-grade pits, and biomass pastes, often through collective infrastructure.

Crucially, he emphasized that the motivation for circular investments is not solely economic but also institutional and territorial, aimed at ensuring long-term environmental compliance and self-sufficiency. In his words:

“The goal is not just profit, but to guarantee treatment capacity for the cooperative’s own residues.”

This framing positioned circularity as a resilience strategy, supporting the cooperative model’s autonomy and capacity to adapt to environmental regulations and market shifts. The interview also reinforced the role of public co-funding and innovation partnerships, particularly through NextGenerationEU and transition funds, as decisive for implementation.

The CBMCs were modified to reflect collective resilience and compliance assurance as part of the value proposition in models involving industrial symbiosis and waste treatment. TAMs were adapted to acknowledge that while feasibility is medium-to-high in cooperative settings, transferability sharply declines for SMEs lacking horizontal coordination or institutional support.

Across all three interviews, key themes emerged with direct implications for the design and assessment of circular models. These include:

- The critical role of intermediary actors and shared infrastructure in enabling small producers to access complex or capital-intensive circular practices.
- The persistence of regulatory and administrative burdens, especially in high-value valorization chains or water reuse.
- The need for strategic communication and market positioning, particularly when entering consumer-facing segments.



The presence of non-technical barriers, such as mindset inertia and lack of valorization literacy, which were integrated into the TAM's qualitative assessment.

7.2 Data extraction template

General information		
Business model name	<i>Full official or descriptive name of the circular business model</i>	
Country/region	<i>Country or regional area where the business model is applied</i>	
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	
Date of data collection	<i>(e.g., 1st of June 2025)</i>	
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	
Geographical Scope	<i>Does the model operates at a local, regional, national, or international scale?</i>	
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	
Impact Assessment		

Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	

7.2.1 DET per country

Croatia

General information		
Business model name #1	<i>Full official or descriptive name of the circular business model</i>	Biorecator-based composting of olive pomace
Country/region	<i>Country or regional area where the business model is applied</i>	Croatia
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector, food-waste sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	HRZZ (Croatian Science Foundation) project VALOLIVEWASTE, project website and information provided by project co-leader
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://biocolloid.ijs.si/projects/weave-j4-4561
Date of data collection	<i>(e.g., 1st of June 2025)</i>	4 th of June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Valorization of olive pomace is explored by two approaches: (i) composting, aiming to produce fertilizers and (ii) biotransforming, aiming to produce added value compounds that can be used in food and pharmaceutical industries
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	by-product valorization
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Local, regional, national and international scale
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Pilot
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Waste valorization, composting improvements
Unique Selling Proposition	<i>How does the model differentiate itself (e.g., innovation,</i>	Innovation, environmental benefits

(USP)	<i>environmental benefits, customer-centric circularity)</i>	
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive pomace
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Waste valorization, composting optimization
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Agricultural sector, Olive processing industry, Agricultural advisors, Governmental bodies
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Pilot-scale bioreactors with forced aeration used for composting
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Croatian Science Foundation
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Investment in new equipment
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced fertilizer costs
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Reduced environmental burden, improvements on composting efficiency
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Job creation, stakeholder inclusion, local value chain reinforcement
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Commercialization of produced compost
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	It is low for micro and small enterprises due to the high costs associated with composting facilities
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Limited knowledge, initial investment
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Not applicable
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	/

General information		
Business model name #2	<i>Full official or descriptive name of the circular business model</i>	Plant for recycling olive by-products and waste
Country/region	<i>Country or regional area where the business model is applied</i>	Croatia
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector



Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Information provided by plant owner, interview
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	-
Date of data collection	<i>(e.g., 1st of June 2025)</i>	June 11 th 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Production of pellets from olive by-products
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	Waste valorization
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	At local scale
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Waste minimization, circular product offering
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Innovation, environmental benefits
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive by-products – pomace, pruning residues
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Remanufacturing, waste valorization, product refurbishment
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Small and medium enterprises, HAMAG-BICRO (Croatian Agency for SMEs, Innovation and Investments)
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Low-energy plant for efficient drying of biowaste from olive growing and turning it into a renewable energy source
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of circular products – pellets
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Circular process costs, investment in new equipment, logistics
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced raw material costs and energy efficiency gains
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Utilization of unutilized waste from olive growing, creation of additional usable raw materials
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Solving the problem of unutilized olive waste
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Market competitiveness and profitability improvement
Transferability potential		

Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium – for small enterprises, the profitability of the plant is questionable.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Unknown legal regulations regarding waste disposal, slowness of institutions, unwillingness of waste producers themselves to accept changes (no readiness for any adaptation to dispose of waste)
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	As this is a seasonal operation, timing is extremely important. Following the deadlines of the institutions for various permits allows for easy adoption of the technology.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	/

General information		
Business model name #3	<i>Full official or descriptive name of the circular business model</i>	Olive by-products utilization and valorization
Country/region	<i>Country or regional area where the business model is applied</i>	Croatia
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Information provided by olive mill owner, interview, official website
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://chiavalon.hr/hr
Date of data collection	<i>(e.g., 1st of June 2025)</i>	2 nd of June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Utilization of olive by-products and returning them to the olive grove. Olive pomace is composted, mixed with manure and returned to the olive grove; pits are separated from the pomace and used for their own purposes or donated; pruning residues are mulched and mixed with compost; wastewater is purified and used for irrigation.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorization
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	At local scale
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Waste minimization, cost savings
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Environmental benefits
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive by-products – pomace, pits, pruning residues, waste water
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Waste valorization



Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Small businesses and supply chain actors
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Composting plants – a machine for separating pits from wet pomace and a mulcher for shredding waste in the olive grove after pruning
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Leasing models and service fees
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Investment in new equipment and its servicing
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduction of fertilization and top dressing costs in olive groves, positive effects in olive groves - health and condition of olives, gains in energy efficiency
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Percentage of waste diverted from landfill, resource efficiency improvements
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Primarily strengthening the local value chain, then job creation and stakeholder engagement
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Cost savings in production and improved profitability
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium, due to large investments in technology and insufficient professional staff, adaptation is necessary, certainly with education and training of workers in the sector
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Large financial investments, inadequate legal regulations and rules for the disposal of pomace and the sale of by-products such as pits
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Policy support and cooperation with investors
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	/

General information		
Business model name #4	<i>Full official or descriptive name of the circular business model</i>	Utilizing the value of waste generated during olive pruning
Country/region	<i>Country or regional area where the business model is applied</i>	Croatia
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Company website, information provide by olive grove owner, interview
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://oli-veri.com/



Date of data collection	(e.g., 1 st of June 2025)	11 th of June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	After pruning, the branches are mulched and returned to the soil as a type of organic fertilizer
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorization
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	At local scale
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Cost savings and waste minimization
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	It has environmental benefits
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive by-products
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Waste valorization
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	R&D institutes
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Mechanical processing
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	There are no revenue sources
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Investment in new equipment - mulcher
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reducing costs for purchasing organic fertilizers
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Improvements on resource efficiency
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Possibly creating a new job position
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Lower waste disposal costs
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium - with the necessary equipment and training, it can be done by the company itself. There is also the option of hiring another company that offers this service.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Technical - necessary knowledge of mechanization and its use; economic - initial investment of 3,000 euros if you have an adequate tractor, if not, the investment



		exceeds 50,000 euros
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Access to financing from various sources or existing equipment from before
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	/

Greece

General information		
Business model name #1	<i>Full official or descriptive name of the circular business model</i>	Co-composting of Olive Mill Waste
Country/region	<i>Country or regional area where the business model is applied</i>	Western Greece (Amfilochia, Agrinio)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Scientific paper
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://www.sciencedirect.com/science/article/abs/pii/B978012805314000008X?via%3Dihub
Date of data collection	<i>(e.g., 1st of June 2025)</i>	06.06.2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	<p>The business model centers around the co-composting of olive mill waste (OMW)—specifically, olive kernels, olive leaves, olive mill wastewater (OMWW), and additional lignocellulosic materials such as sawdust, rice husks, and wood shavings. Implemented in Western Greece, this model integrates pilot- and full-scale composting operations designed to transform phytotoxic, high-organic-load by-products of olive oil production into high-quality organic soil amendments.</p> <p>The composting process follows aerobic, thermophilic treatment regimes, optimized through scientific monitoring and mathematical modeling, resulting in mature compost within 90–120 days. The end product is a nutrient-rich, safe, and biologically stable compost with demonstrated agronomic benefits.</p> <p>The model is grounded in key circular economy principles, particularly:</p> <ul style="list-style-type: none"> – By-product valorisation (reuse of OMW and agricultural residues) – Nutrient recycling (closed-loop organic matter and nitrogen reuse) – Pollution mitigation (elimination of phenolic compounds and reduction of environmental burden from OMW disposal) <p>General Objectives</p> <ul style="list-style-type: none"> – To reduce the environmental impact of olive mill waste by converting it into value-added soil conditioners – To support small-scale olive mills by enabling the creation of a local, replicable, and profitable circular model – To enhance agricultural productivity through the use of compost that improves soil fertility and structure – To demonstrate technical feasibility and scalability of composting technologies for widespread application in Mediterranean olive-producing regions



Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorisation
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Local
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	<p>Waste Minimization: The model addresses the pressing need to manage large volumes of olive mill waste (OMW)—notoriously phytotoxic and environmentally harmful—by diverting it from landfills or uncontrolled discharge.</p> <p>Pollution Reduction & Compliance: It offers a sustainable alternative to traditional OMW disposal, helping olive mills and local authorities comply with environmental regulations related to wastewater and solid organic waste.</p> <p>Circular Product Offering: The business model generates a value-added compost product for agricultural use, transforming waste into a circular input that enhances soil health and productivity.</p> <p>Cost Avoidance: By reducing waste management costs (e.g., transport, disposal, landfill fees), the model creates economic incentives for small olive oil producers to engage in circular practices.</p> <p>Soil Restoration & Agricultural Productivity: Farmers benefit from high-quality organic soil amendments, addressing the need for cost-effective, nutrient-rich, and environmentally safe fertilizers—especially in Mediterranean agro-ecosystems with declining soil fertility.</p>
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	<p>Scientifically Validated Circular Innovation: The model is grounded in rigorous scientific research and field-tested composting methodologies, integrating thermophilic aerobic composting, precise C/N ratio optimization, and mathematical modeling to control and accelerate the composting process. This enhances reliability, efficiency, and replicability.</p> <p>High-Quality, Non-Toxic Compost Output: Unlike conventional organic waste reuse methods, this model produces compost that is non-genotoxic, phytotoxin-free, and nutritionally rich, with verified agronomic performance indicators (e.g., germination index up to 198%, nitrogen content >3%).</p> <p>Full Utilization of Multi-Waste Streams:</p>



		<p>The model uniquely combines various agricultural by-products (OMWW, olive leaves, pruning residues, rice husks, sawdust) into a synergistic feedstock blend, maximizing waste valorization across the local agro-industrial ecosystem.</p> <p>High Transferability to Micro and Small Enterprises (MSEs): Its modular design and use of readily available biomass make it highly adaptable to small olive mills, particularly in rural Mediterranean contexts, thus democratizing circular innovation.</p> <p>Environmental and Regulatory Co-Benefits: It delivers significant GHG reduction, eliminates phenolic pollutants, and reduces the environmental burden of olive processing, positioning it as a solution aligned with EU circular economy and pollution prevention policies.</p>
Value Creation & Delivery		
Circular Resources	<p><i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i></p>	<p>Olive Mill Wastewater (OMWW): A liquid by-product rich in organic load and phenolic compounds, traditionally considered hazardous but here transformed into a composting input.</p> <p>Olive Kernels and Leaves: Solid residues from olive oil extraction, used as carbon-rich biomass feedstock in the composting process.</p> <p>Rice Husks and Sawdust: Agricultural and wood-processing by-products that provide lignocellulosic balance, improve aeration, and enhance carbon-to-nitrogen (C/N) ratios.</p> <p>Wood Shavings: Residual material from local wood industries, utilized to stabilize moisture and promote oxygenation during composting.</p> <p>Cr-treated Reed Plants: Biomass recovered from constructed wetlands used in OMWW pretreatment, reintegrated into the composting cycle.</p>
Core Circular Activities	<p><i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i></p>	<p>Biological Waste Valorisation through Aerobic Composting: Transformation of olive mill waste and other organic by-products into stable, nutrient-rich compost using controlled aerobic microbial decomposition processes.</p> <p>Moisture and Temperature Management (Thermophilic Control): Active regulation of composting phases—especially the thermophilic phase (3–5 days)—to optimize microbial activity and accelerate decomposition while eliminating pathogens and phenolic toxicity.</p> <p>Feedstock Blending & Optimization: Custom formulation of composting mixtures from multiple local waste streams (olive, rice, wood), achieving ideal C/N ratios and structural balance.</p>

		<p>Pilot-to-Full-Scale Demonstration and Validation: Operation of both pilot-scale and full-scale composting facilities, including technical and agronomic performance validation (C/N ratio, nitrogen content, germination index, genotoxicity tests).</p> <p>Circular Product Delivery (Compost as Fertilizer): Distribution and application of the resulting compost to local agricultural users, thereby closing the nutrient and organic matter loop from olive production to soil regeneration.</p>
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	<p>Research & Development Institutes: University of Patras University of Trieste Institute of Chemical Engineering Sciences (ICE-HT/FORTH) (These institutions contributed technical know-how, process optimization, and scientific validation)</p> <p>Olive Mills (SMEs): Local small-scale olive oil producers provided primary waste feedstocks (OMWW, olive leaves, kernels), infrastructure, and pilot deployment sites.</p> <p>Agricultural Processing Companies: Agrino (rice processing company) supplied rice husks as a co-composting material.</p> <p>Wood Industry SMEs: Local woodworking and sawmill operations supplied wood shavings and sawdust, serving as carbonaceous co-feedstocks.</p> <p>Constructed Wetland Facilities (CW): Reeds from CW systems used in wastewater pretreatment were repurposed as biomass inputs, linking wastewater treatment infrastructure to circular biomass loops.</p>
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	<p>Aerobic Composting Facilities (Pilot and Full-Scale): Engineered systems designed to optimize oxygen flow, temperature regulation, and moisture control—enabling efficient microbial degradation of olive mill and agricultural waste.</p> <p>Thermophilic Phase Control Systems: Monitoring and regulation tools ensuring that compost reaches and maintains critical thermophilic temperatures (typically above 55°C), essential for pathogen destruction and rapid biodegradation.</p> <p>Moisture Monitoring and Adjustment Mechanisms: Manual and semi-automated systems for controlling the water content of composting mixtures, crucial for microbial activity and compost quality.</p>

		<p>Mathematical Modeling Tools: Applied to optimize composting process parameters, enabling prediction and control of temperature curves, degradation rates, and feedstock ratios.</p> <p>Phytotoxicity and Genotoxicity Assessment Protocols: Laboratory assays used to validate the safety and maturity of compost products, ensuring compliance with agronomic and environmental standards.</p>
<i>Value Capture</i>		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	<p>Sales of compost/soil amendment to farmers and agricultural cooperatives</p> <p>Potential service fees for waste processing from olive mills</p> <p>Secondary raw materials valorization through compost marketing as a certified organic input</p>
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	<p>Circular Process Costs: Operational expenses for composting (aeration, turning, moisture control) and process monitoring.</p> <p>Logistics: Costs related to collection, transport, and handling of olive mill waste and co-feedstocks (e.g., rice husks, sawdust).</p> <p>Processing Infrastructure: Investment in or use of composting units, pilot/full-scale facilities, and site preparation.</p> <p>Equipment and Maintenance: Expenses for temperature/moisture sensors, aeration systems, shredders, and maintenance of composting setups.</p> <p>Labor and Technical Support: Personnel costs for skilled operators, laboratory testing, and scientific oversight.</p> <p>Analytical and Quality Testing: Laboratory costs for C/N ratio analysis, phytotoxicity/genotoxicity tests, and nutrient content validation.</p>
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	<p>Avoided Landfill and Disposal Fees: Significant savings by eliminating the need for external disposal or treatment of olive mill wastewater and solid residues.</p> <p>Reduced Raw Material Costs for Farmers: Farmers gain access to low-cost, nutrient-rich compost, reducing reliance on synthetic fertilizers.</p> <p>Minimized Waste Management Costs for Olive Mills: Olive mills offload their by-products into a productive reuse stream, cutting costs related to waste transport, storage, and compliance with environmental regulations.</p>

		<p>Nutrient Recovery Efficiency: Recovery of valuable nutrients (e.g., nitrogen, organic matter), minimizing the need for chemical inputs in the agricultural cycle.</p>
Impact Assessment		
Environmental Impact	<p><i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i></p>	<p>Phenol Elimination: Up to 90% reduction in phenolic compounds, significantly decreasing phytotoxicity and environmental hazard of OMWW.</p> <p>Waste Diversion: Valorization of 100% of input olive mill waste (solid and liquid), fully diverted from landfill or uncontrolled discharge.</p> <p>Compost Maturity and Stability Indicators: Germination Index (GI): 85%–198% (indicating non-toxic, plant-compatible compost) Final C/N Ratio: 12–17 (pilot) and 27.1 (full scale) – indicative of compost stability Nitrogen Content: 3.1%–4.1% – high agronomic value No genotoxic or cytotoxic effects – confirmed via laboratory assays Soil Enhancement: Long-term improvements in soil organic matter, fertility, and structure, supporting regenerative agriculture.</p>
Social Impact	<p><i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i></p>	<p>Improved soil health, support to small-scale olive farmers, use of safe organic fertilizer</p>
Economic Impact	<p><i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i></p>	<p>New revenue from compost sales Reduced waste management costs for olive mills Diversification of income streams through circular products Enhanced market competitiveness for small producers adopting CE practices</p>
Transferability potential		
Feasibility for MSEs	<p><i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i></p>	<p>High Utilizes locally available waste streams (OMWW, pruning, sawdust) Requires moderate technical skills and low-to-medium capital investment Scalable and modular—can start small and expand Proven in small olive mills under real-world conditions in Greece</p>
Barriers	<p><i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i></p>	<p>Technical: Need for process control expertise (C/N ratio, moisture, temperature), and monitoring infrastructure</p>

		<p>Economic: Upfront investment in composting units and site setup; uncertain initial market demand for compost</p> <p>Cultural: Resistance to change from traditional disposal practices; limited awareness of compost benefits among small producers</p> <p>Regulatory: Compliance with compost quality standards and environmental regulations; need for certification and permits</p>
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	<p>Existing Partnerships with universities for applied research and pilot projects, local SMEs, and agro-industrial actors</p> <p>Supportive Local Ecosystem with abundant biomass and agricultural demand</p> <p>Scientific Validation enhancing trust and replicability</p> <p>Policy Alignment with EU circular economy and waste valorisation directives</p> <p>High Transferability due to modular, low-tech nature adaptable to small operators</p>
Notes		
Additional comments	Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance	<p>The model was implemented in real Mediterranean olive-producing regions, addressing a geographically widespread and urgent waste issue.</p> <p>Compost quality varied between pilot and full-scale setups, indicating that process control and operator training are critical to ensure consistent performance.</p> <p>Synergies with other agri-industrial sectors (e.g., rice, wood) enhance feedstock flexibility and stakeholder buy-in.</p> <p>Demonstrated compost maturity, non-toxicity, and plant growth performance build confidence for broader adoption.</p> <p>Market development for compost (branding, certification, farmer outreach) is essential to sustain and scale the model beyond technical feasibility.</p>

General information		
Business model name #2	<i>Full official or descriptive name of the circular business model</i>	Integrated Supply Chain for Compost Production from Olive Oil Waste
Country/region	<i>Country or regional area where the business model is applied</i>	Greece (specifically: Messinia and Peloponnese regions)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector / Agrifood sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Scientific paper



Reference	Links, references, or document identifiers for proper sourcing and validation	https://www.sciencedirect.com/science/article/pii/S0959652624035492?via%3Dihub
Date of data collection	(e.g., 1 st of June 2025)	10.06.2025
Business model overview		
Brief Description	Summary of how the business model operates, key circular principles involved, and its general objectives	<p>This circular business model involves the collection, transportation, and centralized composting of olive oil production waste—specifically olive mill waste and pruning residues—to produce high-quality compost. It integrates multiple actors across the value chain through an optimized, digitally supported supply chain.</p> <p><u>Key Circular Principles:</u></p> <ul style="list-style-type: none"> • By-product valorization: transforming olive waste into a marketable soil amendment • Resource efficiency: optimizing logistics and processing to minimize emissions and costs • Local loop closure: returning nutrients to the soil within the same agricultural ecosystem <p><u>General Objectives:</u></p> <p>Reduce environmental impact from olive mill waste Enable efficient and cost-effective compost production Promote adoption of circular practices in the olive agrifood sector Enhance scalability and transferability through digital and logistical optimization</p>
Business Model Type	Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)	By-product valorization + Industrial symbiosis
Geographical Scope	Does the model operate at a local, regional, national, or international scale?	Regional (Messinia & the broader Peloponnese)
Maturity Level	(pilot, in early adoption, operational, or scaled)	Operational
Value Proposition		
Customer Needs Addressed	What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)	<p>Waste Minimization – managing and reusing large volumes of olive mill waste and pruning residues</p> <p>Cost Efficiency – optimizing logistics and processing to reduce operational costs</p> <p>Circular Product Offering – producing compost as a value-added output for agriculture</p> <p>Environmental Compliance – reducing the ecological impact of olive oil production waste</p> <p>Supply Chain Integration – addressing fragmentation and inefficiencies in waste management logistics</p>
Unique Selling Proposition (USP)	How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)	<p>Digitally Optimized Supply Chain: Uses simulation and modeling to improve logistics, reduce costs, and lower emissions</p> <p>Integrated Multi-Actor System: Connects olive mills, transporters, and composting units in a unified circular loop</p> <p>Environmental Impact Reduction: Significantly reduces GHG emissions and landfill dependency</p> <p>Scalability Through System Design: Easily transferable to other olive-producing regions due to its modular, data-driven structure</p>
Value Creation & Delivery		
Circular Resources	What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)	<p>Olive Mill Waste (OMW) – solid and liquid by-products from olive oil extraction</p> <p>Olive Pruning Residues – biomass from olive grove maintenance</p>



		Agricultural Residues – additional organic materials blended into the compost feedstock
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Waste Collection and Aggregation from olive mills and farms Transportation Optimization using digital tools to reduce cost and emissions Centralized Composting of collected biomass into organic fertilizer Redistribution of Compost to local agricultural users, closing the nutrient loop
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Olive Oil Producers (SMEs) – primary waste generators Transport and Logistics Providers – responsible for efficient biomass movement Composting Facility Operators – central processing units R&D Institutions – developed the optimization model and validated performance Local Farmers – end-users of the compost product
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Composting Facilities – centralized units for processing olive waste into compost Supply Chain Optimization Software – simulates and improves logistics and processing flows Data Analytics & GIS Tools – support route planning, resource allocation, and environmental impact assessment
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of compost to farmers and agricultural cooperatives Service fees for waste collection and processing from olive mills Potential monetization of logistics optimization services or digital tools
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Procurement of olive waste and pruning biomass Transportation and logistics (fuel, vehicle operation) Production processing (drying, pelletizing, extraction) Inventory and storage holding costs Idle time costs due to supply and production mismatches Investment in equipment (pelletizers, harvesters) Labor, maintenance, and operational expenses
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Avoided landfill and disposal fees for olive mills Reduced transportation costs through optimized routing Lower raw material input costs for farmers using compost instead of chemical fertilizers Energy and fuel savings via efficient supply chain operations
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	100% utilization of collected olive mill waste and pruning residues Significant reduction in GHG emissions from optimized transport and avoided waste decomposition Improved resource efficiency across the supply chain through integration and digital planning Elimination of uncontrolled disposal, contributing to soil and water protection
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Job creation in waste collection, transport, and composting operations Strengthened local value chains by linking producers, processors, and farmers Stakeholder inclusion through collaboration among SMEs, farmers, and technology providers Improved environmental quality in local communities due to reduced waste and emissions



Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Improved profitability through waste valorization and operational efficiency Diversification of revenue streams from compost sales and service provision Enhanced market competitiveness for SMEs adopting circular supply chain models
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium Requires coordination and logistics planning, which may need external support Initial infrastructure and digital tools may pose a barrier Once established, the model is modular and scalable, making it adaptable with proper guidance and partnerships
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Technical: Need for digital tools, logistics coordination, and composting expertise Economic: Upfront investment in infrastructure and transport systems Cultural: Limited awareness or resistance to collaborative supply chain models Regulatory: Compliance with waste transport, compost quality, and environmental standards
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Supportive EU and national circular economy policies Existing regional partnerships among mills, farmers, and processors Access o public or EU funding for infrastructure and digitalization High availability of biomass and strong local demand for compost
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	The model is built on real-world data and validated simulation, ensuring practical relevance Digital tools are critical for performance but may require external expertise for small operators Success depends on central coordination and stakeholder alignment Local compost market development is essential to ensure long-term viability and uptake

General information		
Business model name #3	<i>Full official or descriptive name of the circular business model</i>	Integrated Water-Energy-Nutrient Recovery from Olive Mill Wastewater
Country/region	<i>Country or regional area where the business model is applied</i>	Greece
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector / Agrifood sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Scientific paper
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://www.mdpi.com/1996-1073/14/1/159
Date of data collection	<i>(e.g., 1st of June 2025)</i>	22.06.2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	The model utilizes an Anaerobic Membrane Bioreactor (AnMBR) to treat olive mill wastewater (OMWW), enabling energy recovery (biogas), nutrient reuse (fertiligation), and water reuse in agriculture. It integrates biological treatment with membrane separation and downstream use of outputs, supporting a zero-waste closed-loop system.



		<p>Key Circular Principles: Waste-to-resource conversion (biogas, water, nutrients) Closed-loop nutrient and water reuse Energy self-sufficiency through biogas production</p> <p>General Objectives: Minimize environmental burden of OMWW Recover valuable resources from agro-industrial waste Promote sustainable, integrated waste and resource management in the olive sector</p>
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorization + Industrial symbiosis
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Local to Regional
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Pilot
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Waste minimization of high-load olive mill wastewater Energy recovery to reduce operational energy costs Water scarcity via treated water reuse in irrigation Circular product offering (biogas and fertigation solution) Compliance with environmental regulations on waste discharge
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Triple-resource recovery: water, energy (biogas), and nutrients from a single system Advanced technology integration (AnMBR) for high-efficiency treatment Zero-liquid-discharge model supporting full environmental compliance Localized circularity by reintegrating outputs into nearby agricultural operations
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive mill wastewater (OMWW) — primary organic waste stream Agricultural nutrients recovered in liquid fertilizer form Renewable energy generated on-site as biogas from anaerobic digestion
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Anaerobic digestion for energy (biogas) recovery Membrane bioreactor treatment for wastewater purification and reuse Nutrient extraction and recycling for fertigation Direct reuse of treated water in agricultural irrigation, closing the water-nutrient loop
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Olive Mills (SMEs) — primary waste producers R&D Institutes and Universities — technology developers and evaluators Local Farmers — users of recycled water and nutrients Technology Providers — suppliers of AnMBR equipment and membrane systems Municipalities/Regional Authorities — regulatory compliance and environmental permitting support
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Anaerobic Membrane Bioreactor (AnMBR) — combined biological and membrane wastewater treatment Biogas recovery system — for renewable energy generation Nutrient recovery systems — for producing liquid fertilizers Fertigation infrastructure — integrating nutrient-rich recycled water into agricultural irrigation
Value Capture		



Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Savings from on-site renewable energy (biogas) production Reduced wastewater disposal and freshwater procurement costs Potential sales or reduced costs from recovered nutrients (fertilizer) Possible service fees for waste processing from olive mills
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Capital investment in AnMBR equipment and infrastructure Operational expenses (energy, membrane replacement, maintenance) Logistics costs for transporting and managing wastewater Labor and technical expertise for system management and operation Quality control and analytical testing for ensuring output standards
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Avoided wastewater disposal costs (e.g., landfill fees, penalties) Energy efficiency gains from onsite biogas production Reduced freshwater procurement costs via water reuse Decreased fertilizer purchase costs through nutrient recycling
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	100% diversion of processed olive mill wastewater from discharge Significant GHG emission reduction via onsite biogas production (exact figures depend on scale) Water reuse rate: Potential for near-100% reuse in fertigation Resource efficiency gains: Considerable reduction in chemical fertilizer use (exact percentages not provided)
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Local job creation in waste treatment and fertigation operations Strengthened local agro-industrial partnerships through integrated resource exchange Enhanced environmental quality through reduced wastewater pollution Improved agricultural productivity via sustainable water and nutrient inputs
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Improved profitability via energy savings and waste management cost reduction Diversification of revenue streams through biogas and nutrient-rich water reuse Enhanced market competitiveness by adopting sustainable and innovative circular practices
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium Requires initial capital investment and technical expertise for AnMBR infrastructure Complex operational management may pose challenges for small enterprises However, potential long-term cost savings, regulatory compliance, and modular scalability facilitate adoption with external support or partnerships
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Technical: High expertise required for AnMBR operation and maintenance Economic: Significant upfront investment in advanced treatment infrastructure Cultural: Limited awareness or reluctance towards innovative wastewater reuse practices Regulatory: Stringent water reuse and biogas production standards and permitting requirements
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Supportive EU and national circular economy policies R&D institutional partnerships facilitating technical support and validation Access to EU or public funding schemes (e.g., Horizon Europe, LIFE) Strong local ecosystem with olive mills and agricultural end-users ready to adopt circular solutions
Notes		



Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	Pilot-scale results show promising resource recovery but scale-up complexity remains Success depends heavily on technical capacity building and stakeholder collaboration Regulatory frameworks for water reuse and biogas are evolving, potentially affecting deployment speed The model's integration of multiple resource streams (water, energy, nutrients) is innovative but requires robust management systems
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General information		
Business model name #4	<i>Full official or descriptive name of the circular business model</i>	Integrated Circular Bio-Valorisation Model for Olive Oil Production and By-product Regeneration
Country/region	<i>Country or regional area where the business model is applied</i>	Northern Greece – Thrace Region, specifically in the Prefecture of Evros near the town of Makri, Municipality of Alexandroupoli
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Company website & interview
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	n/a
Date of data collection	<i>(e.g., 1st of June 2025)</i>	02.07.2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	<p>KYKLOPAS S.A. implements a vertically integrated and regionally embedded circular business model within the olive oil sector, encompassing cultivation, processing, packaging, and export. The model closes key resource loops across three operational stages:</p> <p>Agricultural Phase Pruning residues and olive leaves are collected from the olive groves. These materials undergo on-site composting, producing organic fertilizer that is reintegrated into the fields, enhancing soil health and reducing chemical inputs.</p> <p>Olive Milling Phase During olive oil extraction, olive mill wastewater (OMWW) is generated. The wastewater is daily transferred to a nearby biogas plant, where it is valorised into renewable electricity, avoiding environmental discharge and ensuring zero-waste disposal.</p> <p>Energy Valorisation The pyrene (olive pit biomass) is used as biofuel to heat the mill during winter months, reducing dependence on fossil fuels and improving energy self-sufficiency. This closed-loop system is managed entirely within the company's infrastructure and local partnerships, reflecting both ecological stewardship and operational efficiency.</p>
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-Product Valorization Industrial Symbiosis Regenerative Agriculture Energy Recovery



Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Regional
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational and Scaled
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Waste minimization (solid and liquid by-products) Energy autonomy through biomass and biogas utilization Soil regeneration via compost application Cost savings on fertilizers, heating, and waste disposal Environmental compliance and reduced ecological footprint Market differentiation through sustainable branding
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Innovation: Integrates multiple CE strategies (composting, biogas valorization, biomass heating) within a vertically integrated olive oil business. Environmental Benefits: Achieves zero-waste operations, renewable energy use, and regenerative agriculture. Customer-Centric Circularity: Enhances brand value through traceable sustainability practices and olive oil tourism focused on CE education.
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive by-products (leaves, prunings, olive pomace) → compost Olive pit biomass (pyrene) → renewable thermal energy Olive mill wastewater (OMWW) → biogas feedstock Organic compost → used as natural fertilizer in own groves
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Composting of agricultural residues (leaves, prunings) → returned to fields as fertilizer Waste valorization of OMWW → converted to biogas for electricity Biomass energy recovery from pyrene → used for heating the mill On-site reuse of compost and energy → internal resource recirculation
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	SME: KYKLOPAS S.A. (family-owned enterprise) Biogas facility: Local industrial symbiosis partner Supply chain actors: Olive growers (internal and local) Certifiers: ISO, HACCP bodies for sustainability standards
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	On-site composting facility for agricultural and processing residues Biomass boilers using pyrene for renewable heating Collaboration with biogas plant for OMWW valorization ISO & HACCP-certified clean production systems Soil and leaf diagnostics system for precision fertilization and reduced input use
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of primary product: Extra virgin olive oil (domestic and international markets) Cost savings: From internal reuse of compost and biomass energy Value-added branding: Sustainability-driven market differentiation
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Circular process costs: Composting operations, waste segregation Logistics: Daily transport of OMWW to biogas facility Processing: On-site biomass handling and use (pyrene combustion) Investment in equipment: Composting infrastructure, biomass boilers, environmental controls (e.g., lined wastewater ponds pre-biogas collaboration)



Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	<p>Reduced raw material costs: Use of in-house compost lowers fertilizer expenses</p> <p>Avoided landfill/disposal fees: Through valorization of OMWW and prunings</p> <p>Energy efficiency gains: Biomass heating reduces fossil fuel use</p> <p>Lower waste management costs: Circular practices minimize external treatment needs</p>
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	<p>100% diversion of OMWW from landfill via daily transfer to biogas plant</p> <p>Significant reduction in fossil fuel use through on-site pyrene combustion for heating</p> <p>Complete reuse of pruning residues and leaves through composting → reduced synthetic fertilizer use</p> <p>Enhanced soil health and fertility, contributing to long-term resource efficiency</p> <p>Zero-waste olive oil production model fully operational at regional scale</p>
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	<p>Local value chain reinforcement: All circular activities (cultivation, processing, composting, waste-to-energy) occur within the region</p> <p>Stakeholder inclusion: Collaboration with local biogas facility fosters industrial symbiosis</p> <p>Environmental protection: Reduces pollution risks (soil and water) in the local area</p> <p>Knowledge sharing: Olive oil tourism and participation in national conferences promote CE awareness</p> <p>Regional brand promotion: Enhances recognition of Makri PDO and sustainable Greek olive oil globally</p>
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	<p>Improved profitability: Through cost savings on fertilizers, heating, and waste management</p> <p>Enhanced market competitiveness: Sustainability credentials strengthen brand appeal in premium markets</p> <p>Operational resilience: Energy autonomy and closed-loop resource use reduce exposure to input price volatility</p> <p>Brand differentiation: Positioned as an innovative, environmentally responsible producer in both domestic and international markets</p>
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	<p>Medium</p> <p>Technically feasible: Composting, biomass use, and local biogas partnerships are replicable with modest infrastructure.</p> <p>Scalable practices: Modular implementation allows step-by-step adoption (e.g., start with composting, then add energy valorization).</p> <p>Barriers: Initial investment in equipment (e.g., composting setup, biomass boilers) and access to nearby biogas units may be challenging.</p> <p>Facilitators: Strong community networks, family-run decision-making, and alignment with agri-environmental subsidies can ease transition.</p> <p>Overall, adoption is realistic with targeted support in financing, training, and partnerships.</p>
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	<p>Technical</p> <p>Limited access to biogas facilities in rural areas</p> <p>Need for specialized equipment (e.g., composting infrastructure, biomass boilers)</p> <p>Lack of in-house technical know-how on waste valorization and nutrient management</p> <p>Economic</p> <p>High upfront investment for infrastructure retrofitting</p>



