UNLOCK

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Date: **April 2025**

POLICY UPTAKE REPORT

Deliverable 7.6

This project has received funding from the Bio-based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 101023306. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Bio-based Industries Consortium.

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Technical References

Project Acronym	UNLOCK
Project Title	Unlocking a new feather bioeconomy for keratin-based agricultural products.
Project Coordinator	Sarah Montes, CIDETEC
Project Duration	48 months

Deliverable No.	7.6
Dissemination level [1]	PU
Work Package	WP7 Exploitation Strategy
Task	7.3 Policy Uptake
Lead beneficiary	Greenovate! Europe
Contributing beneficiary(ies)	CIDETEC, Farrelly & Mitchell, ATLANTIS, ALL
Due date of deliverable	30 April 2025
Actual submission date	29 April 2025

[1] PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

Document history

V	Date	Beneficiary	Author
1	24.04.2025	G!E	Laura Nieto (G!E), Giorgio Alessandro (G!E)
1.1	24.04.2025	CIDETEC, F&M	Sarah Montes (CIDETEC), Daniel Traas and Karen McGillicuddy (F&M)
2	28.04.2025	G!E	Laura Nieto (G!E), Giorgio Alessandro (G!E)

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Summary

This deliverable presents a comprehensive overview of the UNLOCK project's contribution to advancing the circular bioeconomy through bioplastics innovation in agriculture. It emphasises the critical importance of aligning innovation efforts with existing EU policy frameworks to ensure scalability, market uptake, and lasting environmental impact.

The document identifies the key challenges faced by UNLOCK in the current market and regulatory landscape. A detailed analysis of the EU's initiatives, strategies, and regulatory framework relevant to the circular bioeconomy follows, providing essential context for understanding UNLOCK's positioning.

The report highlights UNLOCK's specific contributions to the EU Bioeconomy Strategy, focusing on how its innovative solutions support objectives such as reducing reliance on fossil-based resources, promoting soil health, and fostering ecosystem resilience. It also presents the main advantages of the UNLOCK products compared to traditional alternatives.

Building on these insights, the deliverable offers targeted policy recommendations aimed at supporting the effective uptake of UNLOCK's solutions and facilitating a broader impact within the agricultural sector. These recommendations are informed by stakeholder engagement activities, including a dedicated policy uptake workshop.

The conclusions underline UNLOCK's role in demonstrating how innovation, when supported by coherent policy frameworks, can drive forward the transition towards a more circular, resilient, and sustainable European bioeconomy.

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Table of Contents

This project has received funding from the Bio-based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 101023306. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Bio-based Industries Consortium.

Introduction

UNLOCK project presentation

The European poultry sector produces 3.6 million tons of waste feathers annually, mainly valorised in low added value products. In line with EU Bioeconomy strategy, the UNLOCK project aims to transform this waste into valuable raw material to create a new sustainable value chain.

UNLOCK is led by CIDETEC and driven by a well-balanced consortium of 15 partners that covers the whole value chain, from feedstock and supply chain analysis to processes, end-product fabrication and sustainability assessments.

The main objective of the UNLOCK project is the design and demonstration of an economically and environmentally sustainable supply-chain for a feather-based bioeconomy which will generate innovative bio-based functional materials for agricultural applications.

The initiative is working on the creation of bio-based products for agriculture, such as:

- Seed trays
- Mulch films
- Hydroponic foams
- Nonwoven geotextiles

And to do it, is using three different technologies for feather treatment:

- Mechanical grinding
- Steam explosion
- Microbial fermentation

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Importance of policy alignment for scaling bioplastics innovation in agriculture

Policy alignment plays a crucial role in scaling bioplastics innovation in agriculture. Effective policies provide a supportive framework that encourages research, investment, and market adoption of sustainable alternatives to conventional plastics. In the agricultural sector, where innovation must balance productivity with environmental management, alignment with regulatory frameworks, such as the EU Bioeconomy Strategy, the EU Soil Strategy, and the Sustainable Development Goals (SDGs) that we will explore on this document, is essential. Coherent policy support helps bridge the gap between laboratory innovations and large-scale field applications, ensuring that bioplastic solutions can contribute meaningfully to reducing environmental impacts, enhancing soil health, and promoting a more circular, resilient bioeconomy.

The goal of this deliverable is to present a policy framework that supports the development of the bioeconomy, with a particular focus on bioplastics innovation in agriculture. It highlights how the UNLOCK project contributes to advancing this framework through the development of circular products derived from agricultural residues (feathers) and through targeted policy recommendations. By demonstrating practical solutions and proposing supportive measures, UNLOCK aims to strengthen the role of the bioeconomy in reducing reliance on fossil-based materials, enhancing soil health, and fostering a more sustainable agricultural sector.

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1. Current challenges for UNLOCK

As extensively illustrated in **Deliverable 2.3 - EUs Feather-based Economy: The Challenges Ahead**, there are several types of barriers that need to be addressed to realise the full potential of the UNLOCK model.

Regulatory barriers: the EU lacks comprehensive regulations for bio-based, biodegradable, and compostable plastics. Although there is some guidance, for example through the Communication on EU Policy Framework on biobased, biodegradable and compostable plastics, the regulatory framework is not legally binding. This creates uncertainty in market development and investments. Additionally, there is no specific EU regulation for the use of feathers in bioplastics.

Infrastructure barriers: there is insufficient infrastructure to clean feathers and process them into high-value products. Many businesses view switching from a current practice, such as producing feather meal and fertiliser, to producing an innovative product with no current market, as a significant risk.

Feather Quality: A critical consideration within this value chain is the availability of quality feathers. It is essential that any degradation of the feathers is avoided where possible, to allow maximum yields of keratin to be obtained during processing. Preventing biological degradation and maintaining feather quality is a challenging but essential step in creating a new, high-value, feather supply chain

Logistical Challenges: Transport distances and contaminated feathers complicate processing and reuse. Logistical hurdles exist in the path to the establishment of a new feather value chain in the EU. The problems of the carbon footprint and rising transport costs involved in the supply chain are exacerbated by the long distances between different actors in the industry.

Market Hurdles: There is competition from conventional plastics and other bio-based alternatives, along with challenges in consumer acceptance of feather-based products. This is also influenced by potential low feather availability as strong demand from rendering companies and potential supply interruptions due to diseases complicate the availability of feathers for valorisation.

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2. EU Policy Framework for UNLOCK

2.1 EU Initiatives and Strategies for the Circular Bioeconomy

UNLOCK aligns with several EU initiatives for the construction of a **circular bioeconomy**[1]. As highlighted in the **2023 Bio-based Industries Consortium (BIC) Manifesto**[2], a circular bioeconomy is crucial to reduce the EU's dependence on fossil resources, create new jobs, and strengthen the EU's industrial competitiveness with new value chains.

The EU strategy to build a circular bioeconomy intersects with different policy areas, including the **EU Circular Economy Action Plan**, and the **EU Bioeconomy Strategy**. By scaling up technologies to produce circular products in plastics and textiles using biomaterials, UNLOCK plays a crucial role in advancing these initiatives.

Circular Economy Action Plan

The current **Circular Economy** approach in the EU focuses on several key value chains, including electronics, batteries, packaging, plastics, textiles, construction, and food. The European Commission adopted the new Circular Economy Action Plan (CEAP) in March 2020, building on the actions implemented since 2015 when the first Circular Economy Action Plan was introduced.

The new CEAP has a focus on promoting sustainable development and **climate neutrality** by establishing a policy framework to make sustainable products, services, and businesses the norm. In particular, the CEAP includes specific strategies such as the EU Plastics Strategy, which aims to reduce plastic waste and make recycling profitable for businesses. The Plan also contains a Strategy for sustainable and circular textiles, which aims to ensure that by 2030 textile products placed on the EU market are made as much as possible of recycled fibres and free of hazardous substances.

[1] The European Union has defined bioeconomy as "covering all sectors and systems that rely on biological resources (animals, plants, microorganism and derived biomass) their functions and principles

[2] https://biconsortium.eu/sites/biconsortium.eu/files/publications/BIC%20Manifesto%202024.pdf

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Recent policy developments are placing the circular economy at the centre of the EU's green transition and competitiveness. The **Circular Economy Act**, which is expected by the end of 2026, will serve to catalyse investments in recycling capacity and encourage EU industry to effectively substitute raw materials and reduce landfilling and incineration. This will be accompanied by the roll-out of Eco-design requirements on important product groups[3].

