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Benchmarking Europe's Alternative Protein Research and Innovation Ecosystem

A global analysis for 2023-2025



gfi Europe

About this report

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About the data

Funding data sourced from GFI's publicly available global research funding database, which houses information published by funders and research conductors globally. Funding information was also retrieved from Dimensions.ai, an interlinked research information system provided by Digital Science. Kernel Science contributed to data retrieval. **Publications** and **patent** data sourced from Dimensions.ai.

For full methods including search strategy and terms, inclusion and exclusion criteria and other technical details, please see the full technical appendix here.

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About the Good Food Institute Europe

The Good Food Institute Europe (GFI Europe) is a nonprofit think tank helping to build a more sustainable, secure and just food system by diversifying protein production.

We champion the science, policies and investment needed to make alternative proteins delicious, affordable and accessible across Europe.

By advancing plant-based foods, cultivating meat from cells and producing ingredients through fermentation, we can boost food security, meet our climate targets and support nature-friendly farming. GFI Europe is powered by philanthropy.

To learn more or get in touch, visit our website.

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Executive summary

The European alternative protein research and innovation (R&I) ecosystem is globally competitive, but funders need to adopt a strategic approach to stay ahead and ensure that the benefits of public investment to date are secured for Europe.

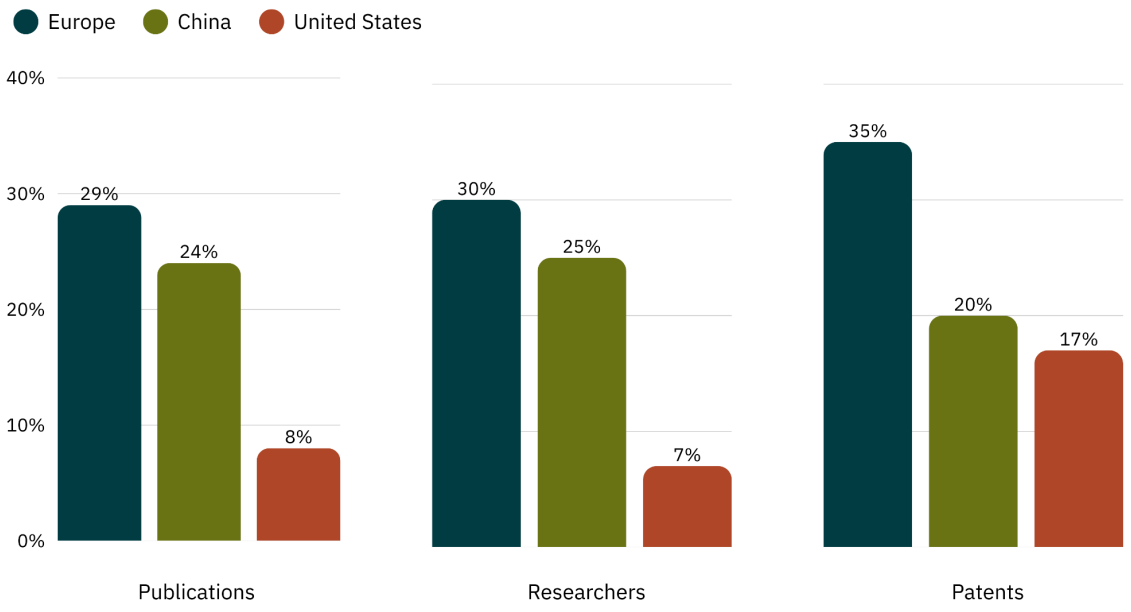


Figure 1. Global share of publications, researchers and patents on alternative proteins, 2023-2025

European[1] public and philanthropic funders have committed almost €1.3 billion to alternative protein R&I since 2020. As a result, Europe is home to the world's largest and most productive alternative protein academic research community (Figure 1). Likewise, European innovators have published the most patents globally and are filing these across a wide range of jurisdictions.

However, Europe's early lead will not guarantee long-term success. China and the United States are the largest single contributors to alternative protein research, and China's research community is catching up with Europe's combined total. China also surpasses Europe in the number of unique innovations patented, and major economies such as Japan and South Korea are increasing their patent output at a higher rate.

This report identifies a misalignment between Europe's public funding and innovation strengths. Compared with other regions, Europe funds a smaller share of

[1] Defined herein as the 27 member states of the European Union, plus Norway, Switzerland, and the United Kingdom.

technological research, with more resources allocated to societal impact studies. European R&I funding is poorly matched to its patent output, and there is a clear disconnect between the research strengths of its public and private R&I actors.

However, Europe already has the research talent to lead in this space. This analysis shows that existing talent pools, which remain almost entirely untapped, could be quickly mobilised through targeted investment, and that this mobilisation would look different across the alternative protein pillars.

A strategic approach will be required to support the growth of these research communities, deliver on Europe's considerable R&I potential, and reap the full societal and economic benefits of the protein transition. This report provides insights and recommendations for how other stakeholders, including public R&I funders, can best support the further development and growth of this research field.

Why a thriving R&I ecosystem is important for Europe

Alternative proteins have significant potential to help meet the growth in global demand for meat, seafood, eggs and dairy, while building a more sustainable food system and making a significant contribution to European economies.

However, European consumers report taste and price as the main barriers to purchasing these foods. To achieve significant uptake, alternative proteins must compete on taste and price, as well as being nutritious and widely available for purchase.

Addressing these challenges means key technological hurdles must be overcome. As many of these technological challenges are pre-competitive in nature, publicly funded research can play a critical role in tackling the kinds of questions that industry isn't incentivised or well placed to address. This kind of research reduces duplication of effort and can ultimately provide a more solid foundation on which to build a successful private sector.

As a global research and innovation powerhouse accounting for over 20% of global R&I investment, Europe has the potential to host a world-leading alternative protein research ecosystem. However, important questions about the health and trajectory of this ecosystem remain unanswered.

What we mean when we talk about alternative proteins



Image: Planted

Plant-based

Foods produced directly from plants that look, cook and taste like conventional animal products. For the purpose of this report, traditional fermentation techniques which use yeast or other microorganisms to modify the flavour, texture, or other characteristics of plant proteins are considered within this pillar.



Image: Quorn

Fermentation

Used in two primary ways. Biomass fermentation leverages the rapid growth and high protein content of microorganisms to produce large quantities of protein for direct use as food. Precision fermentation uses microbial hosts to produce specific functional ingredients for use in alternative protein end products.



Image: Parima

Cultivated meat and seafood

Foods like chicken, pork, beef and fish that are produced by cultivating animal cells and which aim to replicate the sensory and nutritional profiles of conventional meat and seafood.

Cross-cutting research

When research applies to more than one of the above production pillars or seeks to understand an overarching aspect of the entire alternative protein field, such as a social science question, it is labelled as ‘cross-cutting’.

How we generated this data

This report analysed global R&I funding, research publications and patents on topics related to alternative proteins. Data were collected for the years 2010-2025 inclusive for publications and patents, and for 2020-2025 inclusive for funding. Publication and patent data were sourced from Dimensions.ai using a curated set of keywords. Funding data was sourced from both Dimensions.ai and GFI’s grants tracker.

Using inclusion/exclusion criteria, a bespoke automated pipeline reviewed the title and abstract of each publication, patent or grant and determined whether it was in scope for analysis (Figure 2). Borderline cases, where the pipeline could not

confidently classify a record, were flagged for manual review. The pipeline also classified each record into one of the alternative protein pillars (plant-based, fermentation, cultivated, or cross-cutting in cases where the record was relevant to more than one pillar), as well as into research categories, intended end product (patents and funding only), intended ingredient type (patents only) and award purpose (eg, studentship, networking) (funding only).

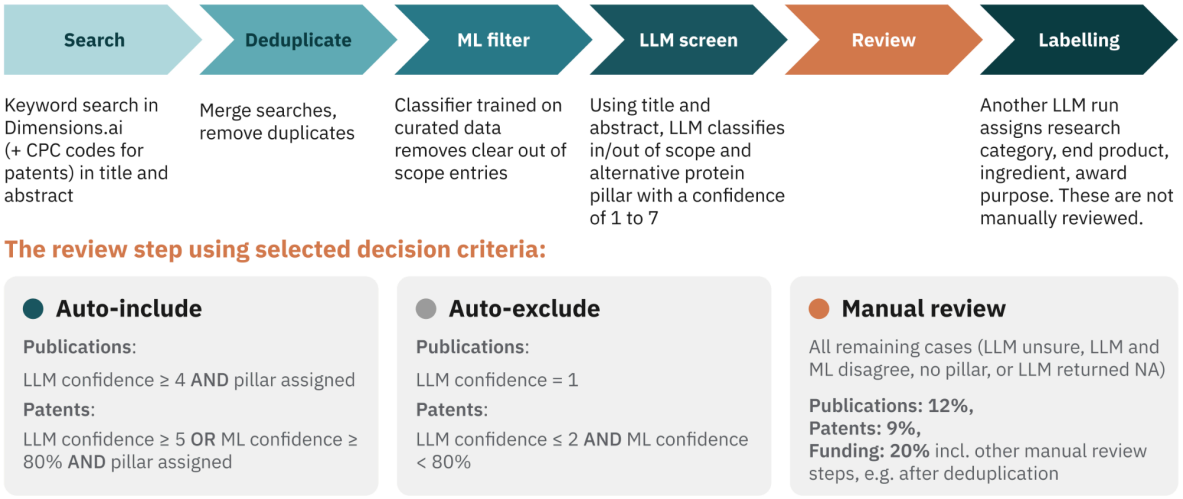


Figure 2. Schematic diagram of the pipeline used to retrieve and classify data for this analysis.

Two levels of analysis were then carried out: publications and patents from 2010 to 2022 were only included if the pipeline confidently classified them as in scope; borderline cases were not reviewed manually. This data should therefore be read as a conservative picture of long-term trends, and it is likely to underestimate the true numbers.

For the 2023 to 2025 data, all borderline cases were reviewed manually. This gave a more complete dataset for recent years, and this period therefore forms the primary basis of this report. All grants flagged as borderline were manually reviewed. Details of the methodology, including search terms, inclusion/exclusion criteria and caveats and limitations, can be found in the technical appendix.

Europe has built the world's largest alternative protein research community

Europe was an early mover in alternative proteins and has committed almost €1.3 billion to the field since 2020, based on combined public and nonprofit R&I funding. While Europe is currently home to the world's largest research community, China is catching up.

Europe has committed more funding to alternative protein R&I than any other region

When public and nonprofit funding are combined, a total of €1.27 billion has been committed to alternative protein R&I across Europe[2] in the years 2020-2025. As a result, European funding for this field exceeds that of other regions, such as North America and Asia Pacific (excluding China, for which data is not available).

Of this total, €1.15 billion has come from public funding bodies across Europe, with the remainder (€123 million) coming from philanthropic funders. The European Commission is the single largest public funder in our global dataset, with a total commitment of €454 million, accounting for approximately half of the total EU[3] commitment (Figure 3). With national-level public funding from member states included, EU countries have collectively committed over €918 million towards the advancement of alternative protein R&I since 2020.

The leading countries in Europe by total funding committed, including public and nonprofit sources, are Denmark (€164 million), the United Kingdom (€150 million), and the Netherlands (€95 million). These figures compare favourably with other leading economies in the alternative protein field such as Singapore (€83 million) and Canada (€63 million).

[2] Hereafter used to refer to the 27 member states of the European Union plus Norway, Switzerland, and the United Kingdom. These countries are used as the basis of this report unless otherwise specified.

[3] Hereafter used to refer to the 27 member states of the European Union plus the European Commission.

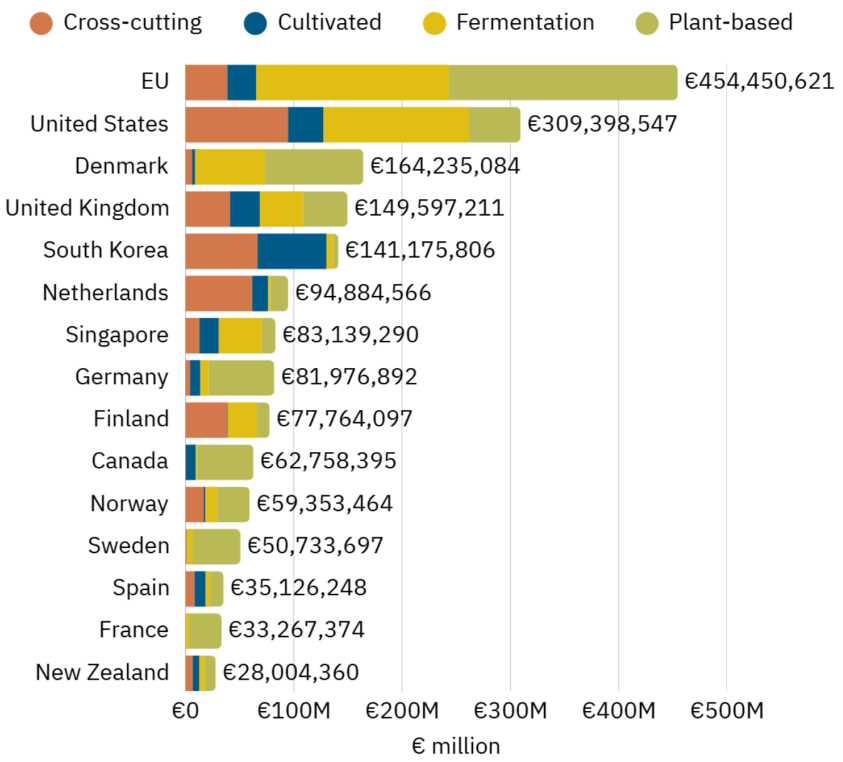


Figure 3. Breakdown of public and nonprofit R&I funding by alternative protein pillar across selected territories in the years 2020-2025.

Public funding per capita varies greatly between countries, ranging from €14 per person in Finland, to €1 per person in Germany. Singapore (€14 per capita) and Norway (€10 per capita) are also among the top performers on this metric (Table 1). Denmark sits at €7 per capita, behind Nordic neighbours Finland, Norway and Sweden, unless nonprofit funding is included, which boosts it to €28. On this metric, many European countries are ahead of the United States, which has committed the equivalent of €309 million since 2020, or €0.57 per million inhabitants. Israel, South Korea, Switzerland and the UK have all invested roughly €2-3 per capita.

The data point to differences in national preferences for specific areas of alternative protein research. Many European countries, such as Germany, Sweden and Switzerland, have invested primarily in plant-based R&I. Denmark's government funding focuses on plant-based research, while its total funding, when nonprofit funders are taken into account, also includes significant investments in fermentation. In contrast, Israel, Japan and South Korea have primarily directed their funding towards cultivated meat.

Globally, almost 70% of all funding across pillars is end-product-agnostic, with cultivated meat being the exception as the technology is geared towards meat or seafood production. Europe appears to be the only region substantially funding R&I for dairy alternatives, with at least €73.5 million invested, compared with €7.8 million in North America.

Asian countries have largely not invested in dairy alternatives, perhaps indicating differences in cultural preferences in dairy and dairy-alternative consumption. Israel, Japan, Norway and Singapore all focus heavily on meat as an end product, accounting for 74-95% of all non-agnostic grants in those countries.

Table 1. Total public funding committed to alternative protein R&I across selected territories in the years 2020-2025 inclusive.

	Total public funding, excluding nonprofit (*€ millions*)	Public funding per capita (*€/million inhabitants*)
Europe	1,115	2.04
EU27	918	2.15
United States	191	0.57
United Kingdom	148	2.16
South Korea	141	2.73
Netherlands	95	5.31
Singapore	83	14.05
Germany	82	0.98
Finland	78	13.92
Norway	59	10.75
Canada	59	1.48
Sweden	51	4.81

Europe was an early mover in alternative protein research

This analysis finds that the volume of research relating to alternative proteins has grown dramatically over the last 15 years. Approximately 13,000 research publications have been produced globally since 2010, with the vast majority coming in recent years. Specifically, 7,775 publications were recorded between 2023 and 2025 alone, accounting for roughly 60% of the total since 2010.

Europe was an early mover in the alternative protein field and established a notable lead in annual research publication output compared with other economies such as China and the US between 2015 and 2022 (Figure 4). Europe produced 30% of the total publications from 2010 to 2025 inclusive,[4] compared with 19% for China and 9% for the US. The EU's contribution during the same time period stood at 26%.