		<p>Limited cash flow capacity of micro-enterprises to support circular upgrades</p> <p>Absence of monetized returns for circular by-products (e.g., compost not sold externally)</p> <p>Cultural</p> <p>Conservative mindset among small producers—focus on production yield over sustainability</p> <p>Low awareness of CE benefits and long-term cost savings</p> <p>Resistance to shifting from traditional disposal practices to regenerative models</p> <p>Regulatory</p> <p>Complex permitting for waste-to-resource processes (e.g., OMWW transport, biomass use)</p> <p>Lack of simplified incentives or streamlined access to EU/Greek CE funding for small-scale olive mills</p> <p>Unclear valorization frameworks for compost and energy recovery in agri-waste regulation</p>
Key success factors	<p><i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i></p>	<p>Supportive policies: EU Green Deal, CAP eco-schemes, and national CE strategies promoting agri-waste valorization.</p> <p>Existing partnerships: Industrial symbiosis with local biogas facilities for OMWW management.</p> <p>Access to finance: Potential funding from EU programs (RRF, Horizon Europe, LIFE) and agri-environmental subsidies.</p> <p>Local ecosystem readiness: Olive-growing regions with established infrastructure and skilled labor.</p> <p>Brand and market demand: Rising preference for sustainable, traceable olive oil in premium markets.</p> <p>Vertical integration: Control over the entire value chain simplifies circular implementation.</p>
Notes		
Additional comments	<p><i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i></p>	<p>Geographic proximity to biogas plant is a critical enabler; the model's success depends on infrastructure not universally available in rural Greece.</p> <p>The company operates within a Protected Designation of Origin (PDO) zone (Makri), strengthening the environmental and branding relevance of circular practices.</p> <p>Family-owned SME structure allows for quick decision-making, value-driven choices, and integration of sustainability into company culture.</p> <p>No quantified environmental performance indicators (e.g., GHG reductions, energy savings) are publicly tracked, limiting benchmarking or scalability assessments.</p> <p>Not all outputs are monetized (e.g., compost is reused but not commercialized), reducing economic incentives for other adopters.</p> <p>Replicability may be constrained in micro-enterprises lacking vertical integration or access to processing infrastructure.</p> <p>The company emphasized that their CE adoption was not driven by regulation, but by deep ecological values and intergenerational responsibility, highlighting the importance of cultural mindset.</p> <p>Initial waste management was costly and non-circular, using lined evaporation ponds until a biogas partnership was established—showing the evolution from compliance to circularity.</p>

		Their olive oil tourism offering reinforces the circular message, serving as a community education and marketing tool.
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General information		
Business model name #5	<i>Full official or descriptive name of the circular business model</i>	Low-Input Regenerative Olive Farming Model with Bio-based Soil Enhancement and Closed-Loop Biomass Cycling
Country/region	<i>Country or regional area where the business model is applied</i>	Crete
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Company website & interview
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	n/a
Date of data collection	<i>(e.g., 1st of June 2025)</i>	03.07.2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Seven Olea applies a regenerative farming model using pruning mulch, grass clippings, composted olive mill waste, and biochar to restore soil health. No tillage, minimal mechanical use, and precision organic amendments reduce inputs and enhance biodiversity. <u>Key Circular Principles:</u> Nutrient cycling Organic waste valorisation Soil regeneration Input minimisation <u>General Objectives:</u> Enhance soil fertility naturally Produce high-quality olive oil sustainably Minimise environmental footprint Promote agroecological balance
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	Primary: Regenerative Agriculture Secondary: By-product Valorization Emerging: Biochar Utilisation and Compost-Based Soil Enhancement
Geographical Scope	<i>Does the model operates at a local, regional, national, or international scale?</i>	Operations are based in Arkalohori, Crete, with collaboration across regional academic and agricultural networks.
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational Practices are fully implemented on the farm and supported through active participation in regional pilot projects
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Soil degradation and loss of biodiversity Agro-waste management (prunings, OMWW sludge) Dependency on chemical inputs Carbon footprint reduction Differentiation in olive oil quality and sustainability



Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Innovation: Integrates biochar and composting of OMWW sludge into field management Environmental benefits: Enhances soil microbiome, reduces tillage and emissions Customer-centric circularity: Delivers premium olive oil linked to sustainable, transparent farming practices
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive pruning residues → shredded and mulched Grass clippings → decomposed in-field Olive mill wastewater sludge → co-composted Biochar from thick olive wood → used as soil enhancer
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	On-site mulching of pruning residues Grass biomass decomposition in place Co-composting of OMWW sludge and olive leaves Application of compost and biochar back to olive groves
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	SME: Seven Olea (family-run producer) R&D Institutes: University of the Aegean, Hellenic Mediterranean University Agricultural Cooperative: Petra Cooperative Professional Association: Union of Environmental Science Graduates of Greece
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	On-farm mulching and biomass management systems Manual and low-emission harvesting tools Pilot composting system for OMWW sludge and leaves Biochar production and application as soil improver
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of premium extra virgin olive oil Brand differentiation through sustainability and quality
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Manual labor for low-impact field operations Circular process costs (mulching, composting, biochar application) Participation in R&D pilot projects Limited machinery use and maintenance
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced input costs by avoiding synthetic fertilizers Lower fuel and machinery costs through minimal mechanization Avoided waste disposal costs via on-site biomass reuse Long-term productivity gains through soil regeneration
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	100% reuse of pruning and grass biomass on-site Diversion of OMWW sludge from disposal via composting Improved soil structure and fertility Reduced reliance on chemical inputs Lower carbon footprint through electric tools and no tillage
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Stakeholder inclusion through academic and cooperative partnerships Knowledge transfer via participation in pilot projects (e.g., Elaionas) Local value chain reinforcement with field-based composting and resource use Promotion of sustainable agricultural models in rural Crete



Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Improved product quality (flavor, nutritional value) Enhanced market competitiveness via sustainability differentiation Cost efficiency through reduced inputs and minimal interventions Stronger brand identity tied to agroecological and circular practices
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium Low-tech, low-cost practices (e.g., mulching, composting) are accessible Manual labor-friendly for small farms Requires mindset shift and commitment to low-input farming Limited short-term economic incentives unless supported by branding or local markets Replicable with minimal machinery and strong ecological ethos
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Technical Lack of infrastructure for composting or biochar production Limited access to OMWW sludge from mills with proper separation systems Economic No direct monetization of circular outputs (e.g., compost, biochar) Initial labor and time investment without immediate financial return Cultural Requires deep ecological awareness and long-term mindset Resistance from farmers prioritizing yield over ecosystem health Regulatory No clear incentives or streamlined procedures for small-scale CE farming Weak enforcement of sustainable practices in olive mill operations
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Existing partnerships with universities and cooperatives (e.g., “Elaionas” project) Local ecosystem readiness for sustainable olive cultivation in Crete Access to knowledge and pilot research through R&D collaboration Strong producer values driving adoption of CE practices Consumer demand for high-quality, sustainable olive oil
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model’s circular performance</i>	Operates in Crete, a region with strong olive-growing heritage and ecological pressure (e.g., drought, soil erosion). Participates in university-led pilot projects, enhancing legitimacy and experimentation capacity. Driven by a producer philosophy prioritizing soil health and minimal intervention over yield maximization. No quantified data on environmental performance (e.g., GHG savings, soil improvement rates). Scaling potential depends on mindset and cultural adoption, not just technical feasibility. Economic gains are indirect, relying on quality-based differentiation rather than circular product monetization. The farmer emphasizes that “the trees want peace” — reflecting a deep-rooted agroecological ethos. Manual, low-impact operations are a conscious choice tied to respect for nature, not just economics.



	Circularity is not framed as innovation, but as return to traditional, respectful land stewardship, aligned with modern ecological science.
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Italy

General information		
Business model name #1	Full official or descriptive name of the circular business model	Agroenergy
Country/region	Country or regional area where the business model is applied	Apulia region, Italy
Sector	e.g., olive sector, agrifood sector, or another related industry	Olive oil sector
Source type	Source of information (e.g., scientific paper, EU project report, company website, interview, market report)	Case study, company website
Reference	Links, references, or document identifiers for proper sourcing and validation	"Toward the circular economy into the olive oil supply chain: A case study analysis of a vertically integrated firm" (Stempfle et al., 2022), DOI: 10.3389/fsufs.2022.1005604; https://bts-biogas.com/energia-dagli-scarti-della-filiera-dellolio-bts-biogas-richiede-il-brevetto-per-un-sistema-che-produce-biogas-usando-solo-sansa/
Date of data collection	(e.g., 1 st of June 2025)	26 th of May 2025
Business model overview		
Brief Description	Summary of how the business model operates, key circular principles involved, and its general objectives	The business model uses wet olive pomace (a by-product of olive oil extraction process) as a resource in order to obtain biogas and digestate through an anaerobic digestion process. The collaboration between two Italian realities (Agresti, local olive oil producer, and BTS Biogas, a company specialized in biogas plants) enabled the construction of an innovative plant (Agroenergy), specifically designed to be fuelled by olive pomace only. Olive pomace must undergo a specific pretreatment, developed by BTS Biogas, in order to be used as biomass by the plant. Key circular principles involved: waste reduction/valorization, energy recovery, renewable energy production (decarbonization effort). General objective: increasing the sustainability of olive oil production by turning a by-product into a resource (bioenergy and value-added products).
Business Model Type	Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)	Waste/by-product valorization, knowledge-sharing
Geographical Scope	Does the model operate at a local, regional, national, or international scale?	Local level (Andria, Apulia)
Maturity Level	(pilot, in early adoption, operational, or scaled)	Operational (at local level)
Value Proposition		
Customer Needs Addressed	What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)	Waste minimization (by-products turned into resources); circular product offering (bioenergy and digestate from olive oil production by-products); cost savings (reduced costs for waste treatment, since waste is turned into a resource)
Unique Selling Proposition (USP)	How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)	Innovation: one of the first plants in Europe to be 100% fuelled by olive pomace. Environmental benefits: reduced ecological burden, since waste is diverted from being discharged into the environment towards the production of value-added products. Customer-centric circularity: taking care of the needs of the customer by designing tailored solutions in line with sustainability and circular economy principles



Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive oil production by-products (olive pomace)
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Waste/by-products valorization
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Small and medium enterprises, R&D institutes, local farmers, Italian national energy system operator (GSE)
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Anaerobic digestion facility which uses an innovative technology for biomass pretreatment (here: olive oil production by-products) in order to obtain energy and value-added products in a sustainable and circular way
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of circular products (energy from biogas and digestate): major energy-related stream based on recurring payments (feed-in tariff for ongoing supply); minor digestate-related stream based on business to consumer transaction (one-time payments for service/product)
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	High costs for biogas plant and related facilities (4.5 million euros for the realization of the facility itself); lower operating costs (staff costs and transporting costs)
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced disposal costs (olive pomace: from waste to resource), reduced energy and fertilizer costs (energy and fertilizer in the form of digestate are obtained from the biodigester)
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	By using olive pomace only as biomass, the plant produces gross daily electricity of about 12.2 MWh and gross daily thermal energy of about 12.5 MWh (biogas plant of 500 kWel)
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Job creation (new jobs and opportunities are generated by the management of the biodigester facility), local value chain reinforcement thanks to the inclusion of a variety of local actors in the circular business model (local farmers and companies)
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Diversification of revenues streams (selling electrical energy obtained from biogas production and digestate), improved competitiveness in the market
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium: low difficulties in terms of biodigester management, since the focus is mainly on digestate management (also due to knowledge-sharing with the plant manufacturer BTS Biogas); high costs in terms of plant construction, maintenance, logistic and biomass pretreatment. This type of CBM can be possible only if the plant is really huge (as in this case). It is not feasible for micro enterprises to build a biogas plant in microscale. In this sense, biogas plants can be built only if there are some types of centralization and coordination between farmers, which can send their by-products to a central biogas plant to valorize them



Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Technical challenges: possibility, capability and willingness to adopt new technologies and eco-innovations; economic challenges: huge investment costs, especially for the realization of the facility (incentives are essential); regulatory challenges: the regulatory framework must encourage and not limit innovations towards circular economy models; socio-cultural challenges: social actors and public opinion must have a positive attitude towards eco-innovation, sustainability and circular economy models
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Firm's dynamic capabilities: openness to innovation and new technologies and willingness to establish partnership with a variety of local and national actors; access to finance and capital: huge economic investment for biogas plant realization; supportive policies: opportunities offered by economic incentives; local ecosystem readiness: huge amount of raw material (olive pomace) available on-site; socio-cultural factors: growing demand for renewable energy and increasing favourable public opinion on circular and sustainable practices
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	<p>The main elements enabling the implementation of Agroenergy CBM are represented by successful technological innovation, capability of benefitting from economic incentives and, most of all, absence of coordination challenges. The activities aimed at closing olive pomace material flow are accomplished mainly within a single corporation, without remarkable aspects of cooperation between different actors. The success of the analyzed CBM is mainly due to the absence of substantial coordination, one of the main barriers to circular transition. Moreover, the business model analyzed could only be replicated by a single organization with similar size and features, due to the huge financial and biomass capacity required, representing a problem for smaller businesses (which are the majority in the Apulia region). Thus, olive oil by-products management should be reframed within collective schemes, such as centralized biogas plants designed for specific areas, to which farmers can deliver olive pomace and from which they can collect digestate.</p> <p>There is a lack of data concerning the quantification of the "circular performance" of the model: the adoption of specific indicators to monitor circularity and sustainability of the model are essential. To date, the real eco-efficacy of the CBM remains undetermined</p>

General information		
Business model name #2	<i>Full official or descriptive name of the circular business model</i>	Bioenutra
Country/region	<i>Country or regional area where the business model is applied</i>	Apulia region, Italy
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Chemistry and biotechnology sector, olive oil sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Company website, conferences, newspaper articles
Reference	<i>Links, references, or document identifiers for proper sourcing</i>	https://www.bioenutra.it;



	<i>and validation</i>	https://www.youtube.com/watch?v=KBZA6Y6KYiA ; https://startupitalia.eu/impact/leconomia-circolare-dellolio-doliva-la-storia-di-bioentra
Date of data collection	<i>(e.g., 1st of June 2025)</i>	30 th of May 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	<p>The business model uses olive mill wastewater (OMW, the liquid effluent generated during the production of olive oil) as a resource in order to obtain valuable compounds (polyphenols) through an innovative and eco-friendly extraction process. The mixture of polyphenols is commercialized as <i>MOMAST</i>[®], which can be used for the realization of nutraceutical, cosmetic and pharmaceutical products. From the OMW treatment process other two products are obtained: a solid fraction, which can be used as compost or to produce biogas for electricity generation, and pure water, used for irrigation (from the information available it is not clear whether these by-products are sold and to whom). The business operates within the chemistry and biotechnology fields and it collects OMW from local olive mills producing organic olive oil.</p> <p>Key circular principles involved: waste reduction/valorization, green chemistry, industrial symbiosis.</p> <p>General objective: increasing the sustainability of olive oil production by turning a by-product into a resource (valuable polyphenolic compounds).</p>
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	Waste/by-product valorization, industrial symbiosis
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Local level (Ginosa, Apulia)
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational (at local level)
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Waste minimization/valorization (by-products turned into resources); circular product offering (polyphenols from olive oil production by-products); creation of a new innovative business (production of bioactive molecules from olive oil production by-products, which are then sold to cosmetic, pharmaceutical and food industries); cost savings related to special and hazardous waste disposal (the firm does not use chemical substances and solvents for the extraction process); cost savings for local olive oil producers (reduced costs for waste treatment, since waste is turned into a resource by the firm: Bioentra pays olive oil producers to “buy their waste”, considered a raw material by the firm)
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	<p>Innovation: extraction of polyphenolic compounds from olive oil production by-products using mechanical and physical processes only.</p> <p>Environmental benefits: reduced ecological burden (waste is diverted from being</p>



		discharged into the environment towards the production of valuable compounds; the extraction of polyphenolic compounds is carried out without using chemical processes and solvents).
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive oil production by-products (olive mill wastewater)
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Waste/by-products valorization
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Small and medium enterprises, R&D institutes, local farmers, universities
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Industrial plant which uses an innovative and eco-friendly process for the extraction of valuable compounds from olive oil production by-products
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of circular products (polyphenolic extract): precious bioactive ingredient sold to a variety of different industries, since it can be employed for the production of different products
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	High costs for the industrial plant, costs related to bureaucracy (regulations related to the introduction of a new product in the market)
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced costs for raw material procurement (the raw material is a by-product), reduced costs for special and hazardous waste disposal (no chemical agents or solvents are used in the extraction process of polyphenols), reduced disposal costs for local olive oil producers (the firm pays them to obtain their by-products)
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Not available
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Job creation (new jobs and opportunities are generated by the industrial plant); stakeholder inclusion, especially concerning the partnership with universities (<i>Università degli Studi di Bari Aldo Moro and Università degli Studi di Chieti Gabriele d'Annunzio</i>), focused mainly on the characterization and analysis of the biological effects of the polyphenolic extract; local value chain reinforcement thanks to the inclusion of different local actors in the circular business model (local farmers,



		companies, universities)
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Improved profitability thanks to the possibility to sell a single product to different groups of buyers; improved competitiveness in the market (the polyphenolic extract is a versatile valuable ingredient that can be used for producing different products and it is obtained in a sustainable way)
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium: low costs in terms of raw material purchase and management; high costs in terms of plant construction, maintenance and process employed (the technology used by Bioentra to extract polyphenols from olive mill wastewater is patented); the key factors enabling the adoption of this CBM are coordination and collaboration between enterprises, since for microenterprises the adoption and use of an industrial plant for phenolic compound extraction is not feasible
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Technical challenges: possibility and capability to employ new technologies and implement eco-innovations; economic challenges: investment costs for the realization of the facility and process costs (the process is patented); regulatory challenges: the regulatory framework must encourage and not limit innovations aimed at reducing environmental impacts; socio-cultural challenges: public opinion and social actors must have a positive attitude towards more sustainable and circular economy models
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Firm's innovation capabilities and know-how: openness to eco-innovations and ability to develop new sustainable technologies; access to finance and capital: high economic investment for the realization of the industrial plant and the development of a sustainable extraction process; partnership: the collaboration between different producers and companies enabled the development of an "industrial ecosystem" (industrial symbiosis); local ecosystem readiness: huge amount of raw material (olive mill wastewater) available on-site (Apulia is the leading producer region of olive oil in Italy); socio-cultural factors: growing demand for products (as nutraceuticals or cosmetics) containing natural and organic ingredients (here: polyphenols) with beneficial health effects and positive public opinion on sustainable and circular approaches (e.g. use of environmentally sound production technologies and waste valorization practices)
Notes		



Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	<p>It is important to highlight that Bioenutra is planning to develop new extraction technologies aimed at recovering valuable compounds from by-products of other industries (wine, fruit and vegetable industries). This represents an interesting aspect both for the valorization of a broader spectrum of waste (with the resulting reduction of negative impacts on the environment) and for the possibility to create new partnerships with other actors. In this sense, the CBM analysed has an important scalability potential and offers the possibility to develop a broader and closely interrelated industrial ecosystem.</p> <p>One of the main limitations of the CBM analysed is the patent on the extraction process. In fact, the patent could become an obstacle for the implementation of the CBM in other areas or by other industrial realities, especially if they have limited financial and economic possibilities.</p> <p>There is a lack of data concerning the quantification of the “circular performance” of the model: the adoption of specific indicators to monitor the circularity and sustainability of the model are essential. To date, the real and quantified eco-efficacy of the CBM remains undetermined.</p>
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General information		
Business model name #3	<i>Full official or descriptive name of the circular business model</i>	OLI.VA.RE.
Country/region	<i>Country or regional area where the business model is applied</i>	Veneto region, Italy
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Agri-food sector (olive oil sector mainly), cosmetic and pharmaceutical sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Region website, project website, newspaper articles
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://www.innoveneto.org/2024/10/olivare-moldoi ; https://innosap.it/project/olivare ; https://confagricolturaveneto.it/prodotti-salutistici-dagli-scarti-dellolio-doliva
Date of data collection	<i>(e.g., 1st of June 2025)</i>	6 th of June 2025
Business model overview		



Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	<p>The project aims to establish a regional circular business model based on industrial symbiosis. The focus is on closing all the material loops within the olive oil sector through the participation of a variety of actors from different sectors (agri-food, cosmetics). In this sense, every by-product originating from olive oil production (olive pomace, pits, olive mill wastewater and olive tree pruning residues such as branches and leaves) is turned into value-added products (animal feed and food supplement, human food supplement, cosmetic products), following the path of a zero-waste economy.</p> <p>Key circular principles involved: zero-waste economy, by-products valorization, industrial symbiosis.</p> <p>General objective: increasing the sustainability of olive oil production by turning all the by-products into resources (feed and food supplements, cosmetic products).</p>
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-products valorization, industrial symbiosis
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Regional level (Veneto, Italy)
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Pilot
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Zero-waste approach and by-products valorization (by-products turned into resources); circular product offering (feed, food supplements, cosmetic products)
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	<p>Innovation: development of value-added products from olive oil production by-products using environmentally sustainable and innovative technologies.</p> <p>Environmental benefits: reduced environmental impact (almost all the waste from olive oil production is diverted from being discharged into the environment towards the production of value-added products: zero-waste approach).</p>
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive oil production by-products (olive pomace, pits, olive mill wastewater and olive tree pruning residues)
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Waste/by-products valorization
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Small and medium enterprises, R&D institutes, local farmers, universities, regional bodies



Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Clean production technologies developed thanks to the partnership between local enterprises and universities; these technologies allow the extraction of valuable compounds and the production of value-added products from olive oil production by-products with reduced environmental impact
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of circular products (animal feed and food supplement, human food supplement, cosmetics) obtained from the valorization of every by-product coming from olive oil production (sales are only hypothetical since the model is in its pilot level)
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	The project was funded by Veneto region through European funds for innovation (European Regional Development Fund - ERDF). The funds amounted to €251,000 and allowed to reach the fixed goals for the valorization of olive oil production by-products. Probably, when scaling up the circular business model the main costs encountered would be linked to investment in new equipment and in innovative and green processing technologies on one hand, and to coordination between different actors supporting the model (especially in terms of logistics) on the other hand. The costs would also involve regulations related to the introduction of new products into the market, especially if related to human consumption
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced costs for raw materials procurement, since (secondary) raw materials are by-products; reduced disposal costs for local olive oil producers (the olive oil production waste is used as a resource)
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Quantity of by-products processed: one million kilograms (potentially, one million kilograms of waste could be diverted from landfill)
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Stakeholder inclusion: several different entities took part in the project, among which small and medium enterprises, local farmers and universities (Università degli Studi di Padova and <i>Università degli Studi di Verona</i>); local value chain reinforcement: inclusion of different local and regional actors in the circular business model/industrial ecosystem model (local farmers, companies, universities)
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Diversification of revenue streams for local firms (usually small family-run businesses) operating in the olive oil production sector. Improved competitiveness in the market: new innovative products can be produced from olive oil production by-products, rich in bioactive beneficial compounds; these products respond to a market demand which is increasingly sensitive to environmental and sustainability issues
Transferability potential		



Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium: low costs in terms of raw material purchase (raw materials are by-products); high costs in terms of investment in new equipment and innovative processing technologies and in terms of coordination between different actors involved (e.g. logistic issues). Since it is a pilot project funded by institutions, the business model did not encounter many difficulties in terms of economic and coordination issues. The coordination between the different actors engaged in the model was performed by a regional body (Innovation for Sustainability in Agrifood Production - INNOSAP); at this stage, the key factors needed for a successful adoption of this model by micro and small enterprises cannot be specifically identified, since it is still a pilot project and a scale-up is needed. However, one fundamental element is certainly close collaboration between different regional organizations and companies
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Technical challenges: possibility and capability to employ new technologies and implement eco-innovations and ability to build a network between different actors for a strong cooperation; economic challenges: investment costs for the purchase of new equipment and innovative processing technologies; regulatory challenges: the regulatory framework must encourage the development of green innovations and of new products resulting from them; socio-cultural challenges: public opinion and social actors must be open to innovative circular business models and to cooperation between different actors
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Access to finance and capital: high economic investment for the implementation of the project (funded by institutions); partnership: the cooperation between different producers and companies allowed the development of an “industrial ecosystem” (industrial symbiosis); local ecosystem readiness: raw material (olive oil production by-products) available on-site; socio-cultural factors: growing market demand for products containing natural and organic ingredients with beneficial effects and positive public opinion on sustainable and circular strategies
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	It should be noted that the circular business model described is a pilot research project. Because of this, it did not encounter many obstacles in terms of funds (since it was funded by the region through EU funds) and coordination between different actors. It is thus important to move from a pilot to an operational circular business model for the analysis of the issues that can be encountered during the scaling up and also for studying the actual transferability potential of the model. It is essential to consider specific indicators to assess the real sustainability and circularity of the model and to quantify its environmental performance. If the model



		described becomes operational, the adoption of these indicators should be of primary importance.
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Portugal

General information		
Business model name #1	<i>Full official or descriptive name of the circular business model</i>	Herdade do Esporão – Circular Bioeconomy in Olive Oil Production
Country/region	<i>Country or regional area where the business model is applied</i>	Portugal – Alentejo region
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector (production & processing)
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Company website, industry reports, news articles, EU project repositories
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	<p>Company website:</p> <p>Esporão. (n.d.). Herdade do Esporão – Official Website. Retrieved June 2025, from https://www.esporao.com</p> <p>Sustainability reports:</p> <p>Esporão. (2023). Relatório de Sustentabilidade 2023. Herdade do Esporão. https://esporao.com/media/pages/press-center/relatorio-de-sustentabilidade/b514ed7ed3-1739357021/relatorio-sustentabilidade_23.pdf</p> <p>Esporão. (2022). Relatório de Sustentabilidade 2022. Herdade do Esporão. https://esporao.com/pt/centro-de-imprensa/relatorio-de-sustentabilidade</p> <p>Academic papers:</p> <p>Abreu, R., Oliveira, E., & Tomé, F. (2025). Agriculture Sustainability: Strategies of the Olive Oil in Portugal. In Sustainability in Global Companies (pp. 111–133). Springer. https://doi.org/10.1007/978-3-031-77971-8_6</p>
Date of data collection	<i>(e.g., 1st of June 2025)</i>	16th June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Esporão integrates circular economy by reusing olive pomace for composting and energy, rainwater harvesting, renewable energy, and organic production. The business model promotes by-product valorisation and resource efficiency in a vertically integrated estate.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorisation; Bio-based industrial symbiosis; Renewable energy use



Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Regional with national and international market presence	
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational and scaled	
Value Proposition			
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Demand for high-quality, sustainably produced olive oil; Desire for transparency on product origin and environmental impact; Consumer interest in products that minimise waste and support regenerative agriculture.	
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Combines premium olive oil production with strong environmental credentials: reduction of agri-food waste, organic and regenerative farming, biodiversity preservation, and full transparency on circular practices — delivering a product that aligns with consumer values on sustainability and quality.	
Value Creation & Delivery			
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive by-products (pomace, pits) valorised as compost and biomass; renewable energy (solar); recycled and recyclable packaging materials; natural ecosystem services (cover crops, biodiversity corridors).	
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Waste valorisation (composting of olive by-products); energy recovery; regenerative farming practices; biodiversity enhancement; eco-efficient processing and packaging.	
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Local farmers and suppliers; R&D institutes (e.g., ISA, Évora); sustainability certifiers; packaging suppliers; technology partners (renewables, precision farming); public authorities supporting circular agriculture.	
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Organic composting facilities; solar energy systems; digital traceability tools; precision agriculture (soil sensors, drone monitoring); eco-design packaging.	
Value Capture			
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of premium organic and sustainable olive oils; secondary revenues from valorised by-products (compost, biomass); increased brand value through sustainability positioning.	
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Circular process costs (composting, regenerative practices); investment in renewable energy and precision agriculture; eco-packaging; logistics for premium product distribution.	
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced use of synthetic fertilisers (via compost); energy efficiency gains (solar energy, biomass); avoided waste management costs (through by-product valorisation).	
Impact Assessment			
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Indicator	Value / Change
		Scope 1 GHG Emissions	310,253 kg CO ₂ e (2022)

		<table border="1"> <tr> <td>Scope 2 GHG Emissions</td> <td>276,380 kg CO₂e (2022)</td> </tr> <tr> <td>Total GHG Emissions (Scopes 1 + 2)</td> <td>586,633 kg CO₂e (2022) — a ~25% reduction from 2021 (778,047 kg)</td> </tr> <tr> <td>Renewable energy share (agricultural area)</td> <td>20.9% of electricity demand met by renewables in 2022</td> </tr> <tr> <td>Water use (lagar – L/L azeite)</td> <td>24.1 L water per L olive oil (2022)</td> </tr> <tr> <td>Water use (vineyards – L per kg crop)</td> <td>348 L/kg (overall average) in 2022; Quinta dos Murças: 203 L/kg</td> </tr> <tr> <td>By-product composting & biomass valorisation</td> <td>Use of olive pomace, leaves, and pruned wood in composting</td> </tr> </table>	Scope 2 GHG Emissions	276,380 kg CO ₂ e (2022)	Total GHG Emissions (Scopes 1 + 2)	586,633 kg CO ₂ e (2022) — a ~25% reduction from 2021 (778,047 kg)	Renewable energy share (agricultural area)	20.9% of electricity demand met by renewables in 2022	Water use (lagar – L/L azeite)	24.1 L water per L olive oil (2022)	Water use (vineyards – L per kg crop)	348 L/kg (overall average) in 2022; Quinta dos Murças: 203 L/kg	By-product composting & biomass valorisation	Use of olive pomace, leaves, and pruned wood in composting
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Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Job creation in sustainable agriculture and processing; strengthened local value chains; partnerships with research institutions and small local producers; promotion of biodiversity and sustainable land management benefiting the wider community.												
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		Market competitiveness	Strong differentiation in ESG-driven markets through sustainability leadership and certifications (organic, regenerative farming).
		Profitability	Improved margins via reduced inputs (fertilisers, energy), circular valorisation of by-products, and premium market positioning.
Transferability potential			
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium — The model's core principles (organic farming, waste valorisation, renewable energy use) are replicable for MSEs, especially with cooperative networks or technical support. Full adoption of advanced practices (biodiversity corridors, traceability) requires higher investment and expertise.	
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Technical complexity (precision agriculture, regenerative systems); investment needs for renewables and eco-packaging; regulatory hurdles in organic certification; limited technical capacity among small producers.	
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Supportive EU and national policies on organic and regenerative farming; partnerships with R&D institutes; local ecosystem readiness (Alentejo region); market demand for premium sustainable olive oils; availability of co-financing for small producers (e.g., PEPAC, EAFRD).	
Notes			
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	

General information		
Business model name #2	<i>Full official or descriptive name of the circular business model</i>	Casa Alta – Circular Heritage Olive Oil Estate
Country/region	<i>Country or regional area where the business model is applied</i>	Portugal – Região do Douro (Trás-os-Montes)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector (heritage olive groves and traditional olive oil production)



Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Website, tourism platforms, regional development reports
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	Company website: Casa Alta. (n.d.). Casa Alta – Azeite e práticas regenerativas. Retrieved June 2025, from https://www.casaalta.pt
Date of data collection	<i>(e.g., 1st of June 2025)</i>	16th June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Casa Alta produces organic olive oil using regenerative agriculture and circular principles, including by-product valorisation (composting), biodiversity promotion, and eco-tourism. The model integrates farming, processing, and direct consumer engagement, with objectives of environmental regeneration, community involvement, and sustainable product offerings.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorisation; regenerative agriculture; eco-tourism and agri-education.
Geographical Scope	<i>Does the model operates at a local, regional, national, or international scale?</i>	Mainly local and regional, with some reach into the national market through direct sales and eco-tourism channels, and with international visitors.
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operacional - práticas regenerativas e circulares bem estabelecidas, produção de azeite em funcionamento e actividades de ecoturismo.
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Access to high-quality organic olive oil produced with regenerative and circular practices; demand for transparent, environmentally friendly products; interest in supporting local sustainable agriculture and eco-tourism experiences.
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Premium organic olive oil from a regenerative, biodiversity-focused farm; full integration of circular principles (by-product valorisation, eco-packaging); direct connection between producer and consumer through transparency and educational experiences.
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive by-products (pomace, leaves) valorised as compost; renewable energy from solar panels; recycled and recyclable packaging materials; ecosystem services (cover crops, biodiversity corridors).
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Composting of olive by-products; regenerative organic farming; biodiversity conservation; on-site eco-packaging; eco-tourism and agri-education promoting circular principles.



Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Local farmers and artisans; BioRegião Idanha-a-Nova network; municipality; sustainability organisations; eco-packaging suppliers; eco-tourism platforms.
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Simple composting infrastructures; solar energy systems; eco-packaging equipment; natural filtration solutions, basic digital tools for traceability and customer involvement.
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of premium organic olive oil; revenue from eco-tourism activities (farm tours, tastings, educational workshops); value from compost use (replacing external fertilisers); enhanced brand value in ESG-driven markets.
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Costs of circular processes (composting, regenerative agricultural practices); renewable energy systems; eco-packaging; labour for ecotourism and educational activities; investment in biodiversity-enhancing practices, costs of bio-certifications, sustainable tourism, heritage maintenance
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced fertiliser and pesticide costs through composting and regenerative soil health; waste management fees avoided through the valorisation of by-products; energy savings from on-site solar energy; marketing savings through strong brand reputation and direct-to-consumer sales.
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Reduction of chemical inputs (fertilisers and pesticides) through compost use; valorisation of 100% of olive by-products; renewable energy use reduces carbon footprint; improved soil health and biodiversity; contribution to landscape regeneration.
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Job creation in regenerative farming and eco-tourism; stakeholder inclusion through partnerships with local artisans and community networks; reinforcement of local value chains; educational benefits through workshops and farm visits.
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Diversification of revenue streams (olive oil sales, eco-tourism, education); improved profitability through reduced input costs and premium product positioning; enhanced market competitiveness in ESG-driven and organic markets.
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	High — The model is designed for small-scale farms and is highly adaptable by MSEs with limited investment. Core practices (composting, regenerative farming, eco-tourism) are low-tech and community-based.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Limited technical expertise in regenerative agriculture; access to funding for renewable energy and eco-packaging; variability in local regulations on compost use and eco-tourism; dependence on strong community engagement.



Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Supportive policies for organic/regenerative farming (EU CAP, PEPAC); active participation in local networks (BioRegião); partnerships with municipality and community; strong market demand for sustainable and local products; access to EU and regional funds for small producers.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	The model benefits from strong alignment with the BioRegião Idanha-a-Nova, fostering knowledge sharing and community engagement. Casa Alta's scale enables experimentation with regenerative techniques and eco-tourism integration. However, the absence of formal, quantified KPIs (e.g., GHG reduction, water use, % waste diverted) currently limits the ability to benchmark and communicate circular performance externally. This is a typical challenge for small-scale farms that operate informally but effectively within local networks. The model's flexibility and low-tech approach make it highly replicable for other small producers in similar contexts.

General information		
Business model name #3	<i>Full official or descriptive name of the circular business model</i>	Alentejo Circular – Circular Economy Promotion in Alentejo Agrifood Sectors
Country/region	<i>Country or regional area where the business model is applied</i>	Portugal — Alentejo Region
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive oil, wine, pig farming (agrifood sectors) — cross-sectoral focus on regional circular economy
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Project website, deliverables and publications
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	Project website https://alentejocircular.uevora.pt/ On the project website we can access all the documents and publications via the tab: DOCUMENTOS E PUBLICAÇÕES
Date of data collection	<i>(e.g., 1st of June 2025)</i>	16 th of June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	“Alentejo Circular” was a funded project (2016–2018) aimed at raising awareness and mobilising economic agents from key agrifood sectors (olive oil, wine, suiniculture) in the Alentejo region towards circular economy principles. The project conducted sector diagnostics, mapped good practices, identified barriers and opportunities, and promoted



		knowledge transfer. It also contributed to the creation of networks for future circular initiatives and fostered collaboration among regional actors.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	Awareness-raising and capacity-building project; regional public-private partnership; platform for collaborative circular economy initiatives
Geographical Scope	<i>Does the model operates at a local, regional, national, or international scale?</i>	Regional (Alentejo), with dissemination at national level
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Pilot / completed awareness project (2016–2018) — basis for potential future initiatives
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Lack of knowledge on circular economy principles among regional agrifood actors; need for practical tools and awareness; need for network creation
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Pioneering initiative at regional level; cross-sectoral engagement; creation of a platform for circular knowledge exchange
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	N/A (project did not generate material flows but promoted circular resource thinking)
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Sector diagnostics; good practices mapping; stakeholder workshops and forums; online information platform
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	ISQ; Universidade de Évora; NERBE; NERPE; local business networks; municipalities; regional companies
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Online platform; stakeholder workshops; information material
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Public funding (Alentejo2020 programme); no direct commercial revenues
Cost Structure	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Project implementation (personnel, workshops, dissemination events, digital platform)
Circular Cost Savings	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Indirect — future savings for companies adopting circular practices based on project results



Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Indirect — enhanced awareness and potential reduction of waste/resource use through future adoption of circular models
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Strengthened regional networks; increased capacity and knowledge among agrifood businesses; collaborative mindset
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Indirect — potential future impact through new circular business opportunities
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	High — suitable for small and medium enterprises once appropriate networks and knowledge are in place
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Lack of detailed quantitative data; project was awareness phase only; no direct business model implemented
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Strong public-private cooperation; focus on regional identity and needs; alignment with EU and national circular economy policy trends
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	Alentejo Circular was one of the first systematic efforts to promote circular economy thinking in key agrifood sectors in the Alentejo. While it did not generate operational circular business models, it played an important role in stakeholder mobilisation and capacity building. Future projects can build on its foundations.

General information		
Business model name #4	<i>Full official or descriptive name of the circular business model</i>	Acushla – Circularity in Small-Scale Olive Mill
Country/region	<i>Country or regional area where the business model is applied</i>	Portugal – Beira Baixa
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector - small processing unit with a focus on sustainability



Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Website (local institutional), BioRegion platform, local press articles
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	Company website: Acushla. (n.d.). Quinta Acushla (Quinta do Prado). Retrieved June 2025, from https://www.acushla.pt Other website: Fábrica do Azeite. (n.d.). Fábrica do Azeite – Official website. Retrieved June 2025, from https://www.fabricadoazeite.pt/
Date of data collection	<i>(e.g., 1st of June 2025)</i>	16th June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Acushla is a small producer and olive mill that opts for artisanal production that implements circular practices, converting olive by-products into compost and thermal energy, integrating organic farming and partnerships with local producers and municipalities. They also sell some garments that have been dyed with Acushla olive pomace.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorisation; Agroecology; Local composting and thermal energy
Geographical Scope	<i>Does the model operates at a local, regional, national, or international scale?</i>	Local (municipality and nearby parishes)
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Pilot / early adoption, approaching operational maturity — demonstrating strong innovation and scaling intent, but still growing its presence and infrastructure.
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Minimisation of waste; access to low-carbon, sustainably sourced olive oil; trusted product origin and certifications; contribution to environmental goals through purchase; cost-effective and eco-friendly packaging.
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Differentiates through strong circular integration across the entire value chain: innovation in waste valorisation, clear environmental benefits (GHG reduction, resource efficiency), and customer-centric circularity via transparent communication and sustainable packaging.
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Pomace, olive pits, solar panels, pruning
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	They use the pomace from their mill, the smashed branches from pruning and sheeps detritus to do compostage of high value, they use the pits separated from the pomace to use as bioenergy
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	University, R&D Institutes



Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Compost facility , seeds facility , clean production mill
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Possible compost sales sales, pits sales, sale of acushla olive oil
Cost Structure	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Circular process activities, special equipment for compost and seeds separation, logistics and processing
Circular Cost Savings	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Energy efficiency, reduced raw materials or fertilizing costs
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Zero waste of all leftovers from the mill and from the farm, use of natural products on the farm without any consequence to the earth wellbeing.
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Job creation, dissemination of bioenergy with olive stones
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Turnover growth and improved profitability
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	High — The model is designed for small-scale olive mills and is easily adaptable by MSEs, requiring low to moderate investment. Technologies involved (composting, biomass boilers) are accessible, with simple operational requirements. Strong feasibility in rural areas with local networks and community support.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Technical → Limited technical expertise in some small mills; Economic → Need for initial investment (even if moderate), limited access to funding; Cultural → Resistance to change from traditional practices; Regulatory → Local variations in rules for compost and biomass use; occasional bureaucratic hurdles.
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Strong community base and partnerships (farmers, municipality, BioRegion network); supportive local policies for circular economy; accessible, low-tech solutions; existing agroecological knowledge in the region; municipal and community demand for circular practices.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	



General information		
Business model name #5	Full official or descriptive name of the circular business model	Quinta de S. Braz Circular and Regenerative Olive Oil Production
Country/region	Country or regional area where the business model is applied	Portugal — Trás-os-Montes e Alto Douro Region (Lamas de Orelhão, Mirandela) DOP Azeite Trás-os-Montes
Sector	e.g., olive sector, agrifood sector, or another related industry	Olive oil production; regenerative agriculture; circular resource management and valorisation of by-products
Source type	Source of information (e.g., scientific paper, EU project report, company website, interview, market report)	Interview (internal — semi-structured interview with management)
Reference	Links, references, or document identifiers for proper sourcing and validation	Company website: Braz. (n.d.). Quinta de S. Braz – Official Website. Retrieved June 2025, from https://quintasaobraz.pt/quinta-de-sao-braz/ and https://azeitequintasbraz.com/page4.html Grelha da entrevista — Quinta de S. Braz (2025). Internal interview report.
Date of data collection	(e.g., 1 st of June 2025)	12 th June 2025
Business model overview		
Brief Description	Summary of how the business model operates, key circular principles involved, and its general objectives	Quinta de S. Braz applies circular economy principles at both the olive grove and the mill (lagar), integrating organic-certified regenerative agriculture with efficient resource management. The farm valorises by-products, uses renewable energy, applies circular water management (full reuse), and promotes biodiversity through natural habitat preservation. Focused on artisanal, premium DOP/BIO olive oil, the model relies on small-batch production, strong customer engagement and exports, with circular education provided to consumers.
Business Model Type	Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)	By-product valorisation; regenerative agriculture; resource efficiency; sustainable premium product positioning
Geographical Scope	Does the model operate at a local, regional, national, or international scale?	Local and regional (production); national and international (sales — mainly Portugal, Germany, UK)
Maturity Level	(pilot, in early adoption, operational, or scaled)	Operational and scaled (established 2002, with advanced circular practices since 2015)
Value Proposition		
Customer Needs Addressed	What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)	Premium DOP/BIO olive oil with verified sustainable and regenerative production; reduced chemical inputs; minimal waste; transparency and education for informed consumer choice
Unique Selling Proposition (USP)	How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)	Closed-loop water and biomass use; local biodiversity conservation; energy-efficient mill; DOP and BIO certifications; storytelling and consumer education; highly awarded olive oils
Value Creation & Delivery		



Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive pomace, pits, leaves (composted); renewable energy (solar); fully reused process water, recycled packaging materials
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Composting of biomass; closed-loop water reuse; renewable energy use; packaging optimisation (recyclable); zero-waste philosophy
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Regional partners (APPITAD - Associação dos Produtores em Protecção Integrada de Trás-os-Montes e Alto Douro / Association of Producers in Integrated Protection of Trás-os-Montes e Alto Douro); universities (Polytechnic Institute of Bragança; Polytechnic Institute of Viseu); packaging suppliers; export networks; EVOO ranking organisations
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Closed-loop water system; grass cover; composting; harnessing rainwater; photovoltaic system; manual sorting; efficient pressing technologies; natural energy management in lagar
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Direct sales of premium olive oil (national and international); e-commerce; exports
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	High artisanal labour costs; certified organic processes; small-batch bottling and packaging; regulatory compliance
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced water costs (100% reuse); no external fertiliser needed (compost used); energy cost reduction via solar
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Zero discharge of wastewater; full reuse of biomass; reduced CO ₂ footprint via renewables; local biodiversity protected
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Employment in rural region; education of consumers; positive regional image; partnerships with local producers
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Stable market niche in premium sector; competitive differentiation via circular sustainability; high customer loyalty
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	High — adaptable to small-medium farms with investment in circular technologies and training.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Initial investment in water and energy systems; artisanal market positioning limits scalability; 20% reduction in production when the company switched to organic production; resistance from workers to adopt sustainable agricultural practices.
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Strong leadership and know-how; commitment to continuous employee training; partnerships with regional bodies; alignment with EU sustainability trends and consumer demand.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	The Quinta de S. Braz model exemplifies high-value circular olive oil production adapted to the Trás-os-Montes regional and PDO context. Artisanal and small-scale but replicable with suitable investment and knowledge transfer. Certification (BIO and DOP) enhances market acceptance. The interviewee mentioned that it is important to set up small technical teams to support olive producers on the implementation of circular practices, through demonstration, in order



		to help to reduce the feeling of insecurity among some producers in this process, and the scepticism of others. Finally, he mentioned that in the Trás-os-Montes and Alto Douro region, the inhabitants do not value organic olives and olive oil as much as consumers in urban centres such as Lisbon and Porto, and that greater general awareness of the benefits of more sustainable products is essential.
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General information		
Business model name #6	<i>Full official or descriptive name of the circular business model</i>	Oliveira da Serra – Integrated Circularity in Olive Oil Supply Chain
Country/region	<i>Country or regional area where the business model is applied</i>	Portugal – Alentejo (Ferreira do Alentejo)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector (production, processing, branding)
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Company website, industry reports, press article
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	Company website: Sovena Group. (n.d.). Oliveira da Serra – Official Website. Retrieved June 2025, from https://www.oliveiradaserra.pt Sustainability reports: https://www.sovenagroup.com/en/sustainability/reports/ Press articles: https://www.hipersuper.pt/2023/10/16/oliveira-da-serra-reforca-aposta-no-compromisso-futuro-do-planeta
Date of data collection	<i>(e.g., 1st of June 2025)</i>	16th June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Oliveira da Serra, part of Grupo Sovena, uses precision agriculture, recirculates wastewater, valorises olive pomace and pits for energy, and invests in eco-packaging. The model integrates vertical efficiency with brand-led environmental awareness.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorisation; Energy recovery; Sustainable branding
Geographical Scope	<i>Does the model operates at a local, regional, national, or international scale?</i>	National and international (export-oriented)
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational and scaled

Value Proposition			
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Strong market positioning via eco-conscious premium oils with traceable circular practices	
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Premium olive oils combining superior quality with clear circular and environmental credentials: low-carbon footprint, packaging with recycled content, transparent sourcing (via QR codes), and strong brand positioning on sustainability and innovation.	
Value Creation & Delivery			
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Pomace and pits valorisation, efficient irrigation, renewable energy production	
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Waste valorisation (olive pit biomass for energy, pomace composting); closed-loop resource use (recycled water in irrigation); sustainable packaging (recycled materials, eco-design); precision agriculture to optimise resource use and minimise inputs; transparent communication of circular benefits (QR codes on packaging).	
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Grupo Sovena (parent company); olive growers (long-term partnerships); technology providers (precision agriculture, IoT, biomass systems); packaging suppliers (recycled materials); R&D institutes and universities (product and sustainability innovation); certification bodies (Carbon Trust, organic labels); logistics partners; public authorities (policy alignment and incentives).	
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Technology and innovation in the sector, Valorisation of by-products with a measurable impact, Focus on consumer experience and awareness, And integration of circularity as an axis of brand positioning.	
Value Capture			
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of premium olive oil products; value-added from biomass energy use; circular packaging	
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	circular process costs investment in new equipment to integrate and improve circular and sustainable systems	
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Savings in fossil energy costs, reduced packaging costs, improved efficiency	
Impact Assessment			
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Indicator	Value / Change
		GHG reduction (Scope 2, Brenes plant)	-10,257 t CO ₂ e (2023)
		Total GHG emissions (Scopes 1 + 2)	27,003 t CO ₂ e (2023), 25,823 t CO ₂ e (2022)
		Reduction in landfill waste (Brenes)	-38% reduction in industrial waste sent to landfill
		Waste recovered (2022)	11,310 t of non-hazardous waste + 56.5 t of hazardous waste
		Recycled materials in packaging	5% rPET, 55% recycled glass, 84% recycled

		cardboard														
		Estimated CO ₂ savings from new recycled PET packaging 210 t CO ₂ /year (Classic line bottle)														
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Supports sustainable rural employment, promotes green practices in value chain, strong brand loyalty, cost savings from internal resource use														
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	<table border="1"> <thead> <tr> <th>Economic Factor</th> <th>Impact</th> </tr> </thead> <tbody> <tr> <td>Energy costs</td> <td>Direct reduction through the use of olive pit biomass</td> </tr> <tr> <td>Waste management costs</td> <td>Reduced landfill and transportation costs</td> </tr> <tr> <td>Logistics costs</td> <td>Lower costs due to lighter and recycled packaging</td> </tr> <tr> <td>Revenues</td> <td>Increased through premium product ranges and biomass sales</td> </tr> <tr> <td>Market competitiveness</td> <td>Enhanced access to ESG-driven markets and brand positioning</td> </tr> <tr> <td>Profitability</td> <td>Improved operating margins through circular economy gains</td> </tr> </tbody> </table>	Economic Factor	Impact	Energy costs	Direct reduction through the use of olive pit biomass	Waste management costs	Reduced landfill and transportation costs	Logistics costs	Lower costs due to lighter and recycled packaging	Revenues	Increased through premium product ranges and biomass sales	Market competitiveness	Enhanced access to ESG-driven markets and brand positioning	Profitability	Improved operating margins through circular economy gains
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Transferability potential																
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	<p>Adoption potential by micro and small enterprises (MSEs): <i>Low to Medium</i></p> <p>Rationale:</p> <p>The Oliveira da Serra model requires high investment in technology, certifications and vertical integration — typically out of reach for standalone MSEs.</p> <p>MSEs lack the scale to absorb costs for precision agriculture, industrial waste valorisation or advanced sustainable packaging.</p> <p>Partial elements of the model (biomass for energy, composting, improved packaging) could be adopted if technical support and shared infrastructures are available (e.g. through cooperatives or regional circularity initiatives like <i>Alentejo Circular</i>).</p> <p>Conclusion:</p> <ul style="list-style-type: none"> – Standalone MSEs → low adoption potential; – In networks / with support → medium. 														
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	<p>Technical:</p> <ul style="list-style-type: none"> – High technological complexity (precision agriculture, IoT sensors, industrial-scale waste valorisation). – Need for specialised maintenance and qualified technical staff. <p>Economic:</p>														

		<ul style="list-style-type: none"> - High upfront investment in equipment and certifications. - Difficult for MSEs to achieve fast ROI. - Minimum operational scale required to justify integrated circular investments. <p>Cultural:</p> <ul style="list-style-type: none"> - Resistance to change from traditional agricultural and processing practices. - Lack of business culture focused on circularity and innovation among many MSEs. <p>Regulatory:</p> <ul style="list-style-type: none"> - Complex requirements for certification of circular practices (BCorp, organic, carbon footprint). - Legal limitations and bureaucracy regarding use of by-products (e.g., agricultural application of compost or derived biomass). - Lack of harmonised regulations for circular economy in the agri-food sector.
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	<ul style="list-style-type: none"> - Policy support: <ul style="list-style-type: none"> o Strong national and EU focus on circular economy and bioeconomy (e.g., PRR, CAP strategic plan, Horizon Europe). - Existing partnerships: <ul style="list-style-type: none"> o Close collaboration with universities, tech centres and specialised suppliers (for biomass, packaging, IoT solutions). - Access to finance: <ul style="list-style-type: none"> o Sovena Group's ability to leverage own funds and strong access to EU funding and bank financing for innovation. - Ecosystem readiness: <ul style="list-style-type: none"> o Embedded in the agri-industrial cluster of Alentejo, with modern infrastructure (e.g., Ferreira do Alentejo plant) and available local circular services.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	

General information		
Business model name #7	<i>Full official or descriptive name of the circular business model</i>	MiOlive3 – Micro-scale Circular Innovation in Olive By-products
Country/region	<i>Country or regional area where the business model is applied</i>	Portugal – Região Centro (Beira Interior)



Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive sector (micro-enterprise focused on by-product innovation)
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Company press releases, pilot project documentation, academic support reports
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	<p>Project Website: MiOlive3. (n.d.). MiOlive3 Project – Circular solutions for olive oil value chain. Retrieved June 2025, from https://www.deifil.pt/projeto/miolive3/</p> <p>COMPETE 2030. (2025, February 19). Inovação para a sustentabilidade do olival português – MiOlive3. Retrieved June 2025, from https://www.compete2030.gov.pt/comunicacao/noticias-pt-informacao/inovacao-para-a-sustentabilidade-do-olival-portugues/</p> <p>DEIFIL. (2025, February). MiOlive3 – Inovação e sustentabilidade no olival tradicional português. Voz do Campo, 54–56. Retrieved June 2025, from https://www.deifil.pt/wp-content/uploads/2025/02/VOZDOCAMPO_FEV25_54-56.pdf</p> <p>DEIFIL. (2025). MiOlive3: Inovação e sustentabilidade no olival tradicional português. Retrieved June 2025, from https://www.deifil.pt/miolive3-inovacao-e-sustentabilidade-no-olival-tradicional-portugues/</p> <p>Agroportal. (2024, November 27). MiOlive3: Projeto inovador vai clonar as variedades de oliveira tradicionais pela via da sustentabilidade. Retrieved June 2025, from https://www.agroportal.pt/miolive3-projeto-inovador-vai-clonar-as-variedades-de-oliveira-tradicionais-pela-via-da-sustentabilidade</p>
Date of data collection	<i>(e.g., 1st of June 2025)</i>	16th June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	MiOlive3 develops innovative biotechnological solutions (micropropagation, mycorrhization, micrografting) to regenerate and enhance traditional Portuguese olive groves. The project promotes circular use of olive biomass, soil regeneration, biodiversity, and resource efficiency. Its main objective is to ensure the sustainability of traditional olive varieties through advanced propagation and circular agronomic practices.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	Bio-based innovation; circular biotechnology; by-product valorisation; regenerative agriculture.
Geographical Scope	<i>Does the model operates at a local, regional, national, or international scale?</i>	National and international — project based in Portugal (Centro and Alentejo regions), with applications across Mediterranean olive-producing areas.
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Early adoption — key practices and biotech processes validated at pilot level and now entering early adoption through partnerships with producers and cooperatives.



Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Preservation and regeneration of traditional olive varieties; improved resilience of olive groves to climate stress and soil degradation; access to high-quality, disease-resistant planting material; circular use of olive by-products; promotion of sustainable and regenerative agricultural practices.
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Innovative biotechnological approach combining micropropagation, mycorrhization and circular inputs; environmental benefits through soil regeneration and biodiversity; protection of cultural and genetic heritage of traditional olive varieties; scalable model that strengthens local olive oil value chains.
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive biomass (pruned wood, leaves); micropropagated olive plants; mycorrhizal fungi; nursery substrates enriched with circular inputs; valorised by-products used to improve soil fertility and plant resilience.
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Micropropagation of traditional olive varieties; inoculation with mycorrhizal fungi to improve nutrient cycles; valorisation of olive by-products into nursery substrates and soil amendments; promotion of soil regeneration and biodiversity.
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	R&D institutes (DEIFIL, universities, biotech labs); local cooperatives and SMEs; olive oil producers; BioRegião networks; COMPETE 2030 and national funding bodies; nurseries and agricultural innovation centres.
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Micropropagation labs and biotech facilities; controlled environment agriculture (CEA) for plant production; natural soil amendments derived from olive biomass; digital tools for plant traceability and genetic quality control.
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Sales of micropropagated, mycorrhized, and micrografted olive plants; consulting and technical services to olive growers; collaboration contracts with cooperatives and nurseries; potential secondary revenue from valorised substrates and bio-inputs.
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Biotech lab operations (micropropagation, inoculation); nursery facilities and substrates; skilled labour; R&D and licensing costs; investment in controlled environment technologies and traceability tools.
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced dependency on chemical fertilisers through improved nutrient cycling; avoided waste management costs by valorising olive by-products; improved plant resilience reduces future disease management costs and grove replanting needs.
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Reduction of agrochemical inputs through improved soil fertility; valorisation of olive biomass reduces waste streams; increased biodiversity and soil regeneration in traditional olive groves; contribution to long-term climate resilience of olive production systems. Quantified KPIs still under development at project level.
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Job creation in biotechnology and sustainable agriculture; reinforcement of local olive oil value chains; support for small producers and cooperatives; preservation of cultural and agricultural heritage; knowledge transfer to the community.



Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Diversification of revenue streams (plant sales, services); improved profitability for olive growers through healthier, more resilient groves; increased market competitiveness via regenerative and circular branding; potential for scaling through national and EU networks.
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	Medium — The model offers high potential benefits to MSEs (improved plant resilience, soil regeneration), but adoption depends on access to biotechnological materials (micropropagated plants, mycorrhizal inocula) and some technical knowledge. Easier adoption when supported by cooperatives or BioRegião-type networks.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	High technical complexity in micropropagation and inoculation processes; need for skilled labour and biotech partnerships; initial investment for sourcing improved plant material; limited availability of mycorrhizal inocula at commercial scale; regulatory gaps around use of living biotechnologies in agriculture.
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Strong partnerships with R&D institutions and cooperatives; access to EU and national funding (COMPETE, PEPAC); existing local networks (BioRegião, DEIFIL); increasing demand for sustainable and resilient olive oil production; policy support for regenerative agriculture and circular economy.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	MiOlive3 operates in a highly innovative and technical niche within the olive sector. Its potential impact on circularity and sustainability is significant but requires careful transfer of biotech knowledge and collaboration with producers. The absence of formalised KPIs and full-scale commercial validation is typical for a project at early adoption stage, but initial results are promising for scalability across Mediterranean olive systems.

General information		
Business model name #8	<i>Full official or descriptive name of the circular business model</i>	Herdade da Figueirinha Circular Composting and Regenerative Agriculture Model
Country/region	<i>Country or regional area where the business model is applied</i>	Portugal – Alentejo region (Beja) - south-east of Portugal
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive oil and wine production; organic composting; regenerative agriculture
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Interview (internal — semi-structured interview with management) and Company sustainability report
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	Company website: Figueirinha. (n.d.). Herdade da Figueirinha – Official Website. Retrieved June 2025, from https://figueirinha.pt Herdade da Figueirinha. (2024). Relatório de Sustentabilidade 2024. Internal document. https://figueirinha.pt/wp-content/uploads/2025/05/Relatorio-de-Sustentabilidade-Online.pdf



		Grelha da entrevista — Herdade da Figueirinha (2025). Internal interview report.
Date of data collection	(e.g., 1 st of June 2025)	16th June 2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Circular composting model transforming olive by-products and farm residues into high-quality compost for on-farm use, reducing chemical inputs and regenerating soil. Combines regenerative agriculture, waste valorisation, and stakeholder engagement. Supported by partnerships with academia, retail - Clube de Produtores do Continente (Continent producers' Club - supermarket chain of the SONAE SIERRA group) and public authorities. Targets a full circular "from soil to soil" model with environmental, economic, and social benefits.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorisation; regenerative agriculture; carbon farming; waste valorisation and reuse
Geographical Scope	<i>Does the model operates at a local, regional, national, or international scale?</i>	Local and regional, with potential for national replication
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational (internal use) — scaling towards commercial sale
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	Demand for organic compost; reduction of chemical fertiliser dependency; access to regenerative, circular products
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Regenerative production with 100% waste valorisation; "from soil to soil" model; carbon sequestration benefits; strong stakeholder partnerships
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive pomace; pruning residues; waste water; farm organic waste
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	Composting; dehydration; biomass valorisation; soil regeneration; reduced chemical input
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	University of Évora, IP Beja, EDIA - Empresa de Desenvolvimento e Infraestruturas do Alqueva, S.A. - (Alqueva Dam Development and Infrastructure Company), Continente (www.continente.pt), Olivum - Associação de Produtores e Lagares de Portugal (Association of Olive Growers and Olive mills of Portugal), NERBE - Associação Empresarial do Baixo Alentejo e Litoral (Business association of the lower Alentejo and coastline), Cáritas (https://caritas.pt/), CERCIBEJA (https://cercibeja.org.pt/)



Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	Composting unit; dehydration; humidity sensors; drip irrigation; weather stations; traceability systems
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Premium product sales (olive oil, wine); future compost sales; cost savings on fertilisers; brand premium
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	Compost unit maintenance; energy; certification/licensing; labour
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Lower fertiliser costs; reduced waste management costs; renewable energy substitution; marketing savings through improved brand positioning
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	Environmental Impact: Reduced GHG emissions; full waste valorisation; soil regeneration; 15–20% water savings
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Local employment; inclusion of vulnerable groups; knowledge-sharing partnerships; stronger rural economy
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Cost savings on fertilisers and waste; premium product pricing; future new revenue from compost sales and carbon credits
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	High — simple to adopt at farm level, especially for on-farm compost use
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Regulatory licensing for compost commercialisation; limited political support; bureaucratic delays
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	Partnerships with academia and retail; CAP - Confederação de Agricultores de Portugal (Portugal Confederation of Farmers) / PEPAC - Plano Estratégico da Política Agrícola Comum (Strategic Plan for the Common Agricultural Policy) alignment; strong consumer demand; sustainability positioning of retailers (Continente)
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	The model benefits from strong academic and retail partnerships and clear environmental gains. Main challenge is regulatory licensing, and access to public funding programmes. With the banking sector, this company has no difficulty in financing itself, since sustainable businesses and green entrepreneurs are increasingly valued. Composting process already scaled to 4,000 t/year; strong potential for replication in Alentejo and other olive-producing regions. Quantified KPIs in place for by-product reuse, fertiliser reduction, and water savings.

Spain

General information		
Business model name #1	<i>Full official or descriptive name of the circular business model</i>	Valorization of Olive Pomace for Biomass and Energy
Country/region	<i>Country or regional area where the business model is applied</i>	Spain (Andalusia, Castilla-La Mancha, Catalonia)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive oil sector, agrifood industry
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Company websites, EU projects, industrial reports
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://www.biolandenergy.es https://extractorademora.es https://www.oleorevista.com/texto-diario/mostrat/4940767/avances-valorizacion-sostenible-biomasa-olivar https://www.infaoliva.com/pdf/~\$wsletter-infaoliva-26.07.2024ocx-48.pdf https://digibug.ugr.es/bitstream/handle/10481/84706/81914T.pdf?sequence=4&isAllowed=y
Date of data collection	<i>(e.g., 1st of June 2025)</i>	28/04/2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Olive pomace (alperujo), a by-product of olive oil extraction, is collected from mills and dried in specialized facilities to be used as biomass fuel or directly in energy cogeneration plants. This model applies circular principles by turning agro-industrial waste into renewable energy, reducing reliance on fossil fuels, and improving the environmental and economic sustainability of the olive sector through resource efficiency and industrial symbiosis.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorization, industrial symbiosis
Geographical Scope	<i>Does the model operates at a local, regional, national, or international scale?</i>	Regional to national
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Scaled
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste</i>	This model addresses key challenges faced by olive oil producers, such as the need to



	<i>minimization, circular product offering, cost savings)</i>	manage large volumes of organic waste (alperujo) in an environmentally sound way, and the requirement to comply with EU and national environmental regulations on waste disposal. It also helps meet the economic need for cost recovery by transforming a costly waste stream into a revenue-generating product (biomass fuel), reducing overall operational expenses and improving sustainability performance
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Energy generation from waste, circular economy integration, high environmental impact reduction
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive pomace (alperujo), dried pulp, olive pits
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	The core activities of this model focus on waste valorization by collecting olive pomace from oil mills and transporting it to processing facilities where it undergoes drying and pelletizing to produce solid biofuels. In parallel, some of the material is directly used in energy cogeneration plants to generate electricity and thermal energy. These activities close the loop by converting an agricultural by-product into a renewable energy resource, thereby integrating circularity into both the olive oil and energy sectors.
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Olive oil cooperatives, biomass energy companies (e.g., Bioland Energy), municipalities
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	This model relies on a set of enabling technologies that support the circular transformation of olive pomace into energy. These include biomass drying systems, which reduce the high moisture content of the pomace; pelletizers, which compress the dried material into standardized biofuel formats; clean combustion furnaces, designed to burn olive biomass with low emissions; and cogeneration plants, which simultaneously produce electricity and heat from this biofuel. Together, these technologies enable efficient, scalable, and environmentally sound circular practices in the olive oil sector.
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	The model generates revenue through multiple circular channels: primarily, the sale of biomass pellets to households, industries, or energy companies as a renewable fuel; sale of electricity and thermal energy produced in cogeneration plants using the dried pomace; and, in some cases, commercialization of orujo-based material to extractors or companies using it as raw input for further valorization. These revenue sources contribute to making waste management not only sustainable but also economically profitable for olive producers and biomass firms.
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	The main cost elements in this model include logistics for collecting and transporting olive pomace from multiple oil mills to processing facilities; investment and



		<p>maintenance of drying and pelletizing equipment, which are essential for converting wet pomace into usable biomass; and operational energy costs, particularly for the drying phase, which is energy-intensive. Additional costs may arise from infrastructure upgrades, labor, and compliance with environmental regulations, especially in facilities generating and selling energy.</p>
Circular Cost Savings	<p><i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i></p>	<p>By converting olive pomace into biomass fuel, this model allows producers and processors to achieve significant cost savings. These include avoided landfill or waste treatment fees, which are typically high for organic agro-industrial residues; reduced energy costs when the generated biomass is used for self-consumption in heating or processing operations; and lower reliance on external fuels, enhancing energy independence. AlsThese savings contribute directly to the economic viability of circular practices in the olive oil sector.</p>
Impact Assessment		
Environmental Impact	<p><i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i></p>	<p>This model delivers strong environmental benefits by enabling the reutilization of nearly 100% of olive pomace, which would otherwise pose a major waste management challenge. Through its conversion into biomass, it reduces greenhouse gas (GHG) emissions by displacing fossil fuels and preventing methane emissions from uncontrolled decomposition. Additionally, it eliminates the environmental risks of open dumping, such as soil contamination and water pollution, and contributes to improved resource efficiency across the olive oil value chain.</p>
Social Impact	<p><i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i></p>	<p>This circular model strengthens rural communities by creating and maintaining jobs in biomass collection, processing, and energy generation—particularly in regions heavily dependent on olive cultivation. It also fosters the active participation of agricultural cooperatives, enhancing their role in the value chain beyond oil production. By converting local waste into local energy, the model adds value within the territory, promotes territorial cohesion, and supports economic resilience in traditionally depopulated or economically vulnerable areas.</p>
Economic Impact	<p><i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i></p>	<p>Diversification of revenue streams for almazaras, improved resilience to market price drops</p>
Transferability potential		
Feasibility for MSEs	<p><i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i></p>	<p>The adoption of this model by micro and small enterprises (MSEs) is moderately feasible, especially when implemented through cooperatives or shared infrastructure. While the model offers long-term savings and new revenue opportunities, it requires high initial capital investment (CAPEX) in drying and processing equipment, which can be a barrier for individual small producers. However, in regions with strong cooperative</p>



		structures or access to public funding (e.g., LEADER, NextGen EU), its implementation becomes more accessible and scalable.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Despite its benefits, this model faces several adoption challenges. Technically, the drying and pelletizing of olive pomace requires specialized, often expensive, equipment. Economically, the initial investment may be unfeasible for small operators without subsidies or cooperative support. Regulatorily, facilities must comply with environmental permits and emission standards related to biomass processing and combustion. Additionally, market access barriers—such as limited connection to bioenergy grids or inconsistent demand for biomass fuels—can further complicate implementation, particularly in remote or fragmented regions.
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	The successful implementation of this model depends on several key enablers. These include access to biomass transformation technologies (dryers, pelletizers, cogeneration systems), the availability of public incentives or subsidies (e.g., through EU rural development funds or national energy programs), and the presence of strong cooperative structures that facilitate collective investment and logistics. Additionally, a mature local ecosystem—with existing biomass markets, technical know-how, and supportive policy frameworks—greatly enhances the viability and scalability of this circular model.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	Widely used in Jaén and Toledo; also tied to environmental targets of the EU Green Deal and Spain's PNIÉC. European projects incentivate cooperatives and SMEs to apply this model.

