

# ACCELERATING PROTEIN DIVERSIFICATION FOR EUROPE

2023

**An EIT Food Protein  
Diversification Think  
Tank Policy Brief**

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Knowledge & Innovation Center on  
Food, part of the European Institute  
of Innovation and Technology (EIT).

[www.eitfood.eu](http://www.eitfood.eu)

This paper was written by the [EIT Food Protein Diversification Think Tank](#) in consultation with experts and stakeholders within the protein diversification field.

EIT Food is a pan-European multi-stakeholder organisation that accelerates innovation to build a future-fit food system, which produces healthy and sustainable food for all.

The EIT Food Protein Diversification Think Tank convenes stakeholders and partners, combining the expertise of academics, research and technology organisations (RTOs), companies, and NGOs. It fosters broad and inclusive participation and aims to create structured dialogue to overcome barriers to innovation in the field of protein diversification. At the time of writing, its members are Danone, Lund University, The German Institute of Food Technologies (DIL), University of Helsinki, VTT Finland, The Good Food Institute (GFI) Europe, Puratos Group, ShakeUpFactory, Aarhus University, Grupo AN, BGI.

# EXECUTIVE SUMMARY

As Europe enters the next phase of the Green Deal, decarbonising the agricultural and food industries will be essential to put the bloc on a path towards climate neutrality by 2050. Currently, the food system contributes to an alarming 26%–34% of greenhouse gas emissions and 78% of global ocean and freshwater eutrophication. Yet, within the realm of food systems, there is an opportunity for change. By diversifying protein sources, we can not only reinforce our food systems but also align with the EU's goals for a healthier, more sustainable, resilient, and equitable food system with minimised environmental consequences. Protein diversification entails reevaluating and changing our production and consumption of protein sources, moving from a strong dependence on resource-intensive animal-based proteins to more sustainable protein sources. Alternative sources of protein include plant-based (protein crops and ingredients), cell-cultured (cultivated meat, mycoprotein, fungal and yeast biomass), precision fermented (e.g., animal, plant proteins), algae-based and insect-based alternative sources for conventional animal-based proteins like meat, dairy, eggs, and seafood.

In 2023, protein diversification captured political interest, both within Europe and globally. At the EU level, anticipation is building for the European Commission's comprehensive review of its protein policy, driven by concerns over dependency on imported feed, as well as the upcoming Sustainable Food Systems Framework. On the national level, countries such as the Netherlands, France, and Denmark committed significant R&I funds, while Italy expressed reservations about the pace of innovation. At the global level, regulatory applications, and approvals outside of the EU indicate that Europe is falling behind as the rest of the world accelerates to deliver novel sources of protein as part of a more sustainable food system.

This policy brief on "Accelerating Protein Diversification for Europe" provides a comprehensive set of recommendations, advocating for a systems thinking approach and acknowledging the importance of engaging with the entire food system. It builds on the [White Paper on Protein Diversification](#) published in December 2022 by the EIT Food Protein Diversification Think Tank and the feedback received, going a step further to look at the pathways ahead. It is the result of a collaborative process between Think Tank members, bringing their expertise, as well as consulting with various experts and stakeholders from the protein diversification field for a more

accurate representation of required developments. The outcome of this collaboration is the following recommendations:

**Systems thinking.** Success in diversifying protein is impacted by many factors and it must be seen as part of a complex and dynamic food system. Systems solutions will require collaboration across the entire food value chain to achieve widespread adoption and inter/trans-disciplinary research. It also requires a holistic understanding of complexity in food systems, as without this, we cannot identify the leverage points for potential solutions. Adopting a systems thinking mindset is crucial and should be applied across all public policies. This should give us a lens to view the overarching narrative, uncover synergies and design more sustainable and circular protein supply chains.

**Enabling policy environments.** This transformation should touch on policy areas such as research funding, regulations, the Common Agricultural Policy (CAP), consumer awareness, and fair competition. EU-level future policies, starting with the EU Protein Strategy, must acknowledge and reward the value of protein crops for direct human consumption and foster the evolution of alternative protein sources. The new CAP will be instrumental in driving protein diversification in Europe.

**Regulation.** To harness the benefits of alternative proteins and ensure a robust food system, consumers must have confidence in the food they eat and the regulatory framework responsible for its approval. Regulation interacts with many aspects of protein diversification across the food system, such as new plant-breeding technologies, taxation, environmental impact assessments, and product labelling. To achieve the full economic, environmental, and societal benefits of protein diversification and to establish itself as a global leader in this space, the EU must assess how its various regulatory frameworks are either hindering or enabling innovation. To spur innovation, it should look at how to improve implementation of the Novel Foods Regulation, without necessarily pursuing legislative change.

**Farming.** Farmers have a pivotal role to play in driving protein diversification. They will remain essential in providing the key ingredients for alternative proteins, serving as suppliers of raw materials for plant-based sources and feedstock for insect, fermentation, and cultivated proteins. Beyond being part of dialogues and transition planning, farmers should be awarded substantial support by governments in research, development, and de-risking investments.

**Research, development, and innovation (RDI).** Protein diversification must be sufficiently funded by governments, as public financing can drive long-term RDI into societal topics such as environmental sustainability and can mitigate risks for private investors. However, a 2023 European Commission study<sup>1</sup> showed that in the period 2007–2020, alternative proteins received less than 1% of all food systems funding. The recommendations also highlight the structural principles needed for public RDI funding, such as the need for inclusive engagement of stakeholders, and ensuring funding is open to all – small and large – as well as advocating for a focus on RDI to improve taste and price, as the key drivers of uptake.

**Going to market.** We must also consider the broader food environments within which these alternatives exist. This includes considerations around availability, affordability, and cultural preferences, and necessitates a wide range of policy measures from information to competitive pricing. These measures influence how people interact with the food system. With regards to production, cooperation among all stakeholders involved will be required to scale up. The EIT Food Protein Diversification Think Tank serves as a good example of convening experts to engage in foresight and prospective reflections that help anticipate challenges and plan for the future of diversified protein.

**Education and training.** The food industry and sector require a larger workforce, and to continuously attract and retain talent, comprehensive education, capacity building and training programmes are needed, covering a wide range of disciplines and sectors. Lifelong learning initiatives are essential as the industry evolves and adopts modern technologies and practices. Such initiatives will be more impactful with a systems approach, for instance by teaching students about food production, nutrition, sustainability, and the broader food system. Not only would this equip the new workforce with valuable knowledge but would also raise awareness of the interactions between the food sector and global challenges.

The EIT Food Protein Diversification Think Tank will continue to engage stakeholders in a structured discussion to examine the existing gaps, barriers, and opportunities. It will co-create evidence-based roadmaps, including recommended actions and policies for protein diversification to drive the food system transformation.

[We welcome contributions and inputs that can help to accelerate protein diversification and bridge gaps between stakeholders. The Think Tank also invites policymakers to join us in this structured co-creation and urges the EU to take a leading role globally in developing a more sustainable, resilient, healthy, and safe food system.](#)

1. European Commission. (2023). FOOD SYSTEMS Research and Innovation Investment Gap Study.

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# INTRODUCTION

Our current food system is contributing to a range of societal issues, including the climate crisis, biodiversity crisis, water pollution, anti-microbial resistance, poor nutrition, and the spread of zoonotic diseases<sup>2,3</sup>. On top of this are the strongly evidenced links between the high consumption of animal-based protein – notably processed meat – and higher risks for certain non-communicable diseases<sup>4</sup>. Concerning the environmental impact of food, 50% of the world’s habitable land and 70% of global freshwater withdrawals are used for agriculture<sup>5</sup>. At the same time, food production accounts for 26%–34% of global greenhouse gas emissions and agriculture is responsible for 78% of global ocean and freshwater eutrophication due to nutrient run-off from agriculture<sup>6,7</sup>. There is wide acknowledgment that our food systems require change.

The urgent need for food systems transformation at national and international levels has most recently been addressed by the UN Food Systems Summit (UNFSS) in 2021. The UNFSS recognises that sustainable food systems are fundamental to achieving the Agenda 2030 with the UN Sustainable Development Goals (SDGs), the Paris Climate Agreement, and the UN global targets for nutrition. Evidently, urgent and concerted collaboration is required by all stakeholders across the entire food value chains.

Similarly, the EU Farm to Fork Strategy, a core element of the EU Green Deal, addresses the challenges of sustainable food systems by recognising the inseparable links between healthy people and a healthy planet. The European Union (EU) aims to reduce the environmental and climate footprint of its food system, enhance resilience and ensure food security in the face of climate change and biodiversity loss, while also spearheading a global shift towards competitive sustainability.

Protein diversification is a key solution to address these societal issues and is likely the most impactful lever for the EU’s transition to sustainable food systems. It offers multifaceted benefits such as improved nutrition variety and health outcomes, bolstered food security, economic potential, innovation and technological progress, and a diminished environmental footprint. The recent SystemIQ report identifies alternative proteins as one of the three “super-leverage points” that can reduce greenhouse gas emissions in key sectors and expedite transition in other facets of the economy<sup>8</sup>. A 2022 Boston Consulting Group report also showed that investing in protein diversification offers the highest greenhouse gas emission reduction per euro invested compared with any other industry<sup>9</sup>. Recent reports from the Climate Advisers and ClimateWorks have also emphasised the role of protein diversification in addressing critical sustainability issues<sup>10,11</sup>.

2. UNEP (2021). 9 Ways Food Systems are failing humanity.

3. United Nations Environment Programme and International Livestock Research Institute. (2020). Preventing the Next Pandemic: Zoonotic diseases and how to break the chain of transmission. Nairobi, Kenya.

4. EIT Food. (2023). Healthier Lives through Food Insight Report.

5. FAO. (2011). The state of the world’s land and water resources for food and agriculture (SOLAW) – Managing systems at risk. Food and Agriculture Organization of the United Nations, Rome and Earthscan, London.

6. Poore, J., & Nemecek, T. (2018). Reducing food’s environmental impacts through producers and consumers. *Science*, 360(6392), 987-992.

7. Crippa, M., Solazzo, E., Guizzardi, D. et al. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food*

8. Meldrum, M., Pinnell, L., Brennan, K., Romani, M., Sharpe, S., & Lenton, T. (2023). The Breakthrough Effect: How to trigger a cascade of tipping points to accelerate the net zero transition.

9. Boston Consulting Group. (2022). The Untapped Climate Opportunity in Alternative Proteins.

10. Climate Advisers. (2023). Decoupling Methane Emissions from Meat with Alternative Proteins.

11. Climate Works Foundation. (2023) Global Innovation Needs Assessments. Food System Methane.

Globally, 77% of agricultural land is used for livestock production, supplying animal-based proteins. This accounts for only 37% of the total global protein consumption, which places a heavy burden on the environment. Shifting from animal-based proteins to diverse sources can significantly cut greenhouse gas emissions, as well as land, water, and fertiliser usage<sup>12</sup>. For instance, cultivated meat could reduce land use by more than 90% compared with beef production<sup>13</sup>. Understanding and acting on the potential of land use changes to foster biodiversity is paramount and requires a system level evaluation.

The EU faces a significant shortfall in plant proteins, largely driven by the high demand from the livestock sector. Consequently, it continues to rely heavily on imported plant-based proteins to meet the dietary needs of livestock, with a staggering 97% of soy used for animal feed being sourced through imports. Protein diversification is one way of mitigating this reliance on imports, which is essential to enhance food security<sup>14</sup>.

Moreover, diversifying protein sources in the EU can create a more balanced and resilient protein system that helps to prevent or mitigate potential future food shortages and insecurity, which could be caused by climate-related disruptions or disease outbreaks.

### Definition of Protein Diversification

Protein diversification entails reevaluating and changing our present and future composition of protein sources, moving from a strong dependence on resource-intensive animal proteins to more sustainable protein ingredients and products. These sustainable alternatives encompass plant-based (protein crops and ingredients), cell-cultured (cultivated meat, mycoprotein, fungal and yeast biomass), precision fermented (e.g., animal, plant proteins), algae-based and insects-based alternative sources for conventional animal-based proteins like meat, dairy, eggs, and seafood<sup>15</sup>.

12. Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360(6392), 987-992.

13. Tuomisto, H.L.(2022). Challenges of assessing the environmental sustainability of cellular agriculture. *Nat Food* 3, 801-803.

14. European Parliamentary Research Service (2023). EU Protein Strategy briefing.

15. Nutrition Investor. (2020). Protein diversification: A roadmap for global food companies.

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The EIT Food Protein Diversification Think Tank is engaging stakeholders in a structured discussion to examine the existing gaps, barriers, and opportunities, and co-create evidence-based roadmaps, including recommended actions and policies for protein diversification to drive the food system transformation.

This policy brief builds on the [White Paper on Protein Diversification](#) published in December 2022 and the feedback received, going a step further to look at the pathways ahead. It is the result of a collaborative process between the Think Tank members, bringing their expertise, as well as consulting with various experts and stakeholders from the protein diversification field for a more accurate representation of required developments.

For this publication, we conducted structured interviews with stakeholders from across the value chain, including representatives from the farming and retail sectors, national governments, NGOs, food industry, financial sector, and philanthropic foundations. This included voices from Farm Animal Investment Risk and Return (FAIRR), European Alliance for Plant-Based Foods (EAPF), Eroski Group (Eroski), Next Food Chain, The Flemish government, Finnish government (Ministry of Agriculture and Forestry), World Economic Forum (WEF), Respect Farms, The Central Union of Agricultural Producers and Forest Owners (MTK), Federation of Spanish Food and Beverage Industries (FIAB), BPI France, SEGES, Novo Nordisk Foundation, and Foundation Earth.



## EIT Food Protein Diversification Think Tank Vision

By 2050, Europeans should have access to a diet with appealing and affordable protein that is sustainable, resilient, healthy, and safe.

Sustainability and health issues related to protein production and consumption are at the heart of the problems with the current food system and so a shift will be essential to address pressing issues such as agricultural emissions, nutrition, and food security.

*The work of the Think Tank is guided by ongoing ecosystem mapping and engagement. Should you wish to participate in our forthcoming discussions, we invite you to contact EIT Food.*



# PROTEIN DIVERSIFICATION DEVELOPMENTS IN 2023

The inclusion of food systems transition into the political agendas of governments, in Europe and on a global scale, signals an increasing awareness of the roles of food systems. From sustainable agricultural practices to ensuring access to nutritional food, the emphasis now lies on fostering resilience and environmentally responsible strategies. Timely interventions and sustained dialogue with stakeholders remain essential to ensure seamless and effective transitions. Through proactive engagement, we aspire to foster a future where food systems adapt to change and actively contribute to the wellbeing of societies and the planet.

**On the EU level**, protein diversification was high on the agenda in 2023. At the beginning of the year, the EU Commissioner for Agriculture confirmed that the European Commission (EC) would prepare a “comprehensive review of its protein policy”, in response to concerns about dependency on imported feed<sup>16</sup>. In July, the European Parliamentary Research Service published a briefing on the upcoming EU Protein Strategy, highlighting the EU protein deficit and ways to address it<sup>17</sup>. Discussions have continued throughout the year, and the European Parliament report on the matter is expected to be adopted before the end of the year. In June 2023, the EC identified biotechnology as one of four critical technology areas for EU industrial competitiveness and economic security<sup>18</sup>, while later in the year the EC outlined its plan to develop an EU biotech and biomanufacturing initiative in 2024<sup>19</sup>. This represents an important opportunity to ensure that protein diversification is recognised as part of the biotech field.

**At national level**, we observe countries within the EU taking diverging routes regarding protein diversification. In early 2023, Italy proposed a ban on cultivated meat products with a view to protect traditional livelihoods and its cultural heritage. Yet, there is robust scientific evidence confirming the safety of cultivated meat, as recognised by the Food and Agriculture Organization (FAO) in its inaugural report on cell-based food safety published in April 2023<sup>20</sup>. The report acknowledges the significance of cultivated meat in food systems, stressing its safety and sustainability, with its potential advantages such as reduced environmental impact and improved food security. It underscores the need to establish efficient, timely review processes to make the benefits of this innovation available to consumers.

16. GFI. Answer to Parliamentary question. Reducing dependence on protein imports (2023). E-000042/2023(ASW)

17. European Parliamentary Research Service (2023). EU Protein Strategy briefing.

18. European Commission. (2023). Commission recommends carrying out risk assessments on four critical technology areas: advanced semiconductors, artificial intelligence, quantum, biotechnologies.

19. European Commission. (2023). State of the Union. Letter of intent.

20. FAO & WHO. 2023. Food safety aspects of cell-based food. Rome.

Other governments have more openly explored the potential of cultivated meat. In July 2023, the Dutch government, in collaboration with cultivated meat producers Meatable, Mosa Meat, and sector representative, HollandBIO, announced the creation of a Code of Practice to enable pre-market tastings for cultivated meat and seafood in controlled environments<sup>21</sup>. This ground-breaking agreement makes the Netherlands the first EU country to allow pre-approval tastings of cell-cultured food before obtaining EU novel food approval.

Aleph Farms has also sought approval for cultivated meat in Switzerland (July 2023) and the UK (August 2023)<sup>22</sup>. The absence of similar applications within the EU's novel foods regulatory framework, despite its large market, raises concerns about challenges companies encounter in navigating the approval process. Some producers argue that the EU's regulatory environment hampers alternative protein innovation<sup>23</sup>, which is leading companies to explore other regulatory jurisdictions for marketing their innovative products<sup>24</sup>. A 2023 report by Atova Consulting highlights the EU's regulatory framework as a hurdle for introducing alternative proteins to the market. In contrast, the Singapore Food Agency and the US Food and Drug Administration (FDA) actively promote collaboration with applicants to streamline evaluation and approval<sup>25</sup>. In June 2023, the FDA approved two cultivated meat products from UPSIDE Foods and GOOD Meat, following a rigorous pre-market safety assessment<sup>26</sup>. The EU seems to be falling behind as the rest of the world accelerates to deliver cell-cultivated meat as part of a more sustainable food system. It also highlights the importance of investments in the sector and ensuring robust and transparent regulatory processes in the EU.

Industry players are adapting to protein diversification trends as well. A Nielsen IQ data study across 13 European countries shows that plant-based meat and dairy sales grew by 21% from 2020 to 2022, reaching a record €5.8 billion<sup>27</sup>, despite challenges like decreased venture capital funding in early 2023 and high inflation rates in Europe<sup>28</sup>. Mosa Meat, a Dutch cultivated meat company, opened a 2,800 square-metre production plant in Maastricht with a 1,000-litre bioreactor, capable of producing thousands of burgers annually. The Swiss consortium of Givaudan, Bühler, and Migros launched the Cultured Hub to support the scaling-up of cultivated meat, fish, and precision fermentation products<sup>29</sup>. The Swedish company Mycorena is finalising the construction of a first full-scale commercial production plant for their fungi-based alternative protein, Promyc<sup>®30</sup>. The Finnish company Solar Foods is preparing to launch their commercial-scale production facility of the novel protein Solein<sup>®</sup> in 2024<sup>31</sup>.

Collaborations in protein diversification are also emerging. The Bel Group, producing Babybel Cheese, partnered with Standing Ovation, a French precision fermentation company that produces animal-free casein<sup>32</sup>. A new industry alliance, Food Fermentation Europe, is tackling labelling, nomenclature for "animal-free" proteins, industrial-scale fermentation capacity issues, and regulatory pathways for novel foods in the EU<sup>33</sup>.

21. TechEU. (2023). Cultivated meat and seafood tasting is coming to The Netherlands thanks to lobbying by Meatable, Mosa Meat and HollandBIO.

22. Aleph Farms. Aleph Farms Submits Application to Swiss Regulators, Marking the First-ever Submission for Cultivated Meat in Europ.

23. Food Navigator. (2023). EU novel foods regulation 'hindering innovation' in meat alternatives sector.

24. Food Navigator. (2022). Why is EFSA yet to receive a novel food dossier on cell-based meat?

25. Atova Consulting. (2023). The status of alternative protein approvals in the EU, Singapore, UK & the USA.

26. ABC News. (2023). USDA approves 1st ever 'cell-cultivated meat' for 2 American manufacturers.

27. GFI. (2022). Market insights on European plant-based sales 2020-2022.

28. FMI. (2023). Alternative Protein Market Size, Trends & Outlook.

29. The future of protein production. (2022). The Cultured Hub in Kempththal launches in the gateway of Europe for cultured foods.

30. Mycorena.

31. Solar Foods. (2023). Solein<sup>®</sup> taking leaps to market: strategic alliance for product development with Ajinomoto Group announced.

32. Vegconomist. (2022). Babybel Parent Company Bel Group and Standing Ovation Partner for Animal-Free Cheese.

33. AgFunder Network Partners. (2023). Precision fermentation startups team up to tackle 'black box' EU novel foods process.

Cargill and Cubiq Foods, a Spanish alternative-fat company, entered product co-development and go-to-market agreements to incorporate Cubiq's plant-based and cultivated fats to Cargill's ingredients and plant-based offerings. Novozymes and Arla Foods partnered to explore advanced protein ingredients through precision fermentation. Lastly, German start-up The Cultivated B, funded by a major German meat producer, is collaborating with Canadian partners to build the largest North American cultivated meat facility in the coming years.

Research and innovation are central to protein diversification in the EU. In 2022, the Dutch National Growth Fund allocated €60 million to cultivated meat and precision fermentation, along with up to €129 million for the Re-Ge-NL project, promoting farmers to shift toward regenerative agriculture and crop diversification. Meanwhile, the Danish government has committed €168 million available up to 2030 to support the growth of the Danish plant-based food sector while reducing the environmental impact of agriculture, promoting sustainability, and fostering economic growth opportunities. In October 2023, the autonomous community of Catalonia in Spain unveiled the creation of its Center for Innovation in Alternative Proteins (CiPA), which is focused on research and innovation in alternative proteins, particularly in ingredients and food products. Operated by IRTA, it receives substantial government support with a €7 million investment from the Catalan government.

- 34. Food Dive. (2023). Cargill enters alternative fats partnership with Cubiq Foods.
- 35. Arla. (2023). Novozymes and Arla Foods Ingredients join forces to harness power of precision fermentation.
- 36. Cultivated B. Cutting-edge biotechnology for scalable and sustainable protein production.
- 37. Gaynor Selby. (2022). Dutch government invests record €60M to boost cellular meat & agriculture. Food ingredients 1st.
- 38. Dutch governmental website. Regenerative Agriculture.
- 39. gfi Europe. (2021). Denmark announces 1 billion kroner for plant-based foods in historic climate agreement.
- 40. Institute of Agrifood Research and Technology. (2023). The Department of Climate Action and IRTA promote CiPA, a pioneering center in research and innovation on alternative proteins. BioTech.
- 41. University of Bath. (2023). University of Bath to lead £12M project on revolutionising food production.
- 42. UK Research and Innovation. (2023). Pre-announcement: Alternative Proteins Innovation and Knowledge Centre.
- 43. Magnetic Capital. (2023). Bold goals for biotechnology and biomanufacturing: Highlights of Biden's plan set the bar for Europe. Medium.

In the UK, initiatives such as the Cellular Agriculture Manufacturing Hub and Alternative Proteins Innovation and Knowledge Centre are being set up with initial financing of £12 million and £15 million respectively. The US government has also deployed substantial financial support, exceeding \$3 billion from USDA, for initiatives such as "Climate-Smart Commodities Partnerships" and alternative proteins. In March 2023, they announced new biotechnology and bio-manufacturing goals, setting a precedent for other nations to follow, as it recognises that the world is on the brink of a new industrial revolution fuelled by biotechnology and biomanufacturing. Singapore, meanwhile, is investing an additional €120 million in the second stage of its Food Story R&D Program to promote innovative and sustainable technologies in agriculture, aquaculture, and biotech-based foods. Israel, through various investments and initiatives, aims to become a leading hub for alternative meat and protein, as stated by prime minister Benjamin Netanyahu.