[4] As measured by fractional counting, a counting method for publications, patents or grants involving several co-authors, co-assignees or co-funders, respectively, where an equal weight is given to each collaborator and summarised by the category of interest, such as countries or institutions. This ensures that each publication, patent or grant receives a total weight of one and records with many collaborators are not overestimated. Fractional counting is used for all analysis throughout this report unless otherwise stated.

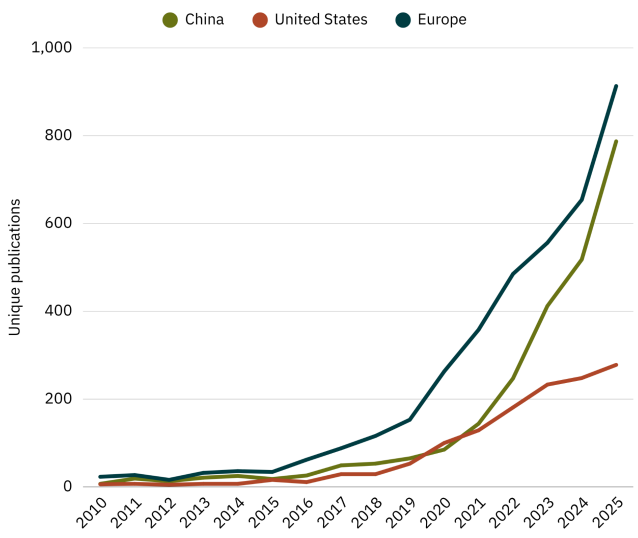


Figure 4. Annual research publication output for Europe, US and China in the years 2010-2025 as measured by fractional counting.

However, the pace of research output in China has increased significantly in recent years, jumping by 92% from 2023 to 2025, meaning it is quickly catching up to Europe, which showed a more modest increase of 60% over the same timeframe. Consequently, Europe's share of unique research publications dropped slightly to 29% in the period 2023-2025 inclusive, while China's rose to 24% (Figure 5).

In contrast, the US lags further behind in overall output (8% of the global total) and shows a slower growth rate (21%). China overtook the US in annual volume of research publications in 2022 to become the top-ranked single country and has maintained that position each year up to 2025, with the US in second place. If current trends are maintained, China will surpass Europe's total output in the coming years.

The outputs from European countries are on par with global trends

Within Europe, the Netherlands has been the largest contributor since 2023, accounting for 3.5% of global publications. It is followed by Germany at 3.0% and the UK at 2.8%. Measured on the basis of publications per million inhabitants, Denmark is the global leader with 29 publications per million inhabitants, considerably higher than the European average of four publications per million inhabitants. Singapore (22 publications per capita) and New Zealand (17) are the closest global comparators, while Ireland comes second within Europe (16).

When we consider publication output per euro of public investment, European countries are roughly on par with global investment and output trends. Israel, Singapore, South Korea, Sweden and the UK sit between 1.6 and 2.2 publications per million euros of research funding committed, while Germany and Switzerland are further ahead at 2.6 and 3.5. Japan and Canada are leading countries globally (6.4 and 4.6, respectively),[5] ahead of the US on 3.1.

[5] Some countries' figures may be overestimated, due to missing funding data.

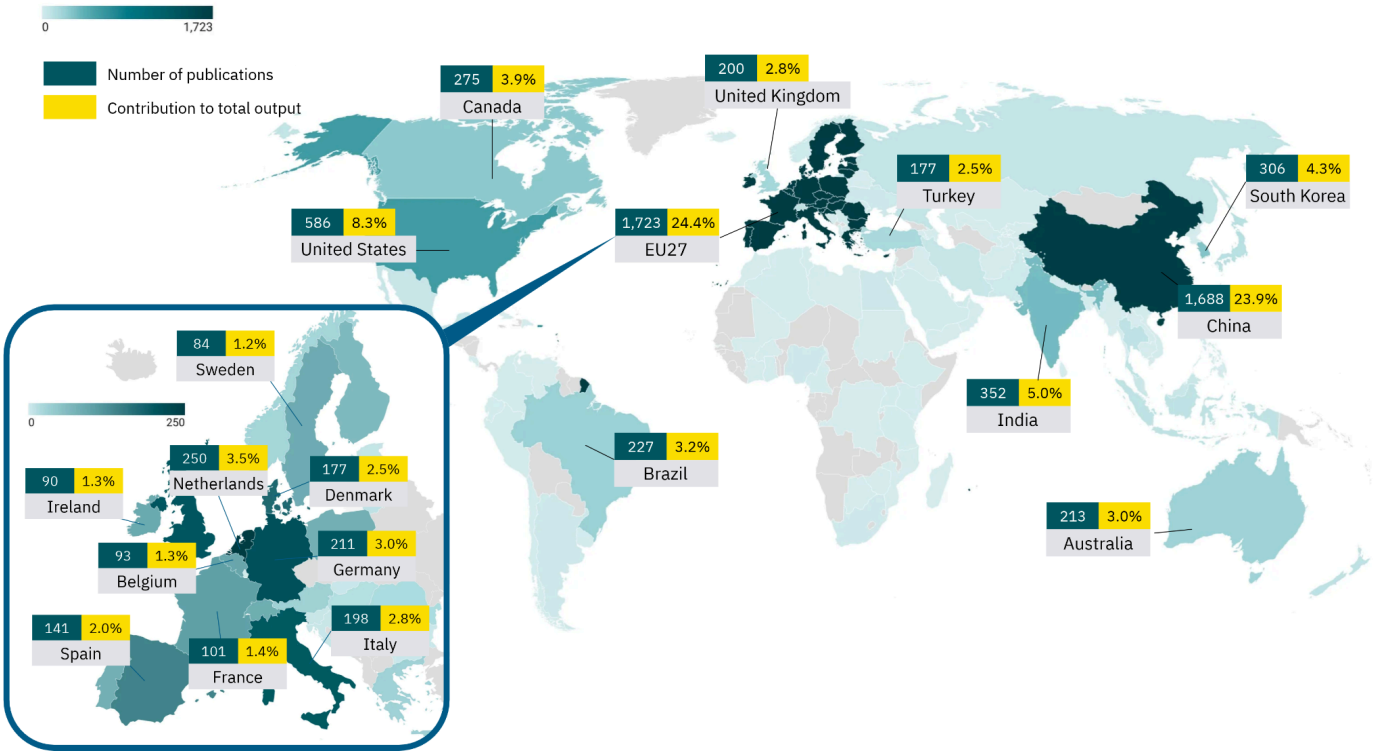


Figure 5. Heat map of research publications on topics related to alternative proteins per territory as measured by fractional counting and proportion of global output in the years 2023-2025 inclusive. Note: French Guiana is counted as part of France.

While these figures are by no means conclusive about research outputs, as publications can be finalised years after the conclusion of research funding, it suggests that Europe has established a strong starting position in this field, as might be expected from the scale of research investment in the region.

Europe has the largest research community and globally competitive institutions

Europe has built the largest alternative protein research community, as measured by the total number of researchers and the volume of research publications from 2023 to 2025 inclusive. Almost 30% of all researchers globally who published on alternative proteins during this period were affiliated with European research-performing organisations, while 25% were affiliated with Chinese organisations and 7% with organisations in the US (Table 2).

Europe has 11 alternative protein researchers per million inhabitants, whereas China and the US each have four. Some countries match or slightly exceed Europe in researchers per million inhabitants, such as Australia, Canada, and South Korea.

Of the 10 most productive research-performing organisations worldwide in the period 2023-2025 inclusive, two are European (Figure 6). Wageningen University & Research was the most productive institution worldwide, with 175 research publications by fractional counting. Aarhus University ranked fifth with 66 publications.

Table 2. Total number of researchers who have published on topics related to alternative proteins across selected territories in the years 2023-2025 inclusive.

	Total researchers (*% of global total*)	Researchers per million inhabitants
Europe	5,882 (*30%*)	11.0
EU27	5,046 (*25%*)	11.2
China	5,019 (*25%*)	3.6
United States	1,437 (*7%*)	4.2
India	971 (*5%*)	0.7
Brazil	756 (*4%*)	3.6
Italy	723 (*4%*)	12.3
South Korea	640 (*3%*)	12.4
Germany	605 (*3%*)	7.2
United Kingdom	550 (*3%*)	7.9
Canada	538 (*3%*)	12.9
Netherlands	497 (*3%*)	27.5

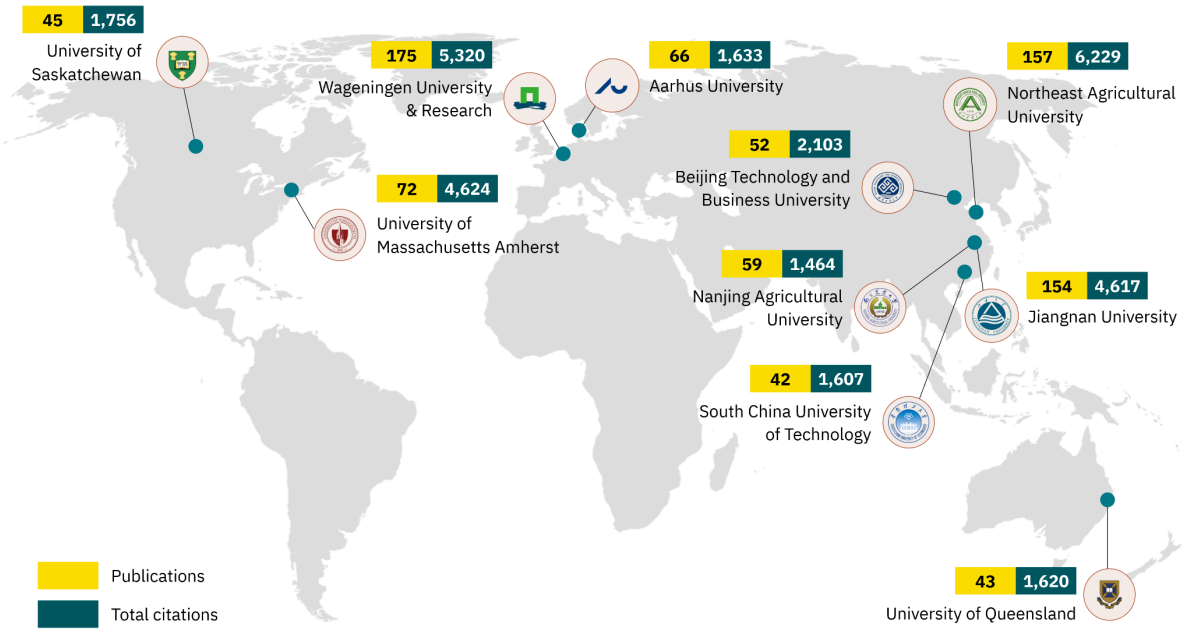


Figure 6. Most productive research performing organisations globally by number of publications on topics related to alternative proteins by fractional counting in the years 2023-2025 inclusive.

China is home to 35% of the world's top 100 institutions as measured by volume of research publications in the period analysed (Figure 7), while 27% are in Europe (25% in the EU) and 9% are in the US. Zooming out further, 29% of the top 1,000 institutions are European (24% are within the EU), while 17% are in China and 8% are in the US.

When public and private research-performing organisations are grouped into clusters of high research density, as measured by combined publication volume within a 100km radius of the most productive institution, we find that the most productive cluster is in Europe (Figure 8). Centring around Wageningen and including organisations situated in or near the cities of Delft and Utrecht, this cluster has contributed 3.2% of the global total publication volume.

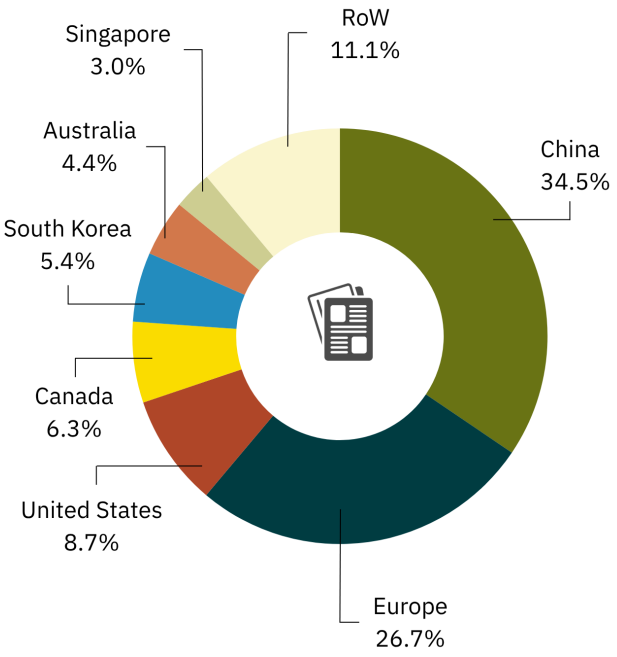


Figure 7. Breakdown of the world's 100 most productive research institutions as measured by total research publications on topics related to alternative proteins in the years 2023-2025 inclusive using fractional counting.

Two other European clusters make the top 10: the Leuven cluster, which includes organisations situated in or near the cities of Ghent and Maastricht, ranks eighth, and a grouping centred on Copenhagen ranks ninth. Five of the top 10 most productive clusters are in China (numbers 2, 3, 4, 6 and 10) (Table 3). The most productive US cluster is placed 11th around Amherst (University of Massachusetts). Zooming out, Europe has 32 clusters in the top 100 most productive compared with 21 in China and 15 in the US.

Table 3. Breakdown of the ten most productive global research clusters as measured by combined research publications on topics relating to alternative proteins in the years 2023-2025 using fractional counting.

	Number of research performing organisations in cluster	Publications from cluster that feature an intra-cluster collaboration (%)	Degree of collaboration above random chance*
Wageningen	36	14	4.5
Harbin	7	9	5.8
Beijing	60	23	4.5
Wuxi	12	18	7.8
Seoul	39	32	10.9
Nanjing	21	17	6.0
Singapore	28	28	8.3
Leuven	31	32	14.5
Copenhagen	17	17	6.7
Hangzhou	24	35	12.6

* calculated by comparing the percentage of the cluster's publications that feature at least two institutions within the cluster, to the percentage you would expect if partners were picked at random from the world's institution pool, given each paper's number of institutions and the cluster's share of all appearances. A score of 1 indicates that collaboration is no more probable than random chance, while a score above 1 indicates a higher probability of collaboration within the cluster.

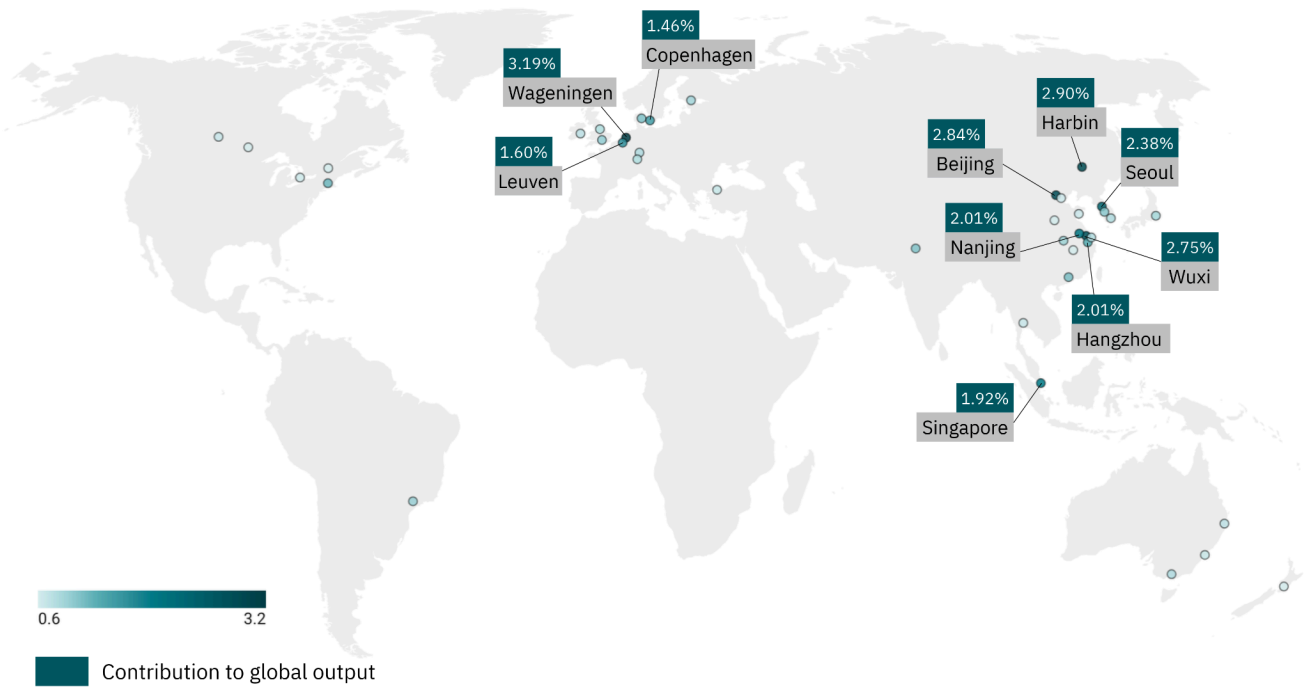


Figure 8. The most productive research clusters globally as measured by the number of publications on topics related to alternative proteins by fractional counting in the years 2023-2025 inclusive. Clusters group research performing organisations within a radius of 100km from the most productive organisation in the cluster.

