

PROTEIN DIVERSIFICATION

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EXECUTIVE SUMMARY

Food systems transformation is critical for meeting our climate goals, and for ensuring individual health and food security by boosting resilience to external shocks. We face the challenge of producing enough nutritious food for our growing global population, whilst reducing our environmental impact at a time of increased competition and scarcity of resources. Protein diversification can play an important role in enhancing the resilience of food systems, in support of the EU's main policy goals.

Alternative proteins, such as those from plants, algae, insects, and ingredients produced with the help of cellular agriculture can make an important contribution toward protein diversification as products or ingredients for food and feed. While certain technologies are more advanced than others, and some protein sources more easily accepted by consumers, alternative proteins have the potential to be a driver to a more sustainable food system.

Partially substituting animal proteins with alternative proteins could lead to large emission reductions and alleviate pressure on land and water use by making more crops available for direct human consumption rather than being used for feed. Alternative proteins could also enable more rapid adjustments to market changes, due to them not being constrained by animal reproductive capacities. This is all while reducing the impacts of intensive animal agriculture on public health.

It is no surprise that a growing number of consumers are turning away from dairy and meat to products made from alternative proteins, for a variety of reasons. Environmental and health benefits are key drivers for the consumption of alternative protein products in Europe, whilst familiarity also plays an important role. This explains the higher uptake of plant-based products, when compared to insects or cultivated meat, which are still viewed with a degree

of scepticism. To drive consumer confidence in the potential of alternative proteins, it will be important to address possible confusion regarding the formulation of these products, as well as their nutritional and environmental profiles.

Policymakers are already taking note of the prospects of protein diversification. For the first time, the European Commission's Farm to Fork Strategy and the Communication on Europe's Beating Cancer Plan recognise the role of a more plant-based diet. Denmark, France, and the Netherlands have all announced investments conducive to protein diversification. Globally, Israel, the United States, Canada, Singapore and China are all leveraging the transition for their respective strategic interests.

Given the important role which proteins play in the European agrifood sector (including both food and feed), their impact on the climate and the sustainability of food systems, this is the right moment to raise these issues on the EU agenda.

As the European Commission embarks on an overarching EU Protein Strategy, there are several critical elements to consider in order to accelerate protein diversification in Europe. In order to achieve higher uptake of alternative proteins, we need to address fundamental knowledge, research and investment gaps, which should be targeted at bringing down costs and improving product formulation. Matching this with an EU regulatory framework which is responsive to these innovative solutions, addressing some of the existing barriers which are currently delaying the production and marketing of alternative products, is an important consideration. Finally, we need to engage in a multistakeholder dialogue to build a long-term vision, projections and a systems approach. Improved coordination and collaboration across the supply chain will be needed to support food producers on this journey and shape the fair, sustainable and resilient value chains of the future, taking into account regional strengths and barriers.



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INTRODUCTION

The transformation towards healthy, sustainable and resilient food systems is critical to reaching key global and European agendas such as the UN Sustainable Development Goals, the Paris Agreement, and the European Green Deal.

Our current food consumption patterns are unsustainable. The number of people who are food insecure is increasing, whilst the prevalence of non-communicable diseases (NCDs) remains high¹. Globally, virtually all countries are affected by some form of malnutrition, ranging from undernutrition, to overweight and obesity, or micronutrient deficiencies. In the EU, over half of adults are overweight², which means there is the risk that no single EU country will meet the WHO Global noncommunicable diseases target of halting the rise of obesity by 2025.

At the same time, we are not reducing the environmental impacts of mainstream agrifood systems fast enough. Food systems account for more than one third of global greenhouse gas emissions, including CO₂, methane and nitrous oxide emissions³. As the world's population grows, increasing demand for food and especially meat will increase competition for land and drive-up food prices. We face the challenge of producing enough nutritious food on less land, whilst reducing our environmental impact and ensuring fair economic value for the agricultural community.

With current food choices, livestock production is one of the most problematic parts of the food system given the burden on planetary health^{4 5} and contribution to food system insecurity as a result of decreasing food supply. Feeding staple crops to

animals to produce proteins for human consumption is an inefficient use of resources, as animals use far more calories of food than they ultimately produce. A more efficient way of using land and biomass is crucial in order to address the huge challenges we face around energy use and food security.