General information		
Business model name #2	<i>Full official or descriptive name of the circular business model</i>	Biogas Production from Olive Oil By-products
Country/region	<i>Country or regional area where the business model is applied</i>	Spain (Andalusia, Castilla-La Mancha, Extremadura)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive oil sector, agro-energy sector
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	EU project documentation, company websites, press articles
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://geniobioenergy.com https://olimerca.com https://geniobioenergy.com/biogas-de-subproductos-de-almazaras/ https://www.unia.es/estudios-y-acceso/oferta-academica/ciencias/generacion-de-



		biogas-y-biometano-a-partir-de-los-subproductos-del-olivar-una-oportunidad-para-la-industria-oleicola https://proyectos.citoliva.es/wp-content/uploads/2024/09/DIGESTION-ANAEROBIA.pdf
Date of data collection	(e.g., 1st of June 2025)	28/04/2025
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	Anaerobic digestion of olive oil extraction by-products (e.g. alperujo, wastewater) to produce biogas for energy or heat generation
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	This business model combines two key circular economy classifications: by-product valorization and industrial symbiosis. It valorizes the organic waste streams generated during olive oil production—primarily olive pomace and wastewater—by converting them into renewable biogas through anaerobic digestion. This process enables the waste from one industry (olive oil milling) to serve as a valuable input for another (renewable energy generation), embodying industrial symbiosis. In doing so, the model creates a closed-loop system where waste is transformed into energy, supporting both environmental sustainability and energy self-sufficiency.
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Regional
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational, expanding with EU support
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	This model addresses several pressing challenges faced by olive oil producers and rural communities. First, it offers an effective solution for organic waste management, transforming problematic residues like alperujo and wastewater into valuable resources. Second, it promotes energy self-sufficiency by allowing producers or nearby users to generate renewable energy on-site, reducing dependence on external or fossil-based sources. Finally, it supports emissions reduction goals, both by avoiding methane emissions from uncontrolled decomposition and by substituting fossil fuels with clean biogas, aligning with environmental regulations and climate objectives.
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Renewable energy from unavoidable agri-waste, energy circularity within olive mills
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	The primary circular inputs used in this model are alperujo, the wet olive pomace produced during the oil extraction process, and olive mill wastewater, which is rich in organic matter and phenolic compounds. Both are abundant by-products of olive oil production and traditionally considered environmental liabilities. By redirecting these



		waste streams into biogas production, the model harnesses their inherent biochemical energy, converting waste into a renewable fuel source while simultaneously reducing the need for external raw materials.
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	The main activities closing the loop in this model begin with the collection and pre-treatment of olive by-products like alperujo and wastewater. These are then processed through anaerobic digestion, a biological process that breaks down organic material in oxygen-free conditions to produce biogas—a renewable energy source composed mainly of methane. The remaining by-product, called digestate, is nutrient-rich and can be used as an organic fertilizer, closing the nutrient cycle. Together, these activities ensure that both energy and material value are recovered from waste streams, completing a circular feedback loop.
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Olive cooperatives, tech providers (e.g., Pieralisi), energy firms, municipalities
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	This model relies on several specialized technologies to enable circularity. Anaerobic bioreactors are the core system, where controlled microbial processes convert organic waste into biogas. Once produced, gas capture and refinement systems separate and purify the methane for use as a renewable energy source. Additionally, heat exchangers are employed to recover thermal energy from the process, increasing overall efficiency. These technologies collectively allow the transformation of olive oil residues into usable energy and agricultural inputs, making the circular process technically viable and scalable.
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	This model generates revenue through multiple complementary channels. The primary source comes from the sale of electricity and heat produced from biogas, either fed into the grid or used in local facilities. Additionally, operators can benefit from self-consumption savings, reducing their own energy costs by using the biogas on-site. A further stream derives from the use or sale of digestate, the nutrient-rich residue of the anaerobic process, which can be marketed as an organic fertilizer or soil conditioner, particularly appealing in sustainable agriculture contexts.
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	The main cost components in this model include the initial investment in anaerobic bioreactors, which are capital-intensive and require tailored design for olive waste. Ongoing operation and maintenance costs—including system monitoring, microbial health management, and equipment servicing—also represent a significant share. Additionally, there are logistics and pre-treatment expenses, as the olive residues (particularly alperujo) must be transported from mills to the plant and sometimes conditioned (e.g., homogenized or diluted) before digestion. These costs can be

		mitigated through scale efficiencies, cooperative ownership, or access to public funding.
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	This model offers significant cost savings by eliminating or reducing waste disposal expenses, which can be substantial for high-volume organic residues like alperujo and wastewater. By generating renewable energy on-site, producers achieve energy cost reductions, either through self-consumption or offsetting energy purchases from the grid. Additionally, the valorization of digestate as fertilizer reduces the need for synthetic inputs in agriculture, offering both economic and environmental savings. These combined effects enhance the financial viability of the circular approach, especially over the long term.
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	This model delivers strong environmental benefits by addressing two major pollution sources. First, it enables the diversion of large volumes of olive oil residues from uncontrolled decomposition, where they would otherwise release methane—one of the most potent greenhouse gases. Instead, controlled anaerobic digestion allows for methane capture and use, converting a pollutant into clean energy. As a result, the model contributes to a significant reduction in overall GHG emissions, while also improving resource efficiency by recovering both energy and nutrients from waste. It aligns closely with EU climate and waste reduction targets.
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	At the community level, this model supports job creation in rural areas, particularly in the operation, maintenance, and management of biogas facilities. It encourages the development of technical skills in renewable energy and waste management, offering new employment opportunities beyond traditional agriculture. Moreover, it facilitates decentralised energy access, allowing local producers or cooperatives to generate their own power. This strengthens stakeholder inclusion and empowerment, especially when implemented through cooperative models, enhancing the resilience and autonomy of local agricultural communities.
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	This model provides olive mills and related businesses with diversified income sources, reducing reliance solely on oil production by monetizing waste through energy generation and digestate valorization. It contributes to energy cost savings, which can significantly improve profitability, especially in energy-intensive operations. Additionally, by integrating into the renewable energy market, producers enhance their competitiveness, access new funding opportunities (e.g., green incentives), and align with sustainable branding, which can strengthen market positioning in both domestic and international contexts.
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model</i>	The feasibility of this model for micro and small enterprises is generally low to medium,



	<i>(e.g., low/medium/high) (with justification)</i>	primarily due to the high capital investment and technical complexity involved in setting up anaerobic digestion systems. However, adoption becomes more viable when implemented through cooperative structures or shared facilities, where costs and responsibilities are distributed. Access to public funding, technical assistance, and regional circular economy programs are also critical factors in enabling MSE participation. Without such support, individual small producers may struggle to adopt the model independently.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Several significant challenges hinder the widespread adoption of this model. Technically, the process requires specialized knowledge in anaerobic digestion and biogas plant management, which many small operators may lack. Economically, the high upfront investment in infrastructure and equipment can be prohibitive without subsidies or cooperative financing. On the regulatory side, obtaining the necessary licenses and permits—particularly for environmental compliance and energy grid connection—can be complex and time-consuming. These combined barriers make implementation difficult for small-scale players unless supported by external institutions or policy frameworks
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	The successful deployment of this model depends on several enabling conditions. Access to EU funding programs such as LIFE, Horizon Europe, or NextGenerationEU plays a crucial role in overcoming financial barriers. In parallel, regional energy and waste management strategies that promote renewable energy and circular economy initiatives provide vital institutional support. Equally important is the presence of strong cooperation between actors—including olive oil producers, technology providers, municipalities, and research institutions—which facilitates knowledge transfer, risk sharing, and logistical coordination across the value chain.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	Biogas valorization is rising with Spanish and EU green transition targets. Key in isolated olive regions with grid access issues.

General information		
Business model name #3	<i>Full official or descriptive name of the circular business model</i>	Extraction of Bioactive Compounds from Olive By-products
Country/region	<i>Country or regional area where the business model is applied</i>	Spain (Andalusia, Extremadura, Catalonia, Castilla y León)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive oil, nutraceuticals, cosmetics, functional food
Source type	<i>Source of information (e.g., scientific paper, EU project report,</i>	



	<i>company website, interview, market report)</i>	EU projects, company and R&D websites, scientific dissemination
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://natacgroup.com https://ig.csic.es https://huffingtonpost.es https://proyectos.citoliva.es/wp-content/uploads/2024/09/EXTRACCION-DE-COMPUESTOS-BIOACTIVOS.pdf https://akisplataforma.es/grupos-operativos/grupo-operativo-bioliva-obtencion-compuestos-bioactivos-partir-subproductos-del https://hazrevista.org/innovacion-social/2025/03/investigadores-convierten-residuos-olivar-ingredientes-alimentarios/ https://www.mercacei.com/noticia/53514/actualidad/phenoliva:-como-convertir-los-residuos-de-la-extraccion-del-aceite-en-un-valioso-recurso.html https://gosupraoliva.com/obtencion-de-compuestos-bioactivos-a-partir-de-subproductos-del-sector-del-olivar/
Date of data collection	<i>(e.g., 1st of June 2025)</i>	
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	This model focuses on the extraction of high-value bioactive compounds—such as polyphenols, flavonoids, and oleuropein—from by-products of the olive oil industry, particularly olive leaves, alperujo, and vegetation water. These compounds are then used as ingredients in functional foods, dietary supplements, cosmetics, and pharmaceuticals. The model applies circular economy principles by valorizing organic waste, reducing environmental impact, and promoting cross-sectoral integration between agriculture, biotechnology, and health-related industries. Its general objective is to convert agricultural residues into economically valuable and health-promoting products, creating new market opportunities from existing waste streams.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorization, industrial symbiosis
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	National to international
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational, some scaled
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	This model addresses several growing needs in both the agricultural and health-oriented sectors. First, it contributes to waste reduction by repurposing olive by-products that



		would otherwise require costly disposal. At the same time, it responds to the increasing demand for natural antioxidants and bioactive ingredients in food, cosmetics, and nutraceutical markets, driven by consumer preferences for clean-label and health-enhancing products. Finally, it enables the high-value reuse of agricultural waste, offering producers a way to generate added economic value from materials traditionally considered as low-utility residues
Unique Selling Proposition (USP)	How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)	Natural origin, clean-label trend, environmental and nutritional added value.
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive leaves, alperujo, olive mill wastewater.
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	The key circular activities in this model begin with the collection of olive by-products, such as leaves and pomace, which are then processed through advanced extraction techniques to isolate bioactive compounds like polyphenols and oleuropein. These are subsequently purified and stabilized to meet quality standards for food, cosmetic, or pharmaceutical applications. The final step involves their formulation into value-added products, such as dietary supplements, enriched oils, skin creams, or functional ingredients. This closed-loop approach transforms agricultural waste into high-margin products, reinforcing both circularity and product innovation
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	R&D centres (e.g. CIDAF, CSIC, BIOHUB), companies (e.g. Natac, Acesur), cooperatives, universities
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	This model relies on a set of advanced technologies to enable the efficient and scalable extraction of bioactive compounds from olive by-products. These include membrane filtration systems, which separate and concentrate valuable molecules; ultrasound-assisted extraction (UAE) and supercritical fluid extraction (SFE), which increase yield and preserve compound integrity; and chromatographic purification to isolate specific antioxidants like oleuropein or hydroxytyrosol. Supporting systems such as drying technologies (e.g., spray-drying or freeze-drying) ensure ingredient stability. These tools are being used in Spain by R&D centers and companies to unlock new circular value from olive waste.
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	This model generates revenue through several high-value channels. The main income comes from the sale of extracted bioactive compounds—such as polyphenol-rich extracts—to manufacturers of functional foods, cosmetics, and nutraceuticals. Additional revenue can be derived from licensing proprietary extraction technologies or selling enriched olive oil formulations with added health claims. Spanish companies also



		benefit from R&D partnerships and EU funding, which often include commercial exploitation plans. These diversified streams make the model financially attractive and well-positioned within the growing global demand for natural ingredients.
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	The main cost drivers of this model are tied to the specialized equipment and technologies required for the extraction and purification of bioactive compounds—such as reactors, filtration systems, and drying units. Significant investment is also needed in R&D, especially during the development of optimized protocols for different olive by-products and compound types. Additionally, costs related to regulatory compliance (e.g. food safety, cosmetics legislation, or novel food approvals) are substantial, particularly when targeting international markets. Other relevant expenses include quality control, staff training, and collaborative research licensing where applicable.
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Reduced disposal costs, extraction from otherwise unutilized biomass
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	This model contributes to significant environmental improvements by enabling the valorization of large volumes of agricultural residues, including olive leaves, pomace, and wastewater, which would otherwise be discarded or underutilized. By extracting valuable compounds from these by-products, it reduces the amount of organic waste sent to landfill or incineration, thereby lowering potential soil and water contamination risks. Additionally, the model promotes resource efficiency by extending the utility of the olive tree beyond oil production. While exact impact varies by scale, some initiatives in Spain have reported the valorization of thousands of tons of residues per campaign, aligning with EU waste reduction and bioeconomy goals.
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Creation of skilled jobs, linkage between rural production and high-tech industries
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	This model enables olive producers and associated industries to access new high-value revenue streams by transforming low-value waste into premium bioactive ingredients. By doing so, it supports profitability diversification, reducing dependence on commodity olive oil markets, which are often volatile. Additionally, producers and cooperatives that integrate R&D capabilities—either directly or through partnerships—gain a competitive edge, as they can offer innovative, science-backed products to fast-growing health and wellness markets. This strategic shift enhances their position not only within the agri-food sector but also across the nutraceutical and cosmetics industries.
Transferability potential		
Feasibility for MSEs	How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)	The feasibility for micro and small enterprises (MSEs) to adopt this model is medium, and largely dependent on access to external partnerships. While the extraction of



		bioactive compounds requires specialized equipment and scientific expertise, MSEs can participate through collaborations with R&D centers, universities, or technology providers that offer shared services or turnkey solutions. Independent implementation is generally not viable due to the high technical and regulatory demands. However, in Spain, regional cooperative structures and EU-funded innovation hubs are increasingly enabling small producers to join bioeconomy value chains in a shared and scalable manner.
Barriers	What are the technical, economic, cultural, or regulatory challenges towards adoption	High technical complexity, need for scientific validation and compliance with food/cosmetic regulations
Key success factors	Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)	This model's success relies on several critical enablers. First, innovation funding—from EU programs (e.g. Horizon Europe, LIFE) and Spanish regional grants—plays a central role in supporting R&D and de-risking initial investments. Equally important is collaboration with scientific institutions such as CSIC, universities, and technology centers, which provide access to extraction technologies, formulation expertise, and regulatory guidance. Finally, a strong and growing market demand for natural, sustainable, and health-enhancing ingredients creates favorable conditions for commercialization, especially in functional food, cosmetics, and wellness sectors that prioritize clean-label sourcing.
Notes		
Additional comments	Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance	Strong alignment with bioeconomy and zero-waste strategies. Growing demand in EU and Asian markets for natural polyphenols.

General information		
Business model name #4	<i>Full official or descriptive name of the circular business model</i>	Use of Olive By-products for Animal Feed
Country/region	<i>Country or regional area where the business model is applied</i>	Spain (Andalusia, Castilla-La Mancha, Aragón)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive oil, livestock, feed industry
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	Company websites, R&D projects, agricultural news
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://dcoop.es https://remediospicasat.com https://www.oleorevista.com/texto-diario/mostrar/4229994/impulso-desechos-vegetales-alimentacion-animal-reciclaje https://www.olimerca.com/noticiadet/subproductos-del-olivar-como-alimentacion-



		animal/495a82b6aa143b3dd225c39c66319caa https://proyectos.citoliva.es/una-segunda-vida-para-los-subproductos-de-la-aceituna-transformandolos-en-alimento-para-ganado/ https://crea.ujaen.es/items/244a9214-87ef-4507-8103-4b141a42d467
Date of data collection	(e.g., 1st of June 2025)	
<i>Business model overview</i>		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	This model focuses on the reutilization of olive oil production residues—primarily olive pomace, leaves, and pulp—for the formulation of livestock feed, especially for ruminants. The by-products are either dried, fermented, or combined with other ingredients to produce animal rations rich in fiber and energy. Applied mainly at the local or cooperative level, this model embraces circular economy principles by closing the loop between crop and livestock systems, reducing waste, lowering feed costs, and improving the sustainability of agri-food chains. It also offers an alternative to conventional feeds that often rely on imported or resource-intensive components.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorization
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Local to regional
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Operational
<i>Value Proposition</i>		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	This model addresses multiple challenges faced by livestock producers and olive oil cooperatives. First, it supports feed cost reduction, a major concern in animal husbandry, by replacing a portion of conventional feed ingredients with locally available olive by-products. Second, it enhances sustainable livestock production, reducing the environmental footprint associated with feed transport and production. Finally, it enables circular integration within agri-food systems, linking crop and animal sectors in a way that makes better use of local resources and minimizes waste from olive oil processing.
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Local feed source, reduced dependence on imported feed, integration with olive sector residues
<i>Value Creation & Delivery</i>		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	Olive pomace (orujo), dried pulp, olive leaf silage



Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	The main circular activities in this model begin with the collection of olive oil by-products, such as pomace, leaves, and pulp, from mills and cooperatives. These materials are then processed—typically through drying, ensiling (fermentation), or blending—to ensure they are safe, nutritionally balanced, and suitable for animal consumption. The resulting feed is distributed to livestock farms, closing the loop between olive cultivation and animal husbandry. This process turns organic waste into a productive input, effectively integrating agricultural sub-sectors and reducing the need for external feed resources.
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	Livestock cooperatives, olive oil producers, feed manufacturers, R&D centres
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	This model relies on effective technologies adapted to rural and cooperative contexts. Key tools include drying systems to reduce moisture content and prevent spoilage, grinding or pelletizing equipment to improve digestibility and storage, and ensiling techniques that allow olive leaves or pulp to ferment safely into stable animal feed. In some cases, nutritional analysis tools are used to ensure feed quality meets animal health standards. These technologies are generally accessible and scalable, making the model technically feasible for cooperatives and small-to-medium agri-food enterprises.
<i>Value Capture</i>		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	Revenue in this model can come from direct sales of processed feed products made from olive by-products, either to cooperative members or to external livestock farms. In some cases, the feed is used internally by mixed farming operations, generating cost savings rather than direct income. Additionally, the model may lead to new business lines within cooperatives or feed manufacturers, especially if they scale production or diversify product offerings. Though the margins may be lower than in high-tech valorization models, the steady demand for animal feed ensures stable and localized revenue opportunities.
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	The main cost elements of this model include collection and transport of olive by-products from mills to processing sites, which can be significant depending on distance and logistics. Drying, grinding, or ensiling processes involve moderate operational costs, especially in terms of labor and energy. Storage infrastructure is also necessary to preserve feed quality. While initial investment is relatively low compared to other circular models, compliance with animal feed safety standards may add costs related to testing and certification. Overall, the model maintains a lean cost structure, especially when operated at a cooperative scale
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	This model offers notable savings by reducing the need for purchased feed ingredients, which are often imported and price-volatile. By substituting part of the conventional



		feed with olive-derived materials, farmers can lower overall feed costs without compromising nutritional value. In parallel, olive oil producers and cooperatives benefit from avoiding waste disposal fees and the associated environmental compliance costs. Additionally, the model helps maximize the use of locally available biomass, improving operational efficiency and resource use across the farming system.
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	This model delivers clear environmental benefits by diverting significant volumes of olive by-products—such as pomace and leaves—from disposal pathways like landfilling, burning, or uncontrolled decomposition. By incorporating these materials into animal feed, it reduces methane and CO ₂ emissions associated with waste breakdown and transportation. Additionally, the model contributes to a lower carbon footprint in livestock production, as it replaces imported or industrially produced feed ingredients with local, upcycled alternatives. This helps improve the overall resource efficiency and sustainability of both crop and livestock systems in olive-growing regions.
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	Local job retention, improved autonomy for livestock cooperatives
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	Improved cost-efficiency for farmers, diversified use of olive subproducts
Transferability potential		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	The feasibility of this model for micro and small enterprises is high, particularly in rural areas where olive oil production and livestock farming coexist. The technologies required—such as drying, ensiling, or basic mixing equipment—are generally affordable and easy to operate. When implemented through cooperatives or local producer associations, the model becomes even more accessible, allowing small actors to share resources, infrastructure, and logistics. Its low capital intensity and alignment with traditional agricultural practices make it a practical and scalable solution for MSEs seeking to increase circularity and reduce costs.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Despite its simplicity, this model faces a few important challenges. Technically, it requires access to basic processing infrastructure, such as dryers or silos, which may not be readily available to all small producers. On the regulatory side, olive by-products must comply with feed safety standards, including limits on contaminants and proper storage conditions, which may require testing and certification that add complexity and cost. Culturally, some farmers may be hesitant to adopt non-traditional feed sources, requiring awareness and training efforts to promote acceptance and confidence in the model.



Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	This model thrives when there is geographic and operational proximity between olive oil production and livestock farming, allowing for low-cost logistics and fresh access to by-products. Another key enabler is the availability of technical support from agricultural agencies or cooperatives, which can guide producers in processing techniques, feed formulation, and regulatory compliance. Existing collaboration structures—such as rural associations or integrated cooperatives—also play a critical role by facilitating shared investment, infrastructure use, and knowledge exchange, making the model more resilient and scalable for small and medium producers.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	Especially effective in integrated agri-food systems. Some studies confirm nutritional viability and improved animal digestion

General information		
Business model name #5	<i>Full official or descriptive name of the circular business model</i>	Reuse of Olive Mill Wastewater for Agricultural Irrigation
Country/region	<i>Country or regional area where the business model is applied</i>	Spain (Andalusia, Extremadura, Murcia)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive oil production, water management, agriculture
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	EU projects, research institutions, news media
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://reutivar.eu https://retema.es https://es.oliveoiltimes.com/production/researchers-convert-olive-mill-wastewater-practical-uses/58845
Date of data collection	<i>(e.g., 1st of June 2025)</i>	
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	This circular business model focuses on the treatment and safe reuse of olive mill wastewater (OMWW), a by-product of olive oil production that is typically rich in organic matter, phenolic compounds, and high chemical oxygen demand (COD). The process begins with the collection of OMWW from olive mills, followed by advanced treatment using technologies such as membrane filtration, constructed wetlands, or aerobic and anaerobic bioreactors. The goal is to reduce the pollutant load and stabilize the water to meet safety thresholds for agricultural irrigation.



		<p>Once treated, the water is reused for irrigating olive groves or other crops, particularly in regions affected by water scarcity. The model closes the loop within the olive oil production cycle by reintegrating a treated waste stream into the same agroecosystem from which it originated. This approach supports key circular economy principles such as resource efficiency, waste-to-resource valorization, and industrial symbiosis.</p> <p>The general objectives of this model are to:</p> <ul style="list-style-type: none"> • Minimize environmental impacts associated with untreated OMWW discharge, • Conserve freshwater resources by replacing conventional irrigation water, • Recover nutrients and organic matter beneficial for soil health, • Comply with EU and Spanish regulations on wastewater management and water reuse in agriculture. <p>This model is currently under pilot or early adoption stages in Spain, especially in water-stressed regions like Andalusia, Extremadura, and Murcia, where it contributes both to environmental sustainability and agricultural resilience.</p>
<p>Business Model Type</p>	<p><i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i></p>	<p>This model is best classified under industrial symbiosis and water reuse. It exemplifies industrial symbiosis by creating a beneficial loop between olive oil production facilities and agricultural systems: a waste stream (olive mill wastewater) is transformed into a usable resource (irrigation water) within the same value chain. This symbiotic relationship reduces environmental burdens and enhances the sustainability of both sectors.</p> <p>Simultaneously, the model falls within the category of water reuse, as it involves the application of treated wastewater for productive use in agriculture. It aligns with EU circular economy strategies that promote the safe and efficient reuse of water resources, especially in areas facing water stress or where agriculture is heavily dependent on irrigation.</p>
<p>Geographical Scope</p>	<p><i>Does the model operate at a local, regional, national, or international scale?</i></p>	<p>The model currently operates at a local to regional scale, primarily through pilot projects and early adoption sites in Spain. It is particularly active in Andalusia, Extremadura, and Murcia, regions that are not only key olive oil producers but also face significant water scarcity challenges. These areas have been targeted due to their suitability for testing water reuse systems under real agricultural and climatic conditions.</p> <p>While still limited in scope, these regional implementations serve as foundational steps for potential broader national scaling, pending regulatory adjustments, economic viability, and public investment in water reuse infrastructure.</p>



Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Pilot to early adoption
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	<ul style="list-style-type: none"> - Water scarcity: In regions where water availability is a limiting factor for agricultural productivity, the reuse of treated olive mill wastewater provides an alternative irrigation source, reducing dependence on freshwater from aquifers or reservoirs. - Sustainable irrigation: By integrating wastewater into localized irrigation systems, the model contributes to more sustainable water management practices, aligning with national drought mitigation strategies and EU water reuse regulations. - Waste management: Olive mill wastewater is a highly polluting by-product with a high organic load and phenolic content, which makes direct discharge environmentally hazardous. This model offers a practical and legal solution for its treatment and reuse, helping producers comply with environmental legislation and avoid disposal-related penalties. - Resource efficiency: The model recovers both water and nutrients contained in the wastewater, contributing to more efficient use of natural resources within the agro-industrial cycle
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	This model stands out for enabling circular water use within the same agroecosystem where the waste originates, significantly reducing the extraction of freshwater resources in water-scarce regions. By treating and reusing olive mill wastewater directly for crop irrigation—particularly in olive groves—it closes the loop on water use in a highly localized and efficient manner. This environmentally innovative approach transforms a traditionally polluting effluent into a valuable agricultural input, offering both ecological benefits (such as reduced pollution and enhanced soil moisture retention) and operational advantages for farmers seeking to improve sustainability and comply with water reuse regulations.
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	The primary circular input used in this model is treated olive mill wastewater (OMWW). This effluent, originally considered a waste due to its high organic and phenolic content, is converted into a valuable resource through advanced treatment processes such as membrane filtration, constructed wetlands, or bioreactors. Once treated to meet agronomic and environmental safety standards, the reclaimed water is reused for irrigation, particularly in olive groves, thereby reintroducing water and residual nutrients into the agricultural cycle and supporting resource efficiency in olive-producing regions.



Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	The key circular activities in this model include the collection and treatment of olive mill wastewater using technologies such as membrane bioreactors, constructed wetlands, or advanced filtration systems. Once treated, the water is subjected to quality monitoring and nutrient profiling to ensure safe reuse. It is then applied through precision irrigation systems, which allow for targeted and efficient water distribution to crops, particularly olive trees. This process closes the loop by transforming a waste stream into a useful input within the same agricultural cycle, enhancing both water efficiency and environmental performance.
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	The successful implementation of this model relies on collaboration among a diverse group of stakeholders. Olive oil producers are central actors, as they generate the wastewater and often manage the surrounding agricultural land. R&D institutes, such as IFAPA and CSIC, play a key role in developing and validating treatment technologies, as well as conducting environmental and agronomic assessments. Municipalities and local water authorities are critical for regulatory oversight and for facilitating infrastructure deployment. Finally, farmers and agricultural cooperatives are essential end-users of the treated water, ensuring that it is applied correctly and sustainably within irrigation systems. This multi-actor cooperation ensures the technical, environmental, and legal viability of the circular model.
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	The circular implementation of this model is supported by several enabling technologies designed to treat olive mill wastewater and ensure its safe reuse. Key systems include membrane bioreactors and ultrafiltration units, which efficiently remove suspended solids and reduce chemical oxygen demand (COD). Constructed wetlands are also used in some pilot sites for eco-friendly treatment, leveraging natural processes to degrade organic matter. In addition, remote sensing and digital irrigation monitoring systems are employed to control water distribution and ensure that application rates meet agronomic and safety criteria. These technologies collectively enable the transformation of a highly polluting waste stream into a usable irrigation input, while minimizing environmental risks and ensuring regulatory compliance.
Value Capture		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	This model is not primarily revenue-driven in the conventional sense. Instead, its value proposition lies in cost savings, particularly through the reduction of freshwater procurement expenses and the avoidance of environmental penalties related to improper wastewater disposal. Additionally, compliance with environmental regulations can unlock eligibility for public funding or incentives under EU water reuse and sustainability programs. While direct income from the treated water is uncommon, some stakeholders (e.g., cooperatives or municipalities) may explore service-based models, such as shared treatment infrastructure or cost-sharing



		agreements for irrigation distribution.
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	The main cost components of this model are relatively high, particularly during the initial implementation phase. Capital investment in treatment infrastructure—such as membrane systems, bioreactors, or constructed wetlands—is a major expense. Additional ongoing costs include water quality monitoring, system maintenance, and energy consumption for treatment operations. Regulatory compliance adds further financial burden, as environmental assessments, water quality testing, and permit acquisition are required under Spanish and EU water reuse legislation. In pilot interviews, stakeholders highlighted that while operational costs can be shared in collective systems (e.g., cooperatives), individual adoption remains economically challenging without public subsidies or technical support.
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	This model offers significant circular cost savings, primarily through the reduction of irrigation water costs, especially in regions where freshwater is scarce, expensive, or subject to usage restrictions. By substituting treated wastewater for conventional water sources, farmers and cooperatives can decrease their operational expenses related to water procurement. Additionally, the model helps producers avoid environmental fines or penalties associated with the improper disposal of olive mill wastewater, which is classified as a highly polluting effluent under Spanish and EU law. In some cases, the reuse of nutrient-rich treated water can also reduce the need for supplemental fertilizers, generating further indirect savings and improving overall resource efficiency.
Impact Assessment		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	The environmental benefits of this model are substantial. First, it leads to a measurable reduction in freshwater extraction from aquifers and surface sources, contributing to the preservation of local water resources in drought-prone areas. By treating and reusing olive mill wastewater, the model also diverts a hazardous effluent from direct discharge into the environment, preventing soil and water contamination caused by its high phenolic and organic content. Moreover, the treated water often retains residual organic compounds and nutrients, which can contribute to soil fertilization and improved moisture retention when used in irrigation, thus enhancing soil health and reducing reliance on synthetic fertilizers. These outcomes align with EU targets for resource efficiency, sustainable agriculture, and pollution prevention in the agro-industrial sector.
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	At the community level, this model offers important benefits, particularly in water-scarce rural areas where agriculture is a primary economic activity. By providing an alternative irrigation source, it helps maintain crop productivity during dry periods, thereby contributing to local food security and economic stability. It also supports



		stakeholder inclusion, fostering collaboration among farmers, cooperatives, municipalities, and research institutions. However, the social impact remains limited at this stage, as most implementations are still in pilot or early adoption phases. Wider deployment and integration into regional water management strategies would be required to generate substantial job creation or long-term value chain reinforcement.
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	The economic impact of this model depends largely on the scale and context of implementation. At the pilot and early adoption stages, direct profitability remains limited, as the model is not primarily revenue-generating. However, it provides economic resilience by lowering production costs associated with irrigation and by avoiding environmental compliance fines. For olive producers, especially in cooperative settings, the reuse of treated wastewater can also help stabilize agricultural output during droughts, indirectly supporting farm income. Additionally, integration into EU and national funding schemes—such as those linked to the Green Deal or PERTE Agua—can improve financial viability. While full economic return is still conditional on broader scaling and policy support, the model offers a strategic advantage in sustainability-focused markets.
<i>Transferability potential</i>		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	The feasibility of this model for micro and small enterprises (MSEs) is generally low to medium, primarily due to the high technical and financial requirements of wastewater treatment infrastructure. Most MSEs lack the resources to independently invest in advanced purification systems or meet the strict regulatory standards for water reuse. However, collective adoption through cooperatives, shared treatment facilities, or public-private partnerships can significantly improve access. When supported by EU or regional funding, and accompanied by technical assistance from research institutions or water agencies, the model becomes more accessible to small producers—especially in areas with strong cooperative traditions or existing water reuse initiatives.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Several barriers limit the widespread adoption of this model. Technically, the treatment of olive mill wastewater is complex due to its high organic load, phytotoxicity, and seasonal variability, requiring advanced and often costly purification technologies. Economically, the high initial capital expenditure (CAPEX) and ongoing operational costs are prohibitive for most small and medium producers without external support. On the regulatory side, Spain—like other EU countries—imposes strict conditions for the reuse of treated wastewater in agriculture, including detailed monitoring and authorization procedures, which can be time-consuming and administratively burdensome. Additionally, cultural and awareness barriers persist, as some farmers are hesitant to use treated effluent for irrigation due to concerns over crop quality or market acceptance. These combined factors restrict the scalability of the model unless



		addressed through coordinated policy, financing, and education strategies.
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	The successful implementation of this model depends on several enabling conditions. First, access to public funding—particularly from EU programs such as LIFE, Horizon Europe, or Spain’s PERTE Agua—is essential to offset the high investment and operational costs. Second, the presence of technical expertise and institutional support, particularly from R&D institutes like IFAPA or CSIC, is crucial for selecting appropriate treatment technologies and ensuring regulatory compliance. Strong cooperation among stakeholders, including farmers, cooperatives, municipalities, and water authorities, facilitates shared infrastructure and efficient governance. Additionally, supportive regulatory frameworks that streamline permitting and promote safe water reuse can accelerate adoption. Finally, in regions with chronic water stress, the urgency to secure alternative water sources increases the practical and political momentum needed to scale the model
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model’s circular performance</i>	Still under technical validation in Spain; promising in regions with extreme drought and supportive policies (e.g. SE Spain). EU and national funding (e.g., PERTE agua) could facilitate wider adoption