Table 4. Distribution of the most productive research clusters in Europe, the US and China as measured by combined research publications on topics relating to alternative proteins in the years 2023-2025 using fractional counting.

	Clusters in the top 10 globally*	Clusters in the top 100 globally*	Average collaboration above random chance**	In top 100 most collaborative***
Europe	3	32	16	26
China	5	21	16	7
North America	0	15	9	9

*ranked by the percentage a cluster contributes to total global publication output.
**calculated by comparing the percentage of the cluster's publications that feature at least two institutions within the cluster, to the percentage you would expect if partners were picked at random from the world's institution pool, given each paper's number of institutions and the cluster's share of all appearances, averaged across all clusters from the region in the top 100. A score of 1 indicates that collaboration is no more probable than random chance, while a score above 1 indicates a higher probability of collaboration within the cluster.
***top 100 clusters with greatest average intra-cluster collaboration above chance

On average, clusters as defined here exhibit a high proportion of intra-cluster publications, with a degree of collaboration that is much higher than random chance, suggesting they are a meaningful representation of collaborative research activity enabled by co-location. Of the 100 most collaborative clusters, as measured by co-publication, 26 are in Europe, while seven are in China and nine are in the US (Table 4). Overall, these data point to a high degree of robustness and collaboration within the European ecosystem.

European Commission funding has been important for Europe-wide talent mobilisation

Analysing funding from the European Commission, delivered mainly through Horizon Europe instruments, is important to understanding how research communities have been built in European countries with little dedicated national-level funding.

This analysis suggests that European funding is a critical gap filler in countries with limited domestic investment in alternative protein research (Figure 9). Spain, France and Germany are the leading recipients of European Commission funding (Table 5). Spain in particular relies on Horizon funds for more than 50% of its direct grant funding. Per capita, Finland, Denmark and Estonia are the three countries that secured the most funding from Horizon Europe, with Ireland a close fourth.

Table 5. Breakdown of the allocation of Horizon Europe funding for alternative protein research across selected European countries.

	Horizon Europe funding received	Total funding received per capita	Pillar I*	Pillar II*	Pillar III*	Widening
Spain	€39,207,122	€0.79	€4,274,461	€28,703,454	€6,139,408	€89,800
France	€30,222,274	€0.44	€3,439,057	€23,938,042	€2,845,175	€0
Germany	€24,190,930	€0.29	€2,720,991	€16,855,279	€4,310,555	€304,106
Sweden	€18,897,865	€1.78	€443,710	€11,826,463	€6,505,371	€122,321
Netherlands	€17,889,264	€.099	€2,318,189	€13,569,869	€2,001,205	€0
Belgium	€15,455,257	€1.29	€1,489,020	€12,615,583	€741,154	€609,500
Finland	€15,247,011	€2.70	€0	€10,279,220	€4,967,791	€0
Portugal	€14,946,986	€1.38	€1,737,511	€8,532,340	€4,677,135	€0
Denmark	€14,393,561	€2.40	€1,225,824	€12,009,678	€698,002	€460,056
Greece	€14,085,437	€1.35	€488,498	€8,738,259	€2,442,728	€2,415,951

* Pillar 1: Excellent Science (includes Marie Sklodowska-Curie Actions and European Research Council), Pillar 2: Global Challenges and European Industrial Competitiveness (includes Cluster 6: Food, Bioeconomy, Natural Resources, Agriculture and Environment), and Pillar 3: Innovative Europe (includes European Innovation Council and European Institute of Innovation and Technology (EIT))

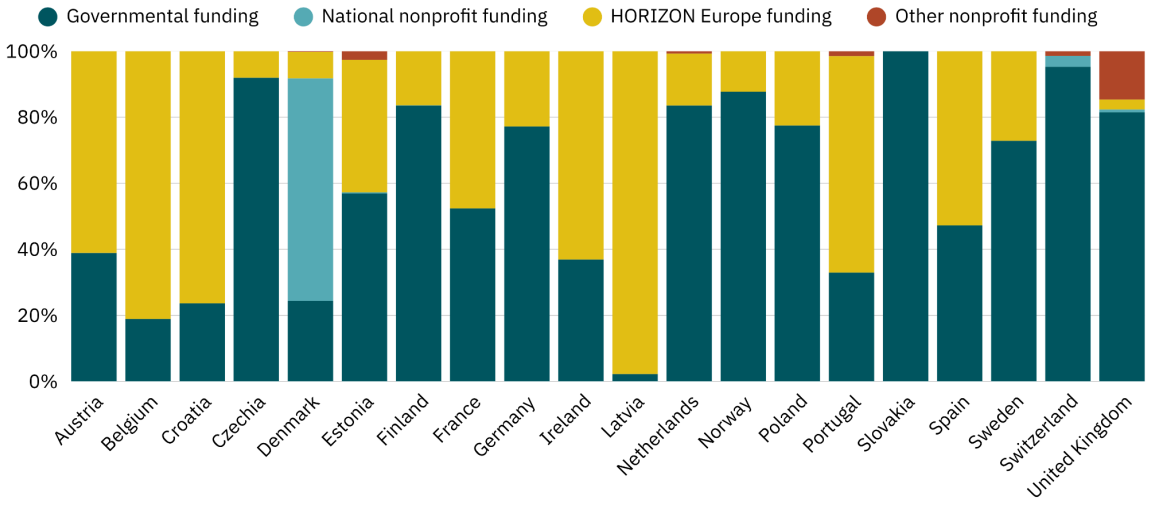


Figure 9. Stratification of funding sources in selected European countries in the years 2020-2025 inclusive.

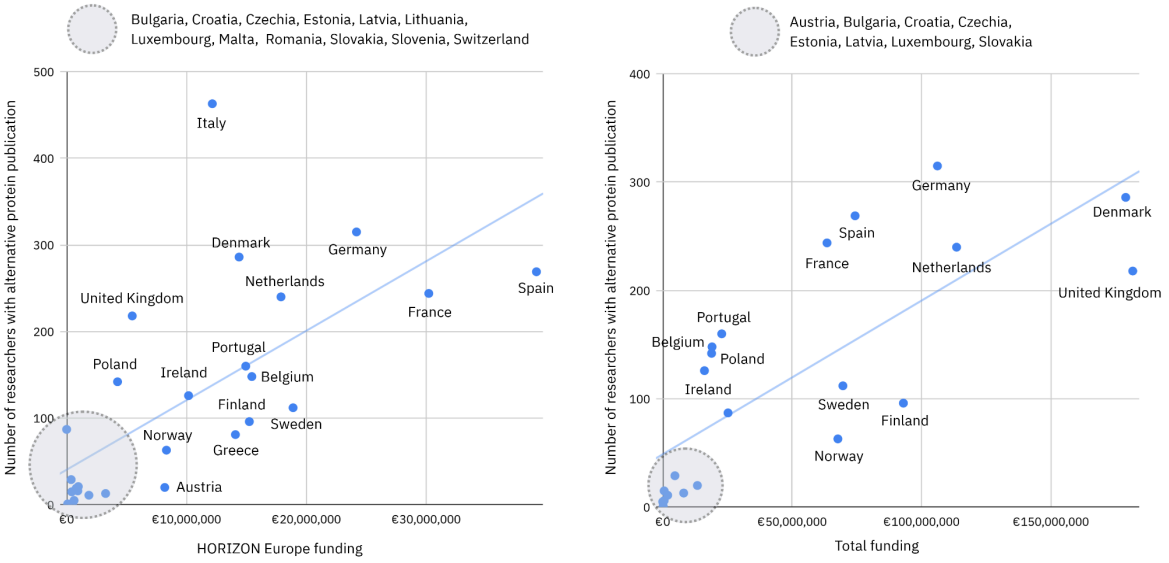


Figure 10. The correlation between the number of researchers publishing on topics related to alternative proteins in selected European countries in the years 2023-2025 inclusive and (a) Horizon Europe funding received by that country (b) Total funding including Horizon Europe, national governmental and nonprofit grants.

Alternative protein funding from national funders across Europe only loosely correlates with research activity in the individual countries. The amount of European Commission funding explains as much of the variance in overall researcher numbers in a given country as national funding does (R^2 of 0.46 vs 0.44) (Figure 10). The trend is improved by considering both sources of funding together (R^2 =0.55).

European research institutions have undoubtedly been strengthened by EU-level investment, but this has not created regional clusters as strong as those in China. The highly productive European research institutions in this space are spread across Europe, with many medium-density clusters. Horizon Europe's Pillar II approach to encouraging Europe-wide collaboration may be responsible for this result.

Differences in collaboration and citation activity can be observed between Europe, China and the US

Europe shows a similar rate of multi-organisational[6] collaborations as both the US and China, but some differences can be observed in rates of international collaboration (Figure 11). This dataset indicates that European and US researchers collaborate across borders to a greater extent than Chinese researchers, who largely collaborate domestically. Almost 60% of Europe's research publications in the years 2023-2025 are the result of cross-border collaborations compared with 55% of US publications and 29% of Chinese publications.[7]

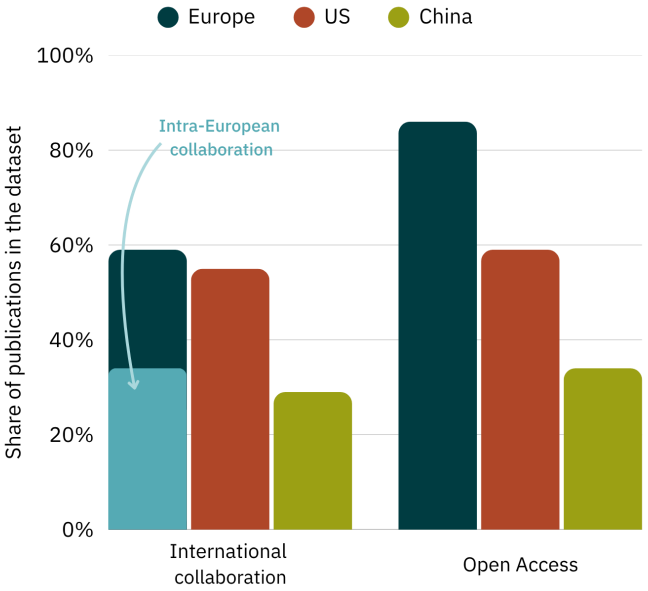


Figure 11. Relative differences in degree of international collaboration and Open Access status between publications involving researchers from Europe, the US, and China in the years 2023-2025 inclusive.

However, the rate of collaboration between European researchers and those outside of Europe[8] is just 29%, demonstrating the prevalence of intra-European collaboration, possibly as a result of the high level of funding the European Commission has invested in this space.

While this analysis has so far benchmarked the performance of Europe's alternative protein research ecosystem *against* other major economies such as China and the US, it is also valuable to understand the degree of collaboration and knowledge sharing *between* them. This analysis finds that China and the US are the non-European countries where European researchers formed the most collaborations in the period 2023-2025, with 5.9% and 5.6% of publications including at least one Chinese or US author, respectively.

[6] Research publications arising from a collaboration between two or more distinct research performing organisations, irrespective of the country where those organisations are located.
[7] Contrary to other sections of this report, the figures in this section are calculated using summed counting rather than fractional counting. This captures the total unweighted number of publications that each country or region has contributed to.
[8] Collaborations between European researchers based in EU member states, Switzerland, Norway, or the UK and at least one researcher based in a non-European country.

Table 6. Breakdown of key citation and impact indicators of the European alternative protein research ecosystem compared to that of the US and China in the years 2023-2025 inclusive.

	Europe	China	United States
Publications by summed counting	2,308	1,904	826
Total citations accumulated	23,651	21,385	12,884
Cited publications (% of total)	96%	98%	98%
Internal citations	8,207	12,057	1,856
Internal citations per publication	3.6	6.3	2.2
Internal citations (% of total)	35%	56%	14%

Interesting differences can also be observed in the rates of knowledge flow as measured by citations. Overall citation rates are very similar when comparing Europe with the US and China, with 96-98% of publications receiving at least one citation across the three regions. However, when examining the average performance of publications from these regions, the US performs better, with an average of 16 citations per publication, while Europe and China see 10 and 11 citations per publication, respectively (Table 6).

Looking at where research is cited, China is the most likely single country to cite research from Europe and the US, accounting for 26% and 33% of citations, respectively. China most frequently cites its own research, with internal citations[9] accounting for 56% of the total number of citations accumulated by Chinese publications in this dataset. This equates to an average of 6.3 citations per publication coming from within China. This contrasts with trends in Europe and the US, where internal citation rates stand at 35% and 14%, respectively, and internal citations per publication stand at 3.6 and 2.2, respectively.

While far from conclusive, this may point to a higher degree of integration and knowledge flow within the Chinese alternative protein research ecosystem, whereas Europe and the US appear to be more globally connected. It may also point to a significant ramping up of research activity relating to alternative proteins in China.

It is unclear to what extent this knowledge flow is impacted by open access publishing practices, but clear differences can also be observed here (Figure 11). While 86% of publications including European authors and 59% of publications including US authors have some form of open-access status, this figure stands at 34% of publications involving Chinese authors.

[9] Citations arising from a publication involving at least one researcher based in the same country as the cited publication.

Key takeaways

With €1.27 billion invested since 2020, European public and philanthropic funding for alternative protein R&I exceeds that of other global regions. European countries are on par with or ahead of the US in terms of investment per capita.

Europe has built the largest research community of any region, and produces the greatest volume of publications. However, China is now producing research at a faster rate and will soon surpass Europe.

Europe is home to three of the world's 10 most productive research clusters, and more than a quarter of the world's 100 most collaborative clusters. The European research community is globally connected but relies heavily on intra-European collaborations.

To capitalise on this strong position and early-mover advantage, Europe needs to continue to invest via both national and European Commission instruments, ensuring regional clusters are strengthened to reach their full potential.

Europe is globally competitive in patent output but less effective in connecting academic research to innovation

Europe's private sector has led global patent output in recent years by competing in global markets. However, Europe is less competitive in the development of new technologies, and its public research institutions are lagging behind their global counterparts in patenting activity.

Europe leads in total patents but not in unique innovations

As with research publications, the global volume of patents related to alternative proteins has grown dramatically over the last 15 years. Globally, over 24,000 patents have been published since 2010, with the majority emerging in recent years. Specifically, 11,894 patents were published between 2023 and 2025 alone, accounting for roughly 50% of the overall total since 2010 (Figure 12).

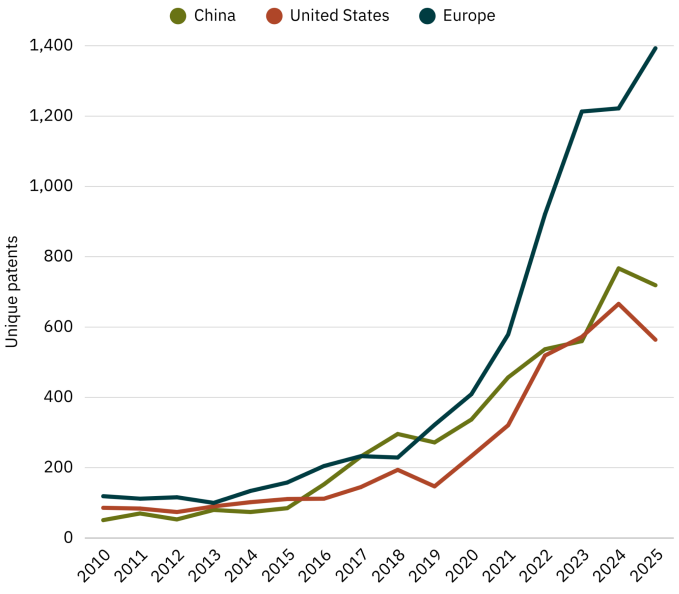


Figure 12. Annual patent output for Europe, US and China in the years 2010-2025 as measured by fractional counting.