The transition to a healthier, more sustainable and resilient food system requires dietary changes which reduce protein demand from traditional animal sources. Protein Diversification is the transition from an over-reliance on a limited set of resource-intensive animal proteins toward a greater variety of lower impact protein ingredients and food products. This can play an important role in enhancing the resilience of food systems, contributing to meeting the needs of a growing population and addressing the environmental and climate impacts of food production and consumption.

Protein is an important part of a healthy diet. We must continue to produce enough of it in a sustainable way. The growth of the global population, expected to increase from 8 billion people today to almost 10 billion by 2050⁶, will generate a demand for protein which cannot be delivered solely through animal agriculture. There will be an increasing demand for protein in developing countries to ensure we meet the

1. O. Yambi et al. Unravelling the Food-Health Nexus to Build Healthier Food Systems. (2020)

2. Eurostat. Over half of adults in the EU are overweight. (2021)

3. M. Crippa et al. Food systems are responsible for a third of global anthropogenic GHG emissions. (2021)

4. Chatham House. Meat Analogues Considerations for the EU. (2019)

5. Ritchie, H. Environmental Impacts of Food Production. Our World in Data. Environmental Impacts of Food Production. (2021)

6. UNCTAD. Now 8 billion and counting: Where the world's population has grown most and why that matters. (2022)

nutritional needs of the population. At the same time, in developed countries, where protein overconsumption has been reported, a more balanced mix of protein sources could bring both health and environmental benefits. Growing more crops for direct human consumption can improve the environmental performance of food production and consumption, while also increasing economic profitability for farmers⁷.

The development of alternative protein products including meat and dairy analogues (defined as those which mimic animal derived meat and dairy products) has the potential to offer further opportunities for nutritious products with a lower environmental footprint. The average consumer's preference for meat alternatives is heavily influenced by flavour and taste, and providing alternative products with a similar consistency, taste or form can be deciding traits in the satisfaction of consumers⁸. If meat and dairy analogues can match animal products in terms of taste, price and accessibility, it could help consumers to shift consumption patterns toward a more balanced diet.

Governments, corporates and investors around the world are recognising the need for dietary changes and achieving protein self-sufficiency as a growing strategic interest. Meanwhile, increasing numbers of consumers are showing interest in alternative proteins for a variety of reasons, including health, animal welfare and sustainability concerns, taste and gastronomic trends. As a result, investments are being made in alternative protein research to meet new dietary trends, new business development and sustainability strategies, and national policy goals.

At the EU level, protein diversification could contribute toward a wide range of policy goals, notably serving as a driver to the EU's net zero emissions commitment, while forming part of the

response to threats posed by food security, antimicrobial resistance, and zoonotic diseases. National governments have recognised this opportunity and have called for a sustainable plant protein strategy which the European Commission has committed to work on in the near future. It would be important that an updated protein strategy recognises the need for food protein crops.

Changing protein production and consumption requires a broad rethinking of food systems. New value chains would need to be created to support the production and consumption of novel proteins, and reduce the impact brought by a transition to new practices in some farming segments. Involving the farming community and providing a framework to identify new economic opportunities (through knowledge building, improved links with the supply chain and financial incentives) and new farming techniques will be crucial. Knowledge gaps about these new food sources and their health and environmental credentials would need to be further examined and addressed.

In this context, it is EIT Food's aspiration to bring together key stakeholders in Europe from academia, industry, agriculture and consumers to debate about the protein challenge from a technological, nutritional, environmental, social, economic and public policy point of view, to shape a shared vision for the future.

This purpose of this paper is to provide policymakers and agrifood stakeholders with information about the current state of technological developments, the business and societal potential of protein diversification, as well as assist in identifying the needs and opportunities in protein research and innovation for the coming years and suggest recommendations to further accelerate innovation in this strategic sector.

7. As outlined in the Commission's report on the development of plant proteins in the EU, cultivating plant-proteins for food (rather than for feed or premium feed) brings highest profit margins for farmers.