EU Bioeconomy Strategy

The **EU Bioeconomy Strategy**, first elaborated in 2012 and then updated in 2018, integrates circular economy principles to ensure the sustainable use of biomass, including animal by products, to support a bio-based economy. Through this strategy, the Commission supports initiatives to develop an efficient and sustainable bioeconomy. The objectives of the revised Strategy are: 1) ensuring food security, 2) managing natural resources sustainably, 3) reducing dependence on non-renewable resources, 4) mitigating and adapting to climate change, and 5) creating jobs and maintaining European competitiveness.

Additionally, in 2024, the Commission proposed targeted actions to boost bio-manufacturing in the EU in the Communication on Building the Future with Nature, which identifies biomanufacturing as **one of the most promising technological areas of this century**. To unlock investments and bring Europe's circular technologies and bio products to market, the European Commission, in partnership with the European Investment Bank established the **Circular Bioeconomy Fund**.

Looking ahead, the **Commission will review the EU Bioeconomy Strategy by the end of 2025**. This review will take into account: 1) current **societal, demographic, and environmental challenges**, 2) the need to reinforce the **bioeconomy's industrial dimension**, and 3) its links to **biotechnology and biomanufacturing** to contribute to a stronger EU economy. The Commission launched by the end of March 2025 the **call for evidence and public consultation** in the Have your Say Portal, where citizens, companies, farmers, foresters and other stakeholders can share their views, needs and aspirations to shape the upcoming Bioeconomy Strategy.

[3] European Commission, *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: A Competitiveness Compass for the EU*

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BOX 1: UNLOCK Alignment with other recent EU Initiatives and strategies

- **Vision for Agriculture and Food**: UNLOCK aligns with the EU Vision for Agriculture and Food which emphasizes the importance of accelerating the commercialisation of bio-based solutions, scaling up biotechnologies, and enabling diversification of value streams. This approach will also support farmers, strengthen primary producers in the value chain, and create new rural jobs.
- The **EU Industrial Strategy:** UNLOCK aligns with this strategy which identifies textiles as a key product value chain with an urgent need and a strong potential for the transition to sustainable and circular production, consumption and business models.
- The **Clean Industrial Deal:** UNLOCK plays a role in integrating circularity in decarbonisation strategy and reaching the circularity target of 24% of materials being circular by 2030.
- The **EU Soil Strategy**: UNLOCK is aligned with this Strategy which aims to protect and restore soils while ensuring sustainable use. In particular, the recently proposed Soil Monitoring law establishes a legal framework to achieve healthy soils by 2050.

2.2 EU regulatory framework for effective uptake of UNLOCK's innovative products

For effective uptake of UNLOCK's innovations, it is crucial that these comply with specific **EU regulatory frameworks**. These will directly influence the selection of end products prioritised for development under the project. In particular:

- **EU Framework for animal by-products**
- **EU Framework for Bioplastics**
- **EU Standardisation for Biobased products**
- **EU legislation for Sustainability claims**
- **Chemical Regulations by European Chemical Agency**

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The EU framework for animal by products

The EU Framework for animal by-products is the key piece of legislation for poultry feather waste. A robust regulatory framework governing the handling, use, and disposal of animal by products (ABPs) is in place within the EU. This framework provides clear guidelines on the processing and treatment of ABPs, such as poultry feathers. With the aim of preventing risks to animal and public health, Regulation (EC) No. 1069/2009 assigns animal by products to specific categories that reflect the level of associated risk. Under this regulation, feathers are classified as **Category 3 ABPs**.

In addition, the regulation determines under which conditions ABPs may be used for applications in animal feed and for various purposes. Under the UNLOCK project, certain innovative bioplastics products incorporating feathers may fall under the definition of soil improvers or organic fertilisers, requiring approved treatments before use in specific derived products. An amendment introduced under Regulation (EU) 2019/1009 lays down EU rules on fertilisers, enabling derived products no longer posing significant risks to animal health to move freely on the EU market as fertilising products.

A detailed description of the conditions that must be fulfilled for UNLOCK products to be placed on the market is illustrated in **Deliverable 6.6 – Feather Processing Compliance with Existing Safety Rules**.

The EU Framework for Bioplastics

There is currently no EU law in place applying to bio-based, biodegradable and compostable plastics in a comprehensive manner. Existing laws with partial objectives - a directive on single-use plastics, and a directive on plastic bags - do not apply to UNLOCK products.