Of this, 35% were filed by European assignees, compared with 20% from China and 17% from the US (Figure 13). This is despite Europe's patent output growing at a slower rate (13% increase from 2023-2025) compared with that of China (27%), Japan (47%), or South Korea (109%), although it compares favourably with the US (4%). EU countries showed more resilient growth with a 22% increase.

However, the individual patent count does not tell the full story of the number of new technologies being developed across regions. To better understand this, it is more informative to analyse the distribution of patent families. Put simply, a patent family is a collection of patents covering the same or similar technical content disclosed by a

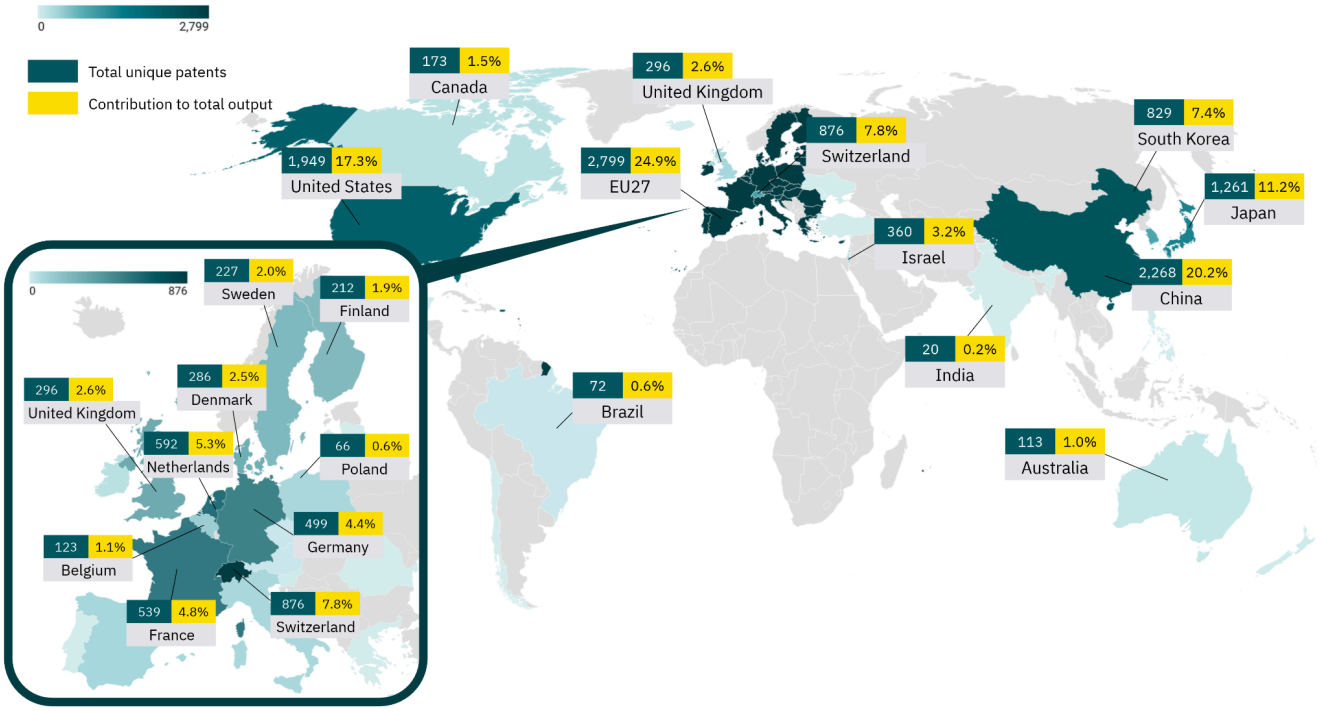


Figure 13. Heat map of published patents on topics related to alternative proteins per territory as measured by fractional counting and proportion of global output in the years 2023-2025 inclusive.

common inventor. Patents arising from the same family can be filed in multiple jurisdictions depending on the importance of the underlying technology to the assignee's commercial strategy.

On this measure, which better represents the breadth of underlying technology, Europe lags behind while China has taken the lead (Table 7). Chinese assignees filed patents relating to 2,147 unique families in the years 2023-2025 compared with 1,461 from Europe and 763 from the US. This means that Europe is leading in patents per invention but not the total number of new inventions.

Table 7. Total number of unique patent families on topics related to alternative proteins published by innovators based in selected territories in the years 2023-2025 inclusive using fractional counting.

	Unique patent families	Contribution to total output
Europe	1,461	23.7%
EU27	1,061	17.2%
China	2,147	34.8%
United States	763	12.4%
Japan	713	11.6%
South Korea	663	10.8%
Switzerland	288	4.7%
Netherlands	225	3.7%
Germany	197	3.2%
France	192	3.1%
Israel	125	2.0%
United Kingdom	110	1.8%

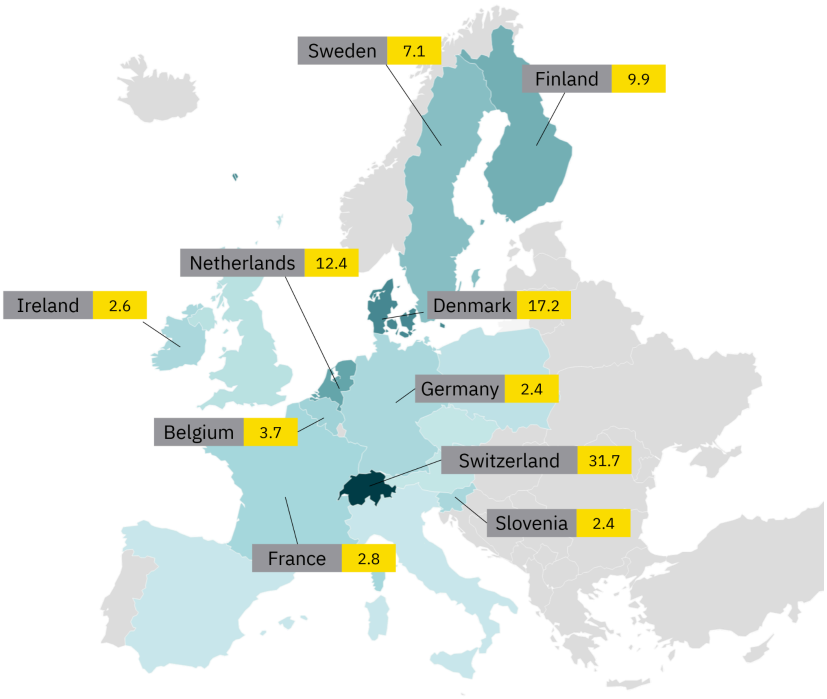


Figure 14. Heat map of published patents per million inhabitants on topics related to alternative proteins as measured by fractional counting in the years 2023-2025 inclusive. Note: data is only shown for countries with five or more patent families in the time period analysed.

However, some European countries have had an outsized impact in patent generation, especially when assessed on a per capita basis. For example, Switzerland published 96 patents per million inhabitants during the time period analysed, and Denmark, Finland, the Netherlands and Sweden also performed strongly (48, 38, 33, and 21 patents published per million inhabitants, respectively) (Figure 14).

Again, these numbers compare favourably with the US and China, which published six and one patent(s) per million inhabitants in the same time frame. However, this analysis also shows considerable differences in patent output between European countries, leading to an overall output of seven patents per million inhabitants for Europe as a whole.

European innovators are patenting in multiple jurisdictions around the world

A key element of IP strategy is determining which countries to file patents in. As there are no global patents, innovators must file patents in each individual country where protection is needed, which can be expensive and time-consuming.[10] While there is no one-size-fits-all approach to filing strategy, patents are typically filed in a range of jurisdictions to encompass countries that are key markets, home to competitors, or host important R&I locations or manufacturing hubs.

This analysis indicates that European innovators have filed patents relating to alternative proteins across a wide range of international jurisdictions, reflecting the high volume of patents Europe has produced compared with other economies. European innovators have filed patents in a total of 54 jurisdictions worldwide, compared with 22 jurisdictions for China, 36 for the US, 19 for Japan, and 18 for South Korea (Table 8). Europe also leads in filings to both the European Patent Office (EPO) and the World Intellectual Property Organization (WIPO), and even leads in filings to the US Patent and Trademark Office.

Table 8. Breakdown of jurisdictions wherein patents on topics related to alternative proteins published in the years 2023-2025 were filed on the basis of assignee location.

	Europe		China		United States		Japan		South Korea	
Filing jurisdiction	Patents filed	% of total	Patents filed	% of total	Patents filed	% of total	Patents filed	% of total	Patents filed	% of total
China	348	9%	2,112	92%	155	8%	166	13%	20	2%
WIPO	747	19%	52	2%	407	20%	228	18%	57	7%
United States	537	10%	48	2%	516	25%	160	12%	48	6%
EPO	810	20%	19	1%	324	16%	164	13%	25	3%
Japan	89	2%	6	0.3%	52	3%	442	34%	8	1%
South Korea	124	3%	7	0.3%	66	3%	29	2%	635	77%
Australia	238	6%	9	0.4%	112	6%	31	2%	8	1%
Canada	140	3%	2	0.1%	92	5%	6	0.5%	4	0.5%
Mexico	124	3%	2	0.1%	94	5%	1	0.1%	1	0.1%
Israel	93	2%	6	0.3%	52	3%	5	0.4%	3	0.4%
Total filing jurisdictions	**54**		**22**		**36**		**19**		**18**	

[10] Although international patents can be filed with the World Intellectual Property Organization (WIPO) under the Patent Cooperation Treaty (PCT), these filings do not provide long-term global protection for the disclosed technology.

In contrast, Chinese innovators focus on the domestic market, with the vast majority (92%) of patents from Chinese innovators being filed in China. These data suggest that, at least in terms of filed patents, Chinese innovators are not currently competing for alternative protein technology dominance in European or US markets. South Korean patent filings follow a similar trend, with 77% of their patents filed domestically.

European research institutions play a minor role in generating patents

The majority (63%) of patent families in the dataset filed by not-for-profit research-performing organisations, such as universities and research institutes,[11] are from China (Figure 15). In contrast, the combined total of all patent families filed by European research institutions sums to less than those of South Korea.

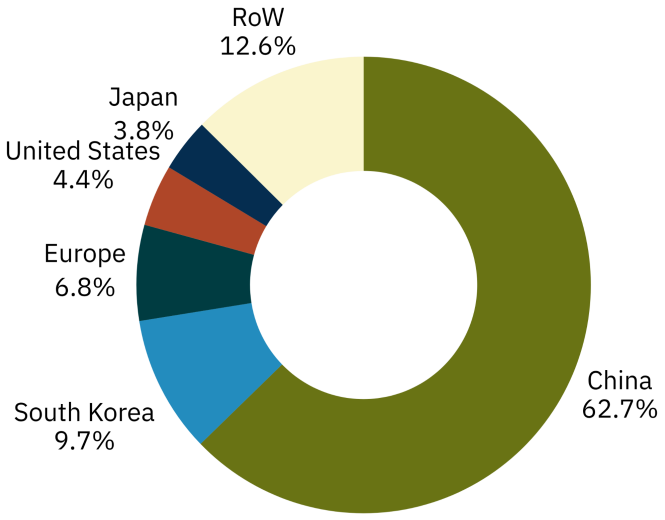


Figure 15. Breakdown of global share of patents published by not-for-profit research performing organisations such as public and private universities and national research institutes in the years 2023-2025 inclusive, as measured by fractional counting.

A significant majority (92%) of unique patents published by both European and US assignees come from the private sector, while in China almost 57% of patents come from research institutions or collaborations between research institutions and private companies (Figure 16). As a result, an interesting dichotomy can be observed wherein the majority of the 10 most productive private sector assignees are European, while all of the 10 most productive research institutions are Chinese.

The highest-ranking European research institutions in terms of patent output are Fraunhofer Society (which encompasses all of the Fraunhofer Institutes across Germany), which comes in 21st place globally, University of Poznan (33rd), and KU Leuven (47th). Tufts University is the highest-ranked non-Chinese research institution, ranking 19th globally. Other countries with institutions among the top 50 are Israel, Japan and South Korea.

[11] Hereafter collectively referred to as 'research institutions'.

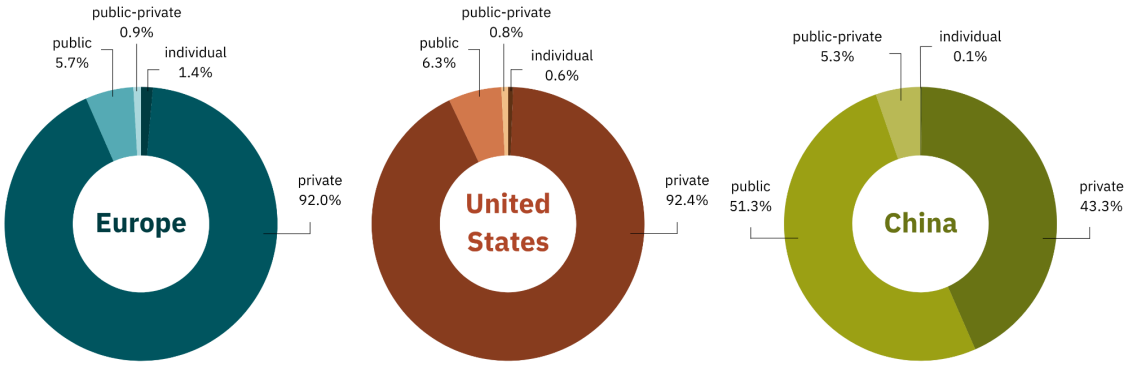


Figure 16. Breakdown of assignee type on patents published by innovators based in Europe, the US, and China in the years 2023-2025.

As a demonstration of the gap between academic research excellence and patent generation in European research institutions, Wageningen University & Research, which ranked first globally for research publication output in the years 2023-2025, ranked 76th globally among research institutes for published patents. Likewise, Aarhus University, which ranks fifth globally for research publications, ranks 153rd globally for patents.

Academic-corporate collaborations make up 7% of research publications in both Europe and the US, but just 3% in China. However, the opposite pattern is observed for patents, with 5% of Chinese patents having both a research institution and a private company as assignees compared with approximately 1% for both European and US patents. Likewise, 5% of Chinese publications in this dataset are cited in a patent filing compared with 3% of European publications, which suggests that the Chinese R&I ecosystem appears to be more effective than that of Europe in joining the dots between research activity and IP generation.

It is well documented that Europe has experienced sector-agnostic challenges with technology transfer. This analysis suggests that the alternative protein field is no different, with a clear gap observed between academic R&I and commercialisation. The following section explores possible reasons for such a gap, examining the alignment of research effort with innovation priorities.

Key takeaways

- Despite European innovators leading in the total number of patents in recent years, Europe trails China in unique innovations, and European output is growing at a slower rate than that of other economies such as China, Japan, and South Korea.
- European innovators are taking a global approach to patenting activity and have filed in more jurisdictions than those from the US or China. In contrast, Chinese innovators focus almost exclusively on their domestic market.
- Research institutions play a minor role in European and US patenting activity, in stark contrast to China, where they are responsible for more than half of Chinese patents.
- Europe needs to better align academic research with private innovation and promote more effective technology transfer from public institutions to ensure commercialisation can take place within the region.

European public funding is not always well aligned to its innovation strengths

Compared with other regions, a smaller proportion of European research funding is dedicated to technological development. European public funding is not always aligned with the research areas that generate the most intellectual property globally.

A third of European funding goes to societal impact research

Funding technological development enables researchers to ready technologies for the market, and ultimately to generate economic impact in the region. As discussed in the previous section, there is a gap between academic research and private innovation within Europe's R&I ecosystem. The research topics prioritised by R&I funders in Europe help to explain this gap.

This report uses research categories[12] to describe the breadth and depth of topics covered within each alternative protein pillar. These categories can be roughly divided into technical research, which aim to improve factors such as the cost and taste of end products, and societal impact research, which analyses the downstream impact of these technologies on areas such as consumer demand, the environment, food safety, and health and nutrition.