South Korea is also emerging as a key market, with 28 South Korean partners, including startups, research centres, and institutions, announcing in February 2023 plans for a dedicated cellular agriculture cluster in Uiseong. This will include a 2,300 m<sup>2</sup> industrial complex designed for cell-cultured meat research and production, supported by €6 million from the Korean State.

In conclusion, the issue of protein diversification has become a subject of significant global discussion, and it is evident that the pace of these innovations and policy developments is speeding up. European policymakers should urgently take this into consideration when shaping their food, agricultural, and climate strategies, and to ensure they are not left behind by other regions taking the lead.

- 44. Singapore Food Agency. Singapore Food Story R&D Programme.
- 45. Sharon Wrobel. (2023). Israel seeks to create R&D fermentation hub to maintain food tech edge. The Times of Israel.
- 46. Cell Based News. (2023). TissenBioFarm Signs Joint MOU on Cellular Agriculture Industry Development in South Korea.

# RECOMMENDATIONS

## 1. Mainstreaming Systems Thinking: Collaboration and Co-generation of Knowledge

All the necessary changes required to advance protein diversification are shaped by investment decisions, economic incentives, societal goals, patterns of consumer demand, technology and by business and governmental actions. This creates complex and dynamic “food systems” with underlying political, and socio-technical/economic sub-systems. A 2023 report from the European Commission’s Joint Research Centre (JRC) emphasises that a successful transition to a sustainable food system requires a systems approach to address the system’s complexity<sup>47</sup>.

Systems solutions require inter/trans-disciplinary research and education, and broad cross-sectoral collaboration across the entire food value chain. Above all, it requires the right approaches, tools, and methods to build a holistic understanding of such dynamic and complex systems. Only by grasping this concept, we can identify the leverage points for potential solutions in such rapidly evolving, inherently complex food systems. Consequently, the radical changes necessary for protein diversification and genuinely sustainable food system transformations imply a strong need for applied systems science and a food systems approach.

Thus, the 2019 Food Systems Policy Brief by the SCAR Group<sup>48</sup> on Food Systems suggests using a food systems perspective to create a shared understanding of systemic challenges and priorities for research and innovation (R&I) intervention. This approach prioritises both integrated and thematic R&I across the domains of food, nutrition and health, farming, fisheries, and natural resource use, as well as the environment.

### Recommendations:

There is an urgent need to develop the competencies in applied systems science (e.g., systems thinking, systems analysis, and system dynamics modelling, systems innovation), participatory and inter/trans-disciplinary processes among public–private sector, and professionals across entire food value chains. This is needed to: 1) better understand such complex and dynamic food systems; and 2) identify and assess the full range of technological, economic, social, and ecological opportunities and challenges in diversifying our protein sources and transitioning to sustainable food systems.

47. Science Advice for Policy by European Academies (SAPEA). (2020). A sustainable food system for the European Union.

48. Niels Halberg and Henk Westhoek. (2019). The added value of a food systems approach in research and innovation - Policy Brief by Standing Committee on Agricultural Research (SCAR) Strategic Working Group on Food Systems. Publication Office of the European Union.

Photo credit: Formo



## Systems Thinking

Policymakers should use systems thinking in the development of all public policies related to protein diversification. This means understanding the interconnections within the system and considering all influential levers and stakeholders to ensure that the proposed measures are both effective and comprehensive, avoiding any exclusions or oversights within the system.

Furthermore, it is important to develop models as decision support tools for integrated sustainability assessments. Such models can create future scenarios to uncover potential unintended consequences, thereby mitigating the risk of new measures inadvertently causing negative outcomes within the system.

Embracing a systems approach helps integrate different perspectives into a broader context while maintaining a central focus on establishing a shared pathway for future development.

By following these recommendations, we can unlock various synergistic benefits, like alternative proteins and sustainable agriculture, which can work together and extend their impact even beyond the food sector. Meeting Europe's bioeconomy, circularity, and food security objectives, as well as fully harnessing the potential of side-streams in food systems and other sectors, will be challenging without these approaches.



## Best-practices: Breaking Down Silos

Stakeholders stress the importance of integrating the value chain and building trust. In Belgium, Next Generation Food's "dinner hack" event hosted plant-based companies, value chain partners, and farmers in 2023, and effectively broke down silos by fostering connections and trust<sup>49</sup>. This approach adopted a systems perspective in prioritising relationships before tackling challenges and provided farmers with a platform to voice concerns and jointly solve issues with value chain partners.

On the R&I side, two noteworthy examples stand out. Plant2Food is a funding platform supporting pre-competitive research partnerships between the food industry and academia, emphasising open sharing of research findings and interdisciplinary cooperation<sup>50</sup>. Horizon4Proteins is another commendable platform, uniting seven EU-funded projects and enabling collaboration among researchers, farmers, producers, policymakers, and anyone interested in sustainable food systems<sup>51</sup>.

49. EIT Generation Food

50. Plant2Food Platform.

51. Smart Protein EU.

## 2. Enabling Policy Environments

To accelerate protein diversification, we need to change how we govern food policy and innovation and create favourable conditions for this transition. This requires addressing various policy aspects that affect protein diversification, from R&I spending, to regulation, the Common Agriculture Policy (CAP), consumer education, and fair competition. Effective coordination will require a more integrated approach, and the EU could consider appointing an alternative protein coordinator, mirroring Israel's initiative.

### Policy Approach: Broad and Ambitious

Governments should establish clear policies as well as long-term commitments that are resilient to economic fluctuations: to inspire consumer confidence and attract private investors<sup>52</sup>.

There is a need for comprehensive legislative frameworks encompassing various food and environmental aspects, including appearance, nutrition, supply length, public procurement, advertising, dietary guidelines, retail, and food services. This has been underscored by both the UN's High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (CFS) and a 2022 WWF vision paper<sup>53</sup>.

The European Alliance for Plant-Based Foods (EAPF) states that to successfully move towards a new sustainable food system in Europe, it is crucial to align vision and ambition with specific, time-bound targets. EAPF says the scientific consensus regarding sustainable food systems and diets should be translated into a clear EU policy vision and ambition<sup>54</sup>.

52. Rima Assi, Hana Dib, David Fine, and Tom Isherwood. (2020). Rethinking resilience: Ten priorities for governments. McKinsey & Company.

53. WWF vision paper. (2022). Valuing Food – For a game changing EU legislative framework for sustainable food systems.

54. EAPF. (2021). EAPF Position on an EU Sustainable Food System Framework.

55. Eat Forum. (2019). Can a Scientific Commission Change the World? Can a Scientific Commission Change the World? - EAT (eatforum.org)

56. Brent Loken et al. WWF. (2020). Bending the curve: the restorative power of plant-based diets.

57. EAPF. (2023). Planting the future of sustainable food systems in Europe.

### Recommendations:

Policymakers should recognise the barriers to behavioural changes and create policies that make it easier for people to modify their habits. Furthermore, policymakers at global and national levels should collaborate to set international and domestic commitments for promoting healthy diets, akin to the way the United Nations Framework Convention on Climate Change (COP27) prioritised food in future sustainability policies<sup>55</sup>. Policymakers should review health guidelines and measures to ensure that protein diversification integrates both sustainability and health considerations. A 2020 WWF report on "The Restorative Power of Planet-Based Diets" suggests forming a group of advocates for food systems and dietary changes, similar to the IPCC (Intergovernmental Panel on Climate Change)<sup>56</sup>. Additionally, it proposes exploring the establishment of a "UN Framework Convention on Healthy and Sustainable Food Systems."

At the EU level, future policies, starting with the EU Protein Strategy, should fully recognise the importance of protein crops for direct human consumption, as well as other alternative proteins. On the plant-based side, this recognition should encompass both protein-rich crops like soybeans, and non-protein crops such as grains, taking into account the implications for both food and feed security<sup>57</sup>. Agricultural policies should shift the focus from a limited range of crops, many of which are used for animal feed, to promoting a wider array of protein sources that can contribute to biodiversity enhancement. The aim is not only to produce sufficient calories to feed the growing global population, but to generate a variety of foods that promote human health and uphold environmental sustainability. Exploring the establishment of a commission to oversee the EU protein strategy is advisable. The Commission should also encourage Member States to develop their own national protein diversification strategies and establish key performance indicators (KPIs) to evaluate their effectiveness.

The CAP should take a central role in advancing protein diversification within the EU food system. It is vital to integrate food and agricultural policies while ensuring greater coherence in the CAP's transformation ambitions. Reevaluating subsidies is essential, considering a shift from area-based incentives to climate impact-based approaches, or redefining them as food-system subsidies. The CAP could also be more effectively used to promote legume cultivation, possibly by establishing dedicated funds for cultivating protein-rich crops for food on set-aside land and for assisting farmers in converting their crops into attractive food products. These efforts should focus on enhancing crop resilience, increasing protein yields, and improving protein quality.

The upcoming EU legislative framework for Sustainable Food Systems (SFSF) should outline binding rules to offer businesses reliability and predictability. Recognising the urgency posed by imminent threats like climate change and biodiversity loss, substantial action must commence promptly. Although voluntary measures and agreements can serve as initial steps, lasting change demands the development of ambitious and binding regulations, as emphasised in the Joint Research Centre Policy Lab reflection paper<sup>58</sup>.

Moreover, echoing the position of the European Alliance for Plant-Based Foods, the EU should address legislative fragmentation that hinders the effective implementation of food sustainability policies. Fragmentation leads to unfair market conditions, making sustainable foods such as plant-based options more expensive and less accessible to consumers (e.g., due to different VAT rates across EU countries and other distorting taxes). Public procurement can also serve as a tool to accelerate the alternative protein transition and foster healthier dietary habits in settings like schools, hospitals and universities.

There should also be a stronger link between protein diversification and the bioeconomy. The upcoming update of the EU Bioeconomy Strategy is an opportunity to emphasise protein diversification more explicitly. This update should be prioritised, given the evolving context around food security. The EU could prompt Member States to acknowledge the importance of food within their national bioeconomy strategies.

58. Anne-Katrin Bock, Laurent Bontoux and Jennifer-Ellen Rudkin. (2022). Concepts for a sustainable EU food system. Joint Research Center (JRC) Publications.



### 3. Regulation

To unlock the potential of alternative proteins in creating a more secure food system, consumers must have confidence in the food they eat and the regulatory framework that approves it. Regulation interacts with many aspects of protein diversification, right across the food system, with new ingredients, processes, practices, and terminologies. Among others, it is implicated in new plant-breeding technologies, taxation, environmental impact assessments, and labelling. Certain regulations apply only to certain parts of the food system. However, they also impact the entire system by fostering confidence among both consumers and investors. To see the full economic, environmental, and societal benefits of protein diversification – and to become a world leader in this space – the EU needs to assess how its different regulatory frameworks are either hindering or enabling innovation.

In the EU, most alternative protein products require authorisation under the Novel Food Regulation, which is among the most robust regulatory frameworks in the world<sup>59</sup>. As different regions have various levels of regulatory stringency, there is international competition on food innovation, and the EU may be at risk of falling behind.

As we see other regions moving ahead with regulatory approval of cultivated meat, and European companies applying outside of Europe, the EIT Food Think Tank urges the European Commission to assess how the implementation of the Novel Food Regulation could be improved. This is the correct framework to assess novel protein products; however, the way it is implemented is making producers reconsider entering the EU market. Bureaucratic inefficiencies, uncertainties, and procedural non-transparency, which are often unrelated to food safety, may deter them from choosing the EU as a market launch destination, as outlined under the Protein diversification developments in 2023 section.