General information		
Business model name #6	<i>Full official or descriptive name of the circular business model</i>	Valorization of Olive Pomace into Activated Carbons for Lithium-Sulfur Batteries
Country/region	<i>Country or regional area where the business model is applied</i>	Spain (Andalusia, particularly Córdoba)
Sector	<i>e.g., olive sector, agrifood sector, or another related industry</i>	Olive oil sector, energy storage, advanced materials
Source type	<i>Source of information (e.g., scientific paper, EU project report, company website, interview, market report)</i>	University research, scientific publications, innovation news, institutional dissemination
Reference	<i>Links, references, or document identifiers for proper sourcing and validation</i>	https://www.mercacei.com/noticia/53456/actualidad/desarrollan-un-carbon-activo-derivado-de-residuos-de-aceite-de-oliva.html https://www.oleorevista.com/texto-diario/mostrar/4990749/carbon-proyecto-convierte-residuos-aceituna-carbon-activado-aplicaciones-industriales https://digibug.ugr.es/bitstream/handle/10481/6621/18935916.pdf?isAllowed=y&sequence=1 https://www.eldiadecordoba.es/cordoba/universidad-cordoba-alperujo-compost-baterias-litio-azufre_0_2002485667.html https://www.mercacei.com/noticia/62298/actualidad/avanza-el-proyecto-



		olive4future-para-la-valorizacion-del-alperujo.html
Date of data collection	<i>(e.g., 1st of June 2025)</i>	09/05/25
Business model overview		
Brief Description	<i>Summary of how the business model operates, key circular principles involved, and its general objectives</i>	This model focuses on transforming olive pomace (alperujo), a by-product of olive oil production, into activated carbon materials for use in lithium-sulfur battery electrodes. Developed through R&D projects at the University of Córdoba, the process includes composting, carbonization, and chemical activation of olive residues. It links agriculture and energy sectors, creating a high-value material from waste and supporting sustainable battery manufacturing.
Business Model Type	<i>Classification based on type (e.g., industrial symbiosis, by-product valorization, product-service system, sharing platform)</i>	By-product valorization, industrial symbiosis
Geographical Scope	<i>Does the model operate at a local, regional, national, or international scale?</i>	Pilot (regional), potential national scaling
Maturity Level	<i>(pilot, in early adoption, operational, or scaled)</i>	Research phase with pilot trials
Value Proposition		
Customer Needs Addressed	<i>What needs or challenges the model addresses (e.g., waste minimization, circular product offering, cost savings)</i>	The model addresses several intersecting needs across the agricultural and energy sectors. On the one hand, it offers a sustainable solution for the large volumes of olive pomace generated during the olive oil production process—by transforming what is traditionally a costly and environmentally problematic residue into a valuable resource. This directly responds to the pressing need for more sustainable and economically viable waste management strategies in olive-producing regions. On the other hand, the model aligns with the growing global demand for eco-friendly and high-performance materials in the battery industry, particularly as the market for lithium-sulfur batteries expands due to their superior energy density and lower environmental impact compared to conventional lithium-ion technologies. By providing a renewable and locally sourced alternative to synthetic or fossil-based carbon materials, this circular approach also supports the diversification and security of supply chains for critical battery components, especially in Europe, where dependency on imported materials poses both economic and strategic risks.
Unique Selling Proposition (USP)	<i>How does the model differentiate itself (e.g., innovation, environmental benefits, customer-centric circularity)</i>	Bio-based activated carbon for batteries, integration of waste-to-energy-materials, scientific innovation in circular economy
Value Creation & Delivery		
Circular Resources	<i>What are the types of circular inputs used (e.g., olive by-products, renewable energy, recycled packaging materials)</i>	The primary circular resource utilized in this model is olive pomace (alperujo), a semi-solid waste generated in large quantities during the two-phase olive oil extraction process. Instead of being discarded or used in low-value applications, this by-product



		undergoes a series of transformations—beginning with composting or drying to stabilize the biomass, followed by carbonization through pyrolysis or hydrothermal treatment to convert it into a carbon-rich material. This carbonized biomass is then chemically or physically activated to produce porous structures suitable for use as electrodes in lithium-sulfur batteries. The process exemplifies a circular use of agricultural waste by extending its life cycle and upgrading its utility from an environmental liability to a high-value functional material, contributing to both waste reduction and sustainable materials sourcing.
Core Circular Activities	<i>What are the main activities that close-the-loop (e.g., remanufacturing, reverse logistics, waste valorization, product refurbishment)</i>	The core circular activities of this business model begin with the collection and selection of olive pomace (alperujo) from local olive oil mills, ensuring the biomass is suitable for subsequent transformation. This raw material undergoes pre-treatment processes such as drying or composting, which stabilize its composition and reduce moisture—key for efficient thermal conversion. The pre-processed biomass is then subjected to carbonization techniques, including pyrolysis or hydrothermal carbonization, which decompose the organic matter under controlled conditions to create a stable carbon matrix (biochar). Following this, the material is activated—typically through physical (e.g., steam or CO ₂) or chemical means (e.g., KOH or ZnCl ₂)—to enhance its porosity and surface area, properties that are critical for electrochemical performance in battery applications. Finally, the activated carbon is processed and shaped into electrode materials, often involving grinding, mixing with conductive additives and binders, and application onto current collectors. These activities form a closed-loop value chain that not only diverts agricultural waste from disposal but also upcycles it into advanced materials for clean energy technologies, demonstrating a high degree of innovation and circularity.
Key Partnerships	<i>Who are the stakeholders supporting the model (e.g., SMEs, cooperatives, municipalities, supply chain actors, R&D institutes)</i>	University of Córdoba (research groups RNM-271, FQM-175), olive cooperatives, battery tech developers
Enabling Technologies	<i>Which are the tools or systems that support circularity (e.g., composting facilities, digital traceability, clean production technologies)</i>	The successful implementation of this circular business model relies on a suite of advanced enabling technologies that facilitate the transformation of olive pomace into high-performance carbon materials for lithium-sulfur batteries. The process begins with drying or composting systems, which reduce moisture and partially stabilize the biomass, preparing it for carbonization. The core transformation step utilizes thermal conversion technologies such as pyrolysis reactors or hydrothermal carbonization units, which thermochemically break down the organic material into a carbon-rich solid (biochar) under controlled conditions. This intermediate product is then refined using activation technologies, which may include chemical activation setups using agents like potassium hydroxide (KOH), or physical methods involving high-temperature steam or CO ₂ flows to develop the material’s porous structure. To ensure the suitability of the



		resulting activated carbon for energy storage, materials characterization tools such as BET surface area analyzers, electron microscopy, and X-ray diffraction (XRD) are employed to assess structural and electrochemical properties. In the final stage, battery prototyping platforms and electrochemical testing systems—such as cyclic voltammetry and galvanostatic charge-discharge testers—validate the performance of the carbon in lithium-sulfur cells. Together, these technologies form a comprehensive and integrated system that not only supports circularity but also enables cutting-edge innovation in the bioeconomy and energy sectors.
<i>Value Capture</i>		
Revenue Streams	<i>Which are the revenue sources (e.g., sales of circular products, service fees, leasing models, secondary raw materials)</i>	This model generates revenue primarily through the sale of bio-based activated carbon materials to battery manufacturers, particularly those developing lithium-sulfur technologies. Additional income can be derived from licensing proprietary carbonization and activation processes developed by research institutions or spin-offs. In some cases, producers may also access public or private funding linked to carbon credits or environmental innovation, especially given the model's alignment with EU Green Deal objectives. As the technology matures, there is also potential for income through contract manufacturing or custom material development services for the energy storage sector. These streams make the model economically attractive, particularly for innovation-driven regions and actors within the bioeconomy.
Cost Structure	<i>What are the main cost elements (e.g., circular process costs, logistics, processing, investment in new equipment)</i>	The main cost components of this model stem from its technological intensity and research-driven nature. Significant capital expenditure (CAPEX) is required for setting up thermal processing units—such as pyrolysis or hydrothermal reactors—and for activation systems, which involve high temperatures or chemical agents. Additional costs arise from laboratory equipment and material testing, essential to ensure that the resulting carbon meets the technical standards required for battery applications. R&D expenses are also substantial, particularly in the early phases of optimization and scale-up. Other recurring costs include energy consumption, especially during the activation phase, handling and logistics of raw materials, and compliance with environmental and material safety regulations. While these costs are higher than those in simpler valorization models, they are justified by the high added value of the final product and the potential for long-term profitability in the advanced materials market.
Circular Cost Savings	<i>What are the savings (e.g., reduced raw material costs, avoided landfill fees, energy efficiency gains)</i>	Low-cost raw materials, reduced waste management costs, sustainable branding potential
<i>Impact Assessment</i>		
Environmental Impact	<i>What are the (quantified) benefits (e.g., GHG reduction, % waste diverted from landfill, improvements on resource efficiency)</i>	This model delivers significant environmental benefits by transforming olive pomace—a high-volume agricultural by-product—into a valuable input for sustainable energy storage systems. It diverts substantial amounts of organic waste from landfills or



		uncontrolled decomposition, which would otherwise emit methane and contribute to soil and water contamination. By converting this waste into activated carbon, the model promotes resource efficiency and supports a circular bioeconomy. Furthermore, it helps reduce dependence on fossil-derived or mined carbon materials commonly used in battery manufacturing, thereby lowering the overall carbon footprint of the energy storage supply chain. Although precise figures depend on scale, pilot studies suggest that this approach can reduce GHG emissions associated with battery material production by up to 50%, while recovering and valorizing over 90% of the biomass used in the process.
Social Impact	<i>Which are the benefits on community-level (e.g., job creation, stakeholder inclusion, local value chain reinforcement)</i>	This model supports local job creation in rural and semi-industrial areas through new roles in biomass processing, materials handling, and applied research. It also encourages collaboration between agricultural cooperatives and research institutions, strengthening knowledge transfer and stakeholder inclusion. By generating value from local waste, it reinforces the regional value chain and fosters innovation-based economic development in olive-producing communities.
Economic Impact	<i>Which are the direct business impacts (e.g., improved profitability, diversification of revenue streams, market competitiveness)</i>	This model enables the diversification of revenue streams for olive producers and associated entities by converting low-value waste into a high-margin material for the energy sector. It enhances market competitiveness through innovation and sustainability branding, aligning with growing demand for circular materials. Additionally, by integrating into the advanced materials value chain, it opens access to new markets and funding opportunities, improving long-term business resilience and profitability.
<i>Transferability potential</i>		
Feasibility for MSEs	<i>How easy it is for micro and small enterprises to adopt the model (e.g., low/medium/high) (with justification)</i>	The feasibility for micro and small enterprises (MSEs) is low to medium, primarily due to the technical complexity and capital investment required for carbonization and activation processes, as well as the strict quality standards in the battery sector. However, adoption becomes more viable if MSEs participate through collaborative models, such as cooperatives, public-private partnerships, or via technology transfer agreements with universities and research centers. Access to EU innovation funding and shared pilot infrastructure can also significantly lower entry barriers.
Barriers	<i>What are the technical, economic, cultural, or regulatory challenges towards adoption</i>	Key barriers to adoption include technical challenges related to the precise control of carbonization and activation processes needed to meet battery-grade specifications. Economic constraints are also significant, as the required infrastructure and R&D investments are often beyond the reach of individual small operators. On the regulatory side, the use of bio-based materials in battery manufacturing is subject to emerging standards and may face additional certification hurdles. Culturally, there may be limited awareness or hesitation among traditional olive producers to engage in high-tech, non-



		agricultural value chains without strong institutional support.
Key success factors	<i>Which are the enabling factors (e.g., supportive policies, existing partnerships, access to finance, local ecosystem readiness)</i>	The success of this model depends on several enabling factors, including supportive public policies that promote circular economy and sustainable materials, especially within the EU Green Deal and battery innovation frameworks. Access to funding from programs like Horizon Europe or regional innovation grants is crucial to overcome initial R&D and infrastructure costs. Strong partnerships between universities, cooperatives, and technology firms facilitate knowledge transfer and industrial scaling. Finally, the presence of a local innovation ecosystem—with existing research capacity and interest in advanced energy materials—greatly enhances feasibility and impact.
Notes		
Additional comments	<i>Any relevant and contextual factors, limitations, or anecdotal insights relevant to understanding the model's circular performance</i>	This model represents a pioneering approach in the intersection of agriculture and advanced energy technologies. While still in early stages, it showcases strong alignment with emerging European strategies on critical raw materials and circular batteries. Its success could position Spain as a reference in bio-based battery components. However, full scalability will depend on market validation, industrial uptake, and regulatory acceptance of bio-derived materials in high-performance energy applications. Initial pilot results in Córdoba highlight both the technical viability and the strategic potential of olive waste beyond traditional uses.

7.3 Circular Business Model Canvas template

This Circular Business Model Canvas template is a combination of the Circular and Sustainable Business Model Canvas (CSBMC) which focuses on embedding sustainability and circular economy within a single firm’s operations and value chains, in terms of environmental and social impact, and the Circular, Collaborative, and Co-Creative Business Model Canvas (C3BMC) which focuses on systemic collaboration and circular ecosystems, in terms of how businesses can leverage collaboration and co-creation within a circular economy network to create and deliver value.

Business Model Identification	<i>[Business Model Name]</i>
Country/Region applied in	
Sector applied to	
Date established	
Value Proposition	
What customer and societal needs are addressed?	
What circular value (e.g., waste reduction, regeneration) is delivered?	
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	
How is value co-created, and partnerships formed?	
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	
What are the enabling technologies that support value delivery?	
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	
What distribution channels align with circularity? (e.g., local, shared logistics)	
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	
Are new streams from resource loops or collaborations generated? Name them	
Circular Cost Structure	



What are the main operational costs? (e.g., reverse logistics)	
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	
Which circular economy principles are applied?	
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	
How this CBM ensures that vulnerable groups are engaged?	
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	
How does the model enhance resilience? (e.g., local sourcing, partnerships)	
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	
How is performance tracked?	

7.3.1 CBMC per country

Croatia

Business Model Identification #1	Bioreactor-based composting of olive pomace
Country/Region applied in	Croatia
Sector applied to	Olive sector
Date established	October 1 st 2022
Value Proposition	
What customer and societal needs are addressed?	Recycling of olive pomace
What circular value (e.g., waste reduction, regeneration) is delivered?	Waste reduction, compost production
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Agricultural companies, R&D institutions
How is value co-created, and partnerships formed?	Through collaboration in research and pilot implementation
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Waste resources
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Recycling, valorization
What are the enabling technologies that support	Pilot-scale bioreactors with forced aeration



value delivery?	
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Currently not directly engaged (pilot stage), but future engagement could include local farmers using the compost
What distribution channels align with circularity? (e.g., local, shared logistics)	Local and regional channels envisioned for future compost distribution
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Through national funding
Are new streams from resource loops or collaborations generated? Name them	No
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Electricity, labor, maintenance of bioreactors, equipment depreciation
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Not applicable
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	It reduces the waste quantity
Which circular economy principles are applied?	Waste valorization
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	New knowledge about waste valorization techniques
How this CBM ensures that vulnerable groups are engaged?	Not applicable
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Variability in olive pomace compost quality
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Not applicable
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	The quality of the compost
How is performance tracked?	Through regular analytical characterization

Business Model Identification #2	Plant for recycling olive by-products and waste
Country/Region applied in	Croatia
Sector applied to	Olive sector
Date established	2013
Value Proposition	
What customer and societal needs are addressed?	Disposal of unutilized waste, offer of competitive energy source to local consumers
What circular value (e.g., waste reduction,	Waste reduction and valorization



regeneration) is delivered?	
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Waste producers, owners of waste processing plants, buyers/distributors of processed waste
How is value co-created, and partnerships formed?	Through cooperation between waste producers and plant owners in creating the energy source through waste processing
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	By-products from olive processing – renewable
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Utilization of unutilized waste
What are the enabling technologies that support value delivery?	Combination of existing technologies and simple new innovative technologies
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Using products for their own energy needs
What distribution channels align with circularity? (e.g., local, shared logistics)	Shared logistics
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sales of circular products
Are new streams from resource loops or collaborations generated? Name them	A new revenue stream is generated by valorizing unutilized olive processing residues, which are transformed into pellets for energy production and sale
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Logistics, energy products, labor
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Lower energy consumption
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	The amount of waste generated from olive processing is reduced
Which circular economy principles are applied?	Waste valorization
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Unutilized waste that pollutes the environment is disposed of
How this CBM ensures that vulnerable groups are engaged?	/
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Raw material supply, slowness of institutions
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Local sourcing
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	The percentage of used waste, currently about 5% is used, and with implementation, the remaining 95% would be used.



How is performance tracked?	Profitability of the investment and the amount of disposed waste
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Business Model Identification #3	Olive by-products utilization and valorization
Country/Region applied in	Croatia
Sector applied to	Olive sector
Date established	2020
Value Proposition	
What customer and societal needs are addressed?	Disposal needs for olive by-products
What circular value (e.g., waste reduction, regeneration) is delivered?	Waste reduction and valorization
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Local community
How is value co-created, and partnerships formed?	Through cooperation with local producers and the local community
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Recycled
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Reuse and utilization of by-products generated in the olive processing process
What are the enabling technologies that support value delivery?	Composting plants – a machine for separating pits from wet pomace and a mulcher for shredding waste in the olive grove after pruning
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Not applicable
What distribution channels align with circularity? (e.g., local, shared logistics)	Local distribution
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Leasing and service contracts
Are new streams from resource loops or collaborations generated? Name them	Not applicable
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Equipment procurement and servicing
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Reduced use of fertilizers and top dressing in olive groves
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	The amount of waste generated after olive processing is reduced, and by returning it to the olive grove, some of the nutrients are also returned to the soil
Which circular economy principles are applied?	Waste reduction and valorization
Social Impact	
In which ways does this CBM contribute to	Spreading awareness about sustainable development, biodiversity conservation, and organic olive growing at the local community level,



community well-being, local jobs, or social inclusion?	with the potential for creating new jobs and cooperation with other olive growers in the area.
How this CBM ensures that vulnerable groups are engaged?	Not applicable
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Regulatory barriers
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Collaborations and partnerships, good interpersonal and business relations with colleagues from the same or similar fields of activity
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Percentage of waste diverted
How is performance tracked?	An increase in the amount of composted pomace and the share of residue after pruning leaves and branches in the total amount of fertilizer used on an annual basis, better results in olive fruit yields and oil yields in certain micro-locations where annual fertilization was carried out

Business Model Identification #4	Utilizing the value of waste generated during olive pruning
Country/Region applied in	Croatia
Sector applied to	Olive sector
Date established	2015
Value Proposition	
What customer and societal needs are addressed?	Reduces costs associated with purchasing organic fertilizers and minimizes waste disposal
What circular value (e.g., waste reduction, regeneration) is delivered?	Organic waste (olive branches) is valorized and returned to the soil, contributing to soil regeneration and circular nutrient flow
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	R&D institutes
How is value co-created, and partnerships formed?	Collaboration with R&D institutes enables knowledge sharing
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive by-products – pruning residues
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Waste valorization through mechanical mulching and reintegration into agricultural soil
What are the enabling technologies that support value delivery?	Mechanical processing equipment - mulcher
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Indirect – customers benefit through more sustainable products - the company communicates environmental benefits to increase awareness
What distribution channels align with circularity? (e.g., local, shared logistics)	Localized operation and application
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	No direct revenue generated from this practice
Are new streams from resource loops or	No - potential future collaborations or services (mulching as a service) may open revenue channels



collaborations generated? Name them	
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Investment in mulcher and other machinery
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Reduces the need to purchase external organic fertilizers and lowers waste disposal expenses
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Decreases organic waste, reduces dependence on chemical fertilizers, improves soil quality
Which circular economy principles are applied?	Resource efficiency, by-product valorization
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	If the business grows it has a potential for job creation
How this CBM ensures that vulnerable groups are engaged?	Not directly addressed
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Mulcher malfunction and not being able to replace the mulcher leads to not being able to valorize the waste
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Local equipment sourcing, potential for service outsourcing
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	No specific metrics currently tracked
How is performance tracked?	It is not tracked



Business Model Identification #1	<i>Composting of Olive Mill Waste for the Production of Soil Amendments</i>
Country/Region applied in	Western Greece (Amfilochia, Agrinio)
Sector applied to	Olive sector
Date established	06.06.2025
Value Proposition	
What customer and societal needs are addressed?	Urgent need to manage phytotoxic olive mill waste. Demand for sustainable and cost-effective soil amendments. Compliance with environmental waste regulations for olive mills
What circular value (e.g., waste reduction, regeneration) is delivered?	Waste-to-value transformation of OMWW, kernels, leaves. Nutrient cycling, soil regeneration, and pollution mitigation. GHG emissions reduction and full organic waste valorisation
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Local olive mills (SMEs), farmers, agricultural cooperatives. R&D partners: University of Patras, University of Trieste, ICE-HT/FORTH. Agrino (rice husk supplier), local wood industries.
How is value co-created, and partnerships formed?	Multi-sector collaboration (agro-industrial, research, farmers). Shared access to feedstocks and co-developed composting protocols. R&D institutes ensure validation and scalability of the process.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive mill wastewater, olive leaves/kernels, rice husks, sawdust, wood shavings, and wetland reeds
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Co-composting of multiple biomass streams under thermophilic aerobic conditions. Feedstock blending and process control (C/N ratio, temp, moisture). Final compost application as soil enhancer.
What are the enabling technologies that support value delivery?	Pilot/full-scale composting facilities. Thermophilic control systems, moisture regulators, process modelling. Genotoxicity/phytotoxicity assays for compost validation.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Farmers adopt compost, reducing chemical fertilizer use. Olive mills reduce waste disposal, engage in circular waste loops.
What distribution channels align with circularity? (e.g., local, shared logistics)	Local/regional distribution of compost to nearby farmers. Potential use of shared transport logistics among partners.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sale of compost as soil amendment to farmers and cooperatives. Cost avoidance for mills (waste disposal fees).
Are new streams from resource loops or collaborations generated? Name them	Valorisation of OMWW and co-feedstocks into certified compost. Potential service model for composting waste on behalf of olive mills.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Collection and logistics of feedstocks. Composting operations: monitoring, aeration, moisture management. Equipment (sensors, compost units), laboratory testing



In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Avoided landfill fees for mills. Reduced synthetic fertilizer purchases for farmers. Minimized regulatory compliance costs through valorisation.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	100% waste diversion from landfill/discharge. Up to 90% phenol elimination. Reduction in synthetic fertilizer use and soil degradation.
Which circular economy principles are applied?	By-product valorisation. Nutrient cycling and regeneration. Pollution prevention and closed-loop resource use.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Supports local farmers with affordable, high-quality compost. Enhances knowledge sharing and stakeholder integration. Contributes to rural development and circular skills formation.
How this CBM ensures that vulnerable groups are engaged?	High potential to engage rural MSEs and traditional producers through training and cooperative models
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Need for process control knowledge (temperature, C/N ratio). Market acceptance of compost. Initial investment in infrastructure for small producers.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Local biomass sourcing reduces supply dependency. Modular and scalable design allows phased implementation. Partnership-based implementation mitigates resource constraints.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Germination Index (85–198%), C/N ratio (12–27), Nitrogen content (3.1–4.1%). Phenol reduction rates, % of OMWW diverted. Genotoxicity and phytotoxicity lab tests.
How is performance tracked?	Scientific validation by university labs. Routine lab testing of compost quality and field performance.

Business Model Identification #2	Integrated Supply Chain for Compost Production from Olive Oil Waste
Country/Region applied in	Greece (specifically: Messinia and Peloponnese regions)
Sector applied to	Olive sector / Agrifood sector
Date established	10.06.2025
Value Proposition	
What customer and societal needs are addressed?	Waste minimization for olive mills and farms. Cost-effective, high-quality compost for farmers. Environmental compliance with waste disposal legislation. Supply chain integration to address logistics inefficiencies.
What circular value (e.g., waste reduction, regeneration) is delivered?	Valorisation of olive mill waste and pruning residues. Closed nutrient and organic matter loop in agriculture. GHG emissions reduction via optimized logistics and composting.
Stakeholder Collaboration & Co-Creation	



Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Olive oil producers (SMEs). Transport and logistics companies. Centralized composting facility operators. R&D institutes (model development and validation). Local farmers and agricultural cooperatives.
How is value co-created, and partnerships formed?	Coordinated network linking waste producers, transporters, and compost users. Scientific input enhances reliability and credibility. Regional partnerships facilitate material and knowledge flow.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive mill waste (OMW), including solid and liquid fractions. Pruning biomass and other agricultural residues
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Aggregation of waste from olive mills and farms. Route optimization and digitally assisted transportation. Centralized composting of biomass. Redistribution of compost to local farming systems.
What are the enabling technologies that support value delivery?	GIS-based supply chain optimization software. Simulation tools for logistics and environmental impact analysis. Digital planning for resource allocation and route planning.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Farmers use compost instead of chemical fertilizers. Olive mills outsource waste while contributing to the circular chain
What distribution channels align with circularity? (e.g., local, shared logistics)	Local compost delivery using optimized transport networks. Shared logistics reduce emissions and costs.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sale of compost to local agricultural customers. Service fees for waste collection and processing from mills.
Are new streams from resource loops or collaborations generated? Name them	Potential commercialization of optimization tools as digital services. Future monetization of logistics insights or partnerships with agri-tech platforms.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Collection and transport of waste. Digital tool operation, software development, or licensing. Composting operations and infrastructure. Personnel, lab testing, and logistics planning
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Avoided landfill fees and lower raw material cost for fertilizers. Transportation cost reductions via optimized routing. Reduced operational inefficiencies through central coordination.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	100% utilization of olive mill waste and pruning residues. Measurable GHG emissions reduction from transport and decomposition avoidance. Improved soil health and elimination of uncontrolled biomass disposal.
Which circular economy principles are applied?	Industrial symbiosis. Resource efficiency and local nutrient cycling. Pollution prevention and circular logistics.
Social Impact	



In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Job creation in transport, composting, and waste handling. Stronger rural value chains and local economic circulation. Knowledge diffusion and collaboration among stakeholders.
How this CBM ensures that vulnerable groups are engaged?	Potential for SME cooperatives and inclusive local employment. High alignment with rural development and agricultural transition policies.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Technical: Digital tool complexity for non-tech-savvy SMEs. Economic: Initial capital for infrastructure and logistics platforms. Cultural: Resistance to supply chain collaboration among fragmented actors. Regulatory: Waste transport and compost certification compliance.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Decentralized but coordinated model increases regional self-reliance. System flexibility through modular, simulation-based design. Risk buffering via stakeholder interdependence and demand-side integration
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Waste volumes collected and composted (in tonnes). GHG reduction per tonne of biomass processed. Compost distribution rate and soil performance improvements. Supply chain optimization benchmarks (km saved, fuel use).
How is performance tracked?	Model simulations and GIS monitoring tools. Periodic environmental and economic impact assessments. Data dashboards (potentially real-time) for logistics management.

Business Model Identification #3	Integrated Water-Energy-Nutrient Recovery from Olive Mill Wastewater
Country/Region applied in	Greece
Sector applied to	Olive sector / Agrifood sector
Date established	22.06.2025
Value Proposition	
What customer and societal needs are addressed?	Waste minimization of high-organic-load olive mill wastewater (OMWW). Energy recovery and reduction of operational costs via biogas. Mitigation of water scarcity through reuse in fertigation. Compliance with EU environmental directives on wastewater discharge
What circular value (e.g., waste reduction, regeneration) is delivered?	Triple output recovery: renewable energy (biogas), clean water, and organic nutrients. Enables near-zero-waste operation in olive oil production.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Olive oil mills (as waste producers). Farmers (recipients of treated water and nutrients). Universities and R&D institutes (developers and evaluators of AnMBR). Technology providers (membrane systems, biogas infrastructure). Municipalities (support with permitting, environmental integration).
How is value co-created, and partnerships formed?	Strong R&D-industry collaboration. Technology validation supported by academic institutions. Regional partnership model across the agrifood-wastewater-energy nexus.
Circular Value Creation & Delivery	



What type(s) of resources are used? (e.g., renewable, recycled)	Olive mill wastewater as the main input. Biologically derived nutrients. Energy generated on-site from anaerobic digestion.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Anaerobic digestion for biogas production. Membrane bioreactor filtration for water purification. Recovery and reuse of nutrients through fertigation. Local water reuse in irrigation—closing water and nutrient loops.
What are the enabling technologies that support value delivery?	Anaerobic Membrane Bioreactor (AnMBR). Biogas recovery units. Nutrient recovery and fertigation infrastructure. Analytical systems for quality control and monitoring.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Farmers utilize treated water and nutrients—reducing reliance on chemicals. Olive oil producers participate in resource recovery rather than waste disposal.
What distribution channels align with circularity? (e.g., local, shared logistics)	Direct reuse onsite or nearby fields for fertigation. Biogas reuse for internal operations (heating/electricity) rather than external sale.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Indirect: Energy cost savings from biogas self-supply. Reduced expenses: Lower disposal and fertilizer procurement costs. Potential service contracts: Processing OMWW from third-party mills.
Are new streams from resource loops or collaborations generated? Name them	Valorisation of previously discarded wastewater into multiple resources. Strengthening of local circular ecosystems around renewable inputs.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Capital investment in AnMBR units and associated infrastructure. Technical operations: membrane maintenance, monitoring, staffing. Testing for compliance (water reuse standards, nutrient levels).
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Avoided wastewater discharge fees and penalties. Energy cost offset via biogas generation. Reduced chemical fertilizer needs via nutrient reuse. Lower freshwater procurement costs through recycling.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	100% OMWW diversion from surface discharge or illegal dumping. Substantial GHG savings through methane capture and clean combustion. Reuse of water significantly mitigates aquifer depletion and irrigation stress.
Which circular economy principles are applied?	Waste-to-resource valorisation. Closed-loop nutrient and water cycles. Renewable energy generation. Pollution prevention and ecological regeneration
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Local job creation in facility operation, monitoring, and fertigation services. Strengthened regional circular economy ecosystem. Improved environmental quality and water management.
How this CBM ensures that vulnerable groups are engaged?	Potential inclusion through cooperatives and shared services. Scalable for engagement of small farmers and community water systems.



Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	High technical complexity and need for skilled operators. Capital intensity limits direct MSE adoption. Cultural resistance to fertigation using recycled water. Regulatory uncertainty around biogas and wastewater reuse
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Modular and centralized design enables shared deployment. Strong alignment with EU environmental and green innovation policy. Partnership with universities mitigates skills and monitoring gaps.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Volumes of OMWW treated. Volume of clean water and biogas produced. Nutrient recovery rates (N, P, K). GHG emissions avoided and cost savings (€/m ³ or €/t).
How is performance tracked?	Lab-grade monitoring of water quality, biogas output, and nutrient concentrations. Real-time system monitoring via SCADA or IoT-enabled platforms.

Business Model Identification #4	Integrated Circular Bio-Valorisation Model for Olive Oil Production and By-product Regeneration
Country/Region applied in	Northern Greece – Thrace Region, specifically in the Prefecture of Evros near the town of Makri, Municipality of Alexandroupoli
Sector applied to	Olive sector
Date established	02.07.2025
Value Proposition	
What customer and societal needs are addressed?	Minimization of solid and liquid waste from olive oil production. Autonomy in energy and soil input provision. Sustainable production that exceeds regulatory compliance.
What circular value (e.g., waste reduction, regeneration) is delivered?	Zero-waste olive oil production via full valorisation of all by-products. Closed-loop nutrient cycling and renewable energy generation. Brand differentiation through traceable sustainability and eco-tourism.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	KYKLOPAS S.A. (vertically integrated SME). Local biogas facility (industrial symbiosis). Olive growers (internal and local). Certifying bodies (ISO, HACCP). Olive oil tourists and sustainability networks.
How is value co-created, and partnerships formed?	Bi-directional symbiosis with energy and waste management partners. Integration of agri-waste valorisation into regional circularity networks. Knowledge sharing via national forums and tourism experiences.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Prunings, olive leaves → compost. Olive mill wastewater → biogas feedstock. Pyrene (olive pit biomass) → renewable heat. Compost → soil enhancer reused internally.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	On-site composting of agricultural and processing residues. Transfer of OMWW to local biogas plant for energy recovery.



	Thermal self-sufficiency using pyrene in biomass boilers. Compost and energy reuse within own operations.
What are the enabling technologies that support value delivery?	Composting units and shredders. Biomass heating system for winter operation. Transport arrangement to external biogas facility. Precision fertilization tools (leaf/soil diagnostics).
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Olive oil consumers engage through eco-labelling and olive tourism. Visitors learn and interact with the zero-waste system in situ.
What distribution channels align with circularity? (e.g., local, shared logistics)	Products (olive oil) distributed with sustainability storytelling. Compost and biomass valorised internally rather than externally.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sales of high-quality, sustainably produced extra virgin olive oil. Cost savings: reduced energy/fertilizer bills, zero waste management fees.
Are new streams from resource loops or collaborations generated? Name them	Co-branded value through partnership with biogas plant. Added value via olive tourism (educational and experiential service).
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Composting labour and equipment. Biomass handling, storage, and combustion system maintenance. OMWW transportation to biogas unit.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Avoided synthetic fertilizer use. Avoided fossil fuel purchases. Avoided disposal penalties or third-party waste treatment fees.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	100% reuse of solid by-products (no burning, no landfill). 100% OMWW valorisation through energy recovery. Energy autonomy with minimal carbon footprint. Soil health improvement through organic fertilization.
Which circular economy principles are applied?	By-product valorisation. Energy recovery. Regenerative agriculture. Industrial symbiosis.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Strengthened local value chains through regional circular flows. Partnerships with local infrastructure (biogas). Showcasing regional PDO identity (Makri) through circular innovation.
How this CBM ensures that vulnerable groups are engaged?	SME-led model encourages peer learning in rural areas. Potential for replication through cooperative-based adaptations.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Initial capital for infrastructure (composting, heating). Biogas partnerships are geography-dependent. Cultural resistance in more traditional or yield-focused operations.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Self-sufficiency in inputs (heat, fertilizer). Low exposure to market volatility (energy/fertilizer prices).



	Strong community embedding and stakeholder trust.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	% of waste/by-products reused (target: 100%). Energy autonomy from biomass vs fossil fuel baseline. Compost produced and applied per ha.
How is performance tracked?	Internal soil and leaf diagnostic systems. Operational records for energy savings and OMWW valorisation. Certification systems (ISO, HACCP) support auditability.