In 2022, the Commission adopted a policy framework on the sourcing, labelling and use of bioplastics with the Communication for an EU policy framework on biobased, biodegradable and compostable plastics. Although not legally binding, the Communication provides guidance on the direction of future EU legislation on the topic and sets out conditions to ensure that environmental impact of bio-based plastics is positive.

Until new legislation on bio-based, biodegradable and compostable plastics is in place, the current gap remains a hurdle to the establishment of the value chain. It is crucial that new regulation considers input materials such as ABP and aligns with existing

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regulations governing the specific categories of ABP to ensure consistency and facilitate market adoption.

A more detailed definition of the EU framework for bioplastics and its applicability to UNLOCK is provided in **Deliverable 6.6 – Feather Processing Compliance with Existing Safety Rules**.

The EU Standardisation for Biobased products

Application of the relevant standards to products developed through the UNLOCK project is an important mechanism for validating the new technologies used in this project, to ensure the products are safe, reliable and ready for adoption across the European Union.

There are a number of standards applying to UNLOCK's products, including:

- ***European standard EN 17033*** *on biodegradation of plastic mulch films in agriculture*
- ***European standard EN 13432*** *on the requirements for industrially compostable packaging and includes both the criteria and a test scheme*
- ***Suite of European standards for biobased products***

These standards are considered the most applicable to UNLOCK products, with some other standards that exist in this area are explored in Appendix 2 of **Deliverable 2.3 – EU's Feather-based Economy: The Challenges Ahead.**

Despite the existence of several standards, the current situation is fragmented and overly complex. This hampers market uptake, value chain optimisation and standardisation in the context of UNLOCK and its future replication. These barriers are explored in detail and **Deliverable 7.7 – Report on Standardisation**.

The EU legislation for chemical safety

Substances intentionally used to manufacture plastics for different applications are required to be assessed for their safety according to different European legal frameworks. The European Chemicals Agency (ECHA) is the European agency responsible for chemical safety in respect of human health and the environment. Under regulation by the European Chemicals Agency, some pieces of legislation will be applicable to UNLOCK, including:

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- ***Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)***
- ***Classification, Labelling and Packaging (CLP)***

EU legislation for sustainability claims

Directive 2024/825 protects consumers against unfair practices relating to sustainability claims, by requiring traders to provide clear, relevant, and reliable information on the sustainable nature of products. There will be a harmonised label for products in the European Union with information on the commercial sustainability guarantee. Member states have until 27 March 2026 to implement this directive into national regulations. Project UNLOCK partners need to consider the sustainability claims that will be made regarding the products and ensure they comply with this new Regulation.

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3. UNLOCK contribution to the EU Bioeconomy Strategy

Biomass-derived materials offer a significant opportunity to source sustainable raw materials. In particular, the current **EU Bioeconomy Strategy** recognises bio-based materials as viable alternatives to fossil materials to help achieve a circular bioeconomy. The Strategy acknowledges that the bio-based sectors can contribute to European goals in the circular economy through its capacity to turn organic waste, residues and side streams into valuable bio-based products and to develop substitutes to fossil resources, such as bio-based and biodegradable substitutes for plastics and textiles[4].

However, the Commission identified some challenges that must be addressed in the development of the **EU Bioeconomy Strategy 2025**. These include **scaling up biotech and bio-based solutions** to reduce fossil dependency and stimulate local development and jobs and **promoting a more circular and resource-efficient bioeconomy**[5]. By valorising feather waste streams and designing new value chains that are economically and environmentally sustainable, UNLOCK aims to contribute to the new EU Bioeconomy Strategy.

In addition, through its bio-based innovations, UNLOCK plays a key role in supporting the achievement of several objectives of the current EU Bioeconomy Strategy. In particular, UNLOCK is scaling up bio-based solutions that contribute to **sustainable resource management (objective 2), reduced dependence on non-renewable resources (objective 3), climate change mitigation and adaptation (objective 4), and job creation and competitiveness (objective 5).**

Indirectly, we can acknowledge that the UNLOCK project is also contributing to **objective 1 on food security** by avoiding contamination and encouraging soil health.

Sustainable Resource Management

Against the backdrop of an increased demand for biomass in the EU, UNLOCK contributes to a sustainable use of biological resources. In particular, UNLOCK

[4] *European Commission,* A Sustainable Bioeconomy for Europe: Strengthening the Connection Between Economy, Society and the Environment. Updated Bioeconomy Strategy, *Directorate-General for Research and Innovation, 2018.*
[5] Sarianne Tikkanen, *Preparing the New EU Bioeconomy Strategy*, presented at BioFUTURE Mutual Learning Workshop, online, February 19, 2025.