8. Ahmad et al. Plant-based meat alternatives: Compositional analysis, current development and challenges. (2022)

UNDERSTANDING PROTEIN INNOVATION

Alternative proteins, such as those from plants, algae, insects, and ingredients produced with help of cellular agriculture (e.g. microbial biomass, microalgae, precision fermentation ingredients, cultivated animal cells, plant cell cultures) can make an important contribution toward protein diversification. EIT Food funds projects which aim to diversify protein sources through efficient and sustainable production and processing methods to yield high quality, safe, healthy and sustainable products or ingredients for food and feed.

Plant proteins provide a market for both feed and food. Plant proteins which are used in alternative products to meat and dairy can be extracted from conventional plants like soy, oat, fava bean, peas, cereals and nuts, and from non-conventional protein-rich plant sources such as chia, hemp, linseed, rapeseed, as well as protein extracted from grass, green leaves and seaweed. The consumer acceptance rate of plant proteins is high, and the technology readiness level is mature, with recent improvements both in the extraction and use of functional proteins from plant sources. Consumer interest in plant-based alternatives to meat and to dairy is growing both in major European countries⁹ and globally with recent estimates suggesting that plant-based foods could make up 7.7% of the global protein market by 2030, with a value of over \$162 billion¹⁰.



9. GFI. Meat consumption and attitudes towards sustainable proteins in Europe, representative survey by OpinionWay. (2022)

10. Bloomberg Intelligence. Plant-Based Foods Poised for Explosive Growth. (2021)

Traditional fermentation can be used to improve the flavour or functionality of plant ingredients. Similarly, fermentation is a process which uses microorganisms to produce alternative proteins, and this can take different forms. Whole microbial biomass utilisation uses edible unicellular microorganisms such as yeasts, fungi, bacteria or algae, which are often used as a substitute for protein-rich ingredients such as for meat analogues. In addition to whole biomass products, precision fermentation is a technology to produce specific functional ingredients like proteins, lipids, pigments or flavour compounds by using microbes as a production host.

An example of this includes development of precision fermentation to produce egg and dairy proteins for food industry needs by precision fermentation¹¹. While fermentation is still an emerging pillar of the alternative protein industry (when compared to plant-based and cultivated meat which remain primary pillars), and activity has been slowest in precision fermentation, partly due to regulatory challenges, innovation is occurring across all these areas¹². An example is Impossible Foods leghemoglobin which is generally recognised as safe by the US FDA, while in the EU, the company is facing a regulatory challenge over permission to use this ingredient, in part because it relies on genetic modification.

Algae (microalgae and macroalgae) can also serve as an important protein source. As derived from a form of fermentation, microalgae are increasingly recognised as a novel source of protein, complementing land-based agricultural food sources, despite protein extraction methods still being relatively new. The demand for microalgae whole biomass with high protein has been led by the popularity of spirulina, which has a protein content of up to 70%¹³. Companies worldwide are therefore finding ways to integrate microalgae into attractive food products, for instance, as an ingredient in pasta production¹⁴.

Macroalgae (seaweed) is also an emerging alternative source of dietary proteins. Red seaweed proteins for instance have been shown to have equivalent functions to plant proteins such as those from soy and pea, and can be used in various applications¹⁵.

11. Järviö, N. et al. Ovalbumin production using *Trichoderma reesei* culture and low-carbon energy could mitigate the environmental impacts of chicken-egg-derived ovalbumin. (2021)
12. Creasey, S. The fermentation flurry in meat alternatives. Just Food Just Food. (2022)
13. GFI. Technological Review of Algae-based Proteins for Alternative Protein Applications.
14. Rawiwan, P., Peng, Y., Paramayuda, I. G. P. B., & Quek, S. Y. Red seaweed: A promising alternative protein source for global food sustainability. (2022)
15. Rawiwan, P., Peng, Y., Paramayuda, I. G. P. B., & Quek, S. Y. Red seaweed: A promising alternative protein source for global food sustainability. (2022)

Cultured or cultivated meat is animal meat that is produced by cultivating animal cells directly. It is made from the same cell types, arranged in the same or similar structure as animal tissues, which replicate the sensory and nutritional profiles of conventional meat¹⁶. Cultivated meat products are still in their early stages of development and are yet to be approved for human consumption everywhere. Some of the barriers slowing down the development of cultivated meat include access to species-relevant cell lines, sourcing of animal-free and cost-effective cell culture media, the need to develop the cultivated animal cell production process at scale, access to infrastructure and equipment and research for growth medium.

There are other methods of protein diversification which should be noted, including **Edible insects**. These are insect species used for human consumption, whether as a whole or as an ingredient in processed food products. In the EU, insects are considered novel foods and require market authorisation. Currently, just three different insect breeds are authorised for safe consumption: migratory locust, house cricket and mealworm¹⁷. In the US and Canada, however, insects for human consumption are not classified as a novel food and their import and sale are permitted, granted they comply with food safety agency's regulations.

The benefit of both cellular agriculture (especially microbial) and insect farming is that they can use side-streams as their nutrient sources, converting feed efficiently into protein and contributing to the circular economy.



16. Swartz, E. GFI. (2022)

17. European Commission. Approval of third insect as a Novel Food. (2022)

THE ROLE AND POTENTIAL IMPACT OF PROTEIN DIVERSIFICATION IN ADDRESSING FOOD SYSTEM CHALLENGES

Diversifying protein sources becomes critical when accounting for the environmental, health and social implications of food production and consumption.

There is emerging consensus that **increasing the availability and source of alternative proteins could help satisfy the needs of a growing population for nutritious and high-protein products** – which cannot be solely met by traditional proteins – while contributing toward building more sustainable food systems^{18 19}. For alternative proteins to have a wide-reaching impact on food systems, taste and affordability are the most important drivers of consumer choice. However, it is also important that safety, nutritional and sustainability criteria are carefully considered, to ensure the new ingredients have a positive impact.

The food system is both a driver of climate change and deeply vulnerable to the impacts of climate change. Globally, the food system is responsible for between 21%-37% of total greenhouse gas emissions²⁰. These emissions come from crop and livestock activities at the farm level, land use changes including deforestation, and from processing, manufacturing, production and food loss and waste. Animal agriculture is a significant contributor to these emissions within the food system. Continued dependency on animal

agriculture for the supply of the world's protein is incompatible with the Paris Agreement targets of 1.5°C²¹. **Partially substituting animal proteins with alternative proteins could lead to large emission reductions.** For instance, reaching an 11% share of alternative proteins of all protein consumption by 2035 could result in a reduction of 0.85 gigatons of CO₂ equivalent worldwide by 2030²².

Protein diversification can also alleviate other key environmental challenges. The way in which water, soil and land are being used is not only alarming, but also unsustainable in the long-term. **Protein diversification can contribute to mitigate current competition between feed and food for crops**, given that using crops for animal feed results in smaller fractions being available for direct human consumption as food. It could also help achieve a substantial reduction in nitrogen emissions from agriculture²³ and address growing environmental concerns like deforestation. Carefully selected high-protein crops such as pulses can provide additional benefits for soil health and climate adaptation due to their nitrogen-fixing properties²⁴.

18. Frezal, C., C. Nenert and H. Gay. Meat protein alternatives: Opportunities and challenges for food systems' transformation", OECD Food, OECD Food, Agriculture and Fisheries Paper. (2022)
19. FAO. Alternative proteins top the bill for the latest FAO–International Sustainable Bioeconomy Working Group webinar. (2022)
20. Mbow, C. et al. Special report on climate change and land. (2019)
21. Ibid
22. Morach B. et al. The Untapped Climate Opportunity in Alternative Proteins. (2022)
23. Westhoek H. et al. Nitrogen on the Table: The influence of food choices on nitrogen emissions and the European environment. (2015)
24. UN Food Systems Summit. Innovation for Protein Diversification. (2021)