In September 2023, GFI Europe surveyed alternative protein producers on the EU regulatory authorisation process and its implications for businesses. All participants stated that the EU pre-market authorisation framework had caused them to delay or rethink submitting an authorisation request in the EU.

- **Guidance:** Respondents consistently raised the quality and specificity of guidance provided to novel food producers as a concern. One respondent argued “There is no single guidance document for novel foods. Instead, we have a multitude of documents covering many sectors, often cross-referencing each other. EFSA’s latest thoughts on a topic may sometimes be found in guidance documents covering different applications.”
- **Consultations:** Respondents clearly expressed that the challenges lie in the implementation of the novel food framework rather than the regulation itself, with one stating: “The Novel Food Regulation is fit for purpose and the timelines outlined in the regulation are acceptable. However, [...] the fact that applicants cannot engage with EFSA during pre-submission consultations adds to uncertainty.”
- **Best practices:** Respondents agree that EFSA could use pre-submission consultations to support producers. One declaring: “Many of the clients we represent are not interested in submitting an EU novel food application because of the uncertainty. Pre-submission advice (as seen in Singapore, USA, Australia & New Zealand) is important. It not only helps the applicant to create a more robust data set and dossier, but it also helps the regulator to understand the technology before the dossier is submitted.”
- **Stop the clock process:** Respondents pointed to examples of novel food submissions which have been undergoing completeness and validity checks for over a year without any public update. This has eroded confidence in EFSA’s ability to ensure transparency and clarity in the authorisation process. One respondent stated “EFSA’s current approach can be argued to violate both the spirit and the text of the Novel Food Regulation”.

59. GFI Asia Pacific. (2023). Novel Food Regulations Around the World.



There are actionable steps the Commission could take to ensure the framework is attractive to producers whilst maintaining high consumer safety standards. Many of these could be implemented without lengthy legislative or regulatory reform which could delay innovation.

The European Food Safety Agency (EFSA) and the European Commission should swiftly enhance transparency of the regulatory framework for

alternative protein while maintaining high food-safety standards. Progress is evident, as seen at the 2023 Scientific Colloquium on Cell culture-derived foods where EFSA displayed openness to novel foods applications and stakeholder feedback for guidance updates. However, EFSA should prioritise non-legislative measures which can be enacted without the need for a potentially lengthy regulatory revision.

## Recommendations to improve the pre-submission period for product authorisation:

**Pre-submission guidance:** The European Commission should work with EFSA to create specific guidance for producers regarding the preparation of safety dossiers for novel fermentation-derived, plant-based and cultivated products. Guidance should provide clear advice on technical requirements and evidence thresholds needed for risk assessment under the Novel Food Regulation. EFSA could take inspiration from the Singapore Food Agency's Requirements for the Safety Assessment of Novel Foods and provide detailed technical information on dossier preparation and safety assessments, broken down by production methods. To protect regulatory capacity, the EU could mirror Food Standards Australia and New Zealand (FSANZ)'s self-service tool, which determines whether a food is novel or not and identifies the relevant authorisation framework.

**Pre-submission consultations:** The EC should create a process for companies to discuss issues like data requirements for toxicology and nutritional testing, production processes and allergens with EFSA before submitting safety dossiers. This could help to build a shared knowledge base and prevent unnecessary assessment delays. The consultation process could be managed by EFSA's front-desk team to maintain scientific independence and reduce transaction costs.

**Pre-market product tastings:** The EC could take inspiration from the pragmatic approach of the Netherlands and establish a framework for companies to gather feedback on novel products through pre-market tastings with consumers. This framework should be developed with input from Member States and include safety criteria and monitoring measures for tastings.

## Recommendations to support with product development:

**Food safety regulatory dialogue:** EFSA can draw insights from examples of collaborative food safety regulation such as the Singapore Future Ready Food Safety Hub (FRESH), which facilitates cooperation between regulators and industry on novel food safety capabilities whilst fostering innovation. Taking inspiration from the UK Financial Conduct Authority's regulatory sandbox, EFSA could enable producers to test products in a controlled environment whilst receiving support in identifying consumer protection measures, ensuring the safe market entry of innovative products. Developing regulatory test beds would also allow companies to benefit from the collection of insights and data required for official submission dossiers. EFSA can also consider a process similar to FSANZ's, where they review draft food safety dossiers and offer feedback for a fee. This approach helps regulators anticipate product trends and pre-emptively resource risk assessment functions.

**Public databases and reference materials:** To promote transparency in the regulatory approval process and encourage innovation through open-access published research, EFSA should collaborate on a public database of pre-approved substances, ingredients and production processes. This database would resemble the US FDA's Inventory of Completed Pre-market Consultations for Human Food Made with Cultured Animal Cells, a public-facing resource on completed pre-market consultations. This database would help consumers find information about new products and serve as a valuable resource for innovators in shaping product development.

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Photo credit: Wildtype



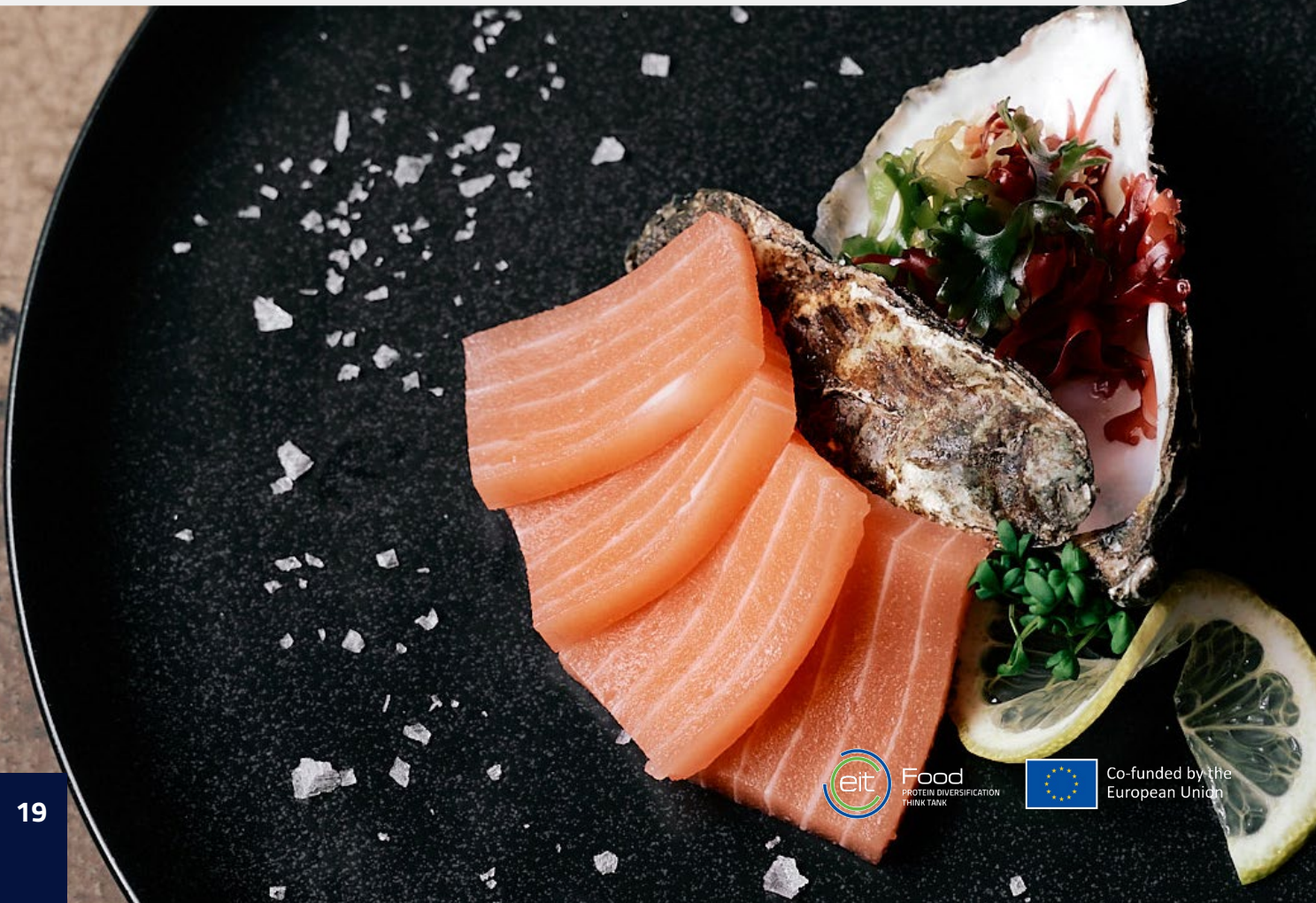
## Recommendations to support with the authorisation procedure:

**Additional information requests:** EFSA and the European Commission should clarify the uncertainty regarding “stop the clock” procedures in risk assessment. There is currently confusion about when the processes can be initiated during the completeness and validity phase of the authorisation process, as well as their frequency and duration. Some requests can extend timelines by a year, regardless of how quickly producers provide EFSA with the required information. EFSA should explore expediting the analysis of additional data submitted during stop-the-clock processes. Providing clarity on when timelines can be shortened would support producers in making informed decisions.

**Enabling flexibility in dossier review processes:** There is a disconnect between the dynamic nature of the alternative proteins sector and the time taken for EFSA to issue approval, which risks allocating resources to outdated applications. Therefore, companies should have the scope to amend existing applications to reflect changes in production processes, and EFSA should clarify the acceptable changes in advance. The EC should streamline the authorisation process by eliminating the need for products to undergo authorisation under multiple frameworks. Some products must be authorised under both the Novel Food Regulation and Flavourings, or other regulations with similar food safety criteria, hence duplicating work for applicants and EFSA without clear benefit to consumer safety.

**Prioritising food safety considerations:** The authorisation process involves risk assessment by EFSA, followed by risk management from the [Standing Committee on Plants, Animals, Food and Feed \(PAFF\)](#). The PAFF Committee’s goal is to ensure Commission recommendations are practical and effective. However, as a forum involving 27 governmental actors, it can also lead to politicised decisions. Novel food authorisations must prioritise consumer protection and food safety above all other considerations.

Photo credit: Bluu Seafood



## 4. Farming

Farmers are pivotal to protein diversification and farming transformation, in environmental, social, and economic terms. Their role in the food system is crucial not only for adapting to changing climatic conditions, but also to adapt to new value chains, to changing consumer demand, and in many cases to invent innovative business models to ensure financially sustainable transitions.

Farmers will continue to grow the ingredients needed for alternative proteins, whether as raw materials for plant-based proteins, or as feedstock for insects, fermentation, and cultivated proteins. Taking cellular agriculture (fermentation or cultivated meat) production as an example, farmers have a key role to play. Microbes and other cells used in this technology require nutrients, especially carbon sources, which can be obtained from existing agricultural supply chains. Byproducts from conventional agriculture, like straw, husks, and parts of vegetables such as tops and stems, may function as feedstocks for cell cultures. Instead of composting or using these materials for energy generation, farmers can generate income from the biomasses produced in their fields and during post-processing. The cultivation of new feedstocks, such as grass and other plants in agricultural fields could also potentially create a new revenue stream for farmers.

In Finland, it is estimated that grassland could supply enough material for microbial protein production that could meet the dietary protein requirements of the Finnish population more than twice over. Surplus agricultural and food industry byproducts could also be transformed into food through microbial processes.

It is essential to acknowledge that farmers are under substantial pressure to embrace innovation. Involving farmers in the protein transition can be complex, as it involves significant changes that may challenge traditional farming practices. Farmers also need to acquire new skills and competencies to provide environmental services and better manage natural resources and biodiversity.

To make the protein transition successful, all stakeholders need to work together to establish and expand future food supply chains. This involves reaching a consensus among all parties involved about their shared vision, needs, expectations, requirements, standards and strategies for scaling and funding the transition. Cooperatives are a useful collaboration model in this context. They are well-suited for driving change because they have the necessary resources and processing capabilities. Moreover, farmers are often less resistant to switching from high value-added products (e.g., cow's milk) to lower value-add products (e.g. growing oats) when they can see financial benefits shared throughout the cooperative.

### Best-practices – Farmers & Food Business Operator Cooperatives

When farmers and processors work together in the same cooperative within the plant-based value chain, it can ensure that shifting to plant-based alternatives does not result in losing high-value products from the farm. Some notable examples of dairy cooperatives that also produce plant-based products include:

**Lantmännen**, a Swedish farming cooperative and Northern Europe's agricultural leader, which invested SEK 1 billion in a pea protein production facility in 2022.

**Valio**, a Finnish company founded by 3,700 farmers in 1905, channels all payments to farmers through dairy cooperatives while also manufacturing plant-based alternatives to milk, dairy, and cheese.

**Axereal**, a prominent French cereal cooperative, successfully converted over 200 farms to regenerative practices with support from the EIT Food alumni startup Soil Capital. In 2023, Axereal partnered with Intact, investing €55 million to establish a supply chain covering 65,000 ha of regenerative agriculture legume crops like yellow peas and Faba beans, combined with an innovative processing plant.

To prepare for the impact of the growing bioeconomy in Europe on agriculture, especially in terms of the demand for biomasses in biotechnology food, feed, fuel and materials, it is crucial to conduct forward-looking, projection-based studies<sup>60, 61</sup>. These studies should inform a planning process that considers the diverse nature of European territories.

Government policies and open-access technologies are needed to ensure that all farmers and food processors receive the appropriate economic and occupational support. This in turn prevents monopolies and facilitates partnerships between farmers and alternative protein producers. By offering governmental support for repurposing farm equipment and providing a financial safety net during the transition to alternative protein production, both existing and future farmers will feel more empowered to move away from animal-intensive practices<sup>62</sup>.

### Protein Diversification and Sustainable Agriculture

Scaling up sustainable meat production will require an expansion of pastureland, which should be sourced from existing cropland rather than encroaching on wilderness areas. This, however, poses risks of reducing the availability of crops for animal feed. Therefore, it should be coupled with more efficient land use, with one of the most efficient options being to scale up protein diversification, e.g., mapping which protein crops are most suited for various regions within Europe.

As regenerative agriculture practices show potential for increasing the nutritional quality of crops, monitoring of nutritional quality and further comparable studies are needed to establish how specific agricultural practices could increase the nutritional content of various crops<sup>63</sup>.

60. EIT Climate KIC. (2021). New report details way forward as future biomass demand may exceed supply.

61. Euractiv. (2022). The Green Brief: Europe's big biomass dilemma.

62. Ruokatieto. (2022). Forkful of facts, Finnish Food Chain Statistics.

63. Frontiers. (2023). Do agronomic approaches aligned to regenerative agriculture improve the micronutrient concentrations of edible portions of crops? A scoping review of evidence.

64. Euractiv. (2023). EU lawmakers insist on monetisation of carbon farming.

### Recommendations:

**Transformation process:** Given the diversity within the farming sector, it is crucial to prioritise support for smaller farmers during the transition. Sustainable agricultural practices should be the focus, ensuring fairness and equity. Moreover, farmers must receive assistance in enhancing their planning, forecast and preparedness for the impact of climate change in the decades ahead. As outlined in recommendation 2, the future Common Agriculture Policy will play a crucial role in driving protein diversification in the food system. Government grants, tax credits for equipment, retraining programmes, and land repurposing can strongly motivate farmers to shift toward alternative proteins.

**Policy measures:** Establishing collaborations can expand production options while ensuring safer working conditions for farmers. Farmers should be seen as custodians of the land, and receive from governments the tools and certainty required to adapt to changing circumstances. In the future, farmers should be compensated for their role, including for activities like reforestation and protecting eco-systems, while Carbon Farming will also have a central part during the transition<sup>64</sup>.



## 5. Research, Development & Innovation

Bottlenecks in research, development, and innovation (RDI) need addressing in order to meet soaring demand for alternative proteins and to make sure that they can deliver the same experience as their animal-based counterparts, all while remaining accessible to as many citizens as possible. Open-access public RDI can help solve pre-competitive research challenges, thus making sustainable options more efficient, attractive, and affordable. Public funding is essential as it ensures that knowledge is shared across the industry, prevents duplication of efforts, and promotes sector-wide growth.



### Structural Principles for Boosting Public RDI Funding

Public funding is needed as it provides confidence to consumers and investors. It can encourage greater flows of private funding as well as sending a positive signal to consumers.

- Fund emerging fields and topics with low Technology Readiness Levels. This is critical to help them mature to a point where industry and society can integrate and adapt.
- Establish (new) specific funding programme(s) for protein diversification, to support targeted research, development, and innovation (RDI).
- Encourage pre-competitive alignment funding as this is crucial to foster collaboration, scaling up, cost reduction, and export.
- Consider regional needs by utilising cluster funding.
- Ensure holistic engagement of SMEs and large businesses as well as industry leaders (collaboration with food industries can help bring innovations to market quickly).
- Explore instruments for scouting emerging technologies used/developed in other sectors like the textile industry or plastics that can be adapted for food production.
- Ensure funding is open to organisations of all sizes.
- Funding for open innovation and discovery research can break knowledge silos and address the pressing requirement for interdisciplinarity in the way we design and execute research in protein diversification.



## Recommendations:

**Value-chain funding:** Developing value chains for protein diversification, including meat industry involvement (as the “classical” processors) as well as new processing technologies, should become a focus. Comprehensive funding is required across the entire RDI chain, from addressing fundamental challenges, to bringing down costs and improving sensory experiences, and developing scale up and piloting infrastructure. Within Horizon Europe, dedicated RDI funds should be allocated to optimise and innovate alternative protein processing techniques.

Additionally, when developing value chains related to new production methods like cellular agriculture, it is important to consider various opportunities, such as using side streams as nutrients/feed stock, and to consider what solutions are needed to ensure sustainable energy and water circulation. The balance between a sufficiently large production scale and short transport distances of inputs should be analysed and optimised. The possible location of production in cities, their suburbs or rural heartland areas and the environmental and economic impacts of the logistics of these alternatives should be investigated. Exploring decentralised local production can contribute to rural development and supply security in Europe, but it is essential to ensure sufficient infrastructure, as is outlined in recommendation 7.

A part of the research budget should also be dedicated to fundamental and applied food system research actions with the objective of improving the understanding of how food systems function. It should focus on the role of actors and their interactions, to be able to identify leverage points for intervention.

**Funding to enhance alternative proteins:** RDI funding should prioritise addressing the primary drivers of alternative protein consumption, which are taste, price, and convenience. Replicating the taste and texture of animal-based products is a challenge requiring further RDI. Technologies such as solid-state fermentation, extrusion, and heat treatments are vital for meat analogue production. Precision fermentation can also provide tools to enhance the sensory quality of meat alternatives, such as by producing lipids, colours, and taste-giving proteins. In particular, this should be explored further with hybrid food development, such as including fermentation-derived proteins in plant-based products. The sensory challenge is even more pronounced in home-cooking, necessitating further RDI to enhance ingredients’ technical properties. Collaboration with meat industry experts and the creation of easy-to-follow recipes are crucial for progress. Furthermore, research should also focus on maximising the nutritional value of alternative proteins by reducing anti-nutritional components in plant-based crops, improving digestibility and bioavailability of new food sources, and assessing how processing impacts nutritional quality. Ensuring the safety and stability of these new ingredients and products is fundamental.

Photo credit: Gourmey

**Recommendations continued:**

**Improving primary production:** More RDI is needed to optimise the cultivation of protein crops for food and thereby make it more attractive for farmers to cultivate. This should focus on crop reliability, new protein sources, crop breeding for higher protein content and functionalities. Moreover, it should include consideration of developing crops to be more resilient with the changing climate. Embracing new breeding technologies is also a key driver, such as by enabling access to the most competitive technical tools like Novel Genomic Techniques (NGTs). Research in this area could empower farmers to take advantage of emerging market opportunities, by improving plant properties and giving farmers insight and tools to start growing crops to supply the plant-based market.

**Strategic funding partnerships:** EU policy-makers should explore amplifying the impact of RDI funding through partnerships, such as by setting up a Horizon Europe Partnership on Protein Diversification.

This partnership would enable a long-term strategy for directing RDI funds while fostering collaboration among key stakeholders. Successful models in Canada and Israel, where RDI funding aligns with policy goals, can be emulated. These partnerships could be with companies or Member States, but also private, philanthropic foundations could have an important role to play here. Our interviews highlighted an interest in this, as the endeavour is considered too big for individual players. Synergies with other funding bodies could be created to accelerate the new sustainable food systems, and private and philanthropic foundations have expressed interest in jointly exploring ways to collaborate with the EU.

Recognising bioeconomy links: Finally, research to explore how to valorise side-streams for use in alternative protein production is a neglected research area and could create new value streams for farmers. SEGES commented that there should also be a focus on dual or multi-purpose crops per design, where a crop is bred/produced for more than one purpose resulting in fewer defined side-streams but two or more 'main streams'.

65. These recommendations are supported by key EU agriculture stakeholders like – COPA & COGECA, FEFAC and EUROSEEDS. FEFAC. (2023). European protein value chain calls to the European Commission and Member States for action.







## Targets for public R&D funding

A recent analysis showed that EU livestock farmers receive 1,200 times more public funding than plant-based or cultivated meat<sup>66</sup>. A report from the European Commission's DG Research and Innovation (RTD) shows that in the period 2007–2020, only 26% of food systems funding (€4.8 billion) aligned with Food 2030 priorities. Within this, just 3% (€135 million) was designated for the "Alternative Proteins and Dietary Shift" pathway, making it the least supported area<sup>67</sup>. This funding level is notably insufficient, especially considering the field is recognised as a priority for Research and Innovation in the Food 2030 Pathways for Action and the Farm to Fork Strategy.

Despite underinvestment, there is substantial demand for RDI funding in alternative proteins. For example, in CBE-JU's 2022 funding call, there were 125 applications across 21 topics, and the only "Proteins" call received 26 applications, constituting 20% of all submissions, with a total funding request of €115 million, which equates to 20% of the available funds. Notably, there are no food-related topics in the 2023 call<sup>68</sup>.

Similarly, public sector funding for food systems RDI at the national level from 2007 to 2020 amounted to €5.5 billion. This funding ranged from 0.1% to 3% of total government RDI expenditure, with most of it consistently directed toward primary production, accounting for nearly two-thirds (63%) of overall spending across EU Member States<sup>69</sup>. The main challenge in boosting national RDI investment lies in the fragmented responsibilities in food policy across various areas, resulting in a lack of strategic direction. To rectify this, Member States could formulate national RDI strategies for food that align with the priorities in the Food 2030 strategy. The above mentioned DG RTD report underscores the same problem, illustrating that RDI funding for food systems is scattered among various organisations, mainly due to the absence of a specific emphasis on food, especially food systems.

66. The Guardian. (2023). 'Gigantic' power of meat industry blocking green alternatives, study finds.

67. European Commission. (2023). FOOD SYSTEMS Research and Innovation Investment Gap Study.

68. Circular Bio-Based Europe Joint Undertaking. (2022). First CBE JU call attracts 125 project proposals.

69. Circular Bio-Based Europe Joint Undertaking. (2023). Second CBE JU call closes with 162 project proposals

Photo credit: Mosa Meat

## 6. Finance

Protein diversification could be the most effective investment to achieve reduction in climate impact, offering the highest greenhouse gas emission reduction for every euro of invested capital, compared with any other industry. When investing in protein diversification, we not only invest in the future of food, but also in sustainability, which is one of the key priorities for Europe. However, developing and scaling new proteins will demand substantial financial investments, whether it is for RDI, labelling, infrastructure, or upskilling. Diverse types of funding sources can be channelled to support the transition. So far, the alternative protein industry has primarily depended on investments from venture capitalists and private equity, with insufficient support from public funds. Therefore, and given the magnitude of investment required to support transitions, it is worth exploring how to incorporate protein diversification in the future CAP and explore innovative financing schemes like carbon farming.