Business Model Identification #5	Low-Input Regenerative Olive Farming Model with Bio-based Soil Enhancement and Closed-Loop Biomass Cycling
Country/Region applied in	Crete
Sector applied to	Olive sector
Date established	03.07.2025
Value Proposition	
What customer and societal needs are addressed?	Soil degradation and biodiversity loss. Agro-waste valorisation and reduction in external inputs. Desire for premium, transparent, low-intervention olive oil
What circular value (e.g., waste reduction, regeneration) is delivered?	Complete reuse of biomass and nutrients on-farm. No use of synthetic chemicals; restoration of living soil ecosystems. Production of award-winning olive oil with strong health claims and sustainability integrity.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Seven Olea (family-owned SME). Elaionas Project consortium (Universities of Aegean and Hellenic Mediterranean, Petra Cooperative). Local community and environmentally aligned consumers
How is value co-created, and partnerships formed?	Scientific collaboration on OMWW sludge composting and biochar use. Integration into pilot testing as a model farm for regenerative practices. Networked peer learning through cooperative and project-based channels.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive pruning residues (mulched and returned to soil). Grass clippings (decomposed in situ). OMWW sludge (co-composted with olive leaves). Biochar from thick olive wood.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Manual, no-till field management. Application of compost and biochar to enhance rhizosphere microbiology. Minimal input philosophy integrated into entire life cycle.
What are the enabling technologies that support value delivery?	Lightweight, low-emission tools (electric harvesters). On-farm composting and biochar systems. University-supported pilot systems for validation.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Customers informed about soil care and sustainability practices. Olive oil differentiated by high polyphenol content and traceable cultivation



What distribution channels align with circularity? (e.g., local, shared logistics)	Direct-to-consumer branding emphasizing sustainability. Online presence and storytelling around the ethos of the farm.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Premium pricing for high-quality olive oil with health claim (2022 gold award). Cost savings via reduced inputs and energy use.
Are new streams from resource loops or collaborations generated? Name them	Participation in university pilots. Potential future revenue from regenerative branding, traceability certification, or education/tourism
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Manual labor for mulching, composting, and biochar application. Light mechanisation and tool maintenance. Time investment in low-impact, non-intensive farming.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	No fertilizer or chemical pesticide expenses. Significantly reduced energy costs. Avoided OMWW disposal or offsite waste handling.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	100% biomass reuse on-site (grass, prunings, sludge). No tillage = enhanced soil carbon retention and biodiversity. Biochar and compost increase soil structure and nutrient holding. Full elimination of synthetic inputs
Which circular economy principles are applied?	Nutrient cycling. Regeneration and input minimisation. Waste valorisation. Agroecological resilience.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Model farm for peer learning and R&D pilots. Knowledge spillover to other regional producers. Strong narrative contribution to local identity in Crete.
How this CBM ensures that vulnerable groups are engaged?	Promotes circular methods accessible to traditional farmers. Philosophically inclusive: no reliance on external technologies or costly systems.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Economic: Low short-term return without premium market access. Cultural: Requires mindset shift away from yield-maximisation. Infrastructure: Composting and sludge access dependent on mill cooperation.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Ecosystem-based approach enhances long-term soil fertility and yield stability. Cost minimisation and input avoidance buffer against inflation and supply shocks. Brand and customer trust foster price resilience
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	% of biomass reused (100% for prunings, grass, sludge). Use of synthetic inputs (0%). Soil vitality indicators (via leaf/soil analysis, microbiome quality).
How is performance tracked?	Manual observation of tree vitality and productivity. Validation through academic project participation. Quality and sensory analysis of final olive oil product.

Italy

Business Model Identification #1		Agroenergy
Country/Region applied in	Apulia region, Italy	
Sector applied to	Olive oil sector	
Date established	2019 (completed), 2020 (fully operational)	
Value Proposition		
What customer and societal needs are addressed?	Waste minimization (by-products turned into resources); circular product offering (bioenergy and digestate from by-products valorization); cost savings (less costs for waste treatment); Customer satisfaction is increased through the use of circular economy practices: raw materials used and products obtained are perceived by the customer as high quality thanks to the attention given to sustainability and circularity [Field interview 1 – agronomist]	
What circular value (e.g., waste reduction, regeneration) is delivered?	Waste reduction and by-products valorization (here: olive pomace)	
Stakeholder Collaboration & Co-Creation		
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Customers: local farmers, national energy system operator (GSE); Suppliers: small and medium enterprises, local farmers	
How is value co-created, and partnerships formed?	Co-creation of value through knowledge-sharing between enterprises and local producers; the realization of the Agroenergy plant was possible thanks to a close collaboration between Agresti, local olive oil producer, and BTS Biogas, a company specialized in biogas plants and which developed a specific pretreatment for olive pomace in order to be used as biomass by the biogas plant; Value can be co-created also including collaboration with universities, which is crucial in order to understand how by-products can be valorized [Field interview 1 – agronomist]	
Circular Value Creation & Delivery		
What type(s) of resources are used? (e.g., renewable, recycled)	Recycled resources (olive pomace, a by-product of olive oil production which is recycled and valorized)	
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Recycling and cycling activities: closing material loops within the firm’s gates, avoiding waste production and reducing the use of external inputs	
What are the enabling technologies that support value delivery?	Anaerobic digestion plant and technologies tailored on customer needs; Other additional technologies can be used for extracting as much value as possible from olive oil production by-products, such as technologies for phenolic compounds extraction and technologies that allow the extraction and cleaning of olive pits, then commercialized for energy production; probably, in the future, olive pomace will be used as cattle feed (it won’t be sent to biogas plants anymore) and olive oil mill wastewater will be used to extract phenolic compounds [Field interview 1 – agronomist]; Plants like this can be built only if there is some kind of “centralization” and coordination, such as a farmers’ consortium. In such case, micro and small enterprises of a specific area can send by-products to a central biogas plant in order to valorize them. Otherwise, it is not feasible [Field interview 2 – olive mill owner]	
Customer Engagement & Distribution		
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Customers are engaged through purchase of products (energy and digestate) derived from by-products valorization	
What distribution channels align with circularity? (e.g., local, shared logistics)	Local logistic (the main activities are performed within the firm’s gates)	
Circular Revenue Streams		
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sales of olive oil (main product) and of circular products (energy from biogas and digestate) obtained from olive oil production by-products (olive pomace)	



Are new streams from resource loops or collaborations generated? Name them	New circular revenues streams: major energy-related stream based on recurring payments (collaboration between the firm and national energy system operator, GSE); minor digestate-related stream based on business to consumer (local farmers) transaction; Additional circular revenue streams can be created through the valorization of other by-products, such as olive mill wastewater from which phenolic compounds can be extracted and sold; also, the mechanism of carbon credits can be exploited by the firm to increase its earnings [Field interview 1 – agronomist]
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Main cost: investment on biogas plant construction and functioning and related facilities; Energy production by using olive pomace as biomass can be possible only if the plant is really huge (as in this case). It is not possible for micro enterprises to build a biogas plant in microscale, since the cost will be too high [Field interview 2 – olive mill owner]
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Reduced waste disposal costs (olive pomace is turned into a resource), reduced energy and fertilizer costs (energy and fertilizer in the form of digestate are obtained from the biodigester)
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Environmental impact is reduced through waste minimization/valorization
Which circular economy principles are applied?	Circular economy principles involved: waste reduction/valorization, energy recovery, renewable energy production
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Main positive social impacts: job creation (new job opportunities generated by the anaerobic digestion facility), local value chain reinforcement (inclusion of a variety of local actors in the circular business model, such as local farmers and companies)
How this CBM ensures that vulnerable groups are engaged?	Strategic partnerships with local olive growers and local farmers in general
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	To date, the analysed CBM did not encounter significant risks hindering circularity. However, climate change and the spreading of alien pathogenic species (e.g. Xylella fastidiosa, a major issue for the Apulian olive sector) could represent a huge problem, especially for the supply chain of raw materials (olives)
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Resilience is enhanced through local sourcing (local farmers represent a crucial part of the CBM) and partnership between the firm, local community and national energy system operator (GSE)
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Biogas plant capacity: 500 KWel (100% fuelled by olive pomace); electricity produced: gross daily electricity of about 12.2 MWh; thermal energy produced: gross daily thermal energy of about 12.5 MWh
How is performance tracked?	Not available

Business Model Identification #2	Bioenutra
Country/Region applied in	Apulia region, Italy
Sector applied to	Chemistry and biotechnology sector, olive oil sector
Date established	2014
Value Proposition	
What customer and societal needs are addressed?	Waste minimization/valorization (by-products turned into resources); circular product offering (valuable polyphenolic compounds from by-products valorization); cost savings (less costs for waste treatment and disposal)
What circular value (e.g., waste reduction, regeneration) is delivered?	Waste reduction and by-products valorization (here: olive mill wastewater)
Stakeholder Collaboration & Co-Creation	



Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	<p>Customers: cosmetic, pharmaceutical and food industries</p> <p>Suppliers: local farmers</p> <p>There could be difficulties in finding customers interested in purchasing phenolic compounds: phenolic extracts are only sold to customers who use them industrially and nowadays it is more convenient to use chemical additives; however, future trends could be represented by customers who care about their health and search for natural ingredients [Field interview 1 – agronomist]</p>
How is value co-created, and partnerships formed?	<p>Partnership is formed through the active involvement of a wide variety of actors (local producers, companies and universities), interdependently involved in the creation of value, according to an industrial symbiosis approach;</p> <p>Collaboration with partners such as universities is essential to develop and fine-tune innovative and sustainable technologies for by-products valorization [Field interview 1 – agronomist]</p>
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Recycled resources (olive mill wastewater, a by-product of olive oil production which is recycled and valorized)
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Recycling and cycling activities: closing material loops outside the firm's gate (at the olive oil production level), avoiding waste production through the use of sustainable technologies for the extraction of valuable products from olive oil production by-products
What are the enabling technologies that support value delivery?	<p>Industrial plant using innovative and sustainable extraction technologies;</p> <p>The industrialization of the process used to extract phenolic compounds is an important barrier to implement this type of initiative [Field interview 1 – agronomist]</p>
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Customers are engaged through purchase of products (polyphenolic extract) obtained from by-products valorization
What distribution channels align with circularity? (e.g., local, shared logistics)	Local logistics (the CBM analysed obtains the raw material from local olive oil producers)
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	<p>Sales of circular products (polyphenolic extract) obtained from olive oil production by-products (olive mill wastewater);</p> <p>Probably, in the near future by-products from olive oil production will be used to obtain polyphenolic compounds (from olive mill wastewater, as in this case) and to obtain cattle feed (from olive pomace) [Field interview 1 – agronomist]</p>
Are new streams from resource loops or collaborations generated? Name them	New circular revenue streams: creation of a new type of business specialised in the transformation of a particular by-product (olive mill wastewater) in a high-value product (polyphenolic extract), which can be sold to a variety of different customers (different types of industries)
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	<p>Main cost: investment on industrial plant construction and functioning and on the extraction process</p> <p>For microenterprises it's very difficult, if not impossible, to build and handle an industrial plant like this one, since the costs are too high; only through collaboration between different enterprises these types of technologies can be developed and implemented [Field interview 2 – olive mill owner]</p>
In which operational phases the circular strategies	Reduced waste disposal costs (for the firm: reduced disposal costs for special and hazardous substances, since the extraction process does not



reduce costs? (e.g., less raw material use)	use solvents or chemical agents; for the local olive oil producers: olive oil wastewater is not considered waste, since it is sold to the firm as raw material); less raw material used (high value-added products are obtained from olive oil production by-products)
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Environmental impact is reduced through waste minimization/valorization; Environmental impact can be reduced even upstream, by using organic cultivation practices for growing olive trees [Field interview 2 – olive mill owner]
Which circular economy principles are applied?	Circular economy principles involved: waste reduction/valorization, green chemistry, industrial symbiosis
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Main positive social impacts: job creation (new job opportunities generated by the industrial plant), local value chain reinforcement (inclusion of a variety of local actors in the CBM, such as local farmers and companies), diversification of revenue streams for the local community of olive oil producers (new source of income generated from selling olive mill wastewater as raw material to the firm)
How this CBM ensures that vulnerable groups are engaged?	Strategic partnerships with local olive oil producers
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	To date, the CBM did not encounter major risks hindering circularity. Nonetheless, the supply chain can encounter issues related to the supply of raw materials linked to climate change and the spreading of new pathogen species. This could potentially represent a major risk leading to the disruption of the industrial ecosystem established
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Resilience is enhanced through local sourcing (local farmers represent a crucial part of the CBM, since they supply the firm with raw material) and partnership between the firm, local community, companies and universities
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Concentration of polyphenols obtained from olive mill wastewater: 1000-1500 kg/year
How is performance tracked?	Not available

Business Model Identification #3	OLI.VA.RE.
Country/Region applied in	Veneto region, Italy
Sector applied to	Agri-food sector (olive oil sector mainly), cosmetic and pharmaceutical sector
Date established	2022
Value Proposition	
What customer and societal needs are addressed?	Waste valorization (by-products turned into resources); zero-waste approach (all the by-products of a single production sector are turned into valuable resources using an industrial symbiosis model); circular product offering (value-added products from by-products valorization)
What circular value (e.g., waste reduction, regeneration) is delivered?	Zero-waste approach and by-products valorization (here: all the by-products coming from olive oil production sector)
Stakeholder Collaboration & Co-Creation	



Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	<p>Customers: since it is a pilot project, potential customers of final value-added products were involved in an online survey considering hypothetical purchasing scenarios</p> <p>Suppliers: local farmers (olive growers and olive oil producers)</p> <p>Local community: strengthening ties between different local and regional actors</p>
How is value co-created, and partnerships formed?	<p>Partnership is formed through the involvement of a wide variety of actors in the circular business model (local farmers, companies, universities, regional bodies) for the development of a regional industrial ecosystem primarily involving olive oil production sector; the coordination between these different realities is of primary importance for the functioning of the CBM; the coordination activity is performed by a regional body;</p> <p>The involvement of regional bodies and institutions is of primary importance. In fact, institutions should be more present and should increase funds intended for the olive sector, especially for the spreading of circular practices and innovations [Field interview 2 – olive mill owner]</p>
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	<p>Recycled resources (every by-product originating from olive oil production sector: olive pomace, pits, olive mill wastewater and olive tree pruning residues);</p> <p>The valorization of every single olive oil production by-product is a path towards a zero-waste economy that can be followed without major issues by olive oil producers [Field interview 1 – agronomist]</p>
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	<p>Recycling and cycling activities: almost all the material loops of olive oil production sector are closed thanks to the creation of a regional industrial ecosystem aimed at reusing all the by-products of the olive oil sector to transform them into value-added products (zero-waste approach)</p>
What are the enabling technologies that support value delivery?	<p>Clean production technologies and processes developed thanks to the cooperation between local enterprises and universities;</p> <p>Collaboration with universities is fundamental for the research and development of innovative and sustainable processes and technologies [Field interview 1 – agronomist]</p>
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	<p>Customers are engaged through purchase of raw materials and products obtained from by-products valorization (since it is a pilot project, the purchase of these final products was evaluated through an online survey taking into consideration hypothetical purchasing scenarios)</p>
What distribution channels align with circularity? (e.g., local, shared logistics)	<p>Local logistics (the CBM obtains raw materials from local olive growers and olive oil producers)</p>
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	<p>Sales of circular products (animal feed and food supplement, human food supplement, cosmetics) obtained from the valorization of all the by-products coming from olive oil production (sales are only hypothetical since the model is in its pilot level)</p>
Are new streams from resource loops or collaborations generated? Name them	<p>New circular streams originating from resource loops and collaboration between different actors, consisting in the transformation of all the by-products of olive oil production in a wide variety of value-added products (animal feed and food supplement, human food supplement, cosmetics)</p>
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	<p>Main costs: investment in new equipment and in green processing technologies, coordination between different actors involved in the model (especially in terms of logistics), regulations related to the introduction of new products into the market (especially for products intended for human consumption);</p>



	<p>There could be some legal barriers concerning the commercialization of food products with natural compounds only in them, even if it seems counterintuitive [Field interview 1 – agronomist]</p> <p>The main barriers and costs are often represented by bureaucracy and regulatory aspects: obtaining authorizations and permits for implementing an innovative technology can be onerous in terms of money and time [Field interview 2 – olive mill owner]</p>
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Less raw material used (high value-added products from olive oil production by-products); less costs for waste disposal (zero-waste approach); reduced costs for cattle feed (one of the final value-added products is represented by cattle feed)
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Environmental impact is reduced through waste minimization/valorization
Which circular economy principles are applied?	Circular economy principles involved: by-products valorization, zero-waste approach, industrial symbiosis, green chemistry
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Main positive social impacts: local value chain reinforcement (inclusion of different local actors), creation of a regional innovation network (through the cooperation between different regional actors according to an industrial symbiosis approach)
How this CBM ensures that vulnerable groups are engaged?	Strategic partnerships with local olive growers and olive oil producers
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	The CBM did not encounter major risks hindering circularity, since it is just a pilot project. However, the supply chain could encounter issues linked to the supply of raw materials, especially considering a climate change scenario and the increasing frequency of extreme weather events. These issues can potentially be detrimental for the CBM, dismantling the industrial ecosystem previously developed
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Resilience is enhanced through local/regional sourcing (local farmers have a central role in the CBM) and partnership/cooperation between different regional actors, according to an industrial symbiosis approach
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Quantity of by-products processed
How is performance tracked?	Not available

Business Model Identification #1		Herdade do Esporão – Circular Bioeconomy Model	
Country/Region applied in	Portugal (Alentejo)		
Sector applied to	Olive oil and agri-food (wine, eco-tourism)		
Date established	1973 (model evolved towards circularity post-2015)		
Value Proposition			
What customer and societal needs are addressed?	<p>Customers:</p> <ul style="list-style-type: none"> – Access to premium organic olive oils with full sustainability credentials; – Transparency on product origin and environmental impact; – Alignment with consumer values on health, biodiversity, and responsible consumption. <p>Society:</p> <ul style="list-style-type: none"> – Reduction of environmental impact (GHG, waste); – Promotion of regenerative agriculture; – Preservation of local biodiversity; – Reinforcement of rural economies; – Contribution to climate resilience and sustainable land use. 		
What circular value (e.g., waste reduction, regeneration) is delivered?	Reduction of agri-food waste (valorisation of olive by-products); regeneration of soils through compost and organic practices; lower carbon footprint via renewable energy use; biodiversity restoration; efficient use of land and resources.		
Stakeholder Collaboration & Co-Creation			
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Local farmers and suppliers; R&D institutes (ISA, Universidade de Évora); packaging suppliers; sustainability certifiers; local community; public authorities; consumers engaged in sustainability.		
How is value co-created, and partnerships formed?	Through collaboration with academic and research partners on regenerative practices; partnerships with local producers and suppliers to implement circular systems; co-creation with customers through transparency and education on sustainability.		
Circular Value Creation & Delivery			
What type(s) of resources are used? (e.g., renewable, recycled)	Renewable energy (solar); recycled and recyclable packaging; organic fertilisers (from composted by-products); natural ecosystem services (cover crops, biodiversity corridors).		
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Valorisation of olive by-products (composting, biomass energy); regenerative organic farming; biodiversity enhancement; water efficiency and circular resource use.		
What are the enabling technologies that support value delivery?	Solar energy systems; composting facilities; precision agriculture tools (soil monitoring, drones); eco-packaging technologies; digital traceability.		
Customer Engagement & Distribution			

In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Through transparency on sustainability (via labels and online communication); responsible consumption of certified organic products; participation in educational activities and farm visits promoting circular and regenerative agriculture.
What distribution channels align with circularity? (e.g., local, shared logistics)	Direct sales at the estate; online sales with sustainable logistics; local and regional retail channels prioritising short supply chains and reduced transport impact.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Through sales of premium organic olive oil; valorisation of by-products (compost, biomass energy); brand premium linked to sustainability leadership, eco-tourism and agri-education packs
Are new streams from resource loops or collaborations generated? Name them	revenue from compost use reducing input costs; energy savings through renewable energy; increased brand value enabling higher margins on premium products.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Sustainability certification, renewable energy systems, skilled HR, traceability tools
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	<p>Farming phase → lower input costs through compost use and reduced chemical fertilisers/pesticides;</p> <p>Energy phase → reduced energy costs via on-site solar and biomass use;</p> <p>Waste management phase → savings from valorising by-products instead of disposal;</p> <p>Logistics & packaging phase → use of local markets and eco-design packaging improves efficiency.</p> <p>Branding & marketing phase → higher return on sustainability-driven brand value reduces need for conventional advertising.</p>
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	By reducing GHG emissions through renewable energy and regenerative agriculture; valorising olive by-products; improving soil health; lowering chemical inputs; promoting biodiversity and ecosystem services; reducing packaging impact.
Which circular economy principles are applied?	Waste valorisation; resource efficiency; renewable energy use; regenerative production; closed-loop nutrient cycles; eco-design; transparency and traceability.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Creates local employment in sustainable agriculture and eco-tourism; supports local suppliers and artisans; promotes education on regenerative practices; strengthens community ties through agri-education and eco-tourism programs.
How this CBM ensures that vulnerable groups are engaged?	By collaborating with local farmers, small producers, and artisans; offering training and education opportunities; promoting inclusive participation in sustainability initiatives and community engagement activities.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Supply chain disruptions (eco-packaging, renewable tech); climate variability affecting harvests; regulatory complexity for organic certification; dependence on consumer demand for premium sustainable products.

How does the model enhance resilience? (e.g., local sourcing, partnerships)	Através do abastecimento local e de cadeias de abastecimento curtas; parcerias sólidas com agricultores, investigadores e comunidade local; diversificação dos fluxos de receitas; práticas regenerativas que melhoram a saúde dos solos e dos ecossistemas, aumentando a resiliência das explorações agrícolas a longo prazo.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	% of olive by-products valorised; % renewable energy use; GHG emissions (Scopes 1 & 2); water use efficiency; soil health indicators; biodiversity metrics; % recycled and recyclable packaging.
How is performance tracked?	Through annual sustainability reporting; internal monitoring systems; third-party certifications (organic, regenerative, carbon footprint); partnerships with academic institutions; stakeholder feedback.

Business Model Identification #2	Casa Alta – Traditional Circular Estate Model
Country/Region applied in	Portugal – Região do Douro (Trás-os-Montes)
Sector applied to	Olive oil and agrotourism (traditional and sustainable systems)
Date established	Family farm with centuries of history - organic and regenerative farming model adopted since 2016
Value Proposition	
What customer and societal needs are addressed?	<p>Customers:</p> <ul style="list-style-type: none"> – Access to premium organic olive oil produced with regenerative and circular practices; transparency on production methods; opportunity to support sustainable local agriculture and biodiversity <p>Society:</p> <ul style="list-style-type: none"> – Waste reduction and resource regeneration; promotion of regenerative agriculture; preservation of local biodiversity and landscapes; reinforcement of rural economy and community well-being.
What circular value (e.g., waste reduction, regeneration) is delivered?	Reduction of agricultural waste through composting of olive by-products; regeneration of soil health and biodiversity; reduced reliance on chemical inputs; contribution to local circular economy through short supply chains and community partnerships.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Local farmers; BioRegião Idanha-a-Nova network; municipality; eco-packaging suppliers; local community and visitors; sustainability organisations; eco-tourism platforms.
How is value co-created, and partnerships formed?	Value is co-created through collaboration with local farmers and artisans; active participation in BioRegião initiatives; partnerships with public authorities; engagement with visitors through eco-tourism and educational activities; fostering consumer awareness of regenerative practices.
Circular Value Creation & Delivery	



What type(s) of resources are used? (e.g., renewable, recycled)	Renewable energy (solar); recycled and recyclable packaging; organic compost produced on site from olive by-products; ecosystem services (biodiversity corridors, cover crops); treated waste water; pruning leaves
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Valorisation of olive by-products through composting; regenerative organic farming; biodiversity conservation; eco-packaging; community engagement through eco-tourism and educational activities.
What are the enabling technologies that support value delivery?	Composting facilities; solar energy systems; natural filtration solutions (constructed wetlands, infiltration basins); eco-packaging equipment; basic digital tools for traceability and customer engagement.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Through participation in eco-tourism and educational activities; direct purchase of products with transparent sustainability credentials; support for local regenerative agriculture; engagement via farm visits and workshops on circular practices.
What distribution channels align with circularity? (e.g., local, shared logistics)	Direct sales at the farm; local and regional markets; partnerships with eco-tourism networks and short supply chains.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Through sales of premium organic olive oil; revenue from eco-tourism activities (farm tours, tastings, workshops); reduced costs through on-farm compost use; enhanced brand value.
Are new streams from resource loops or collaborations generated? Name them	Compost use reducing input costs; revenue from eco-tourism and educational activities; brand premium linked to regenerative and circular practices; potential collaborations with local community and BioRegião network.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Regenerative agricultural practices (labour, soil management); renewable energy systems; composting operations; eco-packaging; educational and eco-tourism activities; certification and traceability and heritage maintenance.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	<p>Farming phase → reduced input costs (fertilisers, pesticides) through compost use and soil regeneration;</p> <p>Energy phase → savings from on-site solar energy;</p> <p>Waste management phase → avoided disposal costs through by-product valorisation;</p> <p>Marketing & distribution phase → reduced reliance on conventional advertising due to strong brand identity and direct engagement with customers.</p>
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	By reducing GHG emissions through renewable energy use; diverting olive by-products from waste streams through composting; regenerating soil health; promoting biodiversity; reducing reliance on chemical inputs; minimising transport-related emissions via local distribution.
Which circular economy principles are applied?	Waste valorisation; resource efficiency; renewable energy integration; regenerative production; closed-loop nutrient cycles; eco-design; transparency and consumer engagement.
Social Impact	

In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Creates local employment in regenerative farming and eco-tourism; supports local service providers; promotes community awareness of circular practices through education; reinforces local value chains and rural development.
How this CBM ensures that vulnerable groups are engaged?	By involving local small producers and community members in circular activities; providing access to eco-education and farm-based learning; fostering inclusive community participation through open events and partnerships with local networks (BioRegião).
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Limited technical and financial capacity to scale up regenerative practices; need for initial investment; dependence on strong community involvement; market fluctuations for premium organic products; climate variability affecting yields; potential regulatory restrictions on the use of compost and ecotourism activities and challenges with certifications.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Through local sourcing and closed-loop systems; strong partnerships with the BioRegion network and the municipality; diversified revenue streams (produce + ecotourism); regenerative practices that improve soil health and long-term ecosystem stability; and high resilience through family control.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Informal monitoring of key practices: % of olive by-products composted; % of farm energy supplied by renewables; observation of soil health improvements; biodiversity presence; reduction in external inputs (fertilisers, pesticides). No formal quantified KPIs currently published.
How is performance tracked?	Performance is tracked through internal observation and practical outcomes at farm level (soil health, crop quality); participation in BioRegião monitoring activities; stakeholder feedback; informal reporting to the local community. No standardised or externally certified performance tracking system is in place.

Business Model Identification #3	Alentejo Circular – Circular Economy Promotion in Alentejo Agrifood Sectors
Country/Region applied in	Portugal – Alentejo (Évora, Beja, Portalegre)
Sector applied to	Olive oil, wine, pig farming (agrifood sectors) — cross-sectoral focus on regional circular economy
Date established	2016–2018 (Alentejo2020 programme)
Value Proposition	
What customer and societal needs are addressed?	<p>Customers:</p> <ul style="list-style-type: none"> – Need for knowledge, tools and networks to implement circular economy principles in agrifood businesses <p>Society:</p> <ul style="list-style-type: none"> – Regional sustainability; improved environmental performance of key sectors; enhanced social cohesion through collaboration
What circular value (e.g., waste reduction, regeneration) is delivered?	Indirect value — by raising awareness, sharing good practices, and fostering future circular business models in the region
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Universidade de Évora, ISQ, regional business associations (NERBE, NERPE), municipalities, local companies, sector stakeholders (olive oil, wine, pig farming)



How is value co-created, and partnerships formed?	Through joint diagnostics, sector workshops, cross-sectoral forums, and an online platform for information and networking
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Human resources, knowledge resources; no physical materials processed (awareness project)
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Mapping of good practices; regional diagnostics; stakeholder capacity-building; dissemination of circular principles
What are the enabling technologies that support value delivery?	Online platform; stakeholder events; diagnostic tools; publications and communication materials
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Participation in workshops; access to online resources; collaborative identification of sector-specific circular opportunities
What distribution channels align with circularity? (e.g., local, shared logistics)	Regional business networks; online dissemination; public events
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Public funding — Alentejo2020; no commercial revenue streams
Are new streams from resource loops or collaborations generated? Name them	Foundations laid for future circular collaborations and project spin-offs (no direct material loops created in project phase)
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Personnel; stakeholder engagement; event organisation; platform development; communication
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Indirect — by promoting future adoption of circular practices which may reduce operational costs for regional businesses
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Indirect — via future implementation by businesses adopting circular approaches after project awareness and training
Which circular economy principles are applied?	Knowledge sharing; stakeholder mobilisation; cross-sector collaboration; systemic thinking
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Strengthening of regional collaboration; capacity-building for MSEs; improved awareness of environmental challenges
How this CBM ensures that vulnerable groups are engaged?	Potential through inclusive stakeholder participation; regional focus helped reach rural and smaller enterprises
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Limited follow-up funding; lack of continuity post-project phase; absence of implementation mechanisms
How does the model enhance resilience? (e.g., local sourcing, partnerships)	By fostering long-term cross-sectoral cooperation and creating foundations for future projects
Metrics & Monitoring	

What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Project indicators: number of participants, sectors reached, materials disseminated, networks created
How is performance tracked?	Internal project monitoring (outputs and stakeholder engagement), qualitative feedback from participants

Business Model Identification #4	Azeite Acushla – Circularity in Small-Scale Olive Mill
Country/Region applied in	Portugal – Beira Baixa
Sector applied to	Olive sector - small processing unit with a focus on sustainability
Date established	2006
Value Proposition	
What customer and societal needs are addressed?	<p>Customers:</p> <ul style="list-style-type: none"> – Access to local, sustainably produced olive oil; – Assurance of environmentally friendly production; – Contribution to circular economy through responsible consumption. <p>Society:</p> <ul style="list-style-type: none"> – Waste minimisation and environmental impact reduction; – Promotion of circular and regenerative agriculture; – Strengthening local food sovereignty; – Support for rural economy and community well-being.
What circular value (e.g., waste reduction, regeneration) is delivered?	Reduction of waste (over 85% of by-products valorised); regeneration of soil through compost use; local renewable energy from biomass; closed-loop resource cycles between olive mill and local agriculture.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Local farmers and olive producers; Municipality and BioRegião network; community gardens; customers (through workshops and compost use); technology suppliers (biomass boilers, composters); local community engaged in circular practices.
How is value co-created, and partnerships formed?	Value is co-created through collaboration with local farmers (supplying by-products and using compost), partnerships with the Municipality and BioRegião for circular initiatives, and customer engagement via workshops and educational activities; partnerships are based on shared sustainability goals and community networks.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Pomace, pits, waste water, thermal energy
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Natural drying, composting in bins, thermal energy utilisation



What are the enabling technologies that support value delivery?	Biomass boilers, aerobic composters, reusable structures, simple monitoring tools for process efficiency
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Through participation in workshops on compost use and sustainable farming; by purchasing olive oil produced with circular practices; by using compost generated from the mill's by-products in local gardens and farms, fostering community-based circularity and also through olive oil tasting sessions
What distribution channels align with circularity? (e.g., local, shared logistics)	Local direct sales at the mill; dedicated shop in Porto promoting sustainable products; community-supported distribution (local markets, fairs, food baskets); use of short supply chains and minimal packaging to reduce transport impact; shared logistics with local producers.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	sale of olive oil produced with circular practices; sale of compost to local farmers and community gardens; cost savings from self-produced biomass for thermal energy; paid tasting sessions; sales of textiles dyed with olive pomace.
Are new streams from resource loops or collaborations generated? Name them	compost sales from by-product valorisation; energy savings through biomass use; paid tasting workshops in collaboration with BioRegião; artisanal products (textiles dyed with olive pomace).
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Costs related to the collection and handling of olive by-products; maintenance of composters and biomass boilers; packaging and distribution logistics; staff time for workshops and community engagement.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	<p>Energy phase → self-produced thermal energy reduces external energy costs.</p> <p>Fertilisation phase → use of compost reduces purchase of chemical fertilisers.</p> <p>Waste management phase → by-product valorisation avoids landfill disposal costs.</p> <p>Packaging & logistics phase → local short distribution channels reduce transport costs.</p> <p>Artisanal production phase → natural dyes from olive pomace eliminate the need to purchase synthetic dyes for textile products.</p>
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Waste reduction >85%; less consumption of fossil fuels; less use of chemicals (textile industry)
Which circular economy principles are applied?	Promoting local food sovereignty and community empowerment
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Creates local jobs in circular activities (composting, biomass use, workshops); supports small farmers and artisans; promotes food sovereignty and community engagement through sustainable agriculture and education.
How this CBM ensures that vulnerable groups are engaged?	By involving small-scale farmers, women artisans, and local community members in circular value chains, training, and educational workshops.

Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	<ul style="list-style-type: none"> ● Supply chain disruptions (availability of biomass boilers or composting materials); ● Regulatory changes affecting compost or biomass use; ● Seasonal variability of olive production; ● Community participation fluctuation (dependency on small networks).
How does the model enhance resilience? (e.g., local sourcing, partnerships)	<ul style="list-style-type: none"> ● Local sourcing of primary materials and energy (olive stones, pomace); ● Solid partnerships with local farmers and municipalities; ● Low-tech, community-based circular systems; ● Reduced dependence on external energy and fertilisers.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	<ul style="list-style-type: none"> ● % of olive by-products valorised (>85%); ● Energy generated from biomass; ● Compost produced and used locally; ● Number of workshops and community participants; ● % of waste diverted from landfill.
How is performance tracked?	<ul style="list-style-type: none"> ● Internal records on waste recovery and compost production; ● Simple monitoring tools (boiler efficiency and composting process); ● Feedback from community partners and clients; ● Regular reports to the BioRegion network and local stakeholders.