The COVID-19 pandemic and the war in Ukraine have reinforced the understanding that food systems are fragile and prone to disruption. According to a report from the Climate Advisers²⁵, the supply chains for alternative proteins are less vulnerable to disruption than those for animal products. Due to not being constrained by animal reproductive capacities, alternative protein could allow for more rapid adjustments to changes in the market. Alternative proteins, for instance, concentrate production in one factory that does not require the coordination of having animals coming in and out (livestock rearing, transport, processing and distributing)²⁶. **Protein diversification could thus play a role in increasing the security and resilience of food systems.**

Diversifying protein sources would also help reduce the negative impacts of intensive animal agriculture on public health. The impact of intense farming on animal welfare and health is reflected both in susceptibility to disease outbreaks as well as wider societal antibiotic resistance. Animal protein consumption is a leading driver of zoonotic disease, and contributing factor to the rise in intense and unsustainable farming, as well as increased use and exploitation of wildlife²⁷.

Supporting a transition toward greater protein diversity in the short-term could make reaching the EU's climate targets significantly cheaper to achieve in the long run. The Global Innovation Needs Assessment Report predicts that public investment in sustainable proteins would make the Paris Agreement 1.5°C temperature target \$5.49 trillion cheaper to meet between now and 2050²⁸. This is due to a projected reduction of annual methane emissions by 70% and nitrous oxide emissions by 40% by 2050, combined with a twofold increase in annual carbon sequestration by using dramatically less land to produce the same total number of calories.

25. Climate Advisers and Good Food Institute. Why the United States should champion alternative proteins as a food and national security solution. (2022)

26. Ibid

27. UN Environment Programme and International Livestock Research Institute. Preventing the Next Pandemic: Zoonotic diseases and how to break the chain of transmission. (2020)

28. Climate works Foundation. "Protein Diversification". (2021)

CONSUMER PERCEPTION AND UPTAKE OF ALTERNATIVE SOURCES OF PROTEIN

Some sources of alternative proteins are more easily accepted by consumers than others²⁹ with their familiarity (choosing options that are already known), taste and appearance, convenience, healthiness and environmental benefits, among the main food motivations reported³⁰.

A growing number of consumers worldwide are turning to plant-based products as alternatives to dairy and meat. Foods derived from plants are the most available non-animal protein sources in the EU market, therefore consumer research largely focuses on these products. Consumer studies have shown that environmental and health benefits are key drivers for the consumption of plant-based alternatives in Europe, and familiarity plays an important role and perceived appeal in the adoption of plant-based diets³¹ ³². However, consumer perception varies between European regions, for instance, in certain southern and eastern regions of the EU, where meat is perceived as a luxury good, plant-based alternatives are growing at a slower pace³³. In a recent survey in 10 EU countries conducted as part of the Smart Protein Project, taste expectation has been identified as an important barrier toward the dietary shift, in addition to price³⁴. However, concerns about the presence of additives, artificiality and insufficient essential vitamins or micronutrients in the formulation of these products may pose a challenge in consumer uptake³⁵.

A survey by the European Consumer Organisation (BEUC) showed that innovative products like insects or cultured meat are still viewed with skepticism by European consumers³⁶. In a study from Wageningen University which analysed the drivers of consumer acceptance of different alternative proteins, insect protein did not seem to appeal to any consumer group, despite its potential as a sustainable protein source, however the more educated on the health and environmental benefits of insects that people were, the more favourable their attitudes toward insect protein³⁷. Consumer acceptance of cultured meat also seems to be influenced by levels of awareness (highlighting the role of knowledge), perceptions (product properties) and personal traits (such as gender, age, education) over environmental and ethical concerns alone³⁸. The extent to which cultured meat is perceived as unhealthy or unnatural, may increase reluctance towards acceptance of this technology³⁹.

How these alternative sources of protein are positioned can, at times, be controversial. There are some concerns about possible consumer confusion or misunderstanding about the sources of alternative proteins and their overall nutritional and environmental profile, which may affect consumer confidence in the potential of alternative proteins.