In 2020, private sector investments in alternative proteins totalled \$3.1 billion, whereas public sector investments were negligible. This level of investment pales in comparison to public and private investments made in sectors like clean energy, which amounted to over \$1.4 trillion in 2022. A 2021 study by the UK Foreign, Commonwealth and Development Office and Climate Works Foundation suggested that global public funding for alternative protein innovation needs to exceed \$10.1 billion per year (\$4.4 billion for RDI and \$5.7 billion for commercialisation), in order to unlock the full public benefits. A 2023 report by the European Commission found that only 4% of the EU public funding available under the 7th Framework Programme for Research and Horizon 2020 was aligned with the Food 2030 priorities and pathways, as outlined in recommendation 4. The report recommended assessing potential gaps that may require additional investment to achieve the goals of the Food 2030 initiative.

Furthermore, EU-based food and drink companies tend to allocate a smaller portion of their total output on RDI compared with international competitors. Between 2015 and 2017, EU food and drink businesses invested about 0.2% of their total output in RDI activities, which was considerably lower than companies in South Korea (0.7%), Japan (0.7%), and the US (0.6%). A 2022 European Commission study on R&I expenditure as a percentage of GDP in Canada, China, the US, and the EU, averaged from 2007 to 2019, revealed that 'business RDI' accounted for only 0.66% of GDP in the EU, while it was 1.41% in China and 1.9% in the US.

### Recommendations:

**Role of private funding:** Companies should consider boosting investments in protein diversification to support RDI for creating and refining new ingredients and processes. They should adapt their value chains, including financing infrastructure, to accommodate these new innovations. According to McKinsey, the annual cost for business adopting alternative proteins could reach \$370 billion.

**Role of public funding:** Governments should provide financial support to companies through grants, reducing risks for private loans. Public investments serve a different purpose and are not expected to displace private investments. Instead, they aim to encourage increased private investment by showing political support. Unlike companies focused on short-term profits, public funds can be invested into long-term, forward-looking R&I that catalyse progress and improve products to maximise public benefits, particularly concerning environmental sustainability. The EU and national governments play a major financing role, supporting farmers in their transition and funding the development of infrastructures across the board.

70. Boston Consulting Group. (2022). The Untapped Climate Opportunity in Alternative Proteins.
71. Climate Works. (2021). Global Innovation Needs Assessments Protein diversity.
72. European Commission, Directorate-General for Research, and Innovation. (2023). Food systems: Research and innovation investment gap study.
73. McKinsey. (2022) Make room for alternative proteins: What it takes to build a new sector.

### **Role of public funding continued:**

A 2021 joint report by FAO, UNDP, and UNEP confirms that 87% of the \$540 billion allocated to support agriculture is either price distorting or detrimental to the environment and health. It calls on governments to reconsider how they subsidise agriculture<sup>74</sup>. Redirecting these funds towards public goods and services for agriculture, such as research, development, and infrastructure, as well as decoupled fiscal subsidies, is essential. The report also shows that worldwide, agricultural support, including price incentives and fiscal subsidies, account for an average of \$540 billion annually from 2016 to 2018. Nearly \$294 billion is allocated to farmers through price incentive policies, and approximately \$245 billion in fiscal subsidies, with more than \$90 billion directed toward input usage and \$10 billion for output levels. Of the total fiscal subsidies, almost 60%, equivalent to \$142 billion, are defined as 'subsidies based on factors of production', with \$73 billion provided to farmers conditional on planting certain crops or maintaining a herd of livestock. In high-income countries, agricultural support was 40% of production value in 2005, down to 28% in 2018<sup>75</sup>.

The EU has allocated a significant part of its €387 billion annual CAP budget to income and market support (€291 billion), and €95.5 billion to support rural development for the period 2021–2027. Between 2023 and 2027, there is a stronger emphasis on enhancing agriculture's contribution to the objectives of the European Green Deal, with a minimum of 25% of direct payments to be directed toward eco-schemes promoting environmentally friendly farming practices<sup>76</sup>. In a 2023 report, a coalition of European organisations proposed establishing a separate subsidy system outside of the current CAP (under the Sustainable Food System framework legislation) to accelerate protein diversification. This seems to be supported by Copa&Cogeca, FEFAC and Euroseeds, through a statement released in 2022<sup>77</sup>.

74. UNDP. (2021) A Multi-Billion-Dollar Opportunity: Repurposing agricultural support to transform food systems.

75. UNDP. (2021) A Multi-Billion-Dollar Opportunity: Repurposing agricultural support to transform food systems.

76. European Commission. Common agricultural policy funds.

77. FEFAC. (2023). European protein value chain calls to the European Commission and Member States for action.

### **Possible contributions from the European Investment Bank (EIB):**

Protein diversification is a critical topic impacting sustainability and resilience on a geopolitical level. Technologies and infrastructures for future alternative proteins are poised to become highly competitive assets. Initiatives like the Bold Goals for US Bioeconomy and Biomanufacturing and the USDA Investment in Climate Smart Commodities show that other regions have initiated voluntary investment programmes to support the development of strategic technologies. In the EU, the role of institutional actors like the EIB in supporting European solutions is essential to remaining competitive.

### **Looking for Future Models - Carbon Farming**

Funders and farmers often use traditional instruments such as investment, grants and subsidies, which mainly support technological innovation and infrastructure creation (such as manufacturing, labour, and value chains). However, new and innovative financing schemes are necessary to support the large-scale transitions and the adoption of agroecological practices.

One such approach is carbon farming, which focuses on capturing and storing carbon dioxide in the soil and places land managers in charge of environmental and climate management. Carbon farming schemes can significantly impact business models and contribute to the shift toward future low-carbon food value chains. These schemes involve creating new types of contracts among all actors within a given supply chain, from farmers to brands and retailers. They ensure the generation of certificates and carbon credits – a financial complementary subsidy for land managers – which can cover the cost and risk of transition. Many protein crops and legumes are among the most efficient carbon sequestration crops and thus, ideal candidates to generate carbon credits that farmers need to finance their transition.

While there are still challenges to address, carbon farming schemes are a key financial lever for the future of food. They should be a priority topic in upcoming EU food policy discussions.

## 7. Infrastructure

Investments and RDI into infrastructure will be crucial to scale up alternative proteins, bring down costs and ensure affordability for a wider population. Infrastructure challenges differ depending on the type of protein, yet they share a common characteristic: they cannot be entirely addressed by the private sector alone. These encompass challenges within biotechnology, such as scaling up fermentation and cultivated meat production, limitations in on-farm infrastructure, and a deficit of processing equipment. An interesting example of comprehensive public support for plant-based infrastructure is the French Protein Plan. It allocates €100 million from the French Recovery Fund to plant proteins, including a €20 million fund to support farmer investment in specific equipment for the cultivation, harvesting and drying of protein-rich plant species, €50 million to establish stronger supply chains, and €27 million for RDI initiatives.

### The infrastructure gap

If the demand for plant-based meat and fish continues its current growth, it could represent around 6% of the global meat and fish market by 2030, equating to approximately 25 million tonnes – roughly six times the present production levels<sup>78</sup>. According to GFI, an estimated 800 large-scale plants globally and \$27 billion in investments would be required. This would require substantially more processing capacity than currently available to cater to the projected demand for alternative protein. It would entail tripling global soy protein concentrate supply and increasing pea protein supply tenfold. In the short term, it is crucial to rapidly build the infrastructure for the upstream supply chain to avoid shortages and higher prices for consumers.

78. Good Food Institute. (2022). Plant-based meat: Anticipating 2030 production requirements.

79. Good Food Institute. (2023). Manufacturing capacity landscape and scaling strategies for fermentation-derived protein.

80. Good Food Institute. (2023). Bio Base Europe – visiting the bridge over the innovation 'valley of death'.

Photo credit: Formo

In the long run, to support fermentation and cultivated meat, it will be essential to ensure sufficient biomanufacturing capacity to unlock economies of scale. Within the fermentation sector, a significant hurdle in scaling up is limited technical capabilities and capacity at the laboratory and demonstration level. Of all existing capacity across the fermentation value-chain, only 4% is at the laboratory and demonstration scale<sup>79</sup>. Pilot plants are either in the planning stage or under construction. According to a McKinsey study, global fermentation capacity must increase from 10-20 million litres to 220-440 million litres by 2030 to meet 1% of the global meat market. Moreover, there is also a need to create scale-up facilities for companies to develop their proof of concept to attract private investment. One example of such a facility is Bio-based Europe in Belgium, which was funded through a public-private partnership<sup>80</sup>.



## Recommendations:

While support for cleantech infrastructure at EU level has been promising, through the Innovation Fund and NZIA, there is a lack of similar support for biomanufacturing, including in the food industry. To maintain a leading position, coordinated government investment in infrastructure is needed in the EU. Building such plants often requires more capital than innovative startups can raise through venture capital. De-risking is the key, which means reducing investment risk through public financial instruments and a clearer policy framework. Policymakers can help during the critical scaling phase with loan guarantees, incentives for minimum purchase contracts, and public subsidies.

Governments can also support the conversion of plants that are no longer used in other sectors for the protein transition.

A 2023 GFI report suggests European businesses repurpose existing food industry facilities to allow for rapid capacity expansion, taking days or months instead of the three-year timeline for new construction, and at potentially only 20% of the cost of a new build<sup>81</sup>. In the realm of fermentation-made foods, retrofitting existing fermentation facilities from parallel industries, like beer, wine, and biofuels, has proven being particularly suitable<sup>82</sup>.

To increase bioeconomy circularity, there should also be a focus on more versatile, multifunctional biorefining. This approach involves refining agricultural side stream inputs in a way that different components can be used for various outputs, ultimately leading to greater collective output and added value. While these technologies are well-established and have high Technology Readiness Levels, they require greater integration into the value chain, as suggested by SEGES.

## Best practices - Singapore, Israel, Canada, and Qatar

Singapore has become a world leader in alternative protein research and infrastructure funding<sup>83</sup>. In 2020, the Singaporean agri-food firm Life3 Biotech set up the country's first local, plant-based protein pilot production facility supported by the Singapore Food Agency and Land Authority.

Between 2011 and 2021, the Israeli Innovation Authority (IIA) granted \$24 million across the country to support the establishment of alternative protein startups and aid more mature startups in building pilot facilities. In 2021, the IIA granted \$2 million for supporting the construction of pilot facilities for alternative protein startups. A year later, it earmarked over \$14 million in a call for proposals to establish pilot and demo-scale RDI infrastructure in the fields of microorganism fermentation meeting production volumes of 10 to 20,000 litres<sup>84</sup>.

Canada has invested nearly \$100 million in infrastructure dedicated to plant proteins<sup>85</sup>. Merit Functional Foods received CA\$90 million (\$70 million) in repayable contributions and debt financing from Farm Credit Canada, Export Development Canada, and the Agriculture and Agri-Food Canada's Agri Innovate Program in 2021.

Doha Venture Capital, a state-backed investment fund, and the Qatar Free Zones Authority announced plans to construct a \$200 million Eat Just cultivated meat production facility in Doha.

81. Good Food Institute. (2023). Plant-based meat manufacturing capacity and pathways for expansion.

82. Good Food Institute. (2023). Manufacturing capacity landscape and scaling strategies for fermentation-derived protein.

83. Singapore Food Agency. Singapore Food Story R&D Programme.

84. Innovation Israel. (2022). Call for proposal to establish infrastructure for microorganism fermentation by a service provider focusing mainly on novel food.

85. Cision. (2020). Boosting Canada's reputation as a global leader in plant proteins.

## 8. Going to market

Numerous global reports emphasise the need to take into account diverse aspects of food environments, including physical, economic, political, and socio-cultural factors. These factors influence how individuals interact with the food system and shape their choices and behaviours when it comes to obtaining, preparing and consuming food<sup>86, 87, 88</sup>. By redesigning food environments, we can foster a transition toward greater consumption of alternative proteins.

### Recommendations

**From the demand side:** The main factor influencing consumers' choices is the flavour and texture of foods. Certain innovative products and brands have been successful by replicating the appearance, taste, and texture of familiar food products. A study conducted in the US by the Food Industry Association confirms that taste was the most frequently mentioned reason to repeat consumption of plant-based foods, but also remains the top barrier for those who have not yet tried them<sup>89</sup>. More than half of the surveyed grocery shoppers are reluctant to explore new plant-based alternatives due to taste concerns and the confusing labelling mechanisms for these products.

The second key lever is price. We must bridge the cost disparity gap between new alternative proteins (typically smaller scale, requiring extensive RDI, and using new value chains) and existing options (often larger scale, well-established value chains, boosting high yields, and productivity). The SAPEA Food Policy Evidence report (June 2023) concludes that pricing based on environmental impact, along with lower taxes on healthy and sustainable alternatives, promotes better dietary choices<sup>90</sup>. Progressively introducing taxes on products whose frequent consumption is considered unhealthy and unsustainable can encourage consumers to make healthier and more sustainable choices. Providing subsidies and reducing VAT to make sustainable alternatives, especially alternative sources of proteins and micronutrients, more accessible and affordable, is paramount.

Additionally, realigning subsidies for eco-friendly production systems and implementing anti-poverty measures are vital steps in this transition.

The third lever is availability. A 2022 McKinsey study in the US, UK, France, and Germany found that less than half of consumers believe that their main grocery store stocks the products they need for healthy and sustainable eating<sup>91</sup>. To address this, the report titled "Towards Sustainable Food Consumption" recommends that Member States consider mandating large and medium-sized food retailers, schools, and other facilities to offer healthy and sustainable products and to place them in an attractive way<sup>92</sup>.

The fourth key factor is information. When introducing new categories and innovative foods to consumers who are naturally hesitant to change their dietary habits, building trust is key. This trust can be built through independent endorsement conveyed by accessible labelling. Labels should be supported by solid policy frameworks which are easy to understand, well-governed, monitored and audited. Only such reliable labels, emphasising the benefits of new proteins, can help consumers understand why they should be willing to pay more.

86. Food Policy Coalition. (2021). Food environments & EU food policy discovering the role of food environments for sustainable food systems.
87. Food and Agriculture Organization. (2016). Influencing food environments for healthy diets.
88. Protein Verde. (2023). Plant-Powered Politics, Europe's shift towards a plant-based system.
89. Food Dive. (2023). Taste Trumps all in plant-based consumption, study finds.
90. Science Advice for Policy by European Academies. (2023). Towards Sustainable Food Consumption.
91. McKinsey & Company. (2022). Hungry and confused: The winding road to conscious eating.
92. European Commission. (2020). Towards a Sustainable Food System.

### **Recommendations continued:**

Notably, the EU food industry has hesitated to deploy a Nutri-Score, despite its proven efficiency in countries where it has been adopted. Therefore, it is strongly recommended that food labelling be included in the upcoming legislative framework for Sustainable Food Systems (SFSF). In the future, a robust eco-scoring/labelling approach will be essential for both consumers and retailers. The trustworthiness of label standards plays a significant role in determining whether consumers use labels to guide their purchasing decisions and prevent confusion. Environmental labelling should encompass all product categories, relying on the composition of food products and should be clearly distinguished from nutritional scoring systems, as some products can be nutritious but have a negative environmental footprint.

**Consumer purchase behaviours:** We recommend that alternative protein foods use the same terms as meat and dairy products, along with additional descriptions. This will help provide clear and transparent information about how to use a product, its composition, and its environmental impact. These efforts aim to ensure that alternative protein companies have fair access to markets, creating a level playing field.

**Value chain:** Scaling up the production of alternative proteins requires the creation and expansion of new value chains through cooperation among all involved stakeholders. A recent food systems study by the Joint Research Centre identifies six influential actors shaping food system sustainability.

Among them, large retailers, major food and drink manufacturers, finance and international traders are considered the most influential in shaping the actions and choices of others in terms of sustainability<sup>93</sup>. Manufacturers play a pivotal role in the transition and should communicate reasonable requirements and expectations to farmers to allow for swift adaptation. In certain situations, coalitions may be needed to align similar value chain actors in Europe and address regional and product category disparities. To foster alignment and preparedness for future needs, stakeholder coalitions should engage in foresight and prospective reflections.

93. Joint Research Centre. (2022). Concept for a Sustainable EU Food System.

94. Süddeutsche Zeitung. (2023). Lidl will run an die Flexitarier.

95. Carrefour. (2023). Carrefour teams up with seven industrial partners to launch an international coalition to boost sales of alternative plant-based products.

## **Best practices – Retailers**

In 2023, discount retailer Lidl is making significant strides in boosting plant-based food sales, especially for budget-conscious flexitarian consumers. In Germany they are aligning prices for their private-label plant-based meat and dairy products with their animal-based counterparts. Their goal is to increase plant-based food sales from 11% to 20% by 2030<sup>94</sup>. Other providers should follow this example to remain competitive in the growing plant-based sector.

In September 2023, French retailer Carrefour, in collaboration with major manufacturers Danone, Unilever, Bel, Andros, Bonduelle, Nutrition & Santé, and Savencia, formed a coalition to meet the rising consumer demand for plant proteins. Together, they aim to generate €3 billion in sales from plant-based products by 2026. Carrefour, in particular, aims to achieve €500 million in European plant-based protein sales by 2026, marking a 65% increase from 2022. To reach these goals, they will undertake joint initiatives and establish a steering committee comprising representatives from the eight founding partners. Their objectives include testing innovations in tastes and flavours, running promotional campaigns, providing customer recipes, and sharing best practices in developing plant-based alternatives<sup>95</sup>.

## 9. Education, training, and tools to engage citizens

***The concern about the impact of protein diversification on farmers' employment is essential and it is widely addressed in recommendation 5.***

The food system relies on a workforce with diverse skills drawn from vocational education and training, universities of applied sciences, and traditional universities. Due to the complexity of the food system, the education and training requirements for the sector encompass a wide range of disciplines, including technologies, information and communication technology (ICT), business, management, law, food, agriculture, sensory, farming practices, nutrition, social sector, service industry and providers, art and humanities, health and wellbeing, etc. More joint activities are needed to promote the food sector as an attractive employer.

### Recommendations:

***Future labour needs of the food sector:*** It is important to offer farmers opportunities to enhance their skills and understand their role in the broader food system. Beyond this, there is a growing need to identify skilled and motivated workers for R&I, management, production, processes and logistics – in both industry (including SMEs) and the public sector. In today's fast-paced world, employees are expected to have a broader skill set, enabling them to comprehend and deal with complex items or concepts on a systemic level, rather than specialising in just one area. Moreover, having universal workplace skills like embracing diversity, effective communication, and teamwork, has become increasingly valuable and applicable to many different roles. An important context to this, is that already today, the European food industry suffers from labour shortages<sup>96</sup>.

96. Business Europe. (2022). Labour force and skills shortages: how to tackle them?

Photo credit: ENOUGH

***Life-long learning actions:*** The European food sector is a major employer and involves people of all ages as consumers, buyers, and users. Food plays a key role in our daily lives, giving us a chance to understand the importance of our daily choices on our health and society. Our food preferences are influenced by learned behaviour and genetic predispositions. Parents and adults are influential role models for young people, shaping their adoption of sustainable eating habits. Food also offers a platform for developing social and communication skills, fostering cross-cultural understanding by allowing interaction between people with diverse backgrounds. Sensory-based food education is an example of food education to promote sustainable and healthy eating focusing on motivation through food-related joy and personal experience. This approach easily integrates into pre-school and school activities, in addition to daily eating sessions. Engaging children in these issues can also have a knock on benefit of engaging parents and other adults as active participants in the food system.





## Best practices – Finland & Denmark

While food is not typically included in school subjects like mathematics and physical education, it is possible to integrate food education activities in the curriculum of early childhood care, following the examples set by countries such as Finland and Denmark. Food education is a promising instrument and tool to promote sustainable and healthy eating among children, but also among adults.

### **Recommendations continued:**

**Citizen engagement:** A comprehensive action plan to get consumers to adopt a new mindset and become more aware can include various strategies, such as applying gamification, campaigns, food events, nudging in restaurants and food stores, activities in social media (TikTok, X, Instagram, Facebook etc.), flash mobs, science education activities for the public, food-related camps for children and adults, food influencers and others. Governments should actively participate in developing innovative education programmes that promote alternative proteins and sustainable diets, with a special focus on younger generations who are more open to embrace new dietary habits.

School meals can be a valuable way to engage children and adults within the school environment. For instance, Finland has implemented a programme where every child and young person attending pre-primary, basic and upper secondary education, can enjoy a free, nutritious lunch at school. The school meal directive includes guidelines on the organisation of school meals, collaboration between schools and families, and ongoing monitoring. The guidelines also cover the nutritional quality of the meals and snacks provided. This approach ensures that students not only get nutritious food but also learn the importance of healthy eating practices. There are already several examples of how to apply and exploit societal interaction, and how to engage citizens as actors in food system on different levels<sup>97</sup>.

97. European Food Information Council, Community of Food Consumer Science, Legumes for Sustainable Food System and Healthy Life, Flavoria, Edulia, School Food for change, Nordic Nutrition Recommendations 2023, Finnish National Agency for Education. School meals in Finland, University of Helsinki. Food SystemCity, EIT Food. Food Educators, Suomen Akatemia.2023.

Photo credit: LikeMeat



# CONCLUSIONS

This paper highlights the essential role of protein diversification in addressing critical global challenges that encompass food security, environmental sustainability, and public health. Embedded in the world of food innovation and transition, EIT Food and its Protein Diversification Think Tank has observed a growing emphasis on protein diversification in 2023, that is driven by the conviction that a dramatic reduction in environmental impact is possible. After a year of in-depth reflection, consultations, stakeholder discussions, and expert interviews, this paper affirms that protein diversification should be a cornerstone of future food strategies and is the most impactful lever to reduce agricultural emissions from the food sector.

As a group of stakeholders which has the expertise and duty to recommend how the food system should be transformed, we have presented a comprehensive set of recommendations, advocating for a systems thinking approach and acknowledging the importance of engaging with the entire food system.

Embracing protein diversification fosters innovation, has the potential to create substantial economic opportunities and position EU Member States at the forefront of rapidly evolving sectors spanning and integrating biotechnology, agriculture, and food processing. The adoption of a comprehensive strategy for protein diversification is not solely an option, but a necessity. It represents a transformative shift in how we produce and consume protein, aligning our actions with the imperative to feed a growing population while mitigating the adverse impacts of food production on the environment and human health.

The EU is at a crucial point, with the momentum to address food security and to reduce agricultural emissions. Other regions globally are cementing their roles as innovation leaders in food systems. The EU has the opportunity to claim a leading position too, and investing in protein diversification would allow it to do so. We believe that the evidence-based recommendations outlined in this paper are essential to accelerate progress.

Putting these recommendations into action requires meaningful collaboration among governments, industry stakeholders, academia, and civil society. Only through shared commitments can we address the main challenges of our time, transcend traditional limitations, and foster a sense of global responsibility.

The EIT Food Protein Diversification Think Tank intends to continue this discussion and invites all policymakers and stakeholders to join us to co-create a more sustainable, resilient, healthy, and safe food system.