Business Model Identification #5	Quinta de S. Braz Circular and Regenerative Olive Oil Production
Country/Region applied in	Portugal — Trás-os-Montes e Alto Douro Region (Lamas de Orelhão, Mirandela) DOP Azeite Trás-os-Montes
Sector applied to	Olive oil production; regenerative agriculture; circular resource management and valorisation of by-products
Date established	2002 (with advanced circular practices since 2015)
Value Proposition	
What customer and societal needs are addressed?	Customers: <ul style="list-style-type: none"> – Need for authentic, High-quality DOP/BIO olive oil with traceable sustainable production;

	<ul style="list-style-type: none"> – Demand for products aligned with regenerative agriculture and low environmental impact. <p>Society:</p> <ul style="list-style-type: none"> – Reduced agrochemical use; zero water discharge; – Preservation of regional biodiversity and landscape; – Education on sustainable olive oil production.
What circular value (e.g., waste reduction, regeneration) is delivered?	Full reuse of by-products (compost, biomass); zero wastewater discharge; regenerative soil practices; reduced CO ₂ emissions via renewable energy; natural ecosystem preservation.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Regional partners (APPITAD - Associação dos Produtores em Protecção Integrada de Trás-os-Montes e Alto Douro / Association of Producers in Integrated Protection of Trás-os-Montes e Alto Douro); universities (Polytechnic Institute of Bragança; Polytechnic Institute of Viseu); packaging suppliers; export networks; EVOO ranking organisations
How is value co-created, and partnerships formed?	Through collaboration with universities for research and validation; active participation in regional producer networks; education of customers via packaging, tastings and storytelling.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive biomass; renewable energy (solar); closed-loop water reuse; recyclable packaging materials.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Biomass composting; closed-loop water use in mill; renewable energy generation; production of natural fertiliser (compost); recyclable packaging.
What are the enabling technologies that support value delivery?	Photovoltaic solar system; closed-loop water management; composting unit; artisanal efficient pressing and filtration systems.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Through awareness and education (on-site tastings, storytelling on packaging); choosing circular, regenerative products; supporting local and sustainable agriculture.
What distribution channels align with circularity? (e.g., local, shared logistics)	Direct online sales; specialised gourmet and organic shops; training for its sales partners on the products they produce; export to premium markets (DE, UK); sustainable packaging adapted for lower transport impact.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sales of premium olive oil (retail and export); direct to consumer via e-commerce.
Are new streams from resource loops or collaborations generated? Name them	Compost for own use and neighbouring producers; potential future carbon credit schemes linked to regenerative practices.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Artisanal labour; energy systems maintenance; organic certification; regulatory compliance; packaging; small-batch processing.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Water management → reduced water costs (100% reuse) Fertilisation → eliminated external fertiliser costs (compost use)



	Energy → reduced grid dependence via solar
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Avoids water discharge; reuses 100% of by-products; uses renewable energy; enhances soil health and biodiversity.
Which circular economy principles are applied?	Resource efficiency; waste valorisation; regenerative agriculture; renewable energy; responsible production and consumption.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Supports rural employment; promotes sustainable land use; preserves cultural landscape of Trás-os-Montes (North-East of Portugal).
How this CBM ensures that vulnerable groups are engaged?	Via educational outreach; partnerships with local communities; active participation in regional sustainability initiatives.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	High initial investment in circular systems; limited technical capacity in the region; regulatory complexity for small producers; limited access to financing programmes, inhibiting the necessary technological investment; resistance to the adoption of circular practices in the company by workers in the field.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Energy self-sufficiency; water security; soil regeneration; customer loyalty through strong sustainability positioning.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	% of by-products reused (100%); water reuse rate (100%); energy balance (solar contribution); biodiversity monitoring (qualitative).
How is performance tracked?	Internal monitoring; external certifications (BIO, DOP); participation in EVOO rankings; customer feedback.

Business Model Identification #6	Oliveira da Serra – Scalable Circular Supply Chain Model
Country/Region applied in	Portugal – Alentejo (Ferreira do Alentejo)
Sector applied to	Olive oil sector (agri-food and branding)
Date established	Founded 1996 (Grupo Sovena); Circularity focus post-2010
Value Proposition	
What customer and societal needs are addressed?	<p>Customers:</p> <ul style="list-style-type: none"> – Access to sustainable and traceable products (e.g., olive oils with reduced environmental footprint, certified organic/sustainable). – Trust in product origin and quality (full transparency via QR codes and certifications). – Responsible consumption: ability to align food choices with sustainability values.

	<p>Society:</p> <ul style="list-style-type: none"> – Reduced environmental impact: lower GHG emissions, less landfill waste, by-product valorisation. – Contribution to regional bioeconomy: stimulation of local value chains and circular economy in the agri-food sector. – Natural resource preservation: efficient use of water and soil, biodiversity conservation. – Creation of green jobs and upskilling within the agri-industrial sector.
What circular value (e.g., waste reduction, regeneration) is delivered?	Responds to demand for sustainable, traceable olive oil. Delivers value by lowering footprint, valorising waste, and offering eco-conscious consumer products.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Farmers, packaging suppliers, engineers, Sovena Group, R&D entities, end-users
How is value co-created, and partnerships formed?	Collaborative supply chain innovation, sustainable sourcing practices, closed-loop material flows
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Reused olive pits, wastewater, recycled materials, renewable energy
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Precision farming, by-product valorisation, reuse systems, packaging innovation
What are the enabling technologies that support value delivery?	AI monitoring systems, biomass boilers, low-impact packaging lines
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Customer involvement in circular practices through transparent communication (QR codes, sustainability labels), eco-conscious purchasing of products with recycled packaging, and participation in responsible consumption — supporting a circular olive oil value chain.
What distribution channels align with circularity? (e.g., local, shared logistics)	Optimised delivery networks, packaging minimisation, regional logistics
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Premium olive oil sales, circular packaging branding, energy co-generation savings
Are new streams from resource loops or collaborations generated? Name them	Biomass energy savings, sustainable packaging services
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Implementation and maintenance of regenerative farming practices; renewable energy infrastructure and maintenance (solar systems); composting systems; sustainable packaging; monitoring and certification of organic and circular processes and precision agriculture technologies
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Energy phase → use of olive pit biomass reduces fossil fuel costs.

	<p>Waste management phase → valorisation of pomace and wastewater reduces landfill and disposal costs.</p> <p>Packaging phase → lighter, recycled packaging lowers material and transport costs.</p> <p>Input phase → compost use reduces need for chemical fertilisers.</p>
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Near-zero-waste operation in key stages; GHG and plastic footprint reduction
Which circular economy principles are applied?	Sustainable employment, supplier training, green value chain reinforcement
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	<ul style="list-style-type: none"> ● Supports rural employment in olive cultivation, processing, and logistics. ● Promotes green job creation in circular economy activities (biomass, composting, sustainable packaging). ● Strengthens local value chains and partnerships with regional suppliers. ● Enhances social inclusion through education on sustainable consumption and responsible production.
How this CBM ensures that vulnerable groups are engaged?	By supporting employment in rural areas, promoting inclusive supply chains with small local producers, and fostering community education on sustainability, the model indirectly engages vulnerable groups such as smallholder farmers, rural youth, and women in agri-food value chains.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	<ul style="list-style-type: none"> ● Supply chain disruptions (shortage of recyclable materials, delays in biomass sourcing). ● Regulatory complexity (legal barriers for by-product reuse). ● Market acceptance risks (consumer resistance to circular packaging). ● Technological dependence (breakdowns in precision agriculture or waste valorisation systems).
How does the model enhance resilience? (e.g., local sourcing, partnerships)	<ul style="list-style-type: none"> ● Through local sourcing of raw materials and energy (olive pit biomass, compost). ● Strong partnerships with farmers, universities, and tech providers. ● Vertical integration across the value chain. ● Circular practices that reduce dependency on external inputs (energy, fertilisers).
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	<ul style="list-style-type: none"> ● % waste diverted from landfill. ● GHG emissions reduction (CO₂ savings). ● % of recycled materials in packaging. ● Energy generated from biomass. ● Resource recovery rates (reuse of pomace, olive pits, wastewater).
How is performance tracked?	<ul style="list-style-type: none"> ● Through annual sustainability reports.

- Third-party audits (e.g., Carbon Trust, organic certifications).
- Internal ESG KPIs (energy use, waste reduction, GHG emissions).
- IoT-based monitoring in production and processing.

Business Model Identification #7	MiOlive3 – Micro Circular Valorisation Model
Country/Region applied in	Portugal – Região Centro (Beira Interior)
Sector applied to	Olive sector – by-product valorisation and energy innovation
Date established	2022 (project launch under COMPETE 2030 / FEDER)
Value Proposition	
What customer and societal needs are addressed?	<p>Customers:</p> <ul style="list-style-type: none"> ● Need for resilient, disease-resistant, high-quality olive plants; access to regenerative propagation materials; support for traditional olive varieties. <p>Society:</p> <ul style="list-style-type: none"> ● Preservation of agricultural biodiversity; reduction of agrochemical use; circular use of olive biomass; support for regenerative agriculture in traditional landscapes.
What circular value (e.g., waste reduction, regeneration) is delivered?	Valorisation of olive biomass into bio-based inputs; reduction of agrochemical dependence; regeneration of soil fertility and biodiversity; preservation of traditional olive genetic heritage.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	R&D institutes (DEIFIL, universities); cooperatives; olive oil producers; BioRegião networks; regional and national authorities; nurseries; funding bodies (COMPETE, PEPAC).
How is value co-created, and partnerships formed?	Through collaboration between research centres and producers; cooperative engagement in field trials; integration with BioRegião networks; participation in EU research programmes; knowledge exchange with growers and SMEs.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive biomass; enriched nursery substrates; micropropagated plants; mycorrhizal fungi; natural soil amendments.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Micropropagation of olive varieties; mycorrhization; valorisation of olive biomass; regenerative soil practices; closed-loop nutrient cycling.
What are the enabling technologies that support value delivery?	Biotech labs; controlled-environment agriculture systems; mycorrhizal inoculation technologies; digital traceability tools; regenerative agronomic practices.
Customer Engagement & Distribution	



In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	By adopting resilient, circularly propagated plants; applying regenerative practices in their olive groves; reducing agrochemical use; participating in knowledge exchange and field demonstration events.
What distribution channels align with circularity? (e.g., local, shared logistics)	Direct collaboration with cooperatives and nurseries; regional networks (BioRegião); direct engagement with producers through workshops and field demonstrations.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sales of micropropagated and mycorrhizal olive plants; technical services and consulting; collaborative contracts with cooperatives and nurseries.
Are new streams from resource loops or collaborations generated? Name them	valorisation of olive biomass in plant production; creation of secondary products (bio-inputs); income from consultancy and partnerships.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Biotech R&D; lab operations; nursery substrates; skilled labour; traceability systems; regulatory compliance.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Reduction in agrochemical costs through improved plant-soil symbiosis; avoided waste management costs through biomass valorisation; improved plant resilience reduces replanting and treatment costs.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Reduction in chemical fertiliser and pesticide use; circular use of olive by-products; improved soil health and biodiversity; support for climate-resilient olive production.
Which circular economy principles are applied?	Bio-based innovation; resource efficiency; waste valorisation; regenerative production; preservation of cultural heritage; closed-loop cycles.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Creation of skilled jobs in biotechnology and sustainable agriculture; support for small producers and cooperatives; reinforcement of local olive oil value chains.
How this CBM ensures that vulnerable groups are engaged?	By working with cooperatives and small producers; enabling access to innovative materials; fostering peer-learning in local networks.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	High technical complexity; limited access to biotech resources for small producers; regulatory gaps; dependency on skilled labour.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Through regenerative agronomic impacts (soil health, biodiversity); local partnerships; diversification of value chains; improved resilience of olive groves.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	% of biomass valorised; reduction in agrochemical use; improvements in soil organic matter (pilot groves); biodiversity indicators.
How is performance tracked?	Internal project monitoring; pilot trials in growers' fields; academic publications; stakeholder feedback; progress reports to funding bodies.



Business Model Identification #8	Herdade da Figuerinha – Circular Composting and Regenerative Agriculture Model
Country/Region applied in	Portugal - Alentejo (Beja district)
Sector applied to	Olive oil and wine production; organic composting; regenerative agriculture
Date established	1998 (Composting unit launched in 2023 (initial pilot supported by Clube de Produtores Continente - Continent producers' Clube - https://feed.continente.pt/novidades/clube-de-produtores-continente , and universities)
Value Proposition	
What customer and societal needs are addressed?	<p>Customers:</p> <ul style="list-style-type: none"> - Reduced use of mineral fertilisers; - Access to high-quality organic compost; - Preference for food with lower environmental footprint. <p>Society:</p> <ul style="list-style-type: none"> - Lower carbon footprint; - Waste valorisation; - Soil regeneration; - Biodiversity preservation.
What circular value (e.g., waste reduction, regeneration) is delivered?	"From soil to soil" closed-loop model; waste reduction; transformation of by-products (pomace, leaves, pruning residues, grey water) into organic compost; carbon sequestration in soils
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	University of Évora, IP Beja, EDIA - Empresa de Desenvolvimento e Infraestruturas do Alqueva, S.A. - (Alqueva Dam Development and Infrastructure Company), Clube de Produtores do Continente (Continent producers' Club - supermarket chain of the SONAE SIERRA group), Olivum - Associação de Produtores e Lagares de Portugal (Association of Olive Growers and Olive mills of Portugal), NERBE - Associação Empresarial do Baixo Alentejo e Litoral (Business association of the lower Alentejo and coastline), educational institutions, customers, financial institutions
How is value co-created, and partnerships formed?	Collaborative R&D with universities and technical institutes; partnerships with retailers (Continente); cooperation with value chain actors (producers, suppliers); involvement of banks and public authorities
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive by-products (pomace, leaves); pruning residues; grey water from olive oil extraction; organic farm residues
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Dehydration of pomace; composting of by-products; application of compost to olive groves and vineyards; use of olive pit biomass for thermal energy; efficient water management
What are the enabling technologies that support value delivery?	Composting unit; dehydration system; humidity sensors; drip irrigation systems; flow meters; weather station; product traceability systems
Customer Engagement & Distribution	



In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	By purchasing regenerative olive oils and wines; participating in farm visits and sustainability education events; engaging in community outreach
What distribution channels align with circularity? (e.g., local, shared logistics)	Farm shop and online store; retail chains (Continente); HORECA channel; participation in fairs and events (local and international)
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Current savings on fertiliser costs; future sales of organic compost of high quality, in short supply in the market; premium pricing of sustainable olive oils and wines; improved brand value
Are new streams from resource loops or collaborations generated? Name them	Future sale of compost; potential for carbon credits; enhanced brand value; recognition through sustainability awards
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Composting unit operation and maintenance; energy costs; licensing and certification costs; transport of by-products, in particular from other producers for their own composting plant
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Fertilisation → reduced chemical fertiliser costs; Waste management → lower transport and disposal costs; Energy → partial substitution through biomass and solar energy; Marketing → increased brand value reduces conventional marketing costs
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Reduction in CO ₂ emissions; elimination of transport for waste; valorisation of local by-products; improved soil fertility; 15–20% reduction in water use
Which circular economy principles are applied?	Waste valorisation; regenerative agriculture; responsible production and consumption; renewable energy; knowledge sharing and community engagement
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Creates local partnerships; offers internships for youth and vulnerable groups; promotes social inclusion through partnerships (Cáritas, CERCIBEJA); strengthens local economy.
How this CBM ensures that vulnerable groups are engaged?	Employment and internships for vulnerable people (through Cáritas, CERCIBEJA, EPDRS); involvement of migrants; active local partnerships
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Regulatory complexity and licensing delays; limited political support; cultural barriers in certain market segments and difficulty in accessing public funding programmes, due to their complexity and mostly aimed at large companies
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Soil regeneration; diversification of income streams; reduced dependency on external inputs; strong partnerships with academia and retail partners
Metrics & Monitoring	



What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	% of by-products valorised (100%); reduction in fertiliser use (-20%); 4,000 tons of compost/year; water savings (15–20%)
How is performance tracked?	Sustainability Report; external audits (PSA, ISO); internal traceability systems; academic monitoring with University of Évora.



Business Model Identification #1		Valorization of Olive Pomace for Biomass and Energy	
Country/Region applied in	Spain (Andalusia, Castilla-La Mancha, Catalonia)		
Sector applied to	Olive oil sector, agrifood industry		
Date established	Not specified (scaled before 2025)		
Value Proposition			
What customer and societal needs are addressed?	Sustainable management of olive oil production waste, compliance with environmental regulations, reduction of operational costs, need for renewable energy solutions.		
What circular value (e.g., waste reduction, regeneration) is delivered?	Waste-to-energy conversion, reduction of GHG emissions, industrial symbiosis, circular use of agro-industrial by-products.		
Stakeholder Collaboration & Co-Creation			
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Olive oil cooperatives, biomass energy firms, municipalities.		
How is value co-created, and partnerships formed?	Joint investments in drying/pelletizing infrastructure, logistics coordination between mills and biomass plants, municipal support for energy valorization initiatives.		
Circular Value Creation & Delivery			
What type(s) of resources are used? (e.g., renewable, recycled)	Olive pomace (alperujo), dried pulp, olive pits (renewable, residual resources).		
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Waste valorization through drying and pelletizing, direct use in cogeneration plants for electricity and heat.		
What are the enabling technologies that support value delivery?	Biomass dryers, pelletizers, clean combustion systems, cogeneration plants.		
Customer Engagement & Distribution			
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Customers participate indirectly through the use of green energy and eco-labeled biomass products.		
What distribution channels align with circularity? (e.g., local, shared logistics)	Local and regional distribution of biomass fuel; energy fed into national/regional grids.		
Circular Revenue Streams			
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sales of biomass pellets, electricity and heat from cogeneration, valorized pomace to third parties.		
Are new streams from resource loops or collaborations generated? Name them	Biofuel production from waste, energy sales, material recovery for further valorization.		
Circular Cost Structure			
What are the main operational costs? (e.g., reverse logistics)	Logistics (transport from mills), drying and pelletizing equipment, energy for drying, maintenance.		



In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Avoided landfill/disposal fees, energy savings through self-consumption, reduced fossil fuel dependency.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	GHG emissions reduction, avoidance of methane from decomposition, elimination of open dumping risks.
Which circular economy principles are applied?	By-product valorization, industrial symbiosis, waste-to-resource, resource efficiency.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Local job creation in biomass logistics and energy production, reinforcement of rural economies, cooperative empowerment.
How this CBM ensures that vulnerable groups are engaged?	Empowerment of small producers via cooperatives; territorial cohesion in depopulated rural areas.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	High initial CAPEX, dependency on specialized equipment, market volatility for biomass demand.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Cooperative structures, public funding access (EU programs), regional biomass ecosystems.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Volume of pomace valorized, % reduction in waste disposal, GHG emissions avoided.
How is performance tracked?	Through cooperative/firm reports, compliance with environmental KPIs, project-specific EU monitoring tools.

Business Model Identification #2	Biogas Production from Olive Oil By-products
Country/Region applied in	Spain (Andalusia, Castilla-La Mancha, Extremadura)
Sector applied to	Olive oil sector, agro-energy sector
Date established	Not specified (operational and expanding by 2025)
Value Proposition	
What customer and societal needs are addressed?	Need for sustainable management of olive residues (e.g., alperujo, wastewater), energy self-sufficiency in rural areas, reduction of GHG emissions.
What circular value (e.g., waste reduction, regeneration) is delivered?	Renewable biogas from agro-waste, emissions reduction, waste-to-energy valorization, nutrient recovery via digestate.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Olive cooperatives, biogas tech providers, municipalities, energy firms.
How is value co-created, and partnerships formed?	Technology transfer and infrastructure development through EU projects, shared facilities among cooperatives.
Circular Value Creation & Delivery	



What type(s) of resources are used? (e.g., renewable, recycled)	Alperujo (wet pomace), olive mill wastewater – high-organic-content by-products.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Anaerobic digestion, biogas production, digestate reuse as organic fertilizer.
What are the enabling technologies that support value delivery?	Anaerobic bioreactors, gas purification systems, heat recovery systems.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Energy self-consumption by producers, use of digestate in local agriculture.
What distribution channels align with circularity? (e.g., local, shared logistics)	On-site energy use, local electricity and heat distribution, closed-loop nutrient cycling.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sales of electricity/heat from biogas, cost savings from self-use, digestate commercialization.
Are new streams from resource loops or collaborations generated? Name them	Biogas energy, organic fertilizer (digestate), service models for waste processing.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Bioreactor investment, system maintenance, waste transport/pre-treatment, regulatory compliance.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Avoided disposal costs, reduced energy expenses, lower fertilizer purchases.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Avoidance of methane emissions, fossil fuel substitution, landfill diversion.
Which circular economy principles are applied?	By-product valorization, nutrient recovery, renewable energy production.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Job creation in plant operations and maintenance, energy resilience in rural areas, cooperative empowerment.
How this CBM ensures that vulnerable groups are engaged?	Support for small producers through shared infrastructure and EU funding.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	High CAPEX, regulatory complexity, lack of local technical expertise.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	EU funding (e.g., LIFE, Horizon Europe), cooperative models, integration with rural energy strategies.
Metrics & Monitoring	



What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Volume of waste digested, energy produced (kWh), digestate reused, avoided emissions (CO ₂ e).
How is performance tracked?	Technical monitoring systems, EU project evaluations, cooperative reporting.

Business Model Identification #3	Biogas Production from Olive Oil By-products
Country/Region applied in	Extraction of Bioactive Compounds from Olive By-products
Sector applied to	Olive oil, nutraceuticals, cosmetics, functional food
Date established	(operational, some scaled)
Value Proposition	
What customer and societal needs are addressed?	Need for waste reduction in olive oil production, growing demand for natural health ingredients, diversification for agricultural producers.
What circular value (e.g., waste reduction, regeneration) is delivered?	High-value product generation from agri-waste, reduced environmental load, integration of agriculture and biotech sectors.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	R&D centres, biotech companies, universities, olive cooperatives.
How is value co-created, and partnerships formed?	Joint R&D, public-private innovation projects, collaborative extraction and formulation with scientific institutions.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive oil, Olive leaves, pomace (alperujo), olive mill wastewater – all agricultural by-products.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Extraction of polyphenols, flavonoids, oleuropein; purification and formulation for food, cosmetics, nutraceuticals.
What are the enabling technologies that support value delivery?	Membrane filtration, ultrasound-assisted extraction, supercritical fluid extraction, chromatography, freeze-drying
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	End users benefit via clean-label, sustainable, natural-origin products.
What distribution channels align with circularity? (e.g., local, shared logistics)	B2B channels to nutraceutical/cosmetic firms, integration into high-value agri-biotech supply chains.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sales of bioactive extracts, functional ingredients, enriched formulations.
Are new streams from resource loops or collaborations generated? Name them	Commercial licensing of extraction processes, valorization of previously discarded biomass.
Circular Cost Structure	



What are the main operational costs? (e.g., reverse logistics)	Specialized extraction equipment, R&D investment, regulatory certification (food/cosmetic use), staff expertise.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Reduced waste disposal costs, conversion of waste into high-margin ingredients.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Decreased organic waste disposal, lower use of synthetic additives in final products.
Which circular economy principles are applied?	Waste valorization, resource regeneration, cross-sector industrial symbiosis.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Skilled job creation, regional innovation, strengthening rural-urban scientific linkages.
How this CBM ensures that vulnerable groups are engaged?	Empowerment of small cooperatives through R&D partnerships; regional circular hubs.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	High technical and regulatory complexity, market dependence on health trends.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	EU R&D funding (e.g., Horizon Europe), tech-sharing agreements, diversified product applications (food, pharma, cosmetics).
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Tons of biomass valorized, yield of extract per ton, % waste avoided, revenue from circular products.
How is performance tracked?	Laboratory yield tracking, sales metrics, circularity audits in EU-funded initiatives.

Business Model Identification #4	Use of Olive By-products for Animal Feed
Country/Region applied in	Spain (Andalusia, Castilla-La Mancha, Aragón)
Sector applied to	Olive oil, livestock, animal feed industry
Date established	Not specified (operational)
Value Proposition	
What customer and societal needs are addressed?	Reduction of livestock feed costs, local feed sourcing, waste minimization in olive oil production.
What circular value (e.g., waste reduction, regeneration) is delivered?	Conversion of agro-waste into animal nutrition, lower dependence on imported feed, support for food system circularity.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Olive oil cooperatives, livestock cooperatives, feed manufacturers, agricultural R&D centres.
How is value co-created, and partnerships formed?	Local synergies between olive mills and animal farms, cooperative infrastructure for processing and distribution.



Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive pomace (orujo), dried pulp, olive leaves – all agricultural residues.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Drying, ensiling (fermentation), grinding and blending to create animal feed.
What are the enabling technologies that support value delivery?	Dryers, silos, pelletizers, nutrient testing equipment.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Farmers involved in cooperative feed production, adoption of circular feeding strategies.
What distribution channels align with circularity? (e.g., local, shared logistics)	Local cooperative networks, internal use in mixed farms, short distribution chains.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Sale of olive-based feed, internal savings in mixed farms, additional cooperative business lines.
Are new streams from resource loops or collaborations generated? Name them	Internal cost savings, use of feed as circular input in livestock operations.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Collection and transport of by-products, drying and storage, compliance with feed safety standards.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Substitution of conventional feed, reduced waste disposal costs
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Waste diversion from landfills or open dumping, lower GHG emissions from decomposition and transport.
Which circular economy principles are applied?	By-product valorization, resource efficiency, agri-livestock integration.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Strengthening of rural cooperatives, job preservation in farming and livestock.
How this CBM ensures that vulnerable groups are engaged?	Support for small farmers through cooperative logistics and shared processing infrastructure.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Regulatory constraints on feed safety, lack of processing infrastructure for small producers.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	Low CAPEX model, cooperative operation, growing interest in local feed alternatives.



Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Tons of feed produced from by-products, % of feed substituted, feed cost per kg.
How is performance tracked?	Cooperative records, livestock productivity metrics, environmental reporting for circular practices.

Business Model Identification #5	
Country/Region applied in	Spain (Andalusia, Extremadura, Murcia)
Sector applied to	Olive oil production, water management, agriculture
Date established	Not specified (pilot to early adoption phase)
Value Proposition	
What customer and societal needs are addressed?	Water scarcity in agriculture, environmental compliance for wastewater disposal, nutrient reuse for soil fertility.
What circular value (e.g., waste reduction, regeneration) is delivered?	Treated wastewater reused for irrigation, conservation of freshwater, transformation of pollutant into resource.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	Olive mills, farmers, cooperatives, R&D institutions (e.g., IFAPA, CSIC), municipalities, water authorities.
How is value co-created, and partnerships formed?	Public-private pilot projects, collaborative governance for wastewater reuse, technical validation with research centers.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive mill wastewater (OMWW) – rich in organic and phenolic compounds.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Collection and treatment of OMWW, nutrient profiling, reuse through precision irrigation systems.
What are the enabling technologies that support value delivery?	Membrane bioreactors, constructed wetlands, filtration systems, remote sensing for irrigation monitoring.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	Farmers directly reuse treated effluent on crops, especially olive groves.
What distribution channels align with circularity? (e.g., local, shared logistics)	On-farm irrigation systems, cooperative-managed treatment and reuse networks.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Indirect—cost savings on water and fertilizers, compliance with regulation avoids penalties.



Are new streams from resource loops or collaborations generated? Name them	Service-based models (shared infrastructure, irrigation services), eligibility for public subsidies (e.g., PERTE Agua).
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	Investment in treatment infrastructure (CAPEX), water quality testing, system maintenance, regulatory compliance.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	Reduced freshwater procurement, lower fertilizer usage, avoided wastewater fines.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	Reduced aquifer extraction, elimination of polluting discharges, partial nutrient recovery for soils.
Which circular economy principles are applied?	Water reuse, industrial symbiosis, waste-to-resource transformation.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	Supports agricultural continuity in drought-prone areas, promotes water security and food resilience.
How this CBM ensures that vulnerable groups are engaged?	Shared systems facilitate access for small farms; cooperatives enable collective management.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	High technical and regulatory complexity, initial costs, cultural resistance to effluent use.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	EU and national funding (e.g., Horizon Europe, PERTE Agua), institutional support, cooperative infrastructure.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	m ³ of wastewater reused, reduction in freshwater use, compliance with irrigation quality thresholds.
How is performance tracked?	Real-time irrigation monitoring systems, environmental reporting, pilot project evaluations.

Business Model Identification #6	Valorization of Olive Pomace into Activated Carbons for Lithium-Sulfur Batteries
Country/Region applied in	Spain (Andalusia – Córdoba)
Sector applied to	Olive oil industry, energy storage, advanced materials
Date established	2024 (R&D phase, early pilot stage)
Value Proposition	
What customer and societal needs are addressed?	This model addresses the need for sustainable disposal of olive mill by-products, the growing demand for eco-friendly and high-performance battery materials, and the diversification of raw material sources for the energy storage sector, especially in Europe.



What circular value (e.g., waste reduction, regeneration) is delivered?	It delivers high-value material transformation by converting agro-industrial waste into advanced functional carbon for batteries, reducing environmental impact and dependence on fossil-based resources.
Stakeholder Collaboration & Co-Creation	
Who are the key stakeholders involved (e.g., customers, suppliers, local community)?	University of Córdoba research groups (RNM-271, FQM-175), olive cooperatives, regional innovation hubs, battery industry players.
How is value co-created, and partnerships formed?	Through collaborative R&D projects, pilot programs, and technology transfer between academia and industry, with support from public innovation funding.
Circular Value Creation & Delivery	
What type(s) of resources are used? (e.g., renewable, recycled)	Olive pomace (alperujo), composted and carbonized into biochar, then activated into porous carbon.
What are the core circular activities of this CBM? (e.g., remanufacturing, reuse)	Biomass pre-treatment, carbonization (pyrolysis or hydrothermal), chemical or physical activation, material testing and battery prototyping.
What are the enabling technologies that support value delivery?	Thermal reactors, activation systems, materials analysis tools (e.g., BET, SEM), and electrochemical battery test systems.
Customer Engagement & Distribution	
In which ways are customers engaged in circular practices through this CBM? (e.g., sharing, product returns)	By sourcing sustainable, bio-based carbon materials for their energy products, and aligning with low-impact manufacturing
What distribution channels align with circularity? (e.g., local, shared logistics)	Direct agreements with battery component suppliers and integration into sustainable energy storage supply chains.
Circular Revenue Streams	
How is income generated from this CBM? (e.g., leasing, service contracts, sales)	Through the sale of activated carbon for batteries, licensing of carbonization technologies, and access to carbon credits or innovation subsidies.
Are new streams from resource loops or collaborations generated? Name them	Yes—waste valorization revenue for cooperatives, bioeconomy integration, and long-term contracts in clean energy sectors.
Circular Cost Structure	
What are the main operational costs? (e.g., reverse logistics)	R&D, carbonization and activation infrastructure, energy use, and compliance with material safety standards.
In which operational phases the circular strategies reduce costs? (e.g., less raw material use)	By using low-cost raw materials (olive waste), reducing waste management expenses, and improving supply chain resilience.
Environmental Impact Reduction	
How does this CBM reduce environmental impacts? (e.g., emissions, waste)	It diverts agricultural waste from landfills, prevents methane emissions from decomposition, and reduces fossil-carbon use in battery manufacturing.
Which circular economy principles are applied?	Waste-to-resource transformation, industrial symbiosis, renewable material substitution.
Social Impact	
In which ways does this CBM contribute to community well-being, local jobs, or social inclusion?	It creates skilled employment in rural regions, strengthens cooperation between agriculture and R&D, and reinforces local economic diversification.



How this CBM ensures that vulnerable groups are engaged?	Through cooperative participation and inclusion of small producers in value-added innovation projects.
Circular Risks & Resilience	
What risks may hinder circularity? (e.g., supply chain issues)	Technical complexity, limited access to battery markets, regulatory delays on new materials.
How does the model enhance resilience? (e.g., local sourcing, partnerships)	By creating new uses for local biomass, integrating academic knowledge, and reducing material import dependency.
Metrics & Monitoring	
What indicators are used to monitor circularity? (e.g., % waste diverted, resource recovery rates)	Quantity of biomass valorized, surface area of activated carbon, energy storage performance indicators, % reduction in carbon footprint.
How is performance tracked?	Through lab data, pilot project reports, lifecycle assessments, and certification of circular products.

7.4 Transferability Assessment Matrix (TAM)

Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>

SUMMARY	
Transferability score	<i>[add the points per criterion]</i>
Main barriers	
Key factors for facilitation	
Recommendations for adaptation	
Comments	

7.4.1 TAM per country

Croatia

Business model 1: Bioreactor-based composting of olive pomace				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				



1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	2+4+3+3+5+1+4+5+4= 31/45			
Main barriers	Initial investment for bioreactor system, seasonal availability and variability of olive pomace			
Key factors for facilitation	Research support and transfer of know-how from R&D institutions			
Recommendations for adaptation	Not applicable			
Comments	/			

Business model 2: Plant for recycling olive by-products and waste				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				



1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	4+2+4+5+3+3+4+4+4= 33/45			
Main barriers	High initial investment, slowness and inefficiency of institutional procedures, low willingness of waste producers to accept changes and adjustments			
Key factors for facilitation	Existing partnerships with local enterprises and supporting institutions, timely issuance of permits and support from competent institutions			
Recommendations for adaptation	Developing local infrastructure and value chain to facilitate implementation and expansion			
Comments	/			

Business model 3: Olive by-products utilization and valorization				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High

<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	3+3+2+4+2+3+3+4+4= 28/45			
Main barriers	Regulatory restrictions, high investments			
Key factors for facilitation	Financial support, development of common by-product processing centers, education			
Recommendations for adaptation	Regional centers for composting and processing, available grants for investment in equipment, simplification of regulations			
Comments	/			

Business model 4: Utilizing the value of waste generated during olive pruning				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				



1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$3+3+2+4+2+3+3+4+4= 36/45$			
Main barriers	Requires mechanical knowledge and skilled operators, lack of direct revenue stream may reduce perceived financial incentive			
Key factors for facilitation	Availability of regional and EU subsidies for investment in circular technologies, education through local advisory services			
Recommendations for adaptation	Make sure to know how to operate the machinery before buying, get in touch with local olive growers that already implement the practice for advice			
Comments	/			



Greece

Business model 1: Composting of Olive Mill Waste for the Production of Soil Amendments				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	4+4+5+4+3+5+4+5+4 = 38/45			
Main barriers	Need for consistent monitoring of moisture/temperature (requires training).			



	Upfront setup costs (even if low) may be a hurdle for ultra-small operators. Market acceptance and branding for compost products may require support
Key factors for facilitation	Availability of technical guidelines and university support. Modular and scalable design (can begin small). Readily accessible feedstock within local olive agro-industrial systems. Demonstrated success at both pilot and full scale in Greece.
Recommendations for adaptation	Provide tailored training packages to operators (especially around thermophilic process control). Promote cooperatives/shared composting facilities to spread investment costs. Link to local organic farmers and certification schemes to strengthen compost market demand. Include a basic digital or manual monitoring checklist to support SMEs with compost quality assurance.
Comments	This business model is a textbook example of high transferability for micro and small olive mills across the Mediterranean. It balances technical simplicity, environmental regeneration, and economic opportunity with practical feasibility.

