



**GIANT
LEAPS**

POLICY BRIEF 6

Food and protein sustainability



OBJECTIVE

Alternative protein sources for human consumption, also called alternative proteins, are central to climate-neutral, resource-efficient, and resilient EU food systems, but sustainability performance varies widely across value chains and production routes. GIANT LEAPS has developed and applied an integrated sustainability assessment framework that combines Environmental Life Cycle Assessment (E-LCA), Life Cycle Costing (LCC) and Social Life Cycle Assessment (S-LCA), complemented by assessments of biodiversity and ecosystem services, climate change mitigation and adaptation, and circularity potential across major alternative-protein value chains. Results from GIANT LEAPS highlight several recurring barriers to the protein transition: limited availability of consistent, granular primary data; fragmented assessment practices that hinder comparability; insufficient support to scale promising alternative protein technologies from pilots to commercial operations; and the risk that processing intensity, energy supply, and climate vulnerabilities offset the expected benefits from alternative protein sources if not addressed early on in their market uptake. In this context, this policy brief lists targeted recommendations to strengthen data access and transparency, harmonise sustainability assessment across Europe, support scale-up and market uptake, and integrate holistic sustainability in food security and protein autonomy strategies, address processing hotspots through eco-design and innovation, and embed climate risk screening into decisions on future production capacity.

KEY POLICY RECOMMENDATIONS

A dietary shift from traditional animal-based protein to protein from alternative sources is expected to reduce the environmental impact of food production and consumption¹. However, this transition also presents potential food system sustainability concerns that must be addressed proactively. To ensure a safe and efficient dietary shift, the following recommendations are provided, along with a Call for Action for three main stakeholder groups (governments and regulators, scientists and research institutions, and food business operators).

Recommendations and Call for actions

1. Enhance data accessibility and transparency
 - ✓ Mandate standardised disclosure of sustainability-relevant data.
 - ✓ Incentivise open data sharing.
 - ✓ Expand EU-supported data platforms.
 - ✓ Establish clear rules on data confidentiality.
2. Standardise and integrate food sustainability assessments in the EU
 - ✓ Develop EU guidance for alternative-protein sustainability assessment.
 - ✓ Build (holistic) sustainability assessment capacity.
 - ✓ Support transparency of trade-offs.
3. Support scale-up to accelerate market uptake and reduce impacts and costs per unit of protein produced
 - ✓ Provide targeted funding and co-financing programmes.
 - ✓ Integrate scale-up support in EU programmes.



- ✓ Facilitate streamlined regulatory pathways.
 - ✓ Support public procurement pilots.
 - ✓ Create pre-commercial acceleration platforms.
 - ✓ Develop tailored organic certification pathways.
4. **Integrate holistic sustainability outcomes into food security and protein autonomy strategy**
- ✓ Align food security and protein autonomy strategies.
 - ✓ Apply evidence-based trade policy criteria for imports and domestic production based on full LCAs rather than transport-distance.
 - ✓ Prioritise agronomic innovations that improve yield stability, resource efficiency and climate resilience.
5. **Address processing intensity and environmental hotspots in protein transition policy**
- ✓ Ensure that labelling and taxonomy differentiates between mildly processed ingredients and highly processed ingredients.
 - ✓ Embed eco-design principles in funding and market rules.
 - ✓ Support innovation in low-impact processing and fractionation technologies.
6. **Perform climate-vulnerability and adaptation analysis for alternative protein production to determine the most resilient options for different European locations**
- ✓ Require climate-vulnerability screening.
 - ✓ Develop regional sustainability maps.
 - ✓ Prioritise investments where climate resilience is strongest.
7. **Use comprehensive sustainability profiles to direct targeted innovation**
- ✓ Mandate holistic and localised sustainability profiling.
 - ✓ Target R&D at proven bottlenecks.
 - ✓ Bridge the “circularity efficiency gap”.