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enhances **resource efficiency** by using feather waste in innovative ways to create sustainable bio-based products, including forest and seed trays, mulch films, hydroponic foams, and nonwoven textiles.

Mitigating and adapting to climate change

The UNLOCK project supports climate change mitigation and adaptation by **addressing feather waste and improving soil health**. By maximising the use of side and residual feather streams, UNLOCK prevents the harmful effects of improper disposal, which can disrupt ecosystems and soil cycles. The project safely reintegrates feather-derived materials into the soil, reducing pollution and preventing feather landfilling. Additionally, the breakdown of keratin in feathers releases nitrogen, enhancing soil fertility and microbial activity. This boosts soil structure, supports plant growth, and improves agricultural productivity, helping to both mitigate and adapt to climate change.

Job creation and competitiveness

The Bioeconomy Strategy aims at positioning the European Union as a leader in the rapidly expanding bio-economy market. The Commission estimated that the further development of the bioeconomy will lead to the creation of 400,000 new highly skilled jobs by 2025, especially in rural areas. UNLOCK will contribute to strengthening the role of primary producers in the value chain and generate jobs in the bioeconomy sector by scaling up and accelerating the commercialisation of innovative bio-based products. In particular, UNLOCK has the potential to **generate employment** in regions with a large poultry sector due to the implementation of biorefineries for the processing of keratin-based materials. This will also increase revenues for farmers who will benefit from selling the feathers for further processing.

Reducing dependence on non-renewable resources

UNLOCK develops feather keratin-based **bioplastics and bio textiles** that are biodegradable, promote soil health, help reduce plastic pollution, and sequester carbon, offering superior alternatives to harmful materials like polyurethane foams. By proposing innovative alternatives to substitute fossil materials in agricultural applications, UNLOCK transforms poultry waste into high-value, bio-based products, fostering a sustainable feather-based economy.

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Box 2: Contribution to Sustainable Development Goals (SDGs)

The UNLOCK project's efforts contribute to several **Sustainable Development Goals (SDGs)**:

- **SDG 8 – Decent Work and Economic Growth**: by generating economic employment on economic growth rates of the poultry industry due to the implementation of biorefineries. Additionally, revenue will increase in the primary sector as feathers will become raw materials sold on the market
- **SDG 9 – Industry, Innovation and Infrastructure**: by fostering innovation across the agricultural plastics sector through the implementation of new keratin-based bio-based materials for the first time.
- **SDG 12 – Responsible Consumption and Production**: by incorporating feather waste as raw materials for final products, following circular economy principles and generating products that abide to sustainable production requirements.
- **SDG 13 – Climate Action**: By promoting the recycling of feather waste, UNLOCK reduces greenhouse gas emissions and contributes to global climate action.
- **SDG 15 – Life on Land**: By addressing the threat posed by feather waste to ecosystems, UNLOCK helps preserve biodiversity and support the resilience of land-based ecosystems, improving soil health and supporting sustainable land management practices.

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4. Advantages of the UNLOCK products

This section presents the end-products developed by the UNLOCK partners: seed trays, mulch films, non-woven geotextiles and biodegradable foams; providing a brief overview of their composition and applications. It also highlights the advantages of these products compared to traditional, fossil-based alternatives used in agriculture.

<table>
<tr><td rowspan="3">Seed trays</td><td>Composition</td><td>Applications</td></tr>
<tr><td>The seed trays are made from a carefully formulated blend of biodegradable plastics, combined with steam explosion-treated feathers. This composition ensures both durability during use and environmental responsibility upon disposal.</td><td>These trays are specifically designed for greenhouse cultivation, providing an optimal environment for the growth and development of a wide variety of plants. They offer structural support and controlled nitrogen input, which enhances germination and seedling growth.</td></tr>
<tr><td colspan="2">Advantages compared to traditional products
Fully compostable under industrial composting conditions, reducing environmental impact.
Contribute to soil fertility by adding nitrogen through the natural decomposition of feather-based components.</td></tr>
<tr><td rowspan="2">Mulch films</td><td>Composition</td><td>Applications</td></tr>
<tr><td>The mulch films consist of a blend of biodegradable plastics integrated with steam explosion-treated feathers. This composition results in a durable yet eco-friendly product that enhances agricultural efficiency.</td><td>Mulch films are applied to soil surfaces in various crop cultivation settings. Their primary functions include:
Preventing the growth of weeds by blocking sunlight.</td></tr>
</table>

