Good Food Institute

2022 State of Global Policy

Public investment in alternative proteins to feed a growing world

About GFI's State of the Industry Report series

GFI's State of the Industry Report series is our annual alternative protein sector deep-dive. The series compiles business developments, key technologies, policy updates, and scientific breakthroughs from around the world that are advancing the entire field. This year's reports include:

- *Cultivated meat and seafood*
- *Fermentation: Meat, seafood, eggs, and dairy*
- *Plant-based meat, seafood, eggs, and dairy*
- ***Public investment in alternative proteins to feed a growing world***

This report covers government support for and regulation of alternative proteins in regions where the Good Food Institute (GFI) has a focus. It is comprehensive through the end of 2022, with a distillation of global highlights from the first six months of 2023 [page 47]. For detailed information on government policy and regulatory actions before 2022, please see GFI's 2021 State of Global Policy Report. All dollar amounts in this report are U.S. dollars unless indicated otherwise.

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Key findings

Public investment

Public funding for alternative proteins increased significantly, with governments worldwide more than doubling their investments in 2022 alone. GFI estimates that governments invested $635 million in the alternative protein ecosystem in 2022, including approximately $180 million on research and development, $290 million on commercialization, and $165 million on initiatives that mixed elements of both. As a result, all-time public support for the alternative protein ecosystem has likely surpassed $1 billion.

Regulatory process

The United States became the second country after Singapore to complete a premarket consultation for cultivated meat. Food Standards Australia New Zealand (FSANZ) became the third regulatory body to receive an application for cultivated meat, and Israel granted regulatory approval for the country's first precision fermentation-derived animal protein.

Legislative landscape

Courts have largely rejected, overturned, or temporarily suspended efforts to constrain alternative protein sales through labeling restrictions, though a ban on plant-based cheese in Türkiye remains in effect.

Far greater support needed

Governments increased their financial, political, and regulatory support for alternative proteins in 2022 but have yet to approach the annual support needed to realize alternative proteins' benefits to the economy, climate, and global food system. Policymakers should consider increasing funding for research and development and product commercialization, as well as for regulatory instruments to ensure the safe, fair, and reliable entry of alternative proteins to the market.

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Executive summary

Few could have predicted the events that shaped the global food system in 2022. The year started with a fragile world economy's rocky recovery from the shocks of the Covid-19 pandemic. Geopolitical turmoil throughout the year caused crop and fertilizer shortages worldwide, increasing global food prices and casting once-reliable food and feed supplies in doubt. Meanwhile, the spread of African swine fever and avian flu afflicted their respective industries. Prices for a variety of foods soared, prompting worries that food insecurity and even famine would fuel global unrest and instability.

Thankfully, most food prices returned to their previous levels by the end of the year. The lesson for governments, however, has not faded: in a world in which distant events are felt at supermarkets from Seoul to São Paulo, the reliable domestic production of food—especially protein—is not simply a matter of good economics but also national security. Animal protein production requires one-third of the world's human-grade staple crops but creates a significantly smaller fraction of the human diet, representing a key area for improving global food security.

For these reasons and many others, alternative proteins began to earn unprecedented support from governments around the globe in 2022. More governments actively participated in researching, scaling up, and domestically producing alternative proteins than ever before. The higher level of public investment also represented a far more diverse array of perspectives, motivations, and strategies than in previous years.

What are alternative proteins?

Alternative proteins are proteins produced from plants or animal cells, or by way of fermentation. These innovative foods are designed to taste the same as or better than conventional animal products while costing the same or less.

Compared to conventionally produced animal products, alternative proteins require fewer inputs, such as land, fertilizer, and water, and generate far fewer negative externalities, such as greenhouse gas emissions and air pollution. They also cut food production's contribution to pandemic risk and antimicrobial resistance.

Some of these products are available to consumers today, including numerous plant-based and fermentation-derived options. Others, such as cultivated meat and seafood, remain primarily in development.

Plant-based meat is produced directly from plants. Instead of relying on an animal to convert plants into meat, we can make meat more efficiently by skipping the animal and turning plant ingredients into meat. Like animal-based meat, plant-based meat comprises protein, fat, vitamins, minerals, and water. Next-generation plant-based meat looks, cooks, and tastes like conventional meat while containing less fat, more fiber, and no cholesterol.

Image courtesy of Beyond Meat

Cultivated meat is meat produced directly from animal cells. Cultivating meat uses the basic elements needed to build muscle and fat and enables the same biological process that happens inside an animal. At the cellular level, cultivated meat is identical to conventional meat. Current life cycle analyses show that compared to conventional beef, cultivated beef is more efficient to produce while also avoiding risks of contamination and disease.

Image courtesy of GOOD Meat

Fermentation is a powerful, flexible process for using microorganisms to produce alternative proteins. *Biomass fermentation* uses the high protein content and rapid growth of microorganisms to make large amounts of protein-rich food efficiently. *Precision fermentation* uses microorganisms to produce specific proteins, enzymes, flavor molecules, vitamins, pigments, and fats. The microorganisms are programmed to be production factories and the final product is extracted in a pure form. This is how insulin for diabetic patients is produced, as well as rennet for cheese.

Image courtesy of Atlast Food Co.

Governments more than doubled the amount of financial support for advancing alternative proteins in 2022.

Singapore boosted funding for the Singapore Food Story R&D Programme's second phase, which prominently includes "developing future foods," with an additional SGD 165 million ($123 million) on top of the SGD 144 million ($108 million) dedicated in 2020.

Denmark outpaced other nations in plant-based investments with a nearly DKK 675 million ($99.4 million) investment in a fund to advance the plant-based food industry.

The Netherlands set the world record for funding cultivated meat and cellular agriculture capabilities by committing over €60 million ($66.2 million) to "building a full cellular agriculture ecosystem." That investment will fund cultivated meat and fermentation research, commercialization, education, and workforce transition programs.

Israel, an established alternative protein leader, committed over $26 million in 2022 to an array of alternative protein research projects and infrastructure development programs, including an $18 million cultivated meat consortium.

Finland, which previously had only invested lightly in alternative proteins, is nearly at the front of the pack with a €34 million ($37.3 million) grant to a startup that produces edible protein from hydrogen.

France, which attempted to restrict plant-based meat labeling in 2022, simultaneously invested at least €30 million ($33 million) in research on plant-based protein functionality and €10.4 million ($11.4 million) towards helping a plant-based meat producer buy and retrofit a production facility.

Amid the global stresses in 2022, some countries sought to protect themselves from vulnerable supply chains by investing in cellular agriculture capabilities and increasing their domestic production of protein-rich foods.

Singapore, already a world leader in cultivated meat research and development (R&D), recommitted to food security through cellular agriculture after neighboring Malaysia banned the export of live chickens from June to October of 2022 in response to skyrocketing domestic food prices, impacting one-third of Singapore's chicken supply.

Other countries leveraged alternative proteins' ability to create nutritious food using excess or undervalued resources to fit their strategic advantages.

Oman's sovereign wealth fund matched the country's over-production of dates to their under-production of high-protein foods by investing in a facility that will convert excess dates to feedstock for a protein-rich biomass fermentation operation. Meanwhile, Australia, Canada, and Denmark invested significant sums in plant-based food research and commercialization programs to create higher-value industries that source specific crops from domestic farmers.

As governments continued to set or pursue goals for reducing greenhouse gas emissions, some policymakers considered alternative proteins as a tool to reduce emissions from food systems.

More than 100 nations signed on to the Global Methane Pledge at the United Nations Climate Change Conference (COP26) in November 2021, pledging to reduce methane emissions by 30 percent by 2030. With 30 percent of current methane emissions coming from animal agriculture already, several considered ways to shift meat and dairy production to lower-impact methods. In 2022, COP27 featured food production for the first time with two pavilions dedicated to transforming food systems, including one cohosted by GFI. Israel's government pavilion highlighted alternative proteins and dubbed the country "the land of alternative milk, alternative honey, and alternative meat," while the government of Singapore arranged for the first-ever serving of cultivated meat outside its borders at the conference.

The world's largest economies took notice of alternative proteins in 2022, with the heads of state of both the United States and China recognizing alternative proteins as promising future industries in their respective nations.

In September 2022, U.S. President Joe Biden released an executive order to promote the American bioeconomy, and directed the heads of relevant agencies to report on how they can support biotechnology R&D, including a report from the U.S. Department of Agriculture (USDA) on "cultivating alternative food sources." Earlier in the year, President Xi Jinping of China stressed the importance of protein diversification in a speech to the Two Sessions, China's most important political conference.

Altogether, governments invested or committed an estimated $635 million in alternative proteins in 2022, including approximately $180 million on R&D, $290 million on commercialization and infrastructure, and $165 million on initiatives that combined elements of both.

This figure more than doubles the amount of cumulative public funding for alternative proteins and likely brought the total all-time government support to over $1 billion for the first time. This figure represents a low estimate of all-time funding, as it does not include research unknown to GFI or from countries that do not report funding totals.

Even with all of these commitments, the emerging alternative protein ecosystem needs significantly more public investment in both R&D and support for commercialization to reach its full potential in creating jobs, diversifying domestic food supplies, and mitigating the impacts of climate change. A Global Innovation Needs Assessment commissioned by the UK Foreign, Commonwealth and Development Office and the ClimateWorks Foundation found that the alternative protein sector could support 9.8 million jobs and $1.1 trillion in economic value by 2050, but only if governments worldwide commit $4.4 billion to R&D and $5.7 billion to commercialization on an annual basis. These investments will advance the science of alternative proteins and ensure that the private sector can finance, construct, and operate enough large-scale facilities to meet the growing global demand for protein. Governments worldwide should work collaboratively to reach this $10.1 billion per year goal, as this field promises to benefit many nations' economies if properly resourced.[1]

[1] For more information on the $4.4B/$5.7B breakdown, see the conclusion.

Governments also developed regulatory standards to ensure the safety of alternative proteins and labeling frameworks to ensure—or in some cases prevent—their fair representation to consumers.

Governments can ensure that alternative proteins are safe for consumption and marketed to consumers responsibly without imposing unnecessary costs on producers or consumers.

In a major milestone, the U.S. Food and Drug Administration completed a premarket consultation for UPSIDE Foods' cultivated chicken in 2022, clearing the way for its eventual entry into the massive U.S. marketplace. Singapore, which was long the only country to have approved the sale of cultivated meat products, approved multiple new products in 2022, including new cultivated meat products and fermentation-derived ingredients, such as Solar Foods' "protein from thin air."

Attempts to censor labels on alternative protein products, for example by banning the use of meat terms on plant-based or cultivated meat, saw an upswing in 2022.

Previously, they failed to pass (in Europe and some U.S. states), were overturned (in Switzerland and some U.S. states), or were preemptively blocked (in Japan). In 2022, France and South Africa instituted and temporarily overturned two additional labeling restrictions, and Türkiye banned the sale of plant-based cheese. Labeling restrictions on alternative meat or dairy products are currently in place in India, Canada, the European Union, and several U.S. states.

Alternative proteins are a crucial global solution that can advance food security, climate-smart agriculture, and pandemic prevention while providing consumers with the foods they want. Governments increased their investment in alternative proteins in 2022, providing the sector with more of the knowledge, commercialization support, and regulatory clarity needed to build and scale a global industry on a crisis timeline.

This State of Global Policy Report showcases the actions governments took to position themselves as the future economic powerhouses of a potentially trillion-dollar, security-enhancing, socially beneficial, and climate-friendly global industry.

Emerging leaders in alternative proteins

Powering plant-based:

- **Denmark** incentivized farmers to grow protein-rich crops and announced a record-breaking DKK 675 million ($99.4 million) investment in a Plant Fund to support the country's growing plant-based foods sector. The move will help Denmark reach their climate goals.
- **Canada** worked toward becoming a plant-based powerhouse. With over CAD 171 million ($127 million) invested through the end of 2022, Protein Industries Canada helped develop value-added plant-based products for Canadian farmers, while Invest in Canada promoted the sector.

Building the future of cultivated:

- **The Netherlands**, known for their innovation in agriculture, invested a record-breaking €60 million ($66.2 million) in "building a full cellular agriculture system." The program will fund research, workforce training, and commercialization.
- **Singapore** made progress toward self-sufficiency in protein production with further investments in cultivated meat, as well as granting regulatory approval to more products and forging international partnerships to jointly develop new technologies.

Providing infrastructure and capital investments:

- **Israel** took steps to maintain their burgeoning alternative protein sector with NIS 50 million ($14 million) for building fermentation facilities and by launching the largest government-backed cultivated meat consortium to date, involving top food producers and academic labs.
- **Australia** not only diversified their protein industry with strategic investments in cellular agriculture projects but also granted AUD 113 million ($74.6 million) to build three plant protein facilities and develop a regional presence in the industry.

Notable newcomers:

- **South Korea** stepped up their alternative protein investments, granting $15 million for cultivated meat development and an unspecified grant for commercializing plant-based pork belly.
- **Sweden**'s Environmental Protection Agency invested SEK 150 million ($14.5 million) in a plant-based protein processing facility operated by a farmer-owned collective.

All eyes on:

- **China**'s President Xi Jinping mentioned protein diversification at the Two Sessions to support national food security, and the nation's first-ever five-year plan for the bioeconomy called for exploring alternative proteins as novel foods.
- **The United States** Food and Drug Administration completed their first premarket consultation of a cultivated meat product, opening the door for sales in 2023. President Joe Biden called on federal agencies to produce reports on biotechnology, including "cultivating new food sources."

Alternative protein updates by country

Americas

Brazil

Brazil is a global food giant, especially in animal protein consumption and export. A major meat supplier, Brazil sources much of their export income from the industry, making the country highly susceptible to global meat demand variation. However, the country also produces many protein-rich crops for plant-based meat applications, including multiple indigenous crops currently being investigated by GFI Brazil and researchers through the Biomes Project. Brazilian multinational JBS, the world's largest meat company, has invested in cultivated meat capabilities and signed on to efforts to reduce deforestation in the country.

Public support

Brazil's public agricultural research ecosystem is increasingly interested in alternative proteins. Embrapa, a think tank affiliated with the Ministry of Agriculture, with 50 research units and a body of 2,500 researchers, is currently engaged in six GFI-funded research projects to advance the science of plant-based and cultivated meat.

Brazil committed public funds to alternative protein research for the first time in 2022, with the Federal Innovation Agency (FINEP) pledging $500,000 in a public notice for research on alternative proteins to be applied to selected projects. The State Government of Paraná, in a heavily rainforested area in the south of Brazil, allocated $808,000 for the Federal University of Paraná, which already offers undergraduate and postgraduate courses in the area of cellular zootechnics, to build a specialized laboratory in cultivated meat within the university campus.

Regulation and labeling

The Brazilian Health Regulatory Agency (ANVISA), which oversees food regulation and labeling, has begun analyzing Brazil's alternative protein regulatory landscape but has not produced formal safety regulations.

In 2022, the Institute of Food Technology, at the request of GFI Brazil, finalized "regulatory studies" on plant-based products. These studies will serve as a basis for the Department of Inspection of Products of Vegetable Origin at the Brazilian Ministry of Agriculture and Cattle Raising to propose regulations in 2023.

On labeling, ANVISA published an official letter finding no evidence that plant-based product labels mislead consumers. Although not a legal instrument, the letter marks the agency's position and will undoubtedly inform their decisions on the appropriate labeling of alternative proteins.

Finally, Brazil took a unique step toward giving alternative proteins a level playing field in the supermarket. In late May 2022, the government issued a decree "zeroing" one of the sales taxes on domestically produced plant-based milks, equalizing their taxation rates with those for other domestic goods like cow's milk, chocolate, and coffee. While most governments have sought to reduce the price of alternative proteins by improving their production efficiency through research and development and scaling up their operations, this action to close the price gap at the point of sale is a unique but promising step.

Canada

Canada cemented their standing as a global leader in public funding for plant-based foods in 2022, focusing on commercialization and market-building in light of the country's substantial production of protein-rich crops like yellow peas, chickpeas, and canola. In addition to running glowing *Globe & Mail* advertisements about plant-based foods' economic potential through Invest in Canada, their foreign direct investment arm, Canada has provided the industry with research, development, and commercialization funding on a growing scale.

> *"Canada has the potential—and is well on our way—of being a global leader in plant-based ingredients and finished food products. By building on our strength as an agricultural powerhouse; with more than 28 million hectares of arable land and a leading producer of high-protein crops such as peas and canola, we have the opportunity to turn this global demand into a long-term, sustainable economic driver for Canada."*
>
> **– Bill Greuel, