Conference Summary

ESNI-NERM 2026 Conference
28 and 29 April 2026 | Ateliers des Tanneurs (Brussels)

This Conference Summary summarise and highlight the main outcomes and conclusions from most of the parallel sessions hosted by the EU funded research projects present at the ESNI-NERM 2026 Conference. These summaries include key messages and take aways. This serves as a document for funding bodies, the scientific community, and policymakers.

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CiNURGi

Parallel session Tuesday 28 April 2026

1. Executive Summary

The seminar highlighted how the EU's updated bioeconomy strategy positions nutrient recycling as central to sustainability, resilience, and strategic autonomy, emphasizing closed loops, data sharing, and market creation for circular solutions. Presentations showed that technical solutions for biobased fertilisers already exist, but their societal benefits vary widely across value chains, making case-by-case evaluation essential. The panel concluded that the main barriers are not technology but misaligned regulations, weak market demand, and lack of incentives, underscoring the need for coherent policies, economic support, and legislative requirements to move from strategy to implementation.

2. Key Scientific & Technical Breakthroughs

The session presented several key advancements demonstrating how nutrient recycling is moving from a conceptual ambition toward a more structured and strategic domain within the EU bioeconomy. A central advancement was the integration of nutrients, particularly nitrogen and phosphorus, into the EU's updated bioeconomy strategy, explicitly linking circularity with food system resilience, strategic autonomy, and reduced dependency on imports. This marks a policy shift where nutrient management is no longer treated as a side issue but as a core component of sustainable growth and competitiveness.

From a technical perspective, the session confirmed that a broad portfolio of bio-based fertiliser technologies is already mature or close to market readiness. Anaerobic digestion, struvite recovery, and composting were highlighted as the most established solutions, with struvite showcased as an example where the scale-up potential is massive (based on feedstock availability and market demand). Furthermore, the discussion moved beyond individual technologies to comparative assessments of full value chains, enabling a clearer understanding of when and where nutrient recycling delivers net societal benefits.

Methodological progress was another key theme. Advances in spatial nutrient mapping and comparison with official statistics, as demonstrated in the CiNURGi project, have improved the ability to identify regional nutrient deficits and surpluses. This work underlined the need for harmonised monitoring methods and shared data to support evidence-based policymaking. Finally, the session advanced the discussion on governance by highlighting emerging regulatory examples—such as mandatory phosphorus recycling in some countries (for example Germany) —and by clarifying that future progress depends less on technological innovation and more on coherent regulation, aligned incentives, and market mechanisms that properly value circularity and resilience.

3. Critical Discussion

What is the Point of Consensus (What did everyone agree is the next step?) and what is the Point of Contention (Where do experts still disagree?). Summarize the Q&A. This provides the "peer-review" context for the findings.

Agreements.

There was strong agreement that the main bottlenecks for advancing nutrient recycling are no longer technological, but instead lie in policy, regulation, markets, and governance. Participants broadly agreed that the next critical step is to move from strategies and pilots to actual deployment, which requires coherent and aligned regulatory frameworks across EU policies (e.g. FPR, ABP, water and nutrient regulations). A shared priority was the need to create or strengthen markets for recycled nutrients, through mechanisms that reward circularity, environmental performance, and system resilience rather than solely nutrient price.

Another clear consensus concerned data and methodologies. Speakers agreed on the need to harmonise monitoring, data collection, and evaluation methods for nutrient management to enable evidence-based decisions, credible impact assessments, and fair comparison between value chains. Finally, there was broad alignment that legislative requirements and economic incentives—such as recycling obligations, subsidies, or long-term policy commitments—will be essential to overcome the "first-mover disadvantage" and unlock scaling of biobased fertilisers.

Disagreements (between experts).

Disagreement remains on how far policy should go in prescribing solutions versus enabling market flexibility. Some argued strongly for mandatory recycling targets and legal obligations, pointing to national examples where regulation has clearly driven investment. Others were more cautious, warning that poorly designed mandates could distort value chains or place additional pressure on farmers.

There was also contention around who should pay for nutrient recycling and how societal benefits should be redistributed. While everyone acknowledged that environmental and resilience benefits exist, opinions diverged on whether these should be channelled back to farmers, producers, or addressed through broader public funding.

4. Barriers to Implementation

Regulatory barriers.

- Lack of regulatory coherence and alignment between EU frameworks (e.g. Fertilising Products Regulation (FPR), Animal By-Products (ABP) Regulation, water and nutrient policies).
- Origin-based rules instead of quality-based rules, especially limiting the use of recycled phosphorus from wastewater and other secondary sources.
- Absence of mandatory recycling obligations at EU level, despite national examples showing effectiveness (e.g. phosphorus recycling laws).
- Unclear or inconsistent terminology, creating ambiguity for regulators, producers, and markets.
- Difficulty translating high-level strategies into implementable national legislation with clear, quantifiable criteria.

Economic barriers.

- Lack of market demand for biobased fertilisers, as farmers already receive sufficient nutrients from conventional fertilisers.
- Higher costs of biobased fertilisers compared to mineral fertilisers, with no compensation for environmental or resilience benefits.

- No systematic valorisation of resilience, circularity, or environmental services in current pricing or support schemes.
- Unclear payment responsibility: uncertainty over whether costs should be borne by farmers, industry, or public budgets.
- First-mover disadvantage for new value chains due to absent or unstable long-term policy commitments.
- Uneven societal benefits across value chains, making some recycling pathways socio-economically unattractive despite technical feasibility.

Social barriers / acceptance.

- Limited acceptance of recycled nutrients, especially those derived from wastewater, sludge, or fish farming residues.
- Farmer scepticism toward new fertiliser products, driven by cost, performance uncertainty, and lack of direct incentives.
- Reluctance of national governments to prioritise nutrient recycling, as it is not perceived as a voter-winning issue.
- Insufficient data sharing between farmers, authorities, and researchers, limiting trust and informed decision-making.
- Gap between research outputs and deployment, with proven solutions failing to reach market adoption.
- Perception gap between societal benefits and individual farm-level value, reducing willingness to adopt new practices.

EU FarmBook

Parallel session ESNI-NERM 2026 – Tuesday 28 April 2026

1. Executive Summary

The workshop presented the EU-FarmBook platform as an open-access European knowledge reservoir designed to increase the visibility, accessibility and long-term impact of EU-funded project results. Live demonstrations highlighted AI-supported functionalities such as multilingual translation, metadata extraction, advanced search tools and flexible upload systems for knowledge objects. The session also showcased how EU-FarmBook supports open science, cross-project collaboration and sustainable dissemination within communities such as BioRefine Cluster Europe.

2. Key Scientific & Technical Breakthroughs

The workshop highlighted several innovative digital and governance-related advancements developed within the EU-FarmBook platform.

A major technical breakthrough is the integration of AI-supported functionalities to facilitate knowledge sharing and accessibility across Europe. Demonstrated features included:

- multilingual translation services capable of preserving the original document layout,
- AI-assisted metadata extraction,
- advanced search functionalities under development,
- chatbot functionalities,
- and flexible upload methods including single uploads, batch uploads, migration of existing repositories and API connections.

Another important advancement concerns the development of a sustainable governance model for long-term preservation and dissemination of project knowledge outputs (KOs). Unlike traditional project websites, which often disappear after project completion, EU-FarmBook offers a durable and centralised infrastructure to maintain access to EU-funded results over time.

The workshop also demonstrated practical frameworks supporting open science and dissemination requirements, including:

- templates for Data Management Plans,
- roadmaps for open knowledge sharing,
- and guidance on Creative Commons licensing, with CC BY 4.0 promoted as the preferred licence to maximise reuse and attribution.

From a stakeholder and community-building perspective, the session introduced the development of thematic community spaces, such as the BioRefine Cluster Europe community page, designed to facilitate interaction, networking and cross-project visibility at European scale.

3. Critical Discussion

There was broad consensus among participants that long-term, open-access and practice-oriented knowledge sharing is essential to increase the implementation in practice and impact of EU-funded project results beyond the duration of individual projects. Participants agreed that the EU-FarmBook

platform can become an important European knowledge hub for sharing and preserving practice-oriented knowledge for actors from the agrifood, forestry-related and rural communities.

The discussion mainly focused on expectations for the future community pages currently under development within EU-FarmBook. Participants expressed interest in functionalities that could stimulate interaction and engagement between projects and users, such as social media integration, "follow this project" options, user feedback mechanisms (e.g. thumbs up/down), and broader thematic integration beyond agriculture alone.