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		• Reducing moisture loss from the soil, improving water retention. • Acting as a protective barrier to stabilize soil temperature and promote healthier plant development. • Serving as a sustainable replacement for conventional polyethylene (PE) mulch films.
	Advantages compared to traditional products	
	• Fully biodegradable in soil, eliminating plastic waste and the need for removal after use. • Enriches the soil by naturally releasing nitrogen, improving soil fertility and plant nutrition. • Reduces dependency on non-biodegradable synthetic mulch films, minimizing plastic pollution.	
Non-woven geotextiles	**Composition**	**Applications**
	Manufactured from a blend of biodegradable synthetic and natural fibers, combined with mechanically ground feathers. This innovative material provides structural integrity while ensuring eco-friendly decomposition.	Non-woven geotextiles serve a vital role in agricultural and environmental protection, including: • Preventing soil erosion by stabilizing soil structure.

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<table>
<tr><td rowspan="3"></td><td></td><td>Inhibiting the growth of weeds, reducing the need for herbicides.
Acting as a substitute for polypropylene-based geotextiles, providing a more sustainable alternative.</td></tr>
<tr><td colspan="2">Advantages compared to traditional products</td></tr>
<tr><td colspan="2">Compostable under industrial composting conditions, ensuring minimal environmental impact.
Enriches soil with nitrogen as it decomposes, promoting healthier soil microbiomes.
Reduces reliance on synthetic geotextiles, which contribute to long-term plastic pollution.</td></tr>
<tr><td rowspan="2">Biodegradable foams</td><td>Composition</td><td>Applications</td></tr>
<tr><td>These foams are created from a foamed biodegradable plastic matrix infused with treated feathers, which undergo microbial fermentation and/or steam explosion treatment to enhance biodegradability and performance.</td><td>Biodegradable foams are primarily used as a growing substrate for hydroponic agriculture. Their key functions include:
Providing a lightweight, porous, and structurally stable medium for root growth.
Acting as a sustainable alternative to traditional hydroponic substrates such as clay pebbles.</td></tr>
</table>

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		• Improving nutrient retention and water absorption efficiency.
	Advantages compared to traditional products	
	• Versatile decomposition options based on formulation: products can either be compostable under industrial conditions or fully biodegradable in soil, offering flexible end-of-life solutions. • Reduces reliance on non-renewable hydroponic substrates such as rock wool or expanded clay, which have a higher environmental impact. • Enhances sustainability in controlled environment agriculture by incorporating bio-based materials.	

As mentioned in previous sections, the UNLOCK project aligns with many aspects of the EU Bioeconomy Strategy and the Sustainable Development Goals (SDGs). The products presented above offer advantages that contribute to both the EU Soil Strategy and the EU Bioeconomy Strategy, particularly to Objective 3, which focuses on reducing dependence on non-renewable resources such as fossil materials and traditional plastics.

In addition, UNLOCK's innovative solutions align with various SDGs, including SDG 9, which promotes innovation in the agricultural sector, and SDG 15, which focuses on life on land and highlights how the project supports the resilience of land-based ecosystems and soil health.

To learn more about the technologies and processes of the UNLOCK solutions, refer **to the products booklet** available on the project's website.

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5. Policy Recommendations

As part of the UNLOCK project, we collected insights from project partners to develop recommendations that support the uptake of circular bioeconomy policies and improve the impact of our results. These contributions have inspired concrete recommendations that can enhance the regulatory framework, market adoption, and sustainability impact of UNLOCK innovations. To guide action, the ideas have been grouped into four key areas: Regulatory and Policy Support, Economic and Market Incentives, Technical Development and Value Chain Optimisation, and Stakeholder Engagement and Awareness.