Divergences in the research effort allocated to technical and societal impact research can be observed across regions (Figure 17). Roughly one-third of European funding goes to societal impact research, whereas countries such as Japan and Canada have mostly or exclusively funded technical research – a trend reflected in their publication output. The US has dedicated just 14% of total funding to societal impact research areas.

[12] See technical appendix for the definition and inclusion criteria for each research category.

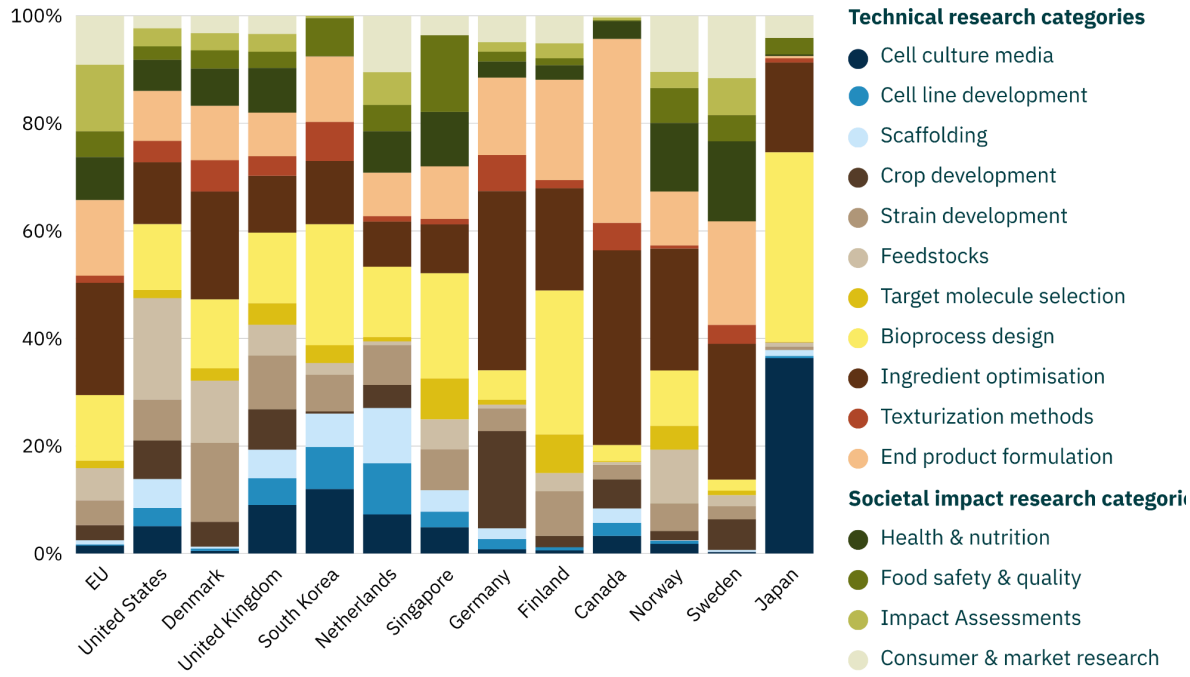


Figure 17. Proportion of total R&I funding committed per research category in selected countries in the years 2020-2025. Note: Funding categorised as 'Other' is not included in this analysis.

China has the highest output in many technical research areas

While European, US and Chinese institutions all conduct research across the alternative protein value chain, China leads in many technical research categories, which represent 85% of its total publications, compared with 61% for Europe (Figure 18).

Europe leads on the total number of publications in some technical categories (bioprocess design, feedstocks, crop development and end product formulation), and all societal impact categories: health & nutrition, impact assessments,

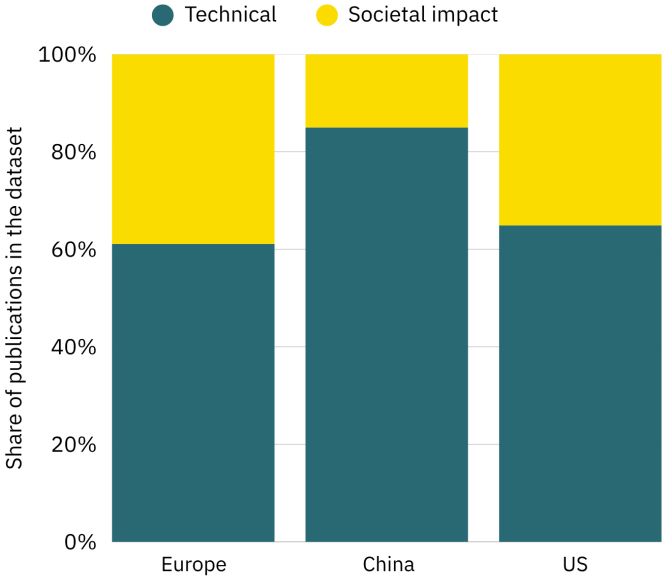


Figure 18. Share of publications in the dataset falling into technical or societal impact research categories.

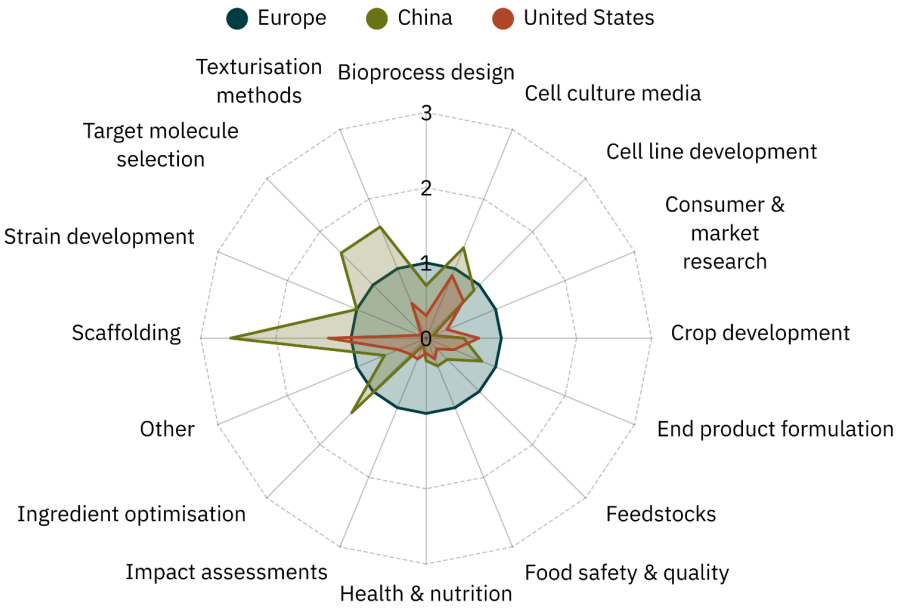


Figure 19. A comparative analysis of the volume of academic publications per researcher category from researchers based in Europe, the US, and China in the years 2023-2025 inclusive. Europe values are normalised to 1 for ease of comparison.

consumer research and food safety & quality. In contrast, China leads in the technical categories of scaffolding, cell media and cell line development, texturisation methods, ingredient optimisation and target molecule selection (Figure 19).

In the case of publications specific to cultivated meat, these differences in research focus are even more pronounced with technical research making up 73% of China's publications but only 33% of Europe's publications on this pillar.

Despite investing a lower proportion of funding in societal impact categories, the US has a similar balance to Europe in terms of output (with 65% of publications falling in technical categories and 35% falling in societal impact). However, the US's overall output is lower, so it does not lead in publication volume in any single category.

European funding is not well-aligned to IP generation

Within any given field, the research topics supported by public funders do not always neatly align with the areas where IP is being generated. Some alternative protein research areas, such as end product formulation, target molecule selection and bioprocess design, result in higher levels of IP output for the level of public funding invested, while others, such as crop development[13] and health and nutrition, have lower outputs (Figure 20).

The US outperforms the global average (relative to the level of public investment) in securing IP in the field of target molecule selection for fermentation, as well as in bioprocessing design for cultivated and end-product formulation for plant-based. Europe performs well in texturisation and cell line development.

Overall, Europe's ability to turn public funding into intellectual property (4.4 patents per million euros of public funding invested in a particular category) is lower than some global benchmarks, such as South Korea (6.2) and Canada (5.2), but ahead of the US (2.7) and Singapore (2.1).[14] This suggests that some countries are benefiting from either a more effective approach to public research funding, a more active private R&I sector, or both.[15]

In part, this may reflect Europe's greater investment in non-patentable categories such as health and nutrition and impact assessment, which are valuable areas of research to pursue in order to secure democratic consensus for large-scale systems change. Research into the societal impacts of alternative proteins can act as an enabler to scale new innovations and deliver economic impacts, but Europe is currently striking a different balance in its funding from countries such as Japan and South Korea, which are generating IP more efficiently.

[13] Crop development in particular represents a research category where technological innovations often take a long time to mature from research to market, so the relatively low output may reflect the time frame analysed in this report not being sufficient for the research in that field to reach commercial readiness.
[14] Because of the lack of public funding data from China, comparison cannot be made. This comparison is possibly subject to error introduced by unavailable public funding data, which likely underrepresents European performance.
[15] As funding here accounts for only public but not private investment, output in some research categories may be driven by commercial R&I. Plant-based product formulation, ingredient optimisation and texturisation are all close-to-market categories, which would be expected to be the target of industry-funded R&I. The US sees more return in IP than Europe for their public investment in all three of these.

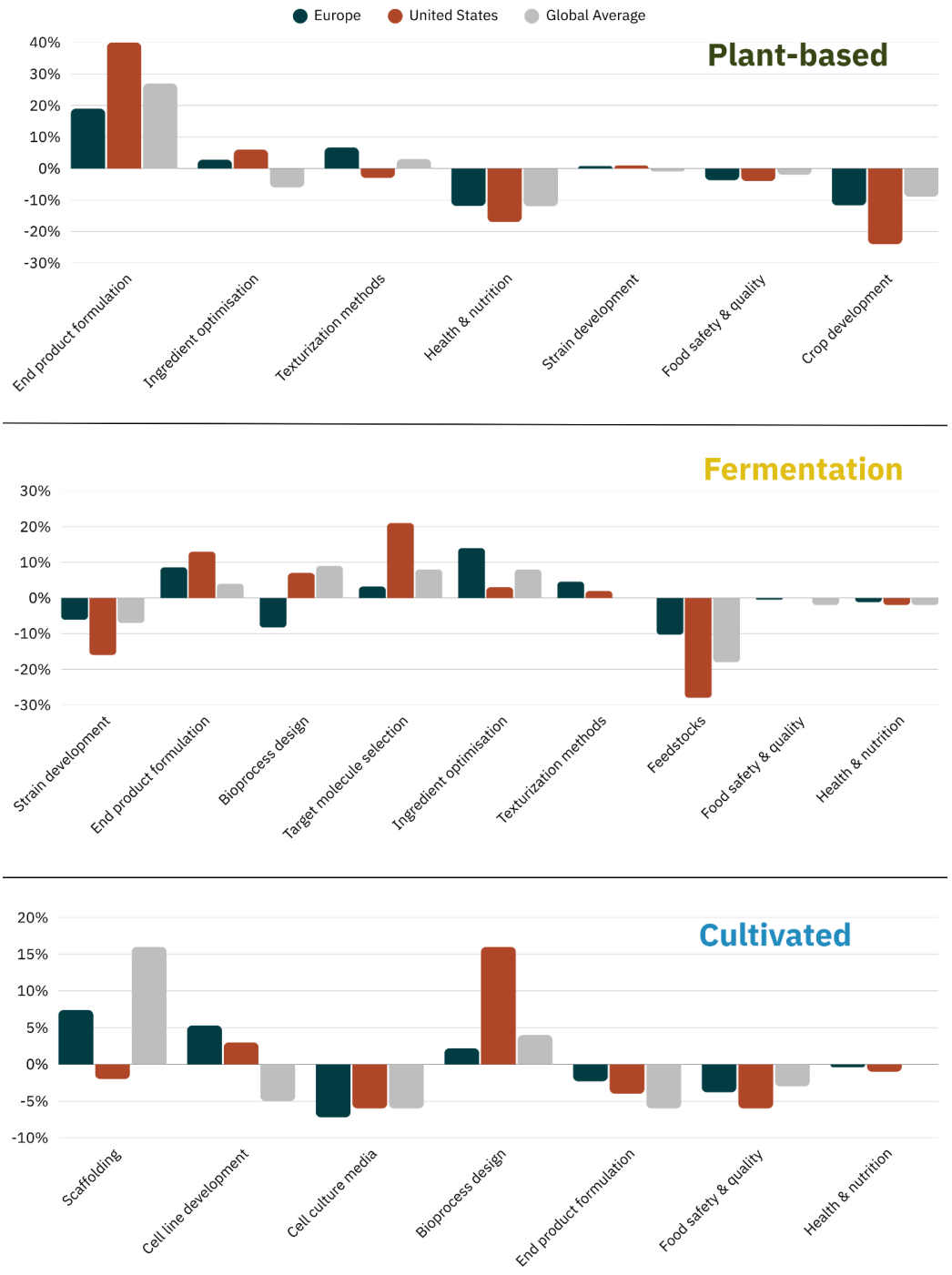


Figure 20. Analysis of the number of patents per research category, in proportion to the amount of funding that has been invested in the EU, US or globally in the years 2023-2025 inclusive. Positive figures show patent output above average.

Notably, many of the patent categories led by China are the same as those that return higher-than-average IP globally. Five of the six categories China leads – scaffolding, cell line development (although not cell media), end-product formulation (except for cultivated meat), ingredient optimisation and target molecule selection – are above average in their return on investment in the form of IP.

However, this analysis of European patent output also suggests that the alternative protein sector suffers from the so-called 'European paradox', the term for Europe's challenges with converting its scientific excellence into successful market innovations. This can be attributed in part to limited access to private capital and scale-up infrastructure, but is also influenced by a lack of efficient mechanisms for technology transfer.

The European private sector is a global leader in a number of patent metrics relating to alternative proteins, and Europe's academic sector is a world leader in producing new knowledge. However, this analysis suggests that more tailored support is needed to convert Europe's academic excellence into innovation impact, and that funders should invest in industrially-relevant research areas.

To maximise the impact of public funding, and remain globally competitive, effective mechanisms for stimulating public-private collaborations should be a priority for European funders.

Key takeaways

- More than a third of European funding goes to societal impact research, which stands in contrast to countries like the US, Japan, and Canada, which have mostly or exclusively focused on funding technical research.
- To generate commercial and, ultimately, economic impact, Europe needs to invest more in technical research, in addition to its existing strong output of societal research.
- Better alignment between public and private R&I funding would improve the link between research effort and innovation outputs and increase the competitiveness of European innovation.

Europe has a large pool of untapped research talent relevant to alternative proteins

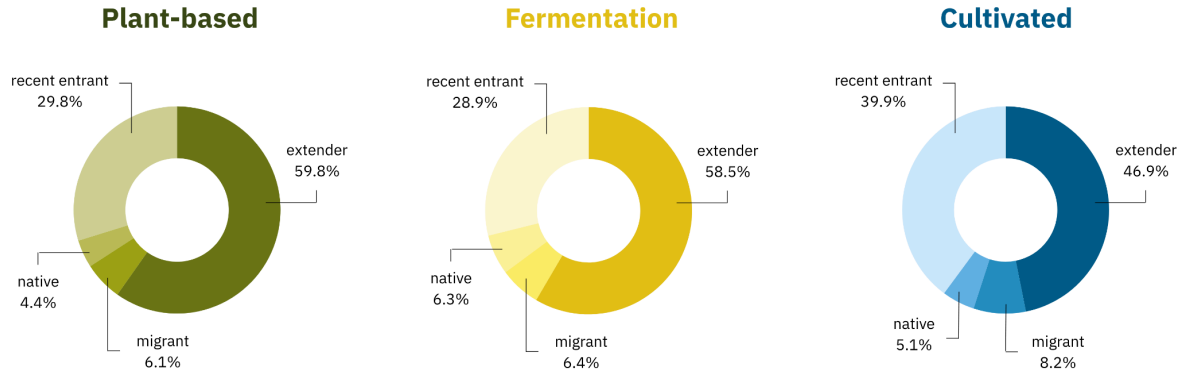
Alternative proteins are a minority but steadily increasing focus in the European academic community. Adjacent talent pools, which remain almost entirely untapped, could be mobilised quickly through targeted investment, but the research communities that make up each alternative protein pillar have different needs.