No major disagreements emerged during the workshop. However, the discussion highlighted the importance of further co-development with users to ensure that the future community pages respond effectively to the needs of projects, practitioners and thematic networks across Europe.

4. Barriers to Implementation

Regulatory

- Harmonised implementation of FAIR data principles (Findable, Accessible, Interoperable and Reusable) remains essential to guarantee interoperability between projects, repositories and platforms.
- Different project-specific data management approaches and open-access practices can complicate the standardised sharing of knowledge objects across Europe.
- Clear long-term policy support and strategic decisions from the European Commission DG AGRI are needed to position EU-FarmBook as the central knowledge reservoir for practice-oriented outputs from Cluster 6 projects.

Economic

- Sustainable operation, maintenance and further development of the platform, including AI-supported functionalities and chatbot services, require continued institutional and financial support.
- Continuous inflow, curation and updating of high-quality practice-oriented materials demand dedicated human resources and active engagement from projects and supporting organisations.

Social/Acceptance

- Projects and organisations differ in their readiness to adopt open knowledge-sharing practices and FAIR data approaches from the beginning of the project lifecycle.
- Users highlighted the importance of intuitive and interactive community functionalities to stimulate active participation and long-term engagement.
- Trust in AI-supported functionalities, such as automated translation, metadata extraction and chatbot services, depends on continuous quality improvement and reliable content feeding of the platform.

ReLEAF / LANDFEED

Parallel session ESNI-NERM 2026 – Tuesday 28 April

1. Executive Summary

This session presented an integrated overview of the ReLEAF and LANDFEED projects, showcasing advanced circular bioeconomy approaches for the valorisation of agri-food and animal wastes into Bio-Based Fertilisers (BBFs) and biostimulants. The novelty lies not only in individual technologies, but in the systemic integration of waste streams, biological processes, and regulatory-compliant outputs at pilot and pre-industrial scale.

2. Key Scientific & Technical Breakthroughs

- **Integrated circular valorisation of olive mill residues (Elli Maria Barampouti - National Technical University of Athens; LANDFEED)**
  A highly novel, multi-process concept was demonstrated, combining:
  - Green solvent extraction to replace hexane while maintaining high olive oil recovery,
  - Optimised biomass combustion of olive stones to generate low-contaminant ash rich in K, P and Mg,
  - Direct CO_2 capture from flue gases to support microalgae cultivation.
  - Recovery of residual oil
  - Production of solid biofuel (dried olive stones)

  The innovation resides in the closed-loop integration of extraction, energy recovery, nutrient recycling and CO_2 valorisation, moving beyond single-process solutions. Pilot-scale validation is underway, marking a significant step towards industrial feasibility.

- **Solid State Fermentation (SSF) of food waste for biostimulant production (Jana Font i Pomarol – Autonomous University of Barcelona and AERIS; ReLEAF)**
  The session highlighted the successful pilot-scale validation of SSF using Trichoderma harzianum on heterogeneous food waste streams, achieving:
  - Three orders of magnitude microbial growth, confirmed via spore quantification,
  - Formation of a functional organic biostimulant matrix
  - The key novelty is the demonstration that complex, mixed food wastes can serve directly

  SSF substrates, confirming SSF as a robust, low-energy alternative to submerged fermentation for biostimulant production within circular systems.

- **Twin-screw extrusion combined with enzymatic hydrolysis of animal by-products (Julien Lequitte – National Polytechnic Institute of Toulouse; LANDFEED)**
  A unique process chain was presented involving:
  - Twin-screw extrusion as a pre-treatment enabling the processing of highly diverse animal wastes,
  - Targeted enzymatic hydrolysis to obtain biostimulants.

  The presented work validates the process stability and parameter optimisation while presenting a high versatility accepting very different feedstocks (fish, molluscs, bones, skins, wool), while maintaining compliance with EU Regulation 2019/1009. Scale-up of the extruder is currently ongoing.

- **Microbial biostimulant production using fish wastewater (Francesca Patrignani - Alma Mater Studiorum-University of Bologna; ReLEAF)**
  This work demonstrated a novel culture-media substitution strategy, replacing conventional growth media with fish-based cultivation media using processing wastewaters and hydrolysates. Key achievements include:
  - Successful cultivation of 13 microbial strains with preserved or enhanced PGPB properties,
  - Safety assessment through antibiotic susceptibility testing,
  - Scale-up of selected strains in 20 L bioreactors.

  The innovation lies in proving that nutrient-rich industrial effluents can directly support safe, high-performance microbial biostimulant production.

3. Critical Discussion

Following the presentation of use cases, participants discussed on relevant interrelated topics though a Q&A section to facilitate a dynamic discussion on the targeted topics. In summary, the discussion session concluded that the transition from pilot to large-scale deployment is no longer primarily a technological challenge, but rather a regulatory, market, and system-integration challenge. However, disagreement persists on which bottleneck is most critical in practice, highlighting the need for context-specific strategies alongside general policy alignment.

- Regulation emerged as a central theme, with multiple interventions stressing that unclear classification (waste status vs. product) delays investment decisions and complicates cross-border operations.
- End-users' perspective was repeatedly highlighted, with participants noting that certification, proven performance, and transparency are prerequisites for market adoption. Some examples were mentioned on how alternative crop production systems and soil management alternatives (e.g. organic farming) can be able to equal conventional crop production in a climate change scenario (e.g. dry years).
- Scale-up challenges were framed as systemic, not purely technical—requiring coordination across value chains, policies, and markets.
- At the same time, practical implementation issues (logistics, feedstock variability, decentralisation) triggered debate, reflecting differences in project experience and regional contexts.

Overall, the Q&A acted as a peer-review mechanism, validating that the findings are robust while revealing key uncertainties related to operationalisation and context dependency.

4. Barriers to Implementation

From the Q&A section, the main extracted challenges for the implementation

- **Scalability**: driven mainly by process efficiency followed by desired product quality, processing-cost and use of chemicals.
- **Regulatory**: [e.g., Lack of harmonized standards]
  - Regulatory constrains related to waste status and its implications on attracting investors for technology implementation and barriers to cross border transportation

- **Economic**: [e.g., High CAPEX for small-scale plants]
    - High energy demand in certain processes: e.g. drying step of olive mill processing.
    - Scale-up constraints across several processes (solid fermentation, olive mill treatment, fish wastewater) including pre-treatment/post-treatment for sanitisation, implying increased CAPEX/OPEX.
    - Process complexity (e.g., flue gas conditioning, enzymatic hydrolysis), which can increase operational costs.
    - Complexity of efficient logistics for practical implementation. Complexity driven by seasonality and variability, perishable organic materials, decentralised production, co-treatment of multiple feedstocks.
- **Social/Acceptance**: [e.g., Farmer perception of treated sludge]
    - Potential concerns around use of waste streams (animal waste, food waste, fish wastewater) in fertiliser and biostimulant production, which may affect market acceptance.
    - Perception challenges related to safety and quality consistency of waste-derived products.
    - Discussion on the most trusted evidence for end-users: being certification systems and field demonstrations the most trusted evidence, followed by technology demonstrations/visits. It was mentioned that in research projects, farmers involved in demonstration sites are willing to be paid for their contribution with their agricultural lands.
- **Main drivers for the wider deployment of complex waste streams valorisation**: 1) end-users trust and acceptance; 2) regulatory adaptation; 3) process robustness; 4) feedstock logistics.

Sempre BIO

Parallel session ESNI-NERM 2026 – Wednesday 29 April

At the ESNI-NERM conference, held in Brussels on 28-29 May, the SEMPRE-BIO project moderated a workshop on the topic "From concept to market: Microalgae cultivation for CO2 and digestate valorisation". The session counted with the presentation of the main results obtained by the two algae pilots in the project, one in Catalonia managed by Beta Technological Center, and another in Flanders managed by Innolab. Both pilots have successfully shown that algae cultivation in digestate and biogenic CO2 is possible, and that batch mode is overall preferred over semi-continuous due to increased control over digestate concentrations and reduced biofilm formation.

Even though the technical results are positive, there are still some uncertainties about the application of this technology on a large scale. To discuss these challenges, a series of questions was proposed to the audience, consisting of around 30 people with different backgrounds and knowledge levels on the topic, but all with a strong involvement in nutrient recycling activities. The following conclusions were drawn:

- 91% of the attendees believed that the European legislation on animal by-products should be amended to explicitly allow algae cultivation on manure (and derived streams such as digestate). This is now regulated by the Member States, but the audience thought that the Member States often wait for Europe to send a clear message about a certain technology before widely adopting it, which might be hampering the spread of this technology. Moreover, the European adoption would create a higher level of confidence for investors.
- 70% also thought that the algae cultivated on manure-based digestate should be allowed for animal feeding due to the high level of processing and change from manure into algal biomass; quality controls and post-processing were suggested for guaranteed quality.
- 50% of the attendees suggested that both algae and digestate quality should be controlled so that the resulting algal biomass could be used for animal feeding. This would cover a potential legislation on digestate processing and the feed quality legislation, while also guaranteeing higher security for all actors in the value chain.

The results indicate that, from a (limited) market perspective, there is no real concern over the use of microalgae grown on manure-based digestate as animal feed. Participants were very positive about the technology and believe that, with the right legal framework to ensure quality control, the produced algal biomass could be a promising local source of protein for animal feeding.

HarvRESt

Parallel session ESNI-NERM 2026 – Wednesday 29 April

1. Executive Summary

The workshop presented the HarvRESt project and Greenhood project as complementary initiatives advancing the integration of biogas systems into farms to improve nutrient circularity and sustainability. Discussions highlighted the potential of technologies such as anaerobic digestion and nutrient recovery to generate valuable products, while emphasizing the need for significant investment and careful management of environmental impacts. While participants agreed on the importance of closing nutrient loops at farm level, debates emerged around the economic viability of specific approaches—particularly phosphorus recovery—and the role of logistics in scaling these solutions beyond local contexts.

2. Detailed Summary

During the HarvRESt's workshop, presentations of the HarvRESt project (which is finalising) and the Greenhood project (which is beginning) provided insights into sustainable nutrient management strategies:

- Ana Robles moderated the workshop and introduced both projects. HarvRESt focuses on evaluating the impact of integrating renewable energy sources, i.e. biogas, within farms, while Greenhood represents the transition toward technology-driven solutions to recycle nutrients from the digestate. Both projects offer holistic solutions that combine environmental assessment, socio-political analyses, and economic evaluation, although the workshop primarily focused on the applied technologies. Both projects share the same biogas use-case in Spain, which was introduced: the farm Torre Santa María, in Catalunya.
- Ignacio García presented a deeper view of the HarvRESt project. The main topic was the environmental impact of integrating anaerobic digestion in farms and using digestate as fertilizer (TLR 9), in a bio-circular economy framework. The presentation included field and pot experiments to evaluate fertilization efficiency, soil health, leaching and pollution risks of using the solid and liquid fractions of the digestate.
- Afterwards, Alexandre Galí presented the Greenhood project, as a continuation of HarvRESt. The project aims to advance technologies that enhance nutrient recovery within biogas-based farming systems, optimizing nutrient flows and circularity in a biorefinery approach. It includes treatments of livestock manure and agri-food residues, using different nutrient recovery technologies.
- To finalise the workshop, a discussion was held based on questions from both in-person and online participants. The main takeaway was that a **key challenge lies in recovering nutrients while reducing the environmental impact in farms, where an important investment is necessary to apply technologies and innovation in waste treatment**.

Sandra Galea was reporter of the session.

3. Key Scientific & Technical Breakthroughs

HarvRESt's use case in Spain included agronomic experiments conducted both in pots and field trials to study N-release dynamics and nutrient losses from application of digestate-derived fertilizers.

Greenhood aims to rebalance nutrient flows and reduce N/P emissions, to this aim new technologies are tested to improve digestate treatment. Preliminary results show potential P extraction through acid treatment (>95% extracted at lab scale). The next steps are to produce tailor-made fertilizers (TMF) from the combination of digestate, solid fraction and liquid fraction and test this on field and pot tests.

4. Critical Discussion

Main questions and answers:

- Is the concentrated gel from the Greenhood project a potential bio-stimulant to be commercialized? Yes, as the objective is to obtain products that are useful for farmer and contribute to close the loops within a circular farm system.
- What happens if the digestate is poor in P, is it economically viable to recover P? Indeed, the economic viability of P recovery depends strongly on the initial P content in the digestate. Although nutrient recovery can create valuable products for both on-farm use and commercialization, P is typically recovered as solid precipitates such as struvite—a highly pure compound that often requires re-solubilization before application. In cases of low P concentration, recovery may be less cost-effective, and alternative approaches that retain P in more readily available forms could be preferable. However, logistical challenges, particularly for transporting and handling liquid or solubilized P products, remain a significant barrier to large-scale commercialization.
- In Catalunya (and probably other regions) there is this feeling of belonging: farmers tend to use local sources, better if they come from their own farms. Hence logistic is not a problem in these systems to recover nutrients such as soluble P, otherwise industrial scale farms can't afford the transport for the treatment of their own waste.

Points of Consensus

- Circular nutrient management is essential
    - Strong agreement that integrating biogas systems and nutrient recovery supports a bio-circular economy.
- Technologies can create value from waste
    - Digestate and derived products can become valuable inputs as raw materials for the fertilizer companies or commercial fertilising products.
- Investment is a major barrier
    - Implementing these technologies requires significant upfront investment, which is a key challenge.
- Logistics matter for scalability
    - Even if solutions work technically, transport and handling influence real-world feasibility.

Points of Contention

- Best strategy for phosphorus recovery
    - Pro-struvite approach: high purity product with market value.
    - Critical view: requires reprocessing (solubilization), reducing practicality.
    - Alternative view: Instead of focusing on producing final fertilizing products for direct application, it may be more effective to recover clean nutrient streams as raw materials that can be supplied to fertilizer companies for further formulation into commercial products.

- Economic viability vs. practicality
    - Some argue nutrient recovery can be profitable.
    - Others highlight hidden costs (processing, logistics) that may limit profitability.
- Impact of logistics
    - One side: logistics is a major limitation, especially for commercialization.
    - Other side: in localized farming systems, logistics is less problematic due to on-farm or nearby reuse.

5. Barriers to Implementation

Economic barrier

For farmers, it is challenging to apply high technology to obtain a full nutrient recovery system, which for the moment it is not developed enough to produce incomes that allow to recover the investment.

NutriBudget

Parallel session ESNI-NERM 2026 – Wednesday 29 April

1. Executive Summary

The workshop "Integrating Soil Nutrient Budgets into EU Climate Policy: Building Climate-Competitive Agriculture" explored how nutrient budgeting, carbon farming, and sustainable nutrient management can support the transition toward a more resilient and climate-compatible agricultural system in Europe.

2. Key Scientific & Technical Breakthroughs

A major focus of the session was the NutriBudget project and the development of the NutriPlatform, a digital decision-support system designed to support both farmers and policymakers. The platform aims to provide farm-level nutrient budgets and help users evaluate which nutrient management measures are most suitable under specific environmental, climatic, and economic conditions. Unlike many traditional nutrient accounting tools, which mainly focus on nitrogen, phosphorus, and carbon, the NutriPlatform expands the analysis to a wider range of nutrients, including calcium, magnesium, sodium, and other macro- and micronutrients. This broader nutrient accounting methodology allows users to better identify interactions and trade-offs between different farming measures.

3. Critical Discussion

The workshop highlighted the range of interconnected environmental, economic, and geopolitical challenges currently affecting European agriculture. Speakers identified rising fertiliser prices, dependence on imported nutrients and feed, climate change, soil degradation, and nutrient pollution as key structural pressures affecting the sector. There was shared recognition of the need to improve nutrient use efficiency and strengthen soil management practices in order to enhance resilience while reducing environmental impacts. Speakers also emphasised the growing importance of monitoring systems, data collection, and policy coordination, noting that future agricultural governance frameworks are likely to rely increasingly on measurable indicators and evidence-based policymaking.

The discussion also highlighted the complexity of nutrient management policies across agriculture, environment, waste, energy, and climate frameworks. It was underlined the importance of fostering greater coherence and coordination between EU, national, and regional policies, particularly in relation to the CAP, the Green Deal, the Farm to Fork Strategy, nutrient management plans, and waste legislation.

The importance of stronger public–private partnerships to support the transition towards more sustainable agriculture was emphasised, with speakers noting that private sector investment will need to complement public funding, particularly in the context of initiatives such as carbon farming. Public funding was also seen as playing a strategic role in enabling long-term sectoral transformation, including through emerging transition finance mechanisms under future policy frameworks.

During the Q&A session, participants raised questions regarding the development of "nature credits" and the broader role of market-based approaches in valuing biodiversity and ecosystem services, including potential challenges related to their implementation and governance. Additional discussions focused on the certification of organic fertilisers and soil improvers within carbon farming systems, as well as on ensuring coherence and compatibility between EU and national regulatory frameworks.

4. Barriers to Implementation

The workshop identified several regulatory, economic, and social barriers that continue to slow the implementation of sustainable nutrient management systems in Europe. Regulatory complexity remains a significant obstacle, particularly regarding waste legislation and the approval of recovered nutrient products. Bureaucratic procedures can prevent recycled nutrient products from reaching wider agricultural markets.

Economic barriers were also discussed extensively. Farmers continue to face rising fertiliser and energy costs, while uncertainty surrounding carbon markets and transition financing creates additional risks. Many sustainable practices require long-term investments and planning, which can be difficult for farmers operating under financial pressure, especially smaller farms.

The workshop also highlighted challenges related to stakeholder coordination and social acceptance. Farmers are often hesitant to adopt carbon farming schemes because of uncertainty regarding monitoring requirements, administrative burdens, and long-term economic returns. In countries where existing agri-environmental subsidy systems already function effectively, there is often limited motivation to adopt new market-based systems. Stakeholder engagement and knowledge transfer were identified as essential for successful implementation. The discussion also highlighted the importance of advisory services, farmer training, and effective communication tools in supporting the translation of scientific knowledge into practical on-farm implementation.

Data availability was identified as another major challenge. Reliable nutrient accounting systems and outcome-based policies depend on high-quality environmental and economic data collected directly from farms, but gathering consistent and comparable data across regions remains difficult.

5. Key opportunities and take-home message

Despite the challenges discussed during the workshop, participants identified important opportunities for improving nutrient management and supporting climate-compatible agriculture in Europe. Improving nutrient use efficiency was presented as one of the main opportunities, as better nutrient management can reduce pollution, lower production costs, improve soil fertility, strengthen carbon sequestration, and reduce dependence on imported fertilisers. Participants also highlighted the potential of circular economy approaches through the increased use of recovered nutrients and bio-based fertilisers.

The overall conclusion of the workshop was that nutrient budgeting and sustainable soil management can become central pillars of Europe's future agricultural strategy. Achieving this transition will require science-based policymaking, reliable monitoring systems, practical farm-level tools, financial support, stakeholder engagement, and coherent regulatory frameworks. While debates continue regarding carbon markets and private-sector financing, improving nutrient management remains essential for building resilient, sustainable, and climate-compatible agriculture in Europe.

NUTRI KNOW

Final Event at ESNI-NERM 2026 – Wednesday 29 April

1. Executive Summary

The NUTRI-KNOW final event consists of an executive summary of the project's main outcomes showcasing how innovation knowledge is helping practice, and an interactive policy workshop with invited panelists diving into the legislative and practical needs of RENURE products, pocket digestion, and algae technology. A clear point of consensus emerged around the need to move from research and pilot activities towards large-scale, practice-oriented deployment, supported by clearer regulatory frameworks and stronger market development.

2. Critical Discussion

The 54 participants to the NUTRI-KNOW final event and policy workshop spread over a diverse professions, with 57% come from research and academia, 11% as technology/fertiliser providers, 6% as policy makers/public authorities, 2% as farmers and practitioners, 9% from civil society organization and 13% the others.

The participants broadly agreed that RENURE products have significant potential under the Nitrates Directive, but that their implementation remains constrained by ongoing regulatory processes and uncertainties. Similarly, pocket digestion was recognised as a promising solution to support decentralized energy production and nutrient recycling, particularly in the context of increasing demand for renewable energy, while algae-based technologies were widely acknowledged as innovative but highly dependent on market creation, consumer awareness, and value chain development.

The panel discussion provided a nuanced, multi-actor perspective on the readiness and challenges of implementing the three policy domains. From a policy standpoint, it was emphasised by Benjamin van Doorslaer (DG AGRI) that RENURE remains in a transitional phase under the Nitrates Directive, with no final authorisation yet in place. While there is strong political interest from several Member States, the ongoing evaluation process—expected to be published in the near term—illustrates that regulatory change is incremental and largely shaped by compromise between existing frameworks. **In this context, the European Commission is also expected to integrate fertiliser-related measures into the upcoming EU Fertiliser Action Plan, including the promotion of circular solutions such as RENURE.** Experts highlighted that future opportunities may also arise through broader EU strategies, such as the upcoming bioeconomy agenda, but uncertainty remains regarding the scope and timing of implementation.

From a practice and market perspective, Ignasi Salaet, the Deputy Director of R&D&I (Research, Development, and Innovation) at Fertinagro Biotech, underlined that the main bottleneck for recovered fertilisers is not only regulation but also market acceptance. Farmers currently rely heavily on established local suppliers who provide integrated services, including product delivery, advice, and trust-based relationships. **For this reason, fertiliser producers need not only a robust product offering but also a strong commercial team capable of building trust, ensuring effective outreach, and securing market positioning**. In contrast, recovered fertilisers often lack consistent quality standards, stable supply chains, and clear positioning within existing distribution systems. Experts stressed that demonstration activities, collaboration with local distributors, and simplified

communication are essential to build farmer confidence, noting that peer-to-peer exchange at the local level remains a decisive factor in adoption.

For pocket digestion, Klaas Vanhee from Biolectric, a Flemish company specified in anaerobic digestion, highlighted both its technical maturity and its practical limitations. While the technology has proven its effectiveness in nutrient recycling and renewable energy production, experts pointed to slow and complex permitting procedures, as well as regulatory inconsistencies regarding installation distances and requirements across countries. Moreover, adoption is hindered by the time and effort required from farmers, who may be reluctant to invest in unfamiliar technologies without clear economic incentives or visible examples in their immediate surroundings. **In this context, resistance to change among established farm managers and the gradual generational renewal of the farming population shape the pace of uptake.** The importance of continuous outreach, local engagement, and viable business models was therefore strongly emphasised.

Regarding algae technologies, the discussion revealed that the primary barrier lies in the lack of a well-developed market. Dr. Marcella de Souza from the RE-SOURCE lab at Ghent University noted that business-to-business approaches alone are insufficient, as consumer acceptance remains low and products are not yet widely recognised. Successful uptake requires stronger integration into existing retail channels, such as supermarkets, as well as public-sector involvement to promote algae-based products through procurement and awareness campaigns. Although regulatory frameworks for certain inputs already exist, stakeholders highlighted the need for clearer incentives, scaling strategies, and coordinated action beyond the EU level, including active engagement from national and regional authorities.

3. Barriers to Implementation

- **Regulatory: fragmentation and complexity of the legislative landscape.**
  The lack of harmonised standards and definitions across EU and national frameworks leads to inconsistent classification of products such as recovered fertilisers, while the absence of clear end-of-waste status further delays their market entry. Slow and burdensome permitting procedures, particularly for technologies like pocket digestion, and ongoing uncertainty around regulatory revisions create additional obstacles. Moreover, discrepancies between policy domains and institutions contribute to delays in aligning innovation with regulatory approval.

- **Economic: high investment costs, uncertain returns, and underdeveloped business models**
  Technologies often need further adaptation to handle variable feedstocks and ensure consistent product quality, which increases complexity and costs. The absence of stable markets for products such as algae biomass or recovered fertilisers limits commercial viability, while insufficient financial incentives and risk-sharing mechanisms reduce the willingness of farmers and companies to invest. Stakeholders also highlighted the need for scalable and flexible solutions that can move beyond pilot projects and operate under real market conditions.

- **Social/Acceptance: trust, awareness, and behavioural resistance**
  Farmers tend to rely on established networks, local advisors, and familiar suppliers, making them cautious about adopting new technologies or products that lack proven track records. Peer-to-peer influence and local demonstration are therefore critical for building confidence. In addition, limited consumer awareness and understanding—particularly for algae-based products—restrict market demand. Resistance to change is further reinforced when existing systems are perceived

as sufficiently effective, especially in contexts where current subsidies or schemes already support conventional practices.

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