29. Onwezen, M. C., van den Puttelaar, J., Verain, M. C. D., & Veldkamp, T. Consumer acceptance of insects as food and feed. (2019)

30. Onwezen, M., Bouwman, E., Reinders, M., & Dagevos, H. A systematic review on consumer acceptance of alternative proteins. (2021)

31. Antoniak, M. A., Szymkowiak, A., & Pepliński, B. The Source of Protein or Its Value? Consumer Perception Regarding the Importance of Meat(-like) Product Attributes. (2022)

32. ProVeg International. 2020. European Consumer Survey on Plant-Based Foods. (2020)

33. M. A. Antoniak et al. (2022)

34. Perez-Cueto et al. How barriers towards plant-based food consumption differ according to dietary lifestyle. (2022)

35. Weinrich. Cross-cultural comparison between German, French and Dutch consumer preferences for meat substitutes. (2018)

36. BEUC. One bite at a time: consumers and the transition to sustainable food. (2022)

37. M.C.Onwezen et al. (2021)

38. Pakseresht, A., Ahmadi Kaliji, S., & Canavari, M. Review of factors affecting consumer acceptance of cultured meat. (2022)

39. Ibid

KEY TRENDS IN GLOBAL MARKETS FOR ALTERNATIVE PROTEINS

The market for alternative protein products is projected to grow exponentially to a value of at least \$290 billion by 2035⁴⁰. In Europe, retail sales of meat and dairy alternatives increased by almost 10% per year between 2010 and 2020⁴¹ ⁴². Several supermarket chains have reported on annual growth rates of nearly 100% for protein alternatives to meat. At this rate, between 11-22% of global meat⁴³, seafood, eggs and dairy are likely to be replaced by alternative proteins by 2035⁴⁴.

Policymakers are taking note of the prospects of protein diversification. For the first time, the European Commission's Farm to Fork Strategy and the Communication on Europe's Beating Cancer Plan recognise the role of a more plant-based diet consisting of less red and processed meat and including more fruits and vegetables in disease prevention and reducing the environmental impact of the food system. Across Europe, governments are investing in research and innovation efforts to accelerate protein diversification.

In 2021, Denmark announced that €168 million in public funding would be made available to invest in plant-based foods – which constitutes the largest investment in plant-based research and development by any EU country to date⁴⁵. France has also systemically invested millions of euros toward developing its domestic production of plant proteins for both feed and human nutrition, with the French government allocating €100 million to the sector based on market needs in 2020⁴⁶. The Netherlands has also increased investment in alternative proteins, to a record funding of €60 million for cultivated meat and precision fermentation in 2022⁴⁷, with a prospect to deploy up to €450 million in the longer term.

40. FAO. Alternative proteins top the bill for the latest FAO–International Sustainable Bioeconomy Working Group webinar. (2022)

41. ING. Growth of meat and dairy alternatives is stirring up the European food industry. (2020)

42. Pardoe, L. Social Market Foundation, Putting British success on the menu: Time for a UK alternative proteins strategy. (2022)

43. Danish Ministry of the Environment and Food. (2018)

44. BCG. Food for Thought: The Protein Transformation. (2021)

45. GFI. 2021. Denmark announces 1 billion kroner for plant-based foods in historic climate agreement. (2021)

46. Duboua-Lorsch, L. France unlocks €100 million to develop its plant-based protein production. (2020)

47. GFI. Netherlands to make biggest ever public investment in cellular agriculture. (2022)



These developments represent an emerging trend which has seen a steady increase in the investment in protein diversification not only at EU level, but globally.

In fact, the leading countries which currently stand out as the main investors in alternative protein production practices are Israel, the United States, Canada, Singapore and China.

Israel has invested more than \$20 million in alternative protein research, including \$18 million for a cultivated meat research consortium⁴⁸. Moreover, Israel-based start-ups were the second largest recipient (after the US) of plant-based food tech investments in the alternative protein industry as a whole in the first half of 2022⁴⁹. In September 2022 in the US, the Biden administration announced plans to invest more than \$2 billion in the biotechnology sector, including for the use of microbes and other biologically-derived resources to make new foods, fertilisers and seeds⁵⁰. Canada has developed a framework to guide the country toward a plant-based ecosystem⁵¹ and invested \$150 million for the development of plant-based foods in 2018.