Regulatory & Policy Support

- **Regulate the use of conventional plastics in agriculture:** Introduce restrictions aiming to phase-out fossil-based plastics and promote biodegradable alternatives through regulatory measures and integration into organic certification programs.
- **Create an overarching sustainability standard:** Develop a harmonised sustainability framework covering all bio-based agricultural materials to avoid greenwashing and ensure market alignment.
- **Establish clear biodegradability standards and certifications:** Develop an EU-wide certification framework to ensure biodegradable materials meet environmental and agricultural safety standards.
- **Encourage circular economy models:** Implement policies that promote the use of waste-based raw materials (e.g., feather-based bioplastics) and support public-private partnerships for infrastructure investment.

Economic & Market Incentives

- **Introduce financial incentives for bio-based materials:** Provide a combination of subsidies, tax breaks, and grants to offset the higher cost of biodegradable alternatives compared to conventional plastics.
- **Expand investment support for emerging bio-based solutions**: Adapt the European Circular Bioeconomy Fund (ECBF) to support smaller-scale investments and early-stage companies developing innovative biodegradable materials.

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Technical Development & Value Chain Optimisation

- **Optimise and standardise material properties:** Enhance research and development efforts to improve the performance, durability, and application of biodegradable materials while ensuring process repeatability and reproducibility.
- **Ensure compliance with agricultural and environmental standards:** Align biodegradable materials with EU policies such as the Green Deal, REACH (Regulation on the registration, evaluation, authorisation and restriction of chemicals), and sustainability regulations to facilitate their adoption.
- **Improve coordination across the value chain to enhance efficiency:** Strengthen collaboration between raw material suppliers, manufacturers, and end-users to optimise production, prevent redundant processes (e.g., sterilisation duplication), and reduce costs.
- **Facilitate the market adoption of bio-based products:** Introduce policies and incentives that encourage end-users (farmers, food producers, packaging industries) to transition to biodegradable alternatives through procurement preferences and regulatory advantages.
- **Strengthen industry & research collaboration:** Foster partnerships between agricultural stakeholders, research institutions, and the private sector to improve market adoption and co-develop innovative applications. Accelerating innovation, creating synergies, and improving the scalability of biodegradable materials.

Stakeholder Engagement & Awareness

- **Enhance farmer engagement through clustering & demonstration activities:** Establish knowledge-sharing hubs, demonstration farms, and pilot projects to showcase the benefits and feasibility of biodegradable materials. Increasing trust in biodegradable solutions, leading to higher adoption rates in the agricultural sector**.**
- **Educate farmers and end-users on the benefits of biodegradable mulch films & products:** Develop awareness campaigns to promote biodegradable solutions, emphasising environmental and economic advantages. Empowering end-users to make informed decisions, reducing reliance on fossil-based plastics.
- **Create awareness of economic benefits of biodegradable products:** Promote cost savings from reduced waste management, lower disposal costs, and improved soil quality as key incentives for transitioning to bio-based materials.

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5.1. Policy uptake workshop & priority recommendations

The UNLOCK Final Conference on Circular Bioeconomy & Policy Innovation in Agriculture took place on 26 March 2025 in Donostia / San Sebastian and online. During the event, a workshop was held to present the project's policy recommendations to both in-person and online participants.

In this interactive session, participants were asked to prioritise each recommendation by assigning it a score from 1 to 5 (with 1 being not important and 5 being essential). This exercise generated meaningful discussion and allowed us to assess the perceived relevance of the recommendations from diverse stakeholder perspectives.
As shown in the image below, all the recommendations received an average score above 3.6, highlighting a general agreement on their relevance.