POLICY RECOMMENDATIONS

Recommendation 1: Enhance data accessibility and transparency

Robust policy and investment decisions for alternative proteins depend on credible, comparable evidence, yet sustainability data are often fragmented, inconsistent, or inaccessible. This is particularly challenging for emerging value chains where primary data are scarce, and reporting practices vary widely across actors and Member States. Limited transparency can slow learning, weaken trust, and make it difficult to distinguish genuine improvements from unsupported claims. Improving data access is therefore a foundational step for method harmonisation, benchmarking, and targeted innovation support across the protein transition. Experience from the GIANT LEAPS sustainability assessments shows that integrated assessments depend on both primary (producer-level) and secondary (literature/database) sources, and that there is a lack of access to high-quality primary data.

Call for action:

- ✓ *Mandate standardised disclosure of sustainability-relevant data* (GHG, land/water use, waste) for alternative protein production under EU food regulation and sustainability reporting frameworks.
- ✓ *Incentivise open data sharing* via preferential access to public R&D funding (e.g. Horizon Europe, EIT Food).
- ✓ *Expand EU-supported data platforms* (such as the GIANT LEAPS cloud data platform) for researchers, policymakers, and SMEs.
- ✓ *Establish clear rules on data confidentiality* and aggregation to protect sensitive business information and aid competitiveness of alternative protein production.

Recommendation 2: Standardise and integrate food sustainability assessments in the EU

Sustainability claims for alternative proteins are difficult to compare when studies use different system boundaries, functional units, impact methods, and allocation rules. This fragmentation creates uncertainty for policymakers, investors, and consumers, and it increases the risk of burden shifting when decisions are guided by a narrow set of indicators. A shared baseline aligned with Environmental Footprint (EF)/Product Environmental Footprint (PEF) practice can improve comparability and credibility, while a holistic and integrated approach that includes economic and social dimensions supports more realistic decisions about scale-up and market adoption. Standardisation and integration of food sustainability assessments should therefore focus on both methodological alignment and practical feasibility for industry, including SMEs.

Call for action:

- ✓ *Develop EU guidance for alternative-protein sustainability assessment* aligned with EF/PEF practice where relevant and define minimum reporting requirements for key indicators.
- ✓ *Build (holistic) sustainability assessment capacity* among LCA practitioners, SMEs, and regulators via training and Horizon Europe platforms.
- ✓ *Support transparency of trade-offs* across sustainability dimensions (e.g. climate vs. price impacts) through integrated reporting.

Recommendation 3: Support scale-up to accelerate market uptake and reduce impacts and costs per unit of protein produced

Many alternative protein products, e.g., microbial, insect-based, or cultivated meat, are currently at a prototype or pilot stage. Despite high sustainability potential, limited access to scale-up infrastructure and investment delays market readiness, hinders competitiveness, and slows reductions in environmental impacts per unit of protein produced. GIANT LEAPS insights suggest that the sustainability advantages of alternative protein sources can be amplified through economies of scale if scale-up is supported through coherent infrastructure, financing, and regulation. Economies of scale result in lower production costs and, thereby, lower prices per unit of protein produced. Price is one of the most determining factors for consumers when choosing which food product to purchase, which is essential for achieving a positive sustainability impact. Additionally, economies of scale may also improve other sustainability parameters by enabling investments that improve efficiency such as precision agriculture, automated high-yield processing lines, energy-efficient equipment with heat recovery, advanced wastewater treatment and by-product valorisation (e.g., biogas from residues). Such efficiency gains reduce emissions, water use, energy consumption, and waste intensity per unit of protein produced.

Call for action:

- ✓ *Targeted funding and co-financing programmes* for pilot-to-demonstration and commercial-scale facilities for alternative proteins, including modular and regional production units.

- ✓ **Integration of scale-up support in EU programs** (e.g. Horizon Europe, innovation funds) through dedicated calls for alternative proteins and related technologies, since scale-up is a learning phase that necessitates iterative improvements of energy efficiency, yields and environmental performance.
- ✓ **Facilitate streamlined regulatory pathways** for scale-up of safe and approved alternative protein production.
- ✓ **Support public procurement pilots** to build predictable demand and validate supply chain readiness (e.g. in municipalities, schools, hospitals).
- ✓ **Create pre-commercial acceleration platforms** for alternative protein producers that combine technical, regulatory, and business scale-up services.
- ✓ **Develop tailored organic certification pathways** for alternative proteins to facilitate market access.