In turn, Canada's plant-based protein is expected to contribute to more than \$4.5 billion to its GDP growth from primary sources like pulses, soybean, canola and hemp⁵². Singapore has also made robust policy and regulatory decisions to encourage investment in the sector, including the regulatory approval of cultivated meat, to achieve their goal of producing 30% of their nutritional needs locally by 2030⁵³. Last but not least, China's five-year plan for agriculture, published in January 2022, includes references to cultivated meat and other alternative proteins for the first time, which could see an acceleration of the country's research and investment in the sector and increase consumer acceptance⁵⁴.

Given the important role which proteins play in the European agri-food sector (including both food and feed), their impact on the climate and the sustainability of food systems, this would be the right moment to raise these issues on the EU agenda.

- 48. GFI. Alternative Proteins: State of Global Policy. (2022)
- 49. The times of Israel. Israeli companies lead world in plant-based food tech investments. (2022)
- 50. The White House. Executive Order on Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy. (2022)
- 51. The Road to 25 billion: A roadmap for Canada's plant-based food, feed and ingredient ecosystem.
- 52. National Research Council Canada. Sustainable Protein Production program. (2022)
- 53. Singapore food agency. Strengthening our food security.
- 54. Baker, A. China's New 5-Year Plan is a Blueprint for the Future of Meat. Time. (2022)

CRITICAL ELEMENTS NEEDED TO ACCELERATE PROTEIN DIVERSIFICATION IN THE EU

As the European Commission commences work on an overarching EU Protein Strategy, EIT Food and its partners wish to contribute with initial reflections and recommendations which may help guide and inform this process.

Scale and scope of research funding. Alternative proteins and their growth in the EU market can contribute to the transition to a more secure and sustainable food system, in line with Europe's environmental goals. However, in order to scale up quickly enough to meet 2030 and 2050 climate neutrality targets, large-scale open access research and impact-focused public investment will be needed, and this should be targeted at improving taste, texture and bring down costs⁵⁵. Unlike private investment which bounds recipients by short-term profit-making margins, public R&I can be invested into long-term, forward-looking solutions that maximise public benefits.

Alternative proteins and the dietary shift associated with them have not received significant funding during the European

Commission's research programmes Horizon 2020 and its predecessor FP7⁵⁶. Between 2007 – 2022, research relating to alternative proteins received less than 6% of all funding, despite scoring high in alignment with the priorities and pathways identified in the Food 2030 policy framework⁵⁷. In addition, funding is overwhelmingly allocated to projects on alternative proteins to be used as animal feed⁵⁸, where there is a real need for alternative proteins for human consumption to enable protein diversification.

Policymakers now have the opportunity to reflect on the role of public R&I in achieving higher uptake of alternative proteins, and direct adequate funding towards the development of the sector for a competitive European industry to emerge.

55. European Alliance for Plant-based Foods, Good Food Institute Europe, Bridge2Food. The European plant-based food sector – R&I priorities to drive further uptake by 2030

56. European Commission, Directorate-General for Research and Innovation. Food systems: research and innovation investment gap. (2022)

57. Ibid

58. European Alliance for Plant-based Foods, Good Food Institute Europe, Bridge2Food.





Improving the regulatory landscape. The current EU regulatory framework can prove to be a hindering factor in the transition to protein diversification, as it may significantly delay the production and marketing of some innovative products. A key barrier that has been identified is the lengthy regulatory market approval process foreseen by the Novel Food Regulation. From an innovator's point of view (for instance in the case of a startup struggling to survive between one funding round and the next one), EFSA's novel food application process provides challenges such as: the length, the cost and administrative requirements of the evaluation phase, which may take up to 2-3 years, in comparison to only a few months in the US. The EU Regulation on the transparency and sustainability of the EU risk assessment in the food chain (2019/1381) which came into force in 2021, appears to have prolonged the European Food Safety Authority's (EFSA) evaluation time of novel foods, in view of the increased technical hours required to complete mandatory prenotifications of the studies enclosed to the dossiers to prove safety. The need to increase efficiency of the approval process should factor into the evaluation of EFSA staffing and funding needs. The transformative potential of genetically modified or edited alternative proteins, such as microbial protein, is also limited by a procedurally and scientifically demanding GM food regulation. To realise the potential of these proteins, it would be beneficial to make this process faster and more accessible to companies, particularly SMEs and startups.