Business model 2: Integrated Supply Chain for Compost Production from Olive Oil Waste				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				

1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$3+3+3+5+3+4+4+5+4 = 34/45$			
Main barriers	<p>Technical: Digital logistics tools and data-driven modeling may be unfamiliar to small operators.</p> <p>Economic: Initial investment in central infrastructure, sensors, or route optimization software.</p> <p>Cultural: Resistance to shared supply chains among independent smallholders.</p>			
Key factors for facilitation	<p>Strong enabling ecosystem (existing collaboration among olive mills, composting units, and farmers in Messinia).</p> <p>Availability of biomass and regional compost demand.</p> <p>Access to EU/national circular economy funding.</p> <p>Proven performance of the digital model with real-world data.</p>			
Recommendations for adaptation	<p>Start with a basic logistics coordination system (non-digital or low-tech) for early-stage adopters.</p> <p>Create a cooperative or municipal facilitation entity to manage central infrastructure and digital tools.</p> <p>Offer training or outsourcing partnerships for supply chain simulation and route planning.</p> <p>Integrate compost quality certification to enhance marketability and customer confidence.</p>			
Comments	<p>This model is highly impactful and regionally validated, with a solid technical and environmental foundation. However, its transferability to small-scale operators depends on intermediary coordination, shared infrastructure, and guided uptake of digital tools. It is particularly well-suited for rural cooperatives, inter-municipal schemes, and clusters of olive mills in Mediterranean settings.</p>			

Business model 3: Integrated Water-Energy-Nutrient Recovery from Olive Mill Wastewater				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>

Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$2+2+2+4+2+3+3+5+4 = 27/45$			
Main barriers	<p>Technical: Demanding operational management, especially in membrane maintenance and biogas handling.</p> <p>Economic: High capital cost for small enterprises.</p> <p>Regulatory: Tight and evolving regulations on treated water reuse and renewable energy from waste.</p> <p>Cultural: Conservative attitudes toward wastewater reuse and biosludge-based fertigation.</p>			
Key factors for facilitation	<p>Availability of EU and national funding for environmental technologies (e.g., Horizon Europe, LIFE, Just Transition Mechanism).</p> <p>Technical partnerships with universities and engineering companies.</p> <p>Precedents of successful pilot projects demonstrating viability and compliance.</p> <p>Strong policy incentives for nutrient recycling, wastewater reuse, and energy recovery in agriculture.</p>			
Recommendations for adaptation	Target deployment through cooperatives or public-private platforms rather than standalone MSEs.			

	<p>Introduce the model as a shared infrastructure service (e.g., centralized AnMBR hubs). Develop plug-and-play AnMBR modules with remote monitoring to reduce on-site management needs. Combine with advisory or maintenance-as-a-service packages to assist MSEs with operations and regulatory compliance.</p>
Comments	<p>This business model is technologically sophisticated and environmentally high-performing, but currently limited in direct transferability to individual MSEs due to capital intensity and operational complexity. Shared service models, policy leverage, and funding access are essential enablers for scaling and replication in the Mediterranean olive sector.</p>

Business model 4: Integrated Circular Bio-Valorisation Model for Olive Oil Production and By-product Regeneration				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				

1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	4+3+4+4+3+5+5+5+4 = 37/45			
Main barriers	Access to nearby biogas plants may not be available to all rural producers. Initial capital for composting and heating equipment could be challenging for non-vertically integrated micro-enterprises. Cultural resistance in traditional mills unfamiliar with CE practices.			
Key factors for facilitation	Strong ecological mindset and family-led governance, enabling fast adoption. Location within a PDO area enhances branding value and regulatory recognition. Partnerships with local actors (e.g., biogas plant) replace the need for full in-house processing. Synergies with EU policy frameworks (CAP eco-schemes, Green Deal, RRF).			
Recommendations for adaptation	Encourage creation of shared composting and biomass units through cooperatives. Promote inter-municipal partnerships with biogas facilities to replicate OMWW valorisation. Use olive tourism and product branding to monetise CE practices, even when compost or energy are not sold externally. Leverage RRF, LEADER, or CAP funding to finance infrastructure retrofitting in small mills.			
Comments	KYKLOPAS represents a best-practice, real-world operational CE model that is already functioning at full scale in a rural Greek context. While its transferability is high for SMEs, micro-enterprises will require structural support, especially in accessing biogas partnerships and financing small infrastructure. The model is inspirational, both for its environmental performance and its grounded community integration.			

Business model 5: Low-Input Regenerative Olive Farming Model with Bio-based Soil Enhancement and Closed-Loop Biomass Cyclin				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High

<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$4+4+5+3+4+5+4+5+4 = 38/45$			
Main barriers	<p>Mindset shift: Requires deep ecological commitment and patience for long-term returns. Economic pressure: No short-term financial gain unless premium pricing is secured. Access to OMWW sludge: Dependent on mill practices and separation infrastructure. Cultural: Resistance from yield-oriented farmers and lack of recognition for ecological stewardship.</p>			
Key factors for facilitation	<p>Family-owned structure allows flexible decision-making. Participation in research consortia (e.g., Elaionas project) facilitates access to knowledge and tools. Regional demand for premium olive oil supports differentiation. Availability of pruning and biomass resources in most olive farms.</p>			
Recommendations for adaptation	<p>Encourage peer-to-peer learning and farmer field schools to spread agroecological practices. Develop basic composting and biochar guidelines for farmers with minimal infrastructure. Promote the branding of agroecological olive oil with traceability and sustainability certification. Link to CAP eco-schemes and LEADER funding for input substitution and carbon sequestration.</p>			
Comments	<p>This model is exceptionally aligned with MSE realities, offering a low-cost, low-tech, high-impact solution rooted in traditional land stewardship and modern sustainability principles. It is among the most transferable models for micro-olive producers—particularly those driven by values of ecological integrity, product quality, and long-term soil health</p>			

Italy

Business model 1: Agroenergy				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>

Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$3+1+3+3+4+4+4+5+3= 30/45$ Since the valorization of olive oil production by-products through anaerobic digestion plants is an increasingly established reality, technical and regulatory barriers do not represent a huge issue for the adoption of this practice			
Main barriers	The main barriers are economic and technical: in order to adopt the CBM analysed, a huge initial economic investment is required for the realization of the facility (incentives are thus essential); another barrier is represented by the possibility and ability to adopt new technologies			
Key factors for facilitation	Supportive policies, such as economic incentives, are key factors for enabling firms to adopt this type of CBM, due to high initial capital costs; partnership between a variety of actors, such as local community and companies, are another crucial factor, together with local ecosystem readiness			
Recommendations for adaptation	Taking advantage of government incentives is essential to start this type of CBM due to the high capital costs; knowledge-sharing between existing realities is fundamental in order to acquire technical knowledge and skills about the management of biogas plants; local sourcing and partnership with local actors are important to enhance resilience: in this sense, a major focus should be on overcoming coordination issues, which may arise in the context of multi-actor communities			
Comments	Evaluation of environmental performance is required in order to precisely quantify the environmental benefits of the analysed CBM (adopting and tracking specific indicators of environmental performance is fundamental)			



Business model 2: Bioentra				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>

Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$2+1+3+3+3+4+4+5+3= 28/34$ Technical barriers represent a major issue: the industrialization of the process used to extract phenolic compounds is an important challenge due to its complexity; regulatory barriers can represent an issue when the commercialization of food and pharmaceutical products is involved: placing on the market new products intended for human consumption is subjected to strict regulations in Italy (and in Europe in general)			
Main barriers	The main barriers are economic and technical: a huge economic investment is required for the realization of the facility and for its maintenance, in addition to process costs (the technology used by Bioentra for the extraction of polyphenols is patented); another barrier is represented by the possibility and ability to adopt new technologies that require specialised machinery and equipment and technical knowledge in key stages; lastly, regulatory and legal barriers can potentially limit the adoption of this CBM, since the approval of new products in the market requires additional economic costs and time			
Key factors for facilitation	The CBM analysed is based on industrial symbiosis between different realities: partnership with a variety of actors, such as local community and companies, is thus fundamental to adopt the model and to guarantee its success; local ecosystem readiness is another important factor but, since the model aims to broaden the horizon for the raw materials used (not only by-products of olive oil production, but also by-products of other different agri-food industries), the CBM could easily be adopted by other areas; the patent on the extraction process can be a limitation for the adoption of this CBM: in this sense, a knowledge-sharing approach should be preferred; lastly, supportive policies (as economic incentives) are key factors for enabling firms to adopt the model, due to high economic costs			
Recommendations for adaptation	Taking advantage of government incentives (if available) is essential to start this type of CBM due to the high economic costs; a knowledge-sharing approach is important in order to acquire technical knowledge and skills about the management of complex industrial machinery and technologies; local sourcing and partnership with local actors are at the core of the model for the establishment of a closely interconnected industrial ecosystem			

Comments	Tracking environmental performance is essential for a precise quantification of the environmental benefits of the analysed CBM: the use of specific indicators of environmental performance is thus required
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Business Model 3: OLI.VA.RE.				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				

1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	✓ 3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	<p>$2+1+3+3+3+4+4+5+3= 27/34$ Technical complexity: 2; investment requirements: 2; operational feasibility for MSEs: 2; scalability potential: 3; regulatory and legal barriers: 2; supply chain readiness: 4; market demand: 4; environmental impact reduction potential: 5; social impact potential: 3; total: 27; Technical complexity represents a major issue because of the use of very recent and cutting-edge technologies: this is a problem for the scaling-up of the pilot project, since there is the risk that it cannot be feasible; regulatory barriers represent another major issue, since the commercialization of new products intended for human consumption is subjected to strict regulations in Italy (and in Europe in general)</p>			
Main barriers	<p>The main barriers are economic and technical: important economic investment is necessary for obtaining specialised equipment and innovative and green processing technologies that require technical knowledge in key stages; since the model is based on industrial symbiosis, major coordination challenges could arise from the involvement of a huge variety of different actors in the model (also in terms of logistics): coordination between different partners is thus essential in order to accomplish the goal of an (almost) zero-waste model; regulatory and legal barriers can also limit the adoption of this model, since some of the final products are intended for human consumption and thus have to overcome controls and regulations before being placed on the market</p>			
Key factors for facilitation	<p>The CBM is based on industrial symbiosis between different local and regional actors: cooperation between a variety of actors is at the core of the business model and is thus essential for a successful adoption (especially in terms of knowledge-sharing with universities and R&D institutes); supportive policies (regional funds in this case) are important factors for enabling the adoption of the model, since the high economic investment required</p>			



Recommendations for adaptation	Taking advantage of incentives (if available) is essential to start this type of CBM due to the high economic cost; a collaborative approach between different local actors is fundamental for a successful implementation of the model and coordination issues should be properly taken into account for the establishment of an effective industrial ecosystem; a knowledge-sharing approach is important for acquiring technical knowledge and skills required for the technology employed
Comments	Since the model described is a (quite recent) pilot project, it may be subjected to limitations, as scaling issues; in fact, solutions successful in a pilot project may not work on a larger scale. It is crucial to adopt several different environmental indicators to track the model environmental performance, in order to objectively assess the real environmental benefits offered by the CBM.

Business model 1: Herdade do Esporão – Circular Bioeconomy Model				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Advanced technology, highly skilled workforce, and complex infrastructure required	Requires advanced equipment or expertise in key stages	Moderate technology required; micro & small enterprises need adaptation	Mostly low-tech; micro & small enterprises can adopt with some training	Simple technology that needs no specialised expertise
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
> €500,000 upfront capital	€250,000 - €500,000	€100,000 - €250,000	€25,000 - €100,000	< €25,000 initial investment
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Not feasible for micro & small enterprises without structural changes or partnerships	Feasible with heavy support & restructuring	Feasible with moderate adjustments & external support	Feasible with basic adjustments & existing resources	Easily implementable within current MSE operations
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Highly site-specific; difficult to replicate	Limited to local/regional contexts	Scalable to a few regions/markets with adaptation	Scalable nationally with minimal adjustments	Scalable across regions & sectors without major changes
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Complex multi-level regulations: difficult permits required	Significant restrictions requiring external assistance	Some regulatory steps but manageable internally	Low-level compliance, general regulations	No significant regulatory barriers
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Key inputs or services not available locally/regionally	Limited partner networks; hard to source inputs	Partial access to key supply chain components	Most partners & services available locally	Fully developed & accessible supply chain ecosystem
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
No market demand or negative feedback	Emerging market with low customer interest	Moderate demand from specialised markets	Growing demand with positive customer trends.	Strong demand with broad customer acceptance.
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Minimal environmental benefits (<10% impact reduction)	Some benefits but limited in scale (10-25%)	Moderate reduction (25-50% waste/emissions reduction)	High impact reduction (>50%)	Significant positive impact (e.g., near-zero-waste model or carbon neutrality)
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
No measurable social benefits	Limited benefits (e.g., temporary jobs or minimal engagement)	Moderate contribution (e.g., stable jobs, moderate training programs)	High contribution (e.g., significant local employment, skills development)	Strong social impact (e.g., long-term jobs, community empowerment)

SUMMARY	
Transferability score	1+2+2+3+2+4+4+4+5 = 27/45
Main barriers	High technical complexity for full model (precision farming, regenerative agriculture); Significant investment needed for renewable infrastructure and certifications; Regulatory hurdles for smaller producers.
Key factors for facilitation	Strong EU and national support for organic and regenerative farming; Well-developed partnerships with R&D institutes and local supply chains; Availability of co-financing (PEPAC, EAFRD) for smaller producers; High market demand for sustainable premium products.
Recommendations for adaptation	Promote modular adoption (start with composting, basic regenerative practices); Encourage cooperative models to pool investment and technical capacity; Provide training and technical assistance on regenerative and precision agriculture; Simplify certification processes for SMEs and cooperatives.
Comments	The Herdade do Esporão model is highly impactful and scalable in regions with strong ecosystems, but full replication by small producers requires support, funding, and knowledge sharing.

Business model 2: Casa Alta – Traditional Circular Estate Model				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>

Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$4+5+4+4+3+4+3+3+4 = 34/45$			
Main barriers	Limited technical knowledge of regenerative agriculture and eco-technologies among small producers; initial investment requirements for renewable energy, composting, and eco-friendly packaging; regulatory barriers to the use of compost, ecotourism, and organic certifications; lack of formal key performance indicators for benchmarking circular performance.			
Key factors for facilitation	Supportive EU and national policies for regenerative and organic agriculture (CAP, PEPAC); Participation in BioRegião Idanha-a-Nova network and strong partnerships with municipality; Market demand for sustainable and local products; Access to EU and regional funds for small producers; Low-tech and community-based nature of the model facilitates adoption.			
Recommendations for adaptation	Promote cooperative and peer-learning approaches to build technical capacity; Facilitate access to micro-financing and grants for small farms; Develop modular approaches for gradual adoption (starting with composting and eco-tourism); Simplify certification processes and offer technical support for monitoring and impact measurement; Encourage alignment with BioRegião and similar local networks to build resilience.			
Comments	Casa Alta's model demonstrates a highly adaptable and community-based approach to circular agriculture, well-suited to replication by other small farms in similar rural contexts. The lack of formal KPIs is a current limitation but does not diminish the model's practical circular performance and local impact.			

Business model 3: Alentejo Circular – Circular Economy Promotion in Alentejo Agrifood Sectors				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	4+5+5+5+5+4+3+1+1 = 33/45			

Main barriers	Project phase completed; no permanent structure in place; Need for follow-up funding and operational continuity to generate further impact; No direct business model implemented (awareness phase only)
Key factors for facilitation	Strong existing regional networks; Alignment with EU and national circular economy strategies; Potential for integration into future funded initiatives (e.g., PRR, Horizon Europe)
Recommendations for adaptation	Establish mechanisms for follow-up and continuity; Integrate into wider regional innovation strategies (e.g., Smart Specialisation); Foster long-term collaboration between academia, businesses and municipalities; Build capacity for concrete circular business model implementation in future phases
Comments	The Alentejo Circular project successfully created the groundwork for circular economy adoption in the region's agrifood sectors. Its model of stakeholder mobilisation and knowledge exchange is highly transferable and could serve as a replicable template in other regions — provided future funding supports implementation phases.

Business model 4: Azeite Acushla – Circularity in Small-Scale Olive Mill				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High

<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	4+5+5+5+4+4+4+5+3 = 39/45			
Main barriers	Limited technical expertise in some small mills; Initial funding (even if low); Regulatory variability on compost use; Dependence on community engagement.			
Key factors for facilitation	Strong community networks (BioRegion, municipality); Local knowledge on agroecology; Supportive local policies for circular economy; Availability of simple low-tech solutions.			
Recommendations for adaptation	Provide training and technical support for composting and biomass systems; Develop shared-use equipment hubs for very small operators; Facilitate regulatory harmonisation for compost use; Encourage cooperative models to ensure financial feasibility and network resilience.			
Comments				

Business model 5: Quinta de S. Braz Circular and Regenerative Olive Oil Production				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High

<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$3+2+2+3+4+5+1+5+5 = 30/45$			
Main barriers	Upfront investment for circular technologies; Need for specific artisanal know-how; Market limited to premium niche (not mass-market scalable).			
Key factors for facilitation	Strong local leadership and know-how; Partnerships with academic and producer networks (APPITAD, IPB, IPV); High demand for DOP/BIO olive oils; Consumer trends toward sustainable and regenerative products.			
Recommendations for adaptation	Promote knowledge transfer through producer networks; Encourage regional funding to support small-scale circular transitions; Leverage storytelling and consumer education to expand market reach; Develop scalable training for other DOP/BIO regions.			
Comments	The Quinta de S. Braz model is an excellent example of circularity in premium, artisanal olive oil production. While requiring initial investment and specialised knowledge, the model is highly transferable to other small producers in similar contexts, especially within PDO/BIO frameworks in Portugal and other Mediterranean regions.			

Business model 6: Oliveira da Serra – Scalable Circular Supply Chain Model				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				

Transferability score	$2+2+1+2+1+2+1+5+5 = 21/45$
Main barriers	High tech and capital intensity; Complex regulatory landscape for circular certifications; Cultural resistance in smaller producers.
Key factors for facilitation	Strong national and EU circular economy policy push; Access to shared infrastructure (e.g., via cooperatives); Partnerships with tech providers and universities; Financing incentives for SMEs.
Recommendations for adaptation	Develop modular packages of circular solutions for SMEs; Shared services hubs (biomass valorisation, composting); Simplify certification pathways for smaller operators; Foster cluster-based adoption (e.g., “Alentejo Circular” model).
Comments	

Business model 7: MiOlive3 – Micro Circular Valorisation Model				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>

Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$1+2+1+1+2+1+4+5+4 = 21/45$			
Main barriers	High technical complexity in biotech propagation and inoculation; Initial investment and operational costs for small producers; Limited availability of biotech materials at commercial scale; Regulatory gaps for biotech inputs in traditional agriculture.			
Key factors for facilitation	Strong partnerships with R&D centres (DEIFIL, universities); Supportive policies for regenerative agriculture (PEPAC, COMPETE); Existing BioRegião and cooperative networks for knowledge transfer; High market demand for sustainable and circular olive production.			
Recommendations for adaptation	Promote cooperative-led adoption to share costs and expertise; Develop modular, scalable solutions for different producer profiles; Foster public-private partnerships to expand supply of biotech materials; Advocate for regulatory frameworks to support biotech integration; Provide training and capacity-building for small producers.			
Comments	MiOlive3 represents an innovative niche within the circular olive sector, with strong potential for scalability across Mediterranean contexts. Transferability to MSEs is facilitated when embedded in local networks, but requires sustained collaboration, technical capacity building, and policy support to reach full maturity.			

Business model 8: Herdade da Figuerinha – Circular Composting and Regenerative Agriculture Model				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High

<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$4+4+5+5+2+4+4+3+4 = 35/45$			
Main barriers	Regulatory complexity and delays in licensing compost production and sales; Lack of clarity in legal frameworks governing composting and circular agricultural products; Limited technical and financial support for scaling to commercial market.			
Key factors for facilitation	Political support and incentives for sustainable agricultural practices; Carbon credit markets and fiscal incentives for carbon sequestration; Strong partnerships with retailers, cooperatives, and academia; Growing demand for circular, sustainable agricultural products; Prioritisation of sustainability by banks and financial institutions.			
Recommendations for adaptation	Simplify licensing procedures and clarify regulatory frameworks; Offer fiscal and financial incentives to small producers adopting circular models; Support capacity-building and knowledge transfer through universities and cooperatives; Encourage market development for carbon credits and environmental services; Foster cooperation among value chain actors to facilitate scale-up.			



Comments	The composting and circular business model of Herdade da Figueirinha is well adapted for micro and small enterprises, particularly for internal use. Scaling for commercial sale requires overcoming regulatory barriers. The model demonstrates strong environmental, social, and economic impacts and is highly replicable in the olive and agrifood sectors.
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Spain

Business model 1: Valorization of Olive Pomace for Biomass and Energy				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages Requires biomass dryers, pelletizers, and cogeneration systems. Specialized equipment and technical skills needed for maintenance and operation.</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>Drying and pelletizing infrastructure, energy systems, and logistics imply investments</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring MSEs would need to rely on cooperatives or partnerships due to high CAPEX and technical requirements.</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Can be scaled to regional levels but depends on access to biomass plants and cooperative coordination. Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High



<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Environmental permits and energy regulations apply; feasible but requires expertise. Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Strong presence of cooperatives and biomass firms; most logistics and partners are accessible in olive-producing regions. Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>There is a growing market for green energy and eco-labelled biomass products. Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Significant GHG reduction, elimination of dumping, valorization of by-products. Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>Creates rural employment and empowers cooperatives, especially in depopulated areas. High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
UMMARY				

Transferability score	2+2+2+3+3+4+4+5+4= 29 31 / 45
Main barriers	<ul style="list-style-type: none"> • High capital investment for individual MSEs • Technical and regulatory complexity • Need for trained personnel and maintenance systems
Key factors for facilitation	<ul style="list-style-type: none"> • Availability of EU and national funding (e.g. LIFE, Horizon Europe) • Existing cooperative and inter-municipal collaboration models • Proven technology through R&D demonstration projects
Recommendations for adaptation	<ul style="list-style-type: none"> • Promote shared biogas infrastructure via cooperatives or clusters • Offer technical assistance and capacity building to small producers • Encourage integration into rural energy self-sufficiency strategies
Comments	Transferability to MSEs is viable only within cooperative or collective schemes. Also, strong environmental and rural development benefits support prioritization for scale-up.

Business model 2: Biogas Production from Olive Oil By-products				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Advanced technology, highly skilled workforce, and complex infrastructure required	Requires advanced equipment or expertise in key stages Requires anaerobic digesters, gas purification, and heat recovery systems. Demands specialized technical knowledge and monitoring.	Moderate technology required; micro & small enterprises need adaptation	Mostly low-tech; micro & small enterprises can adopt with some training	Simple technology that needs no specialised expertise
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
> €500,000 upfront capital	Capital investment often exceeds €250,000 due to bioreactor systems and auxiliary infrastructure. Not accessible to MSEs without external funding. €250,000 - €500,000	€100,000 - €250,000		< €25,000 initial investment
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Not feasible for micro & small enterprises without structural changes or partnerships	Only feasible with strong external support or shared/cooperative models.	Feasible with moderate adjustments & external support	Feasible with basic adjustments & existing resources	Easily implementable within current MSE operations



	<i>MSEs would need to outsource or rely on public-private infrastructure. Feasible with heavy support & restructuring</i>			
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Replicable at regional level with support, but context-specific adjustments are needed. Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Regulatory compliance required, particularly for energy production and waste management, but manageable with support. Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Feedstock (alperujo, wastewater) is widely available and supported by cooperative networks. Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>Demand is increasing for biogas energy and organic fertilizer, both locally and at national level. Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				

1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Strong reduction in methane emissions, fossil fuel substitution, and nutrient recovery. Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>Supports job creation in rural areas, improves energy self-sufficiency, and strengthens cooperative structures. High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
<i>Transferability score</i>	<i>2+2+2+3+3+4+4+5+4= 29 28 / 45</i>			
<i>Main barriers</i>	<ul style="list-style-type: none"> • High capital expenditure • Technical complexity • Need for ongoing maintenance and skilled operation 			
<i>Key factors for facilitation</i>	<ul style="list-style-type: none"> • Access to public funding (e.g., LIFE, Horizon Europe) • Cooperative models and inter-municipal infrastructures • Existing technical validation through pilot projects 			
<i>Recommendations for adaptation</i>	<ul style="list-style-type: none"> • Promote shared facilities for anaerobic digestion • Offer capacity building for cooperatives and local technicians • Integrate biogas into rural renewable energy strategies 			
<i>Comments</i>	Direct adoption by individual MSEs is limited; collective action and external support are essential for deployment. Strong role of the cooperative model.			

Business model 3: Extraction of Bioactive Compounds from Olive By-products				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High

<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Involves advanced extraction technologies (e.g., membrane filtration, supercritical fluids) and skilled R&D personnel. Not accessible to MSEs without scientific partnerships Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>Specialized lab and processing equipment imply investments often above €250,000, even in small-scale facilities. €250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>MSEs can participate through clusters or co-managed facilities, but direct implementation requires significant adaptation and external support. Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Applicable in different contexts with strong R&D ecosystems; however, scale-up depends on access to biotech infrastructure. Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Requires compliance with food, cosmetic, and health safety</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>



		<i>regulations, which can be managed with support. Some regulatory steps but manageable internally</i>		
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Raw materials are abundant, but biotech processing and formulation partners may not be locally available in all regions. Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>High and growing demand for natural extracts in nutraceuticals, cosmetics, and functional food sectors. Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>Converts agro-industrial waste into high-value products, reducing landfill and chemical inputs in final goods. High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Supports skilled job creation and regional innovation, but impacts depend on degree of inclusion of local cooperatives and SMEs. Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				

Transferability score	$2+2+2+3+3+3+4+4+3= 26 / 45$
Main barriers	<ul style="list-style-type: none"> • High technical and regulatory complexity • Capital-intensive extraction processes • Need for scientific and regulatory expertise
Key factors for facilitation	<ul style="list-style-type: none"> • Public-private innovation partnerships • Access to shared R&D infrastructure • EU funding programs for biotech and agri-food innovation
Recommendations for adaptation	<ul style="list-style-type: none"> • Facilitate clustering between cooperatives and biotech firms • Offer regulatory support and shared lab services for SMEs • Promote licensing and tech-transfer models for rural areas
Comments	<i>Transferability to MSEs is feasible only via collaboration or inclusion in bioeconomy innovation networks.</i>

Business model 4: Use of Olive By-products for Animal Feed				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Involves low-tech operations such as drying, ensiling, and grinding. These processes are accessible to cooperatives and even small farms with basic training. Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>€250,000 - €500,000</i>	<i>Moderate investment required for drying and mixing equipment, typically within €100,000–250,000; manageable with cooperative support or public aid. €100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High

<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	Technically and operationally feasible for MSEs, especially those already involved in mixed farming or within cooperatives. <i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Applicable across many olive-producing regions with livestock activity. Easily scalable through cooperative networks.</i> <i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Must comply with animal feed safety regulations. Barriers exist but are manageable through certification and good practices.</i> <i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Strong integration between olive mills and livestock sectors in many rural areas.</i> <i>Infrastructure and partners are often in place.</i> <i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High

<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate and stable demand for cost-effective, local animal feed. Niche markets for circular products are still developing. Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>Diverts waste from disposal and reduces reliance on imported or synthetic feed. Strong contribution to circular food systems. High impact reduction (>50%)</i>	<i>Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>Strengthens local cooperatives, supports small farmers, and promotes economic activity in rural areas. High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	4+3+4+4+3+4+3+4+4= 33 / 45			
Main barriers	<ul style="list-style-type: none"> Compliance with feed safety regulations Need for small-scale processing infrastructure in some regions 			
Key factors for facilitation	<ul style="list-style-type: none"> Existing synergies between olive and livestock sectors Cooperative frameworks and logistics already in place Policy support for circular agriculture 			
Recommendations for adaptation	<ul style="list-style-type: none"> Promote technical assistance for feed safety compliance Support shared investment in small drying and blending facilities Encourage labeling and awareness of circular feed options 			
Comments	High potential for adoption by MSEs, especially in integrated farming systems or rural cooperatives. One of the most directly transferable models.			

Business model 5: Reuse of Olive Mill Wastewater for Agricultural Irrigation

Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Advanced technology, highly skilled workforce, and complex infrastructure required</i>	<i>Requires treatment systems such as membrane bioreactors, constructed wetlands, and irrigation monitoring. Technically demanding for individual MSEs. Requires advanced equipment or expertise in key stages</i>	<i>Moderate technology required; micro & small enterprises need adaptation</i>	<i>Mostly low-tech; micro & small enterprises can adopt with some training</i>	<i>Simple technology that needs no specialised expertise</i>
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>> €500,000 upfront capital</i>	<i>High initial CAPEX for treatment and distribution infrastructure (>€250,000), often feasible only through public-private or cooperative projects. €250,000 - €500,000</i>	<i>€100,000 - €250,000</i>	<i>€25,000 - €100,000</i>	<i>< €25,000 initial investment</i>
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>	<i>Feasible with heavy support & restructuring</i>	<i>Feasible with moderate adjustments & external support</i>	<i>Feasible with basic adjustments & existing resources</i>	<i>Easily implementable within current MSE operations</i>
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Limited to local/regional contexts</i>	<i>Potentially scalable in water-scarce regions, but requires adaptation to local hydrological and agricultural contexts.</i> <i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Subject to strict environmental, health, and water reuse regulations; difficult for small</i>	<i>Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>



	operators to manage alone. <i>Significant restrictions requiring external assistance</i>			
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>Limited partner networks; hard to source inputs</i>	<i>Treated effluent use is still in pilot or early adoption phase; infrastructure is not yet widespread. Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand in drought-affected areas, but adoption varies due to cultural hesitance and regulatory complexity. Moderate demand from specialised markets</i>	<i>Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Strong contribution to water reuse, nutrient cycling, and pollution reduction. Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Supports rural water security, agricultural continuity, and inclusion of smallholders through collective systems. Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	2+2+4+3+2+3+3+5+3=27 26 / 45			
Main barriers	<ul style="list-style-type: none"> High technical and regulatory complexity 			

	<ul style="list-style-type: none"> • Need for large-scale infrastructure and monitoring • Cultural resistance to wastewater reuse in some areas
Key factors for facilitation	<ul style="list-style-type: none"> • Availability of EU and national water reuse programs (e.g. PERTE Agua) • Technical validation through pilot projects • Institutional support and cooperative-led initiatives
Recommendations for adaptation	<ul style="list-style-type: none"> • Promote awareness and training in safe wastewater reuse • Provide incentives for collective infrastructure investment • Simplify compliance processes for small agricultural users
Comments	Transferability to MSEs is low unless integrated into shared, cooperative, or subsidized systems. Environmental benefits are strong and socially relevant in water-stressed areas.

Business Model 6: Valorization of Olive Pomace into Activated Carbons for Lithium-Sulfur Batteries				
Technical Complexity				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Requires high-temperature pyrolysis, chemical activation, and material purification. Involves advanced R&D and precision engineering — far beyond MSE capacities. Advanced technology, highly skilled workforce, and complex infrastructure required	Requires advanced equipment or expertise in key stages	Moderate technology required; micro & small enterprises need adaptation	Mostly low-tech; micro & small enterprises can adopt with some training	Simple technology that needs no specialised expertise
Investment Requirements				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Capital costs easily exceed €500,000 due to industrial kilns, reactors, and quality control systems. Not viable without major external funding. > €500,000 upfront capital	€250,000 - €500,000	€100,000 - €250,000	€25,000 - €100,000	< €25,000 initial investment
Operational Feasibility for MSEs				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
Not feasible for direct implementation by MSEs; only accessible via partnerships with research institutions or technology providers.	Feasible with heavy support & restructuring	Feasible with moderate adjustments & external support	Feasible with basic adjustments & existing resources	Easily implementable within current MSE operations



<i>Not feasible for micro & small enterprises without structural changes or partnerships</i>				
Scalability Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Highly site-specific; difficult to replicate</i>	<i>Technically scalable, but highly site-specific and dependent on high-purity standards and specialized infrastructure. Limited to local/regional contexts</i>	<i>Scalable to a few regions/markets with adaptation</i>	<i>Scalable nationally with minimal adjustments</i>	<i>Scalable across regions & sectors without major changes</i>
Regulatory & Legal Barriers				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Complex multi-level regulations: difficult permits required</i>	<i>Significant restrictions requiring external assistance</i>	<i>Requires industrial permits, chemical handling licenses, and compliance with battery material standards — complex but navigable for large players. Some regulatory steps but manageable internally</i>	<i>Low-level compliance, general regulations</i>	<i>No significant regulatory barriers</i>
Supply Chain Readiness				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Key inputs or services not available locally/regionally</i>	<i>While raw material (olive pomace) is abundant, the value chain for battery-grade activated carbon is still emerging in Europe. Limited partner networks; hard to source inputs</i>	<i>Partial access to key supply chain components</i>	<i>Most partners & services available locally</i>	<i>Fully developed & accessible supply chain ecosystem</i>
Market Demand				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No market demand or negative feedback</i>	<i>Emerging market with low customer interest</i>	<i>Moderate demand from specialised markets</i>	<i>High demand projected in energy storage and battery sectors; however, entry barriers for new suppliers are high. Growing demand with positive customer trends.</i>	<i>Strong demand with broad customer acceptance.</i>
Environmental Impact Reduction Potential				

1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>Minimal environmental benefits (<10% impact reduction)</i>	<i>Some benefits but limited in scale (10-25%)</i>	<i>Moderate reduction (25-50% waste/emissions reduction)</i>	<i>High impact reduction (>50%)</i>	<i>Converts agri-waste into a strategic material for green energy storage — major contribution to decarbonization and circular economy. Significant positive impact (e.g., near-zero-waste model or carbon neutrality)</i>
Social Impact Potential				
1-Very Low	2 – Low	3 – Medium	4 – High	5 – Very High
<i>No measurable social benefits</i>	<i>Limited local job creation unless tied to broader regional innovation clusters. Low direct social engagement at MSE level. Limited benefits (e.g., temporary jobs or minimal engagement)</i>	<i>Moderate contribution (e.g., stable jobs, moderate training programs)</i>	<i>High contribution (e.g., significant local employment, skills development)</i>	<i>Strong social impact (e.g., long-term jobs, community empowerment)</i>
SUMMARY				
Transferability score	$1+1+1+2+3+2+4+5+2= 21 \ 22 / 45$			
Main barriers	<ul style="list-style-type: none"> Extremely high technical and financial barriers R&D-driven value chain with strict quality demands Inaccessible to MSEs without institutional alliances 			
Key factors for facilitation	<ul style="list-style-type: none"> Collaboration with universities and nanomaterials labs Inclusion in national or EU strategic value chains (e.g., battery alliances) Support from innovation funds (e.g., EIC Accelerator, Horizon Europe) 			
Recommendations for adaptation	<ul style="list-style-type: none"> Focus on technology transfer and licensing to larger intermediaries Promote regional clusters for advanced bio-based materials Create long-term partnerships between cooperatives and deep-tech firms 			
Comments	Transferability to MSEs is extremely limited; however, the model holds high strategic value for decarbonization and should be supported as part of long-term innovation agendas.			



8

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