Recommendation 4: Integrate holistic sustainability outcomes into food security and protein autonomy strategies

Food security and protein autonomy are increasingly central policy objectives², but they will not be achieved through localisation of production in Europe alone. Sustainability performance depends partly on yields, input intensity, processing requirements, and exposure to climate and supply-chain risks, which can differ substantially across regions and production routes. Building on GIANT LEAPS findings, integrating sustainability assessment that considers environmental, economic, and social impacts into protein autonomy strategies can prevent early commitment to pathways that perform well on a single metric but underperform across the broader sustainability profile. This supports more resilient policy choices by making trade-offs explicit and enabling decisions that balance environmental integrity, economic competitiveness and social outcomes.

Call for action:

- ✓ **Align food security and protein autonomy strategies** with environmental and social sustainability, competitiveness, circularity, and climate resilience aspects, pairing European localisation objectives with efficiency and performance benchmarks.
- ✓ **Apply evidence-based trade policy criteria for imports and domestic production based on full LCAs rather than transport-distance**, acknowledging that transport is often a minor contributor compared to on-farm environmental efficiency.
- ✓ **Prioritise agronomic and biotechnology innovation** that improves yield stability, resource efficiency, and climate resilience in European protein production.

Recommendation 5: Address processing intensity and environmental hotspots in protein transition policy

Processing choices can dominate environmental performance. Production of highly fractionated ingredients may reduce the benefits of the low-impact crops from which they are produced if consumption of energy, chemicals or water for fractionation is high. GIANT LEAPS findings indicate that environmental performance can differ substantially between mildly processed ingredients (such as flours and protein concentrates) and more highly processed ingredients (such as protein isolates). More intensive fractionation typically increases energy, chemical and water demand, which can reduce or even outweigh some of the environmental advantages associated with the underlying crop.

Call for action:

- ✓ Ensure that **labelling, taxonomy, and sustainability guidance** distinguish between mildly processed ingredients (flours, protein concentrates) and highly processed ingredients (protein isolates) when evidence shows materially different environmental impacts.

- ✓ *Embed eco-design principles in funding and market rules*, prioritising “fit-for-purpose” ingredient choice so the least resource-intensive option is used to meet functional, sensory, nutrition, and safety requirements.
- ✓ *Support innovation in low-impact processing and fractionation technologies* (for example, dry fractionation and energy-efficient separation), coupled with performance reporting³.

Recommendation 6: Perform climate-vulnerability and adaptation analysis for alternative protein production to determine the most resilient options for different European locations

Climate projections indicate that European regions face divergent climate trajectories affecting agricultural yields, water availability, and production stability. The GIANT LEAPS climate adaptation and mitigation analysis demonstrates that assessing climate change-related risks, opportunities, vulnerabilities, and adaptation and mitigation capacities can aid decisions about which alternative protein production routes are better suited to specific European regions. EU-wide risk assessments identify increasing risks to food and water security, with drought and water scarcity being critical in several regions⁴. Integrating climate vulnerability and climate adaptation capacity into protein production strategy can reduce maladaptation and improve resilience.

Call for action:

- ✓ *Require climate-vulnerability screening* (drought/heat/flood risk, water scarcity exposure, supply-chain sensitivity) for publicly funded scale-up projects and regional protein strategies, aligned with EU climate risk assessment evidence.
- ✓ *Develop regional suitability maps* for alternative protein pathways (crop-based, autotrophic algae-based, bioreactor-based or insect-based) integrating the level of water stress, access to renewable energy and infrastructure, and (by-product) feedstock availability.
- ✓ *Prioritise investments where climate resilience is strongest* by aligning new facilities with low water-stress areas and access to low-carbon energy while establishing contingency planning for extreme events.

Recommendation 7: Use comprehensive sustainability profiles to direct targeted innovation

To effectively stimulate a sustainable food system, evaluative tools are needed that go beyond single metrics. The GIANT LEAPS project demonstrates the value of mapping individual protein sources across a comprehensive sustainability profile that includes planetary boundaries and social foundations. Applying this to our case study on the production of the microalgae *Chlorella vulgaris* revealed distinct trade-offs that dictate where scale-up funding should be directed. For example, the visual sustainability profile demonstrates that production of heterotrophic *Chlorella vulgaris* operates safely within boundaries for land use and nutrient surplus, confirming its value as a “land-sparing” protein source. However, the same profile visually flags the critical challenge that production of heterotrophic *Chlorella vulgaris* currently exceeds limits for climate change and economic affordability.

Call for action:

- ✓ *Mandate holistic and localised sustainability profiling*: EU innovation funds should require multi-dimensional sustainability profiling for alternative proteins to prevent burden-shifting. Furthermore, because social and climate risks are heavily tied to background utility grids, funding should require localised sensitivity mapping to ensure facilities are sited in regions with a relatively high share of sustainably sourced grid power.
- ✓ *Target R&D at proven bottlenecks*: Use sustainability profiles to direct investments where needed. For high-tech protein sources, for example microalgae, data shows that labour requirements, infrastructure depreciation, and drying energy consumption are the true barriers to price parity and carbon neutrality.

Policy instruments should specifically incentivise process automation and renewable heat integration.

- ✓ **Bridge the "circularity efficiency gap":** Acknowledge that waste valorisation is not environmentally free. GIANT LEAPS modelling demonstrates that the energy and chemical burden of pre-treating food waste can currently outweigh the benefits of displaced virgin feedstocks. Policy must urgently fund innovations in low-energy and low-chemical pre-treatment technologies to make circular pathways environmentally viable.

BACKGROUND INFORMATION

Need for a shift towards more sustainable protein sources

Food systems contribute roughly one-third of global anthropogenic GHG emissions and drive significant land use, water, and biodiversity pressures⁵. Alternative proteins can reduce these impacts, diversify supply, valorise side streams, and create regional, resilient value chains, but sustainability benefits depend on production technologies, energy systems, agricultural performance, processing intensity, and waste/circularity management. A robust, comparable sustainability assessment is therefore essential across environmental, social, and economic dimensions.

EU regulations impacting the dietary shift

The European Green Deal⁶ and Farm to Fork Strategy⁷ set the policy direction for climate neutrality and healthier, more sustainable food systems. Complementary instruments, such as Horizon Europe, the EU Bioeconomy Strategy⁸, and the harmonised EU-wide application of Environmental Footprint (EF) to measure and communicate LCA performance⁹, provide a basis for method harmonisation and innovation support. Moreover, for the successful shift towards protein sustainability, it is necessary to ensure that the alternative protein sources taken up in the EU are competitive and resilient to the ongoing societal, market, and climatic changes¹⁰. Targeted policy and support measures hold a potential to reduce knowledge gaps in data, methodology, scale-up, efficient processing, and climate risks for alternative proteins, enabling credible performance disclosure and market adoption.

Food system sustainability

Food system sustainability can be defined as the capacity of food systems to provide sufficient, nutritious, and culturally appropriate food for all people, now and in the future, while safeguarding the environment, promoting economic viability, ensuring social equity, and preserving biodiversity¹¹.

A sustainable food system minimises negative environmental impacts (e.g., greenhouse gas emissions, water use, land degradation), while enhancing soil health, ecosystem services, and climate resilience. Economically, it supports fair livelihoods and working conditions, resilient supply chains, and responsible resource management. Socially, it promotes food justice, workers' rights, and equitable access to healthy food.

The integrated sustainability assessment of alternative proteins within the GIANT LEAPS project revealed several problematic areas in terms of sustainability. These are: (i) lack of reliable and consistent data and a lack of standardised approaches for assessing environmental, economic and social impacts of alternative protein production and uptake; (ii) lack of support for upscaling alternative protein production from prototype to large scale production that would enable faster market uptake and reduction of environmental impacts per unit of protein produced; (iii) effects of processing on overall environmental performance, uneven and under-researched climate vulnerabilities and adaptation capacities, and (iv)

missing incentives for enhancing efficiency and circularity of these production systems from the outset, which is currently left to the discretion of concept developers and producers. Based on these gaps, GIANT LEAPS puts forward several recommendations for potential policy improvements.

ABOUT GIANT LEAPS

The EU-funded project 'GIANT LEAPS' aims to accelerate the dietary shift towards a more sustainable and healthier food system, aligning with the EU Green Deal objectives and the Farm to Fork Strategy. The ambition of GIANT LEAPS is to transform European diets by reducing the consumption of traditional animal proteins, targeting a goal where 50% of total protein dietary intake is derived from alternative proteins sources – such as plants, microalgae, insects, and single-cell proteins – by 2030. To achieve this goal, GIANT LEAPS employs a multi-actor approach, actively engaging with policymakers, production sectors, and European citizens. This collaboration fosters key innovations, methodologies, datasets and information that empower all stakeholders in the food system to make informed decisions, strategic investments, and sustainable choices. Ultimately, the Project seeks to facilitate a large-scale dietary shift towards alternative protein-rich foods, maximizing both nutritional and environmental impacts.

DISCLAIMER

This project has received funding from the European Union's HORIZON EUROPE research and innovation programme under grant agreement No 101059632. Views and opinions expressed are, however, those of the authors only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the European Research Executive Agency (REA) can be held responsible for them.

This document is published prior to the completion of the external review related to planned periodic or final reports for GIANT LEAPS under the HORIZON Europe funding framework. Adjustments may be made during the process, if deemed necessary.

CONTRIBUTORS

A. Paul Vos, Wageningen University and Research, Netherlands (Coordinator); 
HJ (Ine) van der Fels-Klerx, Wageningen University and Research, Netherlands (Deputy Coordinator); 
Gloria Bevilacqua, Europa Media, Hungary; 
Laura Malinauskaite, Matís – Icelandic Food Research and Biotech, Iceland; 
Jakob Lewin Rukov, Bugging Denmark, Denmark; 
Andrea Selezjova, Wageningen University & Research, Netherlands; 
Birgir Smáráson, Matís – Icelandic Food Research and Biotech, Iceland; 
Sergiy Smetana; German Institute of Food Technologies, Germany; 
Jasper van Puffelen, Wageningen University and Research, Netherlands; 
Edward Sliwinski, Effost, Netherlands
Hans Verhagen, Food Safety & Nutrition Consultancy, Netherlands; 

REFERENCES

1. Rockström, J., Thilsted, S. H., Willett, W. C., et al. (2025). The EAT–Lancet Commission on healthy, sustainable, and just food systems. *The Lancet*, 406(10512), 1625–1700. [https://doi.org/10.1016/S0140-6736\(25\)01201-2](https://doi.org/10.1016/S0140-6736(25)01201-2)
2. European Parliamentary Research Service. (2023). Food security and food sovereignty in the EU. (Briefing No. 751426). European Parliament. [https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/751426/EPRS_BRI\(2023\)751426_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/751426/EPRS_BRI(2023)751426_EN.pdf)
3. Schutyser, M. A. I., & Novoa, D. F. (2025). Dry fractionation for sustainable production of functional, nutritional and palatable grain legume protein ingredients. *Food Engineering Reviews*, 17(2), 344–358. <https://doi.org/10.1007/s12393-024-09394-2>
4. European Environment Agency. (2024). European climate risk assessment (EEA Report 01/2024). <https://www.eea.europa.eu/en/analysis/publications/european-climate-risk-assessment>
5. Crippa, M., Solazzo, E., Guizzardi, D., et al. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food*. <https://doi.org/10.1038/s43016-021-00225-9>
6. European Commission. (n.d.). The European Green Deal. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
7. European Commission. (2020). Farm to Fork strategy. https://food.ec.europa.eu/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf
8. European Commission. (n.d.). Bioeconomy strategy. https://environment.ec.europa.eu/strategy/bioeconomy-strategy_en
9. European Commission. (2021). Commission recommendation (EU) 2021/2279 of 15 December 2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations. EUR-Lex. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021H2279>
10. EIT Food. Why Protein Diversification Matters. <https://www.eitfood.eu/projects/eit-food-protein-diversification-think-tank/why-protein-diversification-matters>
11. Food and Agriculture Organization of the United Nations. (n.d.). Contexto general. <https://www.fao.org/in-action/territorios-inteligentes/componentes/produccion-agricola/contexto-general/en/>

CONTACT DETAILS

Paul Vos, PhD

Project coordinator
Wageningen University and Research, Netherlands
giantleaps@wur.nl

Visit Us www.giant-leaps.eu

Follow Us



Co-funded by
the European Union