On the other hand, shared definitions and standards for the development of new food sources, nutrition and sustainability standards could aid companies in the production process while providing a common framework and vision to work toward. The regulatory environment plays a critical role in bringing alternative protein solutions to the market. Capturing the full potential of alternative proteins will require a regulatory framework conducive to innovation, with EU public policies assisting in overcoming existing barriers to the acceleration of innovative solutions.

Mitigating the impact on agriculture. The implications of protein diversification for agriculture need to be better understood. It is clear that the EU needs to reduce dependency on imported proteins for animal feed through more effective use of European protein sources, as emphasised by the European Commission in its 2018 report on the development of plant proteins. In 2016/17, the EU demand for plant proteins amounted to nearly 27 million tonnes of crude protein, with the feed market being by far the most important outlet. The EU's deficit in plant proteins has been further exacerbated by the war in Ukraine and resulted in a reliance on imports from elsewhere to satisfy Europe's protein needs. There is therefore a need to boost domestic capacity of EU-grown proteins not only for feed, but importantly for food available for human consumption⁵⁹.

59. Shepon, A et al. Energy and protein feed-to-food conversion efficiencies in the US and potential food security gains from dietary changes. (2016)

Improved coordination and collaboration across the supply chain will be needed to bridge the gap between farmers, food industry processors and producers. Farmers will need support in adopting new practices and new technologies and, if they wish to switch to the cultivation of new protein crops for human consumption, they should have a guarantee that there will be a market for them at a fair payment. Stronger collective collaborations between farmers and the industry should be actively promoted with a view to shape the fair, sustainable and resilient value chains of the future, taking into account regional strengths and barriers.

This should include building more reliable projections on agricultural supply and demand, while accelerating the deployment of new agricultural practices and solutions. At the same time, as costs have an impact on consumer demand, it is important to assess the potentially distortive effect of agriculture subsidies.

Fiscal incentives would have to be aligned with environmental and social goals, with incentives for innovation and scaling-up alternative proteins for human consumption.

Education and skills are also important considerations for the EU agenda. It is critical to educate new experts that can enable the creation of new protein production value chains, development of new solutions and business models which can help reconfigure the role of agriculture in future food systems.

To achieve this, the EU will have to adopt a long-term vision and systems approach, foster multistakeholder dialogue to overcome the significant challenge of knowledge fragmentation in the field of protein diversification, as well as seize the opportunities of sustainable growth and fairer share of added value for every actor in the supply chain.

Critical elements to accelerate protein diversification:

- Address fundamental knowledge, research and investment gaps to achieve higher uptake of alternative proteins
- Address the need of an EU regulatory framework responsive to innovative solutions
- Engage in a multistakeholder dialogue to collectively build a long-term vision, projections and a systems approach

CONCLUSIONS

We are facing unprecedented challenges in the food system. We need to produce more nutritious food for a growing population at a time of increased competition and scarcity of land, water and energy resources. It is important to both address malnutrition and produce food which has a lower carbon footprint and has a positive impact on our environment. Building healthy, sustainable food systems will help to improve the resilience of our food systems to external shocks and supply chain disruptions cause by conflicts and political instability. Alternative proteins promise to be one of the solutions with the highest potential to address these challenges.

However, in order to benefit from this solution, Europe needs to reflect on its own strategic autonomy both in terms of resilience and self-sufficiency to avoid being dependent on technologies and regulatory frameworks developed outside its jurisdiction and consider the scale of investment in new food technologies and emerging favourable policies in other regions.

To do this, a clear vision of what the transition to protein diversification entails and a roadmap paving the milestones to getting there is needed. A European Protein Strategy would be a good opportunity to define this roadmap, and we look forward to discussing this with policymakers and all interested stakeholders.

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EIT food, together with the engagements of its mentioned partners, has established a Protein Diversification Think Tank to lift the barriers and to accelerate innovation efforts on Protein Diversification toward sustainable, healthy, and fair agri-food ecosystems ([contact](#)).

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 eight 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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