Alternative proteins are a minority focus for most researchers

While the number of researchers in Europe publishing on alternative proteins is growing steadily, only a small minority focus exclusively on the field. Our dataset shows an average 67% increase in the number of European researchers publishing on topics related to alternative proteins from 2023-2025 across all three alternative protein pillars. This growth varies across pillars, ranging from a 60% increase in the plant-based community to a 126% increase in the cultivated meat community over the same period. Fermentation tracks close to the mean with a 68% increase.

However, only 6-8% of these researchers fully adopted alternative proteins as the sole focus of their research (a group referred to here as ‘migrants’) (Figure 21). Between 47% and 60%, depending on pillars, who have moved into the field have also continued to publish in their original fields (‘extenders’).

This talent pool of ‘extenders’ represents significant untapped potential for further growth of the field in Europe. These researchers already have the expertise and research skills relevant to alternative proteins and, given their only partial focus, further funding could incentivise a pivot towards a majority focus on alternative proteins. Growing this pool of extenders to bring in new research expertise could also be beneficial for the alternative protein field and lead to a more diverse range of perspectives and, therefore, a broader range of creative ideas on how to solve the most pressing technical challenges.



Native
Two or fewer pre-entry publications, or first alternative protein publication came in the period 2010-2011. As a result, no transition took place; alternative proteins is where their record begins.

Migrant
A substantive pre-entry record, and alternative protein research accounts for at least 50% of post-entry output. The transitioning group.

Extender
A substantive pre-entry record that continues after entry, with alternative protein research a minority focus of their overall research output. A sideline rather than a move.

Recent entrant
Entered in the final two years, so post-entry output is too short to distinguish migrant from extender.

Figure 21. Stratification of researchers based in Europe who published on topics related to alternative proteins in the years 2023-2025 inclusive on the basis of whether alternative proteins are a minority or majority focus of their research.

The alternative protein pillars are rooted in distinct scientific disciplines

While these patterns of movement into the field look similar across the pillars, the characteristics of the research communities that make up those pillars are quite different. Analysis of the topics covered by researchers before they moved into the alternative protein field can help us understand how the community has grown, and crucially, how it might develop further.

This analysis reveals that the alternative protein pillars are rooted in distinct scientific disciplines. Researchers covering topics in the plant-based and fermentation pillars most commonly originate from food sciences. A large number of fermentation researchers also come from industrial biotechnology and chemical engineering. In contrast, cultivated meat scientists are more likely to come from clinical sciences and biomedical engineering, as well as food science (Figure 22).

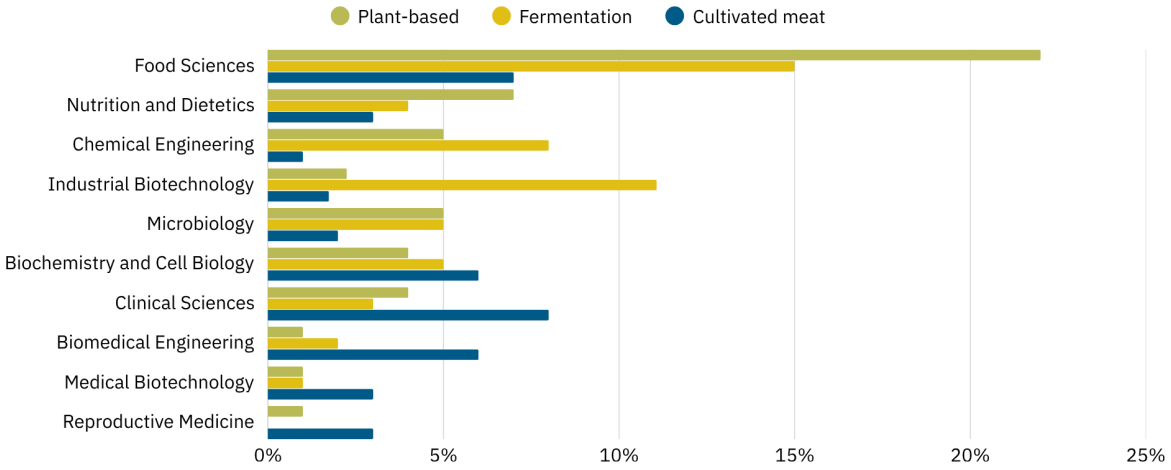


Figure 22. Sub-fields of research from which researchers based in Europe who published on topics related to alternative proteins in the years 2023-2025 inclusive have transitioned.

Of the disciplines that contribute publications to the field, food science has the highest saturation of alternative protein researchers. Some smaller countries, such as Denmark, Finland, Ireland and the Netherlands, have mobilised a substantial group of their food scientists into alternative protein research, but across Europe less than 11% of the total food science community in 2025 had contributed to the field, meaning there is substantial room for growth (Figure 23). In other critical disciplines, such as industrial biotechnology, this figure is less than 2%. These largely uncoordinated researcher movements give an indication of the breadth of expertise from adjacent fields that is relevant to alternative proteins, and provide clues as to how the underlying talent base for alternative proteins can be built further. Each pillar needs a tailored approach to support its growth, given they recruit from different fields and for different expertise.

A strategic funding approach could strengthen the European research community in targeted ways. For example, incentivising researchers from food science to consider research challenges related to fermentation that can improve hybrid product formulation, or expanding opportunities for researchers from engineering disciplines to explore second-generation texturisation methods for plant-based proteins.

Likewise, as highlighted in earlier sections, it is clear that the European alternative protein research community has benefited from the expertise of international collaborators from around the world. To build on this progress, funders should design multilateral funding mechanisms to draw on cross-border knowledge-sharing to strengthen European research in areas where it would benefit from international cooperation.

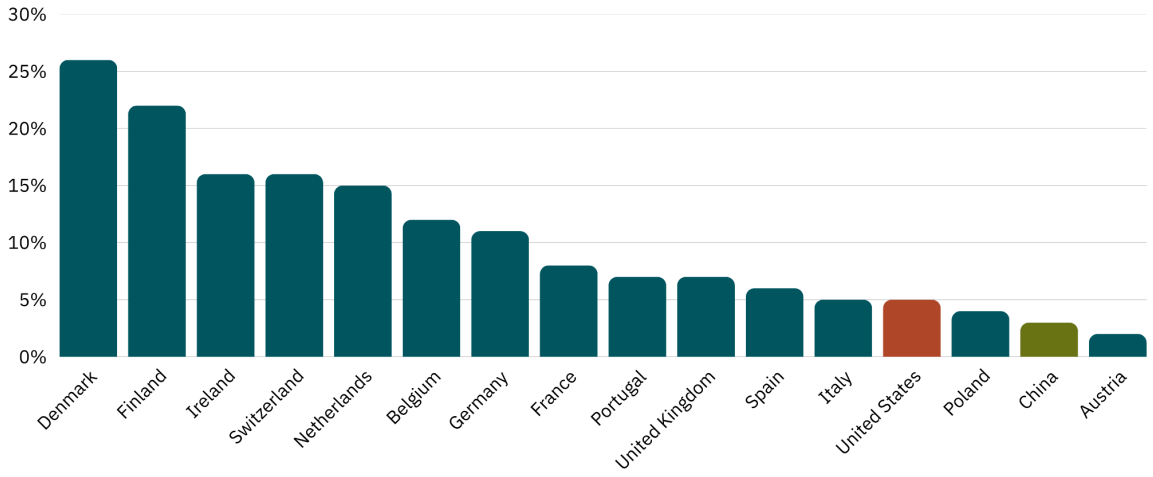


Figure 23. Proportion of food science researchers based in selected European countries who published on topics related to alternative proteins in the year 2025 and comparison to the US and China.

The alternative protein pillar research communities have different needs for growth

As well as recruiting from different fields, the three pillars exhibit different distributions of academic maturity.[16] Cultivated meat has a much younger research community, with 30% of the 500 most productive European researchers, as measured by publication output, being within 0-5 years of their first publication of any kind (early career researchers, or ECRs) (Figure 24). This figure is almost twice that of plant-based researchers (17%) and higher than for fermentation (24%).

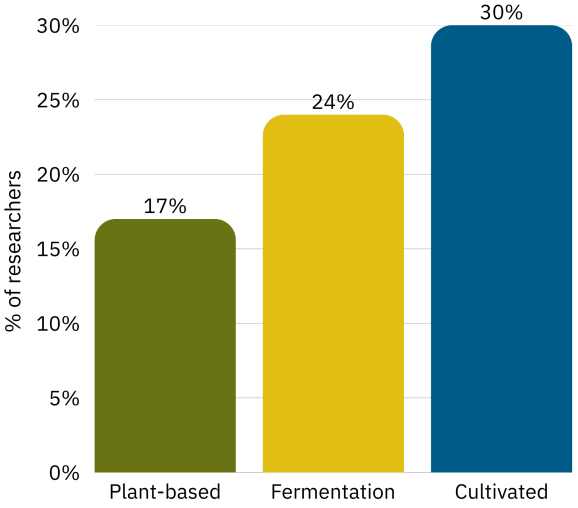


Figure 24. Proportion of researchers in the top 500 most productive in Europe from each alternative protein pillar, as measured by number of research publications in the years 2023-2025 inclusive, with 0-5 years of academic maturity.

[16] Academic maturity (also referred to as 'academic age') is calculated using the difference between the last and first publication year and indicates the stage of the researchers' academic career.

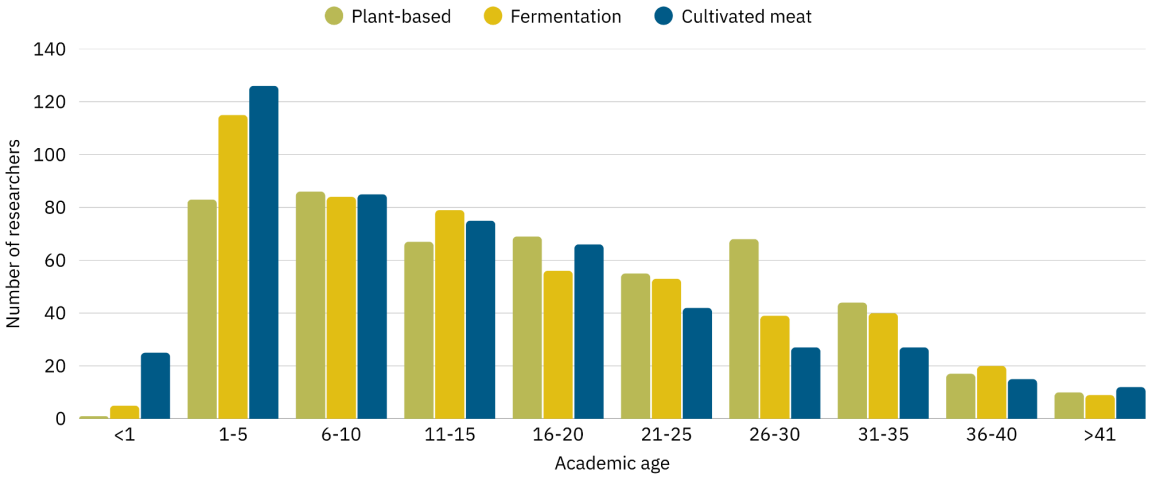


Figure 25. Researchers in the top 500 most productive in Europe for each alternative protein pillar, as measured by publications in the years 2023-2025 inclusive, on the basis of academic maturity. Academic maturity (also referred to as 'academic age') is calculated using the difference between the last and first publication year and indicates the stage of the researchers' academic career.

As a result of this younger community, as well as having a higher proportion of recent entrants than the other pillars, the cultivated community appears less settled, and therefore more vulnerable to occurrences that might disrupt a budding research field, such as gaps in funding availability. In contrast, the more established plant-based pillar has proportionally far fewer young researchers in the top 500 most productive (Figure 25).

This further points to the need for tailored approaches to meet the distinct needs of these research communities. A traditional mix of funding mechanisms may be sufficient to support the continued expansion of the plant-based research community. However, a greater focus on promoting career progression for early-career researchers may reap better results for the fermentation and cultivated communities, providing follow-on funding to enable these junior researchers to establish their own research groups and consolidating the nascent growth of these research disciplines.

Key takeaways

Alternative proteins are a minority but steadily increasing focus in the European academic community. Europe already has the talent base to be a leader in the alternative protein space, with room to grow further.

The alternative protein pillars are rooted in distinct scientific disciplines and have different requirements for growth. Europe needs coordinated and concerted investment to attract talent from adjacent fields, which remain almost entirely untapped.

By better tapping the underlying talent base, Europe can deepen its research strengths and establish a stronger basis from which innovation can spring.

Conclusions and recommendations

Europe is a leader in alternative protein research, but is less effective than other leading economies at translating science into innovation. The region needs a coherent research strategy on protein diversification, aligned with Europe's industrial strategy, to develop its technological strengths, support greater public-private collaboration, and ensure it reaps the benefits of its leadership position.

Europe has established an early lead in alternative protein R&I

Europe was an early mover in alternative protein research, committing almost €1.3 billion to alternative protein R&I since 2020. As a result, Europe is the leading region for academic research as measured by volume of publications. Backed up by globally competitive institutions and the world's largest alternative protein research community, Europe is playing a crucial role in addressing a broad range of research areas across technological development and societal impact assessments.

Europe has also published the highest volume of patents in recent years, and European innovators have filed patents in a broad range of jurisdictions around the world. Many of the most productive private sector assignees are European, suggesting a healthy, research-active private sector. As a result, some European countries are making an outsized contribution to global patent generation, especially on a per capita basis.

Taken together, these data indicate that Europe is laying the groundwork to reap the economic and societal benefits of the protein transition. However, Europe's early success in alternative protein R&I is by no means a guarantee of securing a long-term leadership role in this sector. In recent years, the global research community has grown substantially and, in particular, China is quickly catching up in terms of research publication output. China also leads Europe in patenting unique innovations by a significant margin, and, alongside Japan and South Korea, is increasing its rate of patent output faster than Europe.

This points to a potential future technology deficit if European R&I cannot keep pace with other leading economies. It is therefore vital that Europe continues to fund alternative protein R&I, consolidating existing research capacity but also supporting greater collaboration both within Europe and with international partners.

There is a significant gap between public and private R&I in Europe

While this report shows that Europe has established a leadership role in both the academic and industry spheres of alternative protein R&I, it also points to a gap between these sectors and a sense that Europe is not capitalising on the considerable potential of its R&I ecosystem.

The data presented here indicate that European researchers collaborate with industry on publications more frequently than their Chinese or US counterparts do. This suggests that links between European industry and academia do exist and can therefore be strengthened with the right interventions. However, only a very small proportion of European patents relating to alternative proteins have both a public and private assignee.

In contrast, Chinese public institutions play a major role in driving patent generation, a clear area of weakness for European institutions. While there are important differences in patenting trends between Europe and China, not least in the form of historical Chinese government subsidies for patenting activity,[17] this suggests European research institutions may be underperforming in relation to patenting activity in this field.

To build on the progress made to date and strengthen its leadership role in the alternative protein sector, Europe must close the gap between academic research and private innovation. Following examples where the European private sector has been incentivised to collaborate with academia, such as in the Circular Biobased Europe Joint Undertaking, can help Europe solidify its standing in alternative protein IP generation.

Public funding must be aligned to innovation strengths

This analysis finds that many leading countries outside of Europe have mostly prioritised funding for technology development. In contrast, roughly one third of European funding goes to societal impact research. As a result, China leads in many technical research categories, while Europe leads in all four of the societal impact categories, such as consumer acceptance and impact assessments.

There is no disputing the importance of societal research in helping to understand the route to the sustainable adoption of alternative proteins. However, research in these areas does not directly generate new technologies that can solve challenges associated with achieving taste and price parity for alternative proteins, and thereby bring successful products to market. Europe currently leads in some technology

[17] These subsidies were phased out in mid-2021, so are not necessarily relevant to the results of this analysis.

categories, such as bioprocess design, demonstrating that it has the necessary technical skills to be a frontrunner, but investment is not sufficiently targeted towards moving new technologies out of the research lab and into commercial deployment. If the goal is to stimulate economic growth and build domestic capabilities in bioindustries, Europe is losing out.

Europe requires a focused research strategy to develop true technological strengths in alternative proteins. This should be based on analysis of its current position and aim to support greater public-private collaboration. Working together, the European Commission and national governments should align their funding efforts to ensure Europe directs effort towards solving critical technological roadblocks and supporting the scale-up and commercialisation of those solutions.

Europe already has a deep well of research talent to draw from

Alternative proteins are a minority but steadily increasing focus in the European academic community. Yet only a small fraction of researchers are fully dedicated to the field, and adjacent talent pools remain almost entirely untapped. This analysis reveals that there are skilled scientists in relevant disciplines that are yet to explore the field of alternative proteins, and targeted funding could enable them to do so.

Incentivising scientists from diverse backgrounds to apply their knowledge and skills to this research field can accelerate progress on the technical challenges associated with achieving taste and price parity in alternative proteins. Understanding the needs of each alternative protein pillar's research community, and the sub-communities that make it up, will be crucial to achieving this.

This opens a window of opportunity for Europe: by putting a plan in place to mobilise the existing talent base, which remains largely untapped, the region can deepen its research strengths and establish a stronger research basis from which innovation can spring. Some European countries, such as Denmark, Finland and the Netherlands have already begun to do this successfully, and the rest of Europe can follow their lead. As evidenced in this report, both national and EU funding play a critical role in enabling the mobilisation of talent, further reinforcing the need for a coherent industrial strategy for alternative proteins at the European level.

Glossary

Assignee: organisations or individuals listed as assignees on patents in the result set. Assignee country is the country in which an assignee is located.

Citations: The count of all publications which reference the publications in the result set, regardless of if they are also in the result set.

Cooperative Patent Classification (CPC) codes: A hierarchical system used by patent offices to classify patents by technology area. In this analysis, CPC codes were used to retrieve additional relevant patents and to restrict results to relevant technology areas. The definitions can be found here.

EU: The 27 member states of the European Union plus the European Commission.

Europe: In this report, Europe refers to the 27 member states of the European Union plus Norway, Switzerland and the United Kingdom.

Fields of Research (FoR): The research classification used by Dimensions, based on the Australian and New Zealand Standard Research Classification (ANZSRC 2020). Each publication is assigned to one or more fields, such as food sciences or biological sciences.

Fractional counting: A counting method for publications, patents or grants involving several co-authors, co-assignees or co-funders, respectively, where an equal weight is given to each collaborator and summarised by the category of interest, such as countries or institutions. In contrast with summed counting, this ensures that each publication, patent or grant receives a total weight of one and records with many collaborators are not overestimated.

Internal citations: Citations arising from a publication involving at least one researcher based in the same country as the cited publication.

Jurisdiction: The jurisdiction in which a patent has been filed, e.g. United States, Germany, European Patent Office.

Multi-organisational collaborations: Research publications arising from a collaboration between two or more distinct research performing organisations, irrespective of the country where those organisations are located.

Patent: An exclusive right granted for an invention. Patents benefit inventors by providing them with legal protection of their inventions.

Patent family: A group of patent documents covering the same invention, filed in different countries or at different times. Classification and labelling were only

performed for one representative per patent family and propagated to all other family members.

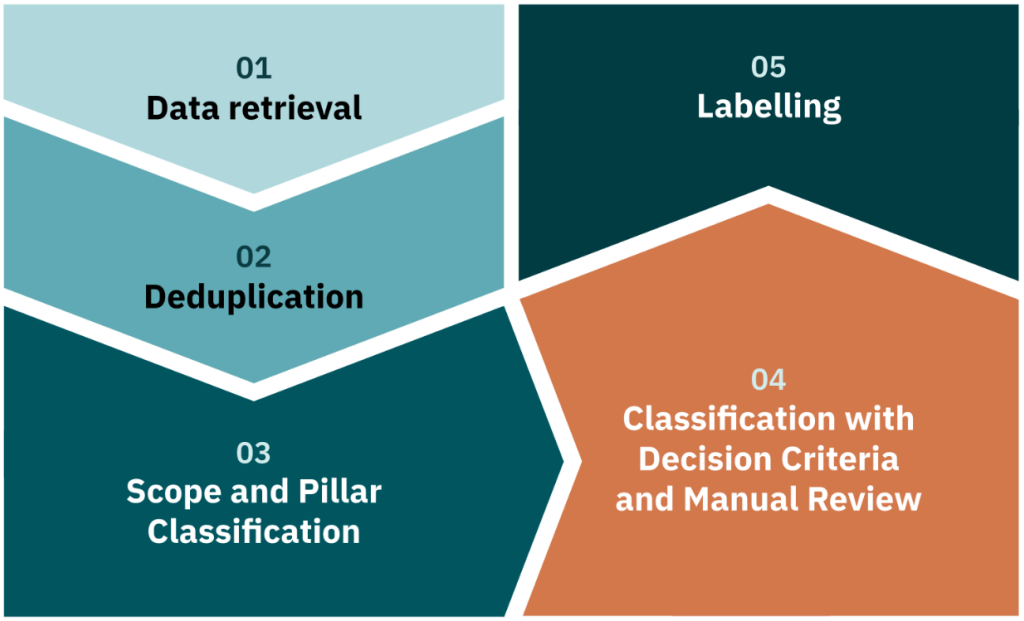
Research institutions: An umbrella term for not-for-profit research-performing organisations, such as universities, research institutes, and government laboratories.

Summed counting: A counting method for publications, patents or grants involving several co-authors, co-assignees or co-funders, which captures the total unweighted number of publications, patents or grants that each country, region, or institution has contributed to. In contrast with fractional counting, this ensures that the total contribution made by each collaborator is accounted for, but does not allow for proportional comparisons.

Technical appendix

Data collection and classification pipeline

Publications, patents and public research funding were collected, screened and classified using a semi-automated pipeline. Publications and patents were collected for 2010-2025 and funding for 2020-2025, globally.



The pipeline consists of six steps: (01) data retrieval, (02) deduplication, (03) scope and pillar classification, (04) classification with decision criteria and manual review, and (05) labelling. The steps are the same for all three data types, with dataset-specific adjustments described below. The full code, LLM prompts and documentation are available in the GitHub repository.

01 **Data retrieval.** All publications and patents, and part of the funding data, were retrieved from Dimensions (https://www.dimensions.ai) via its API using keyword search strings (Table S1). For patents, a manually curated list of Cooperative Patent Classification (CPC) codes was used to retrieve additional patents (Table S2). Data were accessed between 10 July 2026 and 30 July 2026.

Table S1. Dimensions search strings

	Search string	Used for
1	("alternative protein" OR "meat substitutes" OR "slaughter-free meat" OR "animal-free meat" OR "vegan meat" OR "meat alternative" OR "animal-free" OR "animal substitute" OR "meat substitute" OR "meat analogue" OR "meat analog" OR "seafood substitutes" OR "plant-based seafood" OR "fake fish" OR "fish substitutes" OR "plant-based fish" OR "smart protein" OR "clean meat" OR "future food" OR "sustainable protein" OR "protein production")	Publications Funding
2	"food" AND "protein" AND ("plant" OR "plant based" OR "plant based meat" OR "vegetable" OR "vegetarian" OR "vegan" OR "plant based seafood" OR "plant based fish" OR "algae" OR "algal" OR "macroalgae" OR "kelp" OR "microalgae" OR "seaweed" OR "crop")	Publications Funding
3	("plant based milk" OR "non dairy milk" OR "oat milk" OR "soy milk" OR "rice milk" OR "plant based cheese" OR "plant based dairy" OR "vegan dairy" OR "vegan cheese" OR "vegan milk" OR "dairy substitute" OR "milk substitute" OR "dairy alternative" OR "milk alternative" OR "dairy replacement" OR "milk replacement" OR "cashew cheese" OR "plant based egg" OR "egg substitute" OR "egg replacement" OR "egg alternative" OR "vegan egg")	Publications Funding Patents
4	"food" AND "protein" AND ("precision fermentation" OR "fermentation derived" OR "fermentation made" OR "biomass fermentation" OR "fermentation" OR "mycoprotein" OR "single cell" OR "microbial" OR "fusarium" OR "quorn" OR "fusarium venenatum" OR "fungus" OR "fungi" OR "fungal" OR "mycelium" OR "mycelial" OR "recombinant protein" OR "microbial cell factories" OR "recombinant expression" OR "microalgae" OR "microalgal" OR "yeast" OR "cellular agriculture" OR "synthetic biology" OR "edible filamentous fungi" OR "fungal hyphae" OR "bacteria" OR "bacterial" OR "engineering biology" OR "hydrogen oxidizing bacteria" OR "microbial biomass" OR "saccharomyces cerevisiae")	Publications Funding
5	("cultivated meat" OR "cultured meat" OR "cell cultured meat" OR "lab grown meat" OR "cell-based meat" OR "cellular agriculture" OR "synthetic meat" OR "cell grown meat" OR "cellular meat" OR "stem cell meat" OR "cultivated seafood" OR "cultured seafood" OR "lab grown seafood" OR "cell based seafood" OR "lab grown fish" OR "cell-based fish" OR "cell cultured fish" OR "cell cultured seafood" OR "cellular aquaculture" OR "cell grown seafood" OR "cell-grown fish" OR "cellular seafood" OR "in vitro meat" OR "cultivated fat" OR "cultured fat")	Publications Funding Patents with "artificial meat" added
6	("meat substitute" OR "meat analogue" OR "meat analog" OR "vegan meat" OR "meat alternative")	Patents

	Search string	Used for
7	("fish substitute" OR "fish analogue" OR "fish analog" OR "fish meat" OR "fish alternative" OR "seafood substitute" OR "seafood analogue" OR "seafood analog" OR "seafood meat" OR "seafood alternative")	Patents
8	("precision fermentation" OR "fermentation derived" OR "fermentation made" OR "biomass fermentation" OR "fermentation" OR "mycoprotein" OR "single cell" OR "microbial" OR "fusarium" OR "fusarium venenatum" OR "fungus" OR "fungi" OR "fungal" OR "mycelium" OR "mycelial" OR "recombinant protein" OR "microbial cell factories" OR "recombinant expression" OR "microalgae" OR "microalgal" OR "yeast" OR "edible filamentous fungi" OR "fungal hyphae" OR "bacteria" OR "bacterial" OR "engineering biology" OR "hydrogen oxidizing bacteria" OR "microbial biomass" OR "saccharomyces cerevisiae") AND ("meat substitute" OR "meat analogue" OR "meat analog" OR "vegan meat" OR "meat alternative" OR "plant based milk" OR "non dairy milk" OR "oat milk" OR "soy milk" OR "rice milk" OR "plant based cheese" OR "plant based dairy" OR "vegan dairy" OR "vegan cheese" OR "vegan milk" OR "dairy substitute" OR "milk substitute" OR "dairy alternative" OR "milk alternative" OR "dairy replacement" OR "milk replacement" OR "cashew cheese" OR "plant based egg" OR "egg substitute" OR "egg replacement" OR "egg alternative" OR "vegan egg")	Patents

Table S2. CPC codes used for patent retrieval and filtering

Purpose	CPC codes
Search (35 codes): selected manually based on CPC definitions. Patents with ≥ 1 of these codes were retrieved	A23C11/065, A23C11/10, A23C11/103, A23C11/106, A23C20/005, A23C20/02, A23C20/025, A23J1/005, A23J1/006, A23J1/007, A23J1/008, A23J1/009, A23J1/12, A23J1/14, A23J1/18, A23J3/14, A23J3/16, A23J3/18, A23J3/20, A23J3/225, A23J3/227, A23L11/40, A23L11/45, A23L11/50, A23L11/60, A23L11/65, A23L15/35, A23L17/35, A23L31/00, A23L33/185, A23L33/195, A23V2200/264, C12N5/0043, C12N5/0653, C12N5/0658
Filter (108 codes): only patents with at least one of these codes, or with no CPC code, were kept. The list contains all CPC codes assigned to the in-scope patents of GFI Europe's previous patent dataset	A21D2/266, A22C7/0007, A22C7/0023, A22C17/10, A22C18/00, A23B2/754, A23C9/1522, A23C9/1526, A23C11/00, A23C11/02, A23C11/04, A23C11/06, A23C11/10, A23C11/103, A23C20/00, A23C20/02, A23D9/02, A23G1/423, A23G1/48, A23G3/0097, A23G9/42, A23J1/14, A23J3/10, A23J3/14, A23J3/16, A23J3/20, A23J3/22, A23J3/227, A23J3/26, A23K10/30, A23K20/147, A23L2/39, A23L2/395, A23L11/05, A23L11/30, A23L11/50, A23L13/00, A23L17/60, A23L19/01, A23L25/40, A23L27/20, A23L27/24, A23L27/88, A23L29/10, A23L29/212, A23L29/238, A23L29/256, A23L33/14, A23L33/185, A23L33/21, A23N1/02, A23P30/20, A23V2002/00, A47J31/401, A47J31/4485, A47J31/4489, A61K9/107, A61K31/155, A61K2800/10, A61L24/102, A61L27/52, A61Q13/00, B07B1/46, B26D2210/02, B29B7/82, B65B3/04, C07K14/415, C07K14/49, C07K14/503, C08L3/02, C09B61/00, C10K3/023, C11C3/10, C12F3/06, C12M21/08, C12M23/26, C12M23/58, C12M25/10, C12M25/14, C12M27/02, C12M29/04, C12M29/10, C12M41/48, C12N1/14, C12N1/16, C12N1/20, C12N1/205, C12N5/0075, C12N5/0653, C12N5/0658, C12N9/6483, C12N9/80, C12N9/88, C12N9/90, C12N15/67, C12N2501/115, C12N2501/125, C12N2501/999, C12N2510/00, C12N2513/00, C12P19/04, C12P21/02, C12R2001/645, E04H5/02, G01N1/08, G01N33/04, G16C20/70, G16H30/00

02 **Filtering and Deduplication.** Records were deduplicated by their unique Dimensions ID. All patents were additionally filtered with a list of CPC codes, containing all codes assigned to the in-scope patents of GFI Europe's previous patent dataset, keeping only patents with at least one code from this list or with no CPC code at all (Table S2). Only the newest version of a patent was kept and one representative patent per patent family selected for classification. Publications were limited to journal articles.

03 **Scope and Pillar Classification.** Each record was classified in two steps, based on its title and abstract. First, ML classifiers trained on a manually labelled training dataset predicted scope and alternative protein pillar. Title and abstract of publications were embedded using the SPECTER2 model and classified with logistic regression. Title and

abstract of patents were embedded using the PatentSBERTa model and support vector machine models. The ML threshold was set to remove as many out-of-scope records as possible while retaining at least 99% of in-scope records, based on the training data. Second, all records passing the ML stage were classified by an LLM (Claude Sonnet 4.6, Anthropic). The LLM returned a scope decision (in or out), a confidence score from 1 (clearly out of scope) to 7 (clearly in scope) and the relevant pillar: plant-based, fermentation, cultivated or cross-cutting. Records assigned to more than one pillar were classified as cross-cutting. The ML training labels and the LLM prompts are based on the same inclusion and exclusion criteria (Table S3).

Table S3. Inclusion and exclusion criteria

Inclusion criteria	Applies to
Plant-based, fermentation-derived or cultivated substitutes for protein-rich animal-derived foods (meat, seafood, dairy, eggs), at ingredient or product level	All
Research or inventions on the development, production, processing, formulation or characterisation of alternative protein ingredients or products, or the processes used to produce them	All
Non-protein and functional ingredients (e.g. lipids, fibres, hydrocolloids, enzymes, pigments, vitamins) intended to improve the nutritional, sensory or functional performance of alternative protein products	All
Enabling technologies (e.g. scaffolds and biomaterials, cell culture components, extraction and processing methods, encapsulation, texturisation equipment) with alternative protein production as a stated application	All
Agronomic research on high-protein crops (e.g. pea, faba bean, soy, lupin) explicitly concerning protein extraction, quality, yield or processing for alternative protein applications	All
Hybrid products combining alternative and animal proteins, where the research is relevant to alternative protein development	All
Flavour, aroma, nutrition or allergenicity of alternative proteins where the use case is substituting animal products (patents: only with a development or optimisation aim)	All
Societal, policy, regulatory, consumer, market, environmental, safety, life-cycle or techno-economic research in which alternative protein products are explicitly named	Publications Funding
Comparisons of alternative and animal proteins where alternative protein ingredients or products are named and studied	Publications Funding

Inclusion criteria	Applies to
Nutritional products for healthy populations (e.g. infant formula, products for children)	Publications Funding
Patents with at least one explicitly stated alternative protein application, even alongside other applications	Patents
Modification of protein isolated from staple crops (e.g. corn protein, wheat gluten, rice protein) to improve food ingredient properties	Patents
Apparatus and methods designed for biomass fermentation, and biomass production of established food-grade organisms (e.g. Chlorella, Spirulina, mycoprotein-producing fungi)	Patents
Established alternative protein product categories (e.g. plant-based milks, meat and seafood analogues), even when not described as substitutes	Patents
Functional ingredients (e.g. flavour maskers, binders, emulsifiers, texturisers) addressing protein-related sensory or functional challenges	Patents

Exclusion criteria	Applies to
Insects and insect-based proteins	All
Non-human food applications: animal feed, aquafeed, pet food, biofuels, pharmaceuticals (patents: also cosmetics)	All
Foods that do not substitute animal products (e.g. bread, pasta, snacks, sauces, sweeteners, condiments, flavourings, fermented beverages)	All
Dietary, health or socioeconomic studies where alternative protein products or ingredients are not named or studied (e.g. general plant-based, vegan or Mediterranean diets)	All
General agronomic research on staple or starch crops where protein is not the primary value (e.g. wheat, rice, maize, potato)	All
Medical nutrition and products for diagnosed medical conditions (e.g. nutraceuticals, bioactive peptides, therapeutic formulas)	All
Meat analogues or hybrid products in which the primary protein source is animal-derived	All
Conventional animal products enriched with plant- or fermentation-derived ingredients	All

Exclusion criteria	Applies to
Agricultural economics, food security or rural development research where alternative protein products are not named	All
Fermentation for vitamins, pigments or micronutrients where protein is not a primary focus	All
Fermentation of animal-derived substrates	All
Inputs or processes aimed at the valorisation of animal-derived materials	Patents

01b **Reverse searches.** To capture relevant records that the keyword search missed, two reverse searches were run. For publications, the researcher ID's of the top 500 researchers were used to retrieve all of their publications within the time window. The publications went through the same subsequent classification steps as publications retrieved via the keyword search. For patents, the family ID's of the patent families identified as relevant were used to retrieve all patents belonging to these families and received the same classification as their other family members.

04 **Classification with Decision Criteria and Manual Review.** The ML probability and the LLM confidence score were combined into decision rules that sorted each record into automatically included, automatically excluded or manual review (Table S4). For 2023-2025, all manual review records were classified manually by the GFI Europe team, who assigned the final scope and pillar. For 2010-2022, manual review records were not reviewed and were excluded. To keep long-term trends comparable across all years, analyses covering 2010-2025 use only automatically included records, while analyses of 2023-2025 alone use the full, manually reviewed dataset.

Table S4. Decision rules and share of share of retrieved data (after deduplication & CPC filtering)

Outcome	Publications	Patents	Funding
Auto-include	LLM in scope with confidence ≥ 5 with a predicted pillar 7.6%	LLM in scope with confidence ≥ 5 or ML probability ≥ 0.8 with a predicted pillar 24.8%	LLM in scope with confidence ≥ 5 14.5%
Manual review	All remaining records 12.0%	All remaining records 8.7%	LLM confidence 2-4 20.8%
Auto-exclude	Removed by ML or LLM confidence = 1 80.4%	LLM out of scope with confidence ≤ 2 and ML probability < 0.8 66.5%	LLM out of scope with confidence 1 64.7%

05 Labelling. In-scope records were then labelled by the LLM with additional categories, using pillar-specific prompts where relevant:

- **Research category** (all data types): publications and patents received one research category label, grants one or more categories. The available categories differ by pillar and data type (Table S5)
- **Sub-pillar** (patents and grants): the fermentation pillar was further divided into the additional sub-pillars biomass or precision fermentation. For funding, plant-based grants were also flagged for traditional fermentation, and cross-cutting grants were split into broad R&D, technical research and socioeconomic research.
- **End product** (patents and funding): Table S6
- **Ingredient** (patents only): Table S7
- **Award purpose** (funding only): Table S8

Research category, sub-pillar, end product, ingredient and award purpose labels were not reviewed manually.

Table S5. Research categories by pillar

Relevant pillars: Plant-based (PB)[18], Fermentation (F), Cultivated (CM), Cross-Cutting (CC)
Data types: Publications, Patents, Funding[19]

Research category	Description	Relevant pillar(s)	Data type(s)
Strain development	Screening and optimisation of novel strains to identify the most efficient pathways for producing targets or modifying substrates.	F PB	All
		CC	Funding
Cell line development	Sourcing, optimising, and banking new and existing cell lines to achieve faster cell growth, greater stability and stress tolerance, improved cell line performance (such as adherence and differentiation), and higher cell density in terrestrial and aquatic cell lines.	CM CC	All Funding
Target molecule selection	Target identification and validation to broaden the scope of food ingredients produced by precision fermentation.	F CC	All Funding
Cell culture media	Reducing cell culture media costs and increasing their availability by characterising and validating novel sources of growth factors, amino acids, and other media components.	CM CC	All Funding
Feedstocks	Innovations in media, including new components and feedstock utilisation strategies (including the use of alternative feedstocks) to achieve higher efficiency, greater scale, and reduced costs.	F CC	All Funding
Bioprocess design	Innovations in bioreactor design including improved efficiency, monitoring and control, and both upstream and downstream process innovations.	F CM CC	All
Crop development	Breeding of crops and increased use of underutilised protein crops for higher protein yields and functionality.	PB CC	All Funding
Ingredient optimisation	Improved protein fractionation and functionalisation to achieve higher-quality ingredients with less processing. Also covers the development of novel ingredients to augment nutritional profiles and enhance the sensory experience of alternative protein products.	PB F CC	All
Scaffolding	Improved scaffolding biomaterials that support cell adherence and differentiation to allow the replication of complex animal meat structures.	CM CC	All
Texturisation methods	Process innovations, including (but not limited to) novel texturisation methods such as extrusion, electrospinning, 3D printing, and enzymatic processing to match the texture of animal protein.	PB F CM CC	All

[18] Refers to the use of traditional fermentation techniques to modulate or enhance the characteristics of plant proteins.

[19] More research categories were available for grants assigned cross-cutting than for other data types, because funding data could be assigned to multiple research categories.

End product formulation	Formulation and product design and testing including fat integration, shelf life and stability testing, evaluations of sensory quality, and nutritional assessment and fortification.	PB F CM CC	All
Health & nutrition	Dietary impacts of alternative proteins including population-wide studies, systematic reviews, and *in vitro* studies on health impacts, for example, bioavailability.	PB F CM CC	All
Food safety & quality	Toxicological and safety assessments, regulatory improvements, such as assay development or validation.	PB F CM CC	All
Consumer & market research	Consumer behaviour research including nomenclature studies, purchasing intent (including retail and food environments), and market scoping and brand development.	PB F CM CC	Publications & Funding
Impact assessments	Impact assessments including life cycle or techno-economic analyses, economic and other broader environmental impact assessments, and social/geopolitical impacts including policy interventions.	PB F CM CC	Publications & Funding
Other	Publications on topics not covered by the other research categories described here. This can include discussions on the political, ethical, or philosophical implications of alternative protein or the protein transition. Broad-scope review articles covering numerous aspects of alternative proteins are also assigned to this category.	PB F CM CC	All

Table S6. End product categories

End product	Definition
Meat	Products replicating whole cuts, mince, burgers, sausages, nuggets, deli meat and other meat formats
Fish and seafood	Products replicating fish fillets, tuna, shrimp, crab and other seafood
Milk and milk proteins	Liquid milk alternatives and milk protein ingredients
Yoghurt and fermented dairy	Non-dairy yoghurt, kefir and other fermented dairy analogues, and cultures for producing them
Cheese	Cheese analogues and cheese-making technologies, e.g. rennet and chymosin replacers
Cream and ice cream	Plant-based cream and frozen dairy-style desserts
Infant formula	Alternative protein infant formula and its ingredients
Dairy	Dairy alternatives where the specific dairy subcategory cannot be determined
Eggs and egg proteins	Egg replacers and egg proteins, including precision fermentation-derived egg proteins
Chocolate, desserts and confectionery	Dairy-free chocolate, desserts and confectionery
Spreads, sauces and condiments	Plant-based mayonnaise, dressings, sauces and fat-phase spreads such as butter alternatives
Cross-cutting	Inventions explicitly designed for several distinct end product categories
Agnostic	No specific food product application, e.g. equipment, organisms or processes

Table S7. Ingredient categories

Ingredient	Definition
Isolates, concentrates and flours	Purified or concentrated protein ingredients in dry or powder form from plant, fungal, yeast or microbial sources
Emulsions, gels and binders	Ingredients whose main function is emulsifying, gelling, binding or thickening
Fats and oils	Fat or oil ingredients, e.g. microbial oils, plant-based fats, oleogels
Flavours and aromas	Ingredients providing, enhancing or masking taste, flavour or aroma
Colours	Ingredients imparting or controlling colour, e.g. natural pigments and browning compositions

Table S8. Award purpose categories

Award purpose	Definition
Research and development	Scientific research, experimentation or development of a product, process or technology
Education and training	Fellowships, PhD or postdoctoral positions, courses, workshops or capacity building
Networking	Travel, exchange visits or the coordination of a research network, consortium or partnership
Research infrastructure	Shared, institutional or multi-partner research facilities, hubs or instrumentation
Equipment and infrastructure	A single organisation's own production or manufacturing equipment or facility for making or scaling a product

Accuracy

Measured against the manually labelled training dataset, the pipeline retained 98.4% of in-scope publications, 99.6% of in-scope patents and 97.1% of in-scope grants, either through automatic inclusion or manual review. False-negative rates were 2.2% (publications), 0.4% (patents) and 2.9% (funding); false-positive rates were 0% (publications), 1.2% (patents) and 0.7% (funding). Pillar accuracy was 90–99% for plant-based, fermentation and cultivated in publications and patents, and lower for cross-cutting (84% publications, 63% patents); for funding it was around 75% across pillars. Research category accuracy was 91–99% for publications and 76–98% for patents.

Funding data retrieval and screening

The funding pipeline differs substantially from the publications and patents pipeline: Funding data covers grants from public and non-profit funders with a project start between 2020 and 2025. It combines three sources: GFI Europe's previously curated funding dataset, GFI's grants tracker and new grants retrieved from Dimensions with keyword search (Table S1).

Merging and deduplication. The three sources were merged and deduplicated. Grants with matching Dimensions IDs were merged automatically. Grants with identical or highly similar titles were flagged and checked manually against funder, amount and start date, as some funders issue a new grant with the same title each year. Where a match was confirmed, missing information in one record was filled in from the other. Grants without a project start date were completed manually or removed, and funder types missing in the grants tracker were assigned manually.

Screening. Unlike publications and patents, new Dimensions grants were classified by the LLM directly, without an ML step, using the same inclusion and exclusion criteria (Table S3). Borderline grants were reviewed manually (Table S4). Grants from the previous dataset and the grants tracker had already been curated and were not re-screened. After labelling, a final completeness check identified grants with missing labels, which were completed manually.

Funding amounts and currencies. Amounts were taken in the original currency, US dollars and euros. Where available, euro amounts were taken directly from Dimensions, including for grants-tracker records linked to a Dimensions grant, remaining amounts were converted with the European Central Bank exchange rate on the project start date, or on 1 January of the start year if no exact date was available.

Data analysis

Long-term trends and current state. Two versions of the publications and patents datasets were analysed. Long-term trend analyses (2010-2025) use only automatically included records, so that all years were screened the same way. Analyses of the current state of the ecosystem (2023-2025) use the full dataset, including manually reviewed records, which gives a more complete picture of recent activity. Figures from the two versions are therefore not directly comparable.

Country attribution and fractional counting. Publications were attributed to the countries of their authors' affiliations, patents to the countries of their assignees, and grants to the country of the funder. Where a record involved several co-authors, countries or affiliated institutions, the contributions were counted using fractional counting, resulting in a count of 1 per publication, patent or grant.

Funding conventions. Funding analyses use the government and non-profit contribution in euros, which excludes private co-funding and, for public-private partnerships, the private

share. Only awarded grants with a project start between 2020 and 2025 were included, and grants funding only equipment or infrastructure were excluded. Grants were attributed to the year the project started or, for the analysis of funding per year, the funding amount was spread evenly across the years the project was active.

Tools. Data processing and analysis were carried out in Python and R. Figures and tables were created in Google Sheets and Canva.

Analyses using additional data

Some analyses required data beyond the publication, patent and funding datasets described above.

- **Academic maturity.** For each researcher in the dataset, the academic age was retrieved from Dimensions. The academic age of a researcher is calculated using the difference between the last and first publication year and indicates the stage of the researchers' academic career.
- **Researcher transition and fields of origin.** For all researchers with a European affiliation in the dataset, all of their publications were retrieved from Dimensions for the period of 2010-2025. Comparing these with the alternative protein dataset gave each researcher's share of alternative protein publications. The Fields of Research of their publications before their first alternative protein publication were used to identify the fields of research the pillars recruit from.
- **Talent pools.** Publication and researcher counts for adjacent Fields of Research (Crop and Pasture Production, Food Sciences, Biochemistry and Cell Biology, Industrial Biotechnology, Microbiology, Nutrition and Dietetics, and Chemical Engineering) were retrieved from Dimensions and compared with the alternative protein dataset.
- **HORIZON Europe funding.** For all HORIZON Europe grants in the funding dataset, the exact funding amount per recipient organisation was retrieved from the grant's entry on CORDIS, the European Commission's database of EU-funded projects.
- **Normalisation to population and GDP.** Population, gross domestic product and gross domestic expenditure on R&D were taken from the World Bank, Worldometer and OECD.

Additional data were accessed between 23 July 2026 and 30 September 2026.

Caveats and limitations

Limitation	Rationale and possible implications
Ongoing activities are not captured	Publications and patents reflect research completed months or years earlier, so ongoing activity is not captured. As such, this report does not capture the volume of research activity that is currently ongoing. Equally important is the fact that much of the historical R&D work on this topic has been done in the commercial realm by startups, established industry, and contract research organisations. As a result, the data presented in this analysis do not give a full overview of the total body of research that has been done on alternative proteins in Europe.
Data limitations	While this analysis was developed using a rigorous protocol, due to inevitable limitations around the identification of appropriate search terms and classification based on title and abstract only as well as the total number of publications available in the Dimensions.ai platform, it is likely an underestimate of the true size of the global alternative protein research community.
Classification errors	The automated classification misses 0.4–2.9% of in-scope records and includes 0–1.2% out-of-scope records. These rates were measured on the training dataset and may be slightly higher on new data. Pillar accuracy is lower for cross-cutting records, and research category, sub-pillar, end product, ingredient and award purpose labels were not reviewed manually.
Long-term trends vs. current state	Long-term trends use only automatically included records and therefore underestimate the true number of publications and patents. Numbers from long-term trend analyses and from current state analyses using the 2023-2025 dataset should not be compared directly.
Patents are only one metric for measuring innovation	Patents are not the only way to protect IP and the food industry relies heavily on trade secrets, so this likely only represents a small fraction of innovation going on across the sector.
Recently filed patents are not captured	This analysis is based on published patents as they are the most reliable source of information. However, patents under examination are not captured (due to the 18-month publication delay), so this does not capture the full breadth of patents filed and is therefore an underestimate of the total.

Limitation	Rationale and possible implications
Funding is reported by the jurisdiction of the funder	It is important to note that the regional analysis above was performed on the basis of the jurisdiction of the funding body. This means that the total funding in a given region will not reflect all the funding that has gone into that region from external funders, and excludes all funding from the European Commission. For the purpose of this report, funding from the European Commission was analysed as a separate jurisdiction, as the EU.
Inconsistent levels of public funding data	The funding data include only public and non-profit research funding, private investment is not included. For some countries, data coverage is significantly less extensive than others (particularly where the public funder does not release detailed funding information). Factors that influenced data availability for this report included the presence or absence of grants in the Dimensions.ai database, the GFI grants tracker or other national databases. Some grants have no recorded funding amount. All currencies were reported in Euros except where otherwise mentioned, amounts converted from other currencies depend on the exchange rate used.
Researcher classification	We acknowledge that not all of the researchers who have contributed to the publications included in this analysis would consider themselves 'alternative protein researchers' and this exercise is not about labelling them as such. Rather, it aims to understand which researchers are contributing to moving alternative proteins towards taste and price parity with conventional animal proteins and what can be done to better support them.
Measuring impact	Throughout this report we rank countries and institutions on the basis of their total research output as measured by unique publications. We acknowledge that overall research *output* is not a reliable indicator of *quality* or *impact* and, as a result, the overall contribution that specific actors have made to the growth of this field may not be accurately represented.