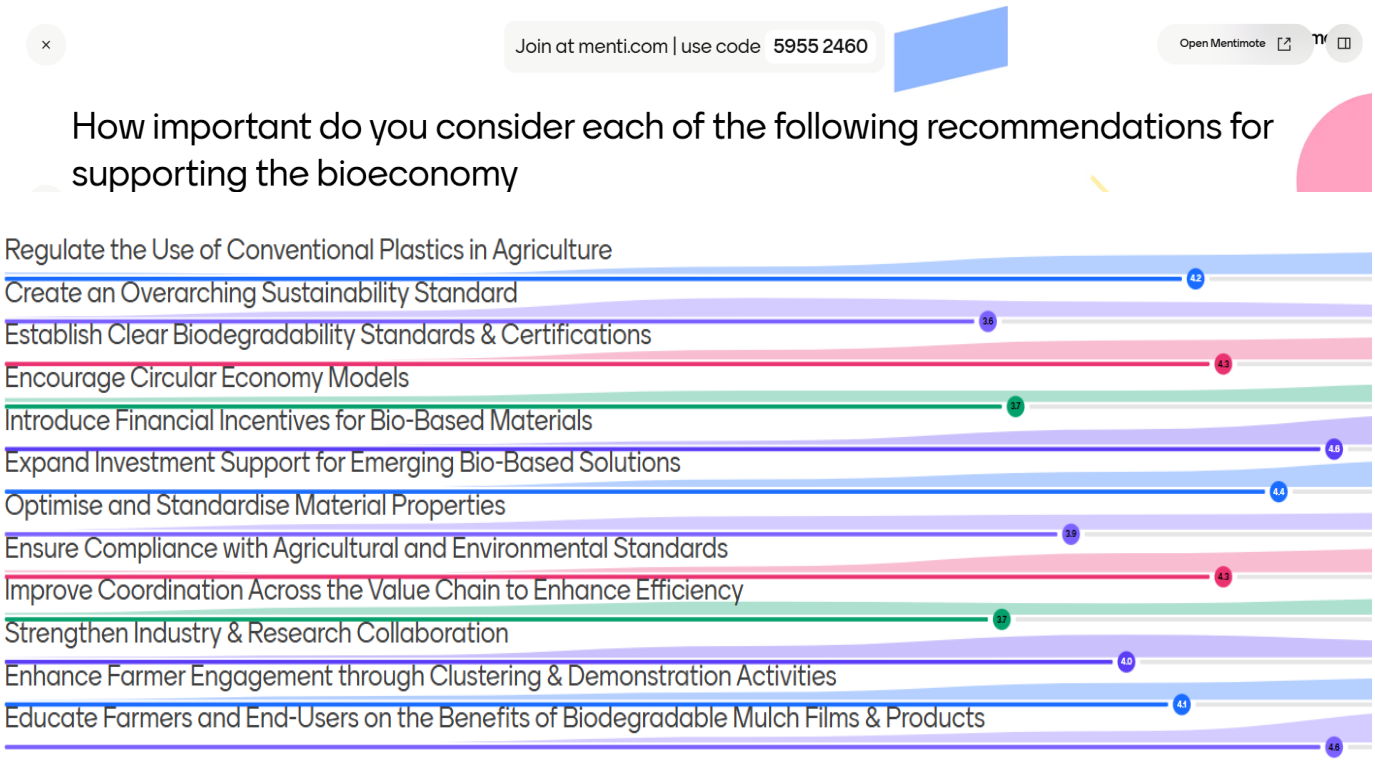

Figure 1. Mentimenter consultation at the policy uptake session at UNLOCK's Final conference.

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The two top-rated recommendations, each scoring 4.6 out of 5, were:

- **Introduce financial incentives for bio-based materials**
- **Educate farmers and end-users on the benefits of biodegradable products**

These were followed closely by **"Expand investment support for emerging bio-based materials"**, which received a score of 4.4.

At the lower end of the scale (but still considered relevant, with scores between 3.6 and 4.0), we find broader and more systemic recommendations, such as:

- **Create an overarching sustainability standard**
- **Encourage circular economy models**
- **Improve coordination across the value chain to enhance efficiency**

The prioritisation exercise highlights a strong preference for practical, action-oriented measures that directly support those who are expected to adopt bio-based solutions, especially farmers and end-users. Two critical factors emerged as essential for encouraging widespread uptake:

- **Economic feasibility**: Financial incentives are seen as crucial to make bio-based materials competitive with conventional alternatives. Without economic support, adoption is likely to remain limited.
- **Awareness and education**: Providing targeted information and training on the benefits and use of biodegradable products is vital. End-users need to clearly understand how these products work and why they are worth the transition.

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Conclusions

These findings together with the regulatory frameworks presented in this document, suggest that successful policy frameworks must go beyond high-level sustainability goals. They must also address practical challenges and build trust and knowledge at the farmer's level.

While broader recommendations (such as creating sustainability standards and improving coordination across the value chain) are still relevant, participants perceived them as less immediate. Their lower prioritisation may reflect the fact that such systemic changes, although important, do not directly influence day-to-day decision-making for those working on the ground.

In short, enabling a real market uptake of bio-based and biodegradable materials in agriculture requires a dual approach: make it **financially viable**, and make it **understandable**. By focusing on these priorities, we can accelerate the shift away from traditional plastics and support a circular, more sustainable agricultural economy.

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