# REFERENCES

- [ABC News. \(2023\). USDA approves 1st ever 'cell-cultivated meat' for 2 American manufacturers.](#)
- [AgFunder Network Partners. \(2023\). Precision fermentation startups team up to tackle 'black box' EU novel foods process.](#)
- [Aleph Farms. \(2023\). Aleph Farms Submits Application to Swiss Regulators, Marking the First-ever Submission for Cultivated Meat in Europe.](#)
- [Anne-Katrin Bock, Laurent Bontoux and Jennifer-Ellen Rudkin. \(2022\). Concepts for a sustainable EU food system. Joint Research Center \(JRC\) Publications.](#)
- [Answer to Parliamentary question. \(2023\). Reducing dependence on protein imports E-000042/2023\(ASW\)](#)
- [Arla. \(2023\). Novozymes and Arla Foods Ingredients join forces to harness power of precision fermentation.](#)
- [Atova Consulting. \(2023\). The status of alternative protein approvals in the EU, Singapore, UK & the USA.](#)
- [Brent Loken et al. WWF. \(2020\). Bending the curve: the restaurative power of planed-based diets.](#)
- [Carrefour. \(2023\). Carrefour teams up with seven industrial partners to launch an international coalition to boost sales of alternative plant-based products.](#)
- [Cell Based News. \(2023\). TissenBioFarm Signs Joint MOU on Cellular Agriculture Industry Development in South Korea.](#)
- [Circular Bio-Based Europe Joint Undertaking. \(2022\). First CBE JU call attracts 125 project proposals.](#)
- [Circular Bio-Based Europe Joint Undertaking. \(2023\). Second CBE JU call closes with 162 project proposals submitted.](#)
- [Cision. \(2020\). Boosting Canada's reputation as a global leader in plant proteins.](#)
- [Climate Advisers. \(2023\). Decoupling Methane Emissions from Meat with Alternative Proteins.](#)
- [Climate Works Foundation. \(2023\). Global Innovation Needs Assessments. Food System Methane.](#)
- [Climate Works. \(2021\). Global Innovation Needs Assessments Protein diversity.](#)
- [Community of Food Consumer Science \(2023\). Landing Page](#)
- [Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F. N., & Leip, A. \(2021\). Food Systems are responsible for a third of global anthropogenic GHG emissions. Nature Food, 2\(3\), 198–209. doi:10.1038/s43016-021-00225-9](#)
- [Cultivated B. \(2023\). Cutting-edge biotechnology for scalable and sustainable protein production.](#)
- [Daniel Crow, Insa Handschuch, Gabriel Saive and Leonie Staas. \(2021\). Behaviour Change: strategies and case studies for reaching net-zero by 2050. energy-post.eu.](#)
- [Dutch National Growth Fund. \(2023\). Regenerative Agriculture.](#)
- [EAPF. \(2021\). EAPF Position on an EU Sustainable Food System Framework.](#)
- [EAPF. \(2023\). Planting the future of sustainable food systems in Europe.](#)
- [Edulia. \(2023\). Landing Page](#)
- [EIT Climate KIC. \(2021\). New report details way forward as future biomass demand may exceed supply.](#)
- [EIT Food. \(2022\). FoodEducators](#)
- [EIT Food. \(2023\). Healthier Lives through Food Insight Report.](#)
- [Euractiv. \(2022\). The Green Brief: Europe's big biomass dilemma.](#)
- [Euractiv. \(2023\). EU lawmakers insist on monetisation of carbon farming.](#)
- [European Commission, Directorate-General for Research, and Innovation. \(2023\). Food systems: Research and innovation investment gap study.](#)
- [European Commission. \(2020\). Towards a Sustainable Food System.](#)
- [European Commission. \(2023\). Commission recommends carrying out risk assessments on four critical technology areas: advanced semiconductors, artificial intelligence, quantum, biotechnologies.](#)
- [European Commission. \(2023\). Common agricultural policy funds.](#)
- [European Commission. \(2023\). FOOD SYSTEMS Research and Innovation Investment Gap Study.](#)

[European Commission. \(2023\). State of the Union. Letter of intent.](#)

[European Food Information Council. \(2023\). Landing Page](#)

[European Parliament Think Tank. \(2023\) EU protein strategy.](#)

[European Parliament. \(2023\). EU protein strategy.](#)

[FAO & WHO. \(2023\). Food safety aspects of cell-based food. Rome.](#)

[FAO. \(2011\). The state of the world's land and water resources for food and agriculture \(SOLAW\) – Managing systems at risk. Food and Agriculture Organization of the United Nations, Rome and Earthscan, London.](#)

[FEFAC. \(2023\). European protein value chain calls to the European Commission and Member States for action.](#)

[Finish National Agency for Education. \(2023\) School meals in Finland.](#)

[Flavoria. \(2023\). Landing Page](#)

[FMI. \(2023\). Alternative Protein Market Size, Trends & Outlook.](#)

[Food and Agriculture Organization. \(2016\). Influencing food environments for healthy diets.](#)

[Food Dive. \(2023\). Cargill enters alternative fats partnership with Cubiq Foods.](#)

[Food Dive. \(2023\). Taste Trumps all in plant-based consumption, study finds.](#)

[Food Navigator. \(2022\). Why is EFSA yet to receive a novel food dossier on cell-based meat?](#)

[Food Navigator. \(2023\). EU novel foods regulation 'hindering innovation' in meat alternatives sector.](#)

[Food Policy Coalition. \(2021\). Food environments & EU food policy discovering the role of food environments for sustainable food systems.](#)

[Frontiers. \(2023\). Do agronomic approaches aligned to regenerative agriculture improve the micronutrient concentrations of edible portions of crops? A scoping review of evidence.](#)

[Gaynor Selby. \(2022\). Dutch government invests record €60M to boost cellular meat & agriculture. Food ingredients 1st.](#)

[Generation Food. \(2023\). Landing Page](#)

[GFI Asia Pacific. \(2023\). Novel Food Regulations Around the World.](#)

[GFI Europe. \(2021\). Denmark announces 1 billion kroner for plant-based foods in historic climate agreement.](#)

[GFI. \(2022\). Market insights on European plant-based sales 2020-2022.](#)

[Good Food Institute. \(2023\). Bio Base Europe – visiting the bridge over the innovation 'valley of death'.](#)

[Good Food Institute. \(2023\). Manufacturing capacity landscape and scaling strategies for fermentation-derived protein.](#)

[Good Food Institute. \(2023\). Plant-based meat manufacturing capacity and pathways for expansion.](#)

[Good Food Institute. \(2023\). Plant-based meat: Anticipating 2030 production requirements.](#)

[Innovation Israel. \(2022\). Call for proposal to establish infrastructure for microorganism fermentation by a service provider focusing mainly on novel food.](#)

[Institute of Agrifood Research and Technology. \(2023\). The Department of Climate Action and IRTA promote CiPA, a pioneering center in research and innovation on alternative proteins. BioTech.](#)

[Joint Research Centre. \(2022\). Concept for a Sustainable EU Food System.](#)

[Leg4Life. \(2023\). Legumes for Sustainable Food System and Healthy Life](#)

[Magnetic Capital. \(2023\). Bold goals for biotechnology and biomanufacturing: Highlights of Biden's plan set the bar for Europe. Medium.](#)

[McKinsey & Company. \(2022\). Hungry and confused: The winding road to conscious eating.](#)

[McKinsey. \(2022\). Make room for alternative proteins: What it takes to build a new sector.](#)

[Meldrum, M., Pinnell, L., Brennan, K., Romani, M., Sharpe, S., & Lenton, T. \(2023\). The Breakthrough Effect: How to trigger a cascade of tipping points to accelerate the net zero transition.](#)

[Mycorena. \(2023\). Landing Page.](#)

[Niels Halberg and Henk Westhoek. \(2019\). The added value of a food systems approach in research and innovation – Policy Brief by Standing Committee on Agricultural Research \(SCAR\) Strategic Working Group on Food Systems. Publication Office of the European Union.](#)

[Nordic Council of Ministers. \(2023\). Nordic Nutrition Recommendations 2023](#)

[Nutrition Investor.\(2020\). Protein diversification: A roadmap for global food companies.](#)

[Plant2Food Platform. \(2023\). Landing Page](#)

[Poore, J., & Nemecek, T. \(2018\). Reducing food's environmental impacts through producers and consumers. Science, 360\(6392\), 987-992.](#)

[Protein Verde. \(2023\). Plant-Powered Politics, Europe's shift towards a plant-based system.](#)

[Rima Assi, Hana Dib, David Fine, and Tom Isherwood. \(2020\). Rethinking resilience: Ten priorities for governments. McKinsey & Company.](#)

[Ruokatieto. \(2022\). Forkful of facts, Finnish Food Chain Statistics.](#)

[Sapere AISBL. \(2023\). Sensory Food Education](#)

[School Food 4 Change. \(2023\). Landing Page](#)

[Science Advice for Policy by European Academies \(SAPEA\). \(2020\). A sustainable food system for the European Union.](#)

[Science Advice for Policy by European Academies. \(2023\). Towards Sustainable Food Consumption.](#)

[Sharon Wrobel. \(2023\). Israel seeks to create R&D fermentation hub to maintain food tech edge. The Times of Israel.](#)

[Singapore Food Agency. \(2023\). Singapore Food Story R&D Programme.](#)

[Smart Protein EU. \(2023\). Horizon Projects.](#)

[Solar Foods. \(2023\). Solein® taking leaps to market: strategic alliance for product development with Ajinomoto Group announced.](#)

[Süddeutsche Zeitung. \(2023\). Lidl will ran an die Flexitarier.](#)

[Suomen Akatemia. \(2023\). Ratkaisuja Suomen](#)

[TechEU. \(2023\). Cultivated meat and seafood tasting is coming to The Netherlands thanks to lobbying by Meatable, Mosa Meat and HollandBIO.](#)

[The Federation of the Food Industry. \(2023\). Improving dialogue between businesses and training providers in the food sector.](#)

[The future of protein production. \(2022\). The Cultured Hub in Kempththal launches in the gateway of Europe for cultured foods.](#)

[The Guardian. \(2023\). 'Gigantic' power of meat industry blocking green alternatives, study finds.](#)

[Tuomisto, H.L. \(2022\). Challenges of assessing the environmental sustainability of cellular agriculture. Nat Food 3, 801-803.](#)

[UK Research and Innovation. \(2023\). Pre-announcement: Alternative Proteins Innovation and Knowledge Centre.](#)

[UN. \(2021\). Food systems account for over one-third of global greenhouse gas emissions.](#)

[UNDP. \(2021\). A Multi-Billion-Dollar Opportunity: Repurposing agricultural support to transform food systems.](#)

[UNEP. \(2023\). 9 Ways Food Systems are failing humanity.](#)

[United Nations Environment Programme and International Livestock Research Institute. \(2020\). Preventing the Next Pandemic: Zoonotic diseases and how to break the chain of transmission. Nairobi, Kenya.](#)

[University of Bath. \(2023\). University of Bath to lead £12M project on revolutionising food production.](#)

[University of Helsinki. \(2023\) Food SystemCity](#)

[Vegconomist. \(2022\). Babybel Parent Company Bel Group and Standing Ovation Partner for Animal-Free Cheese.](#)

[WWF vision paper. \(2022\). Valuing Food – For a game changing EU legislative framework for sustainable food systems.](#)

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## ABOUT EIT FOOD

EIT Food is the world's largest and most dynamic agri-food innovation community. We accelerate innovation to build a future-fit agri-food system that produces healthy and sustainable food for all.

Supported by the EU, we invest in projects, organisations and individuals that share our goals for a healthy and sustainable food system. We unlock innovation potential in businesses and universities and create and scale agri-food startups to bring new technologies and products to market. We equip entrepreneurs and professionals with the skills needed to transform the food system and put consumers at the heart of our work, helping build trust by reconnecting them to the origins of their food.

We are one of nine innovation communities established by the European Institute for Innovation & Technology (EIT), an independent EU body set up in 2008 to drive innovation and entrepreneurship across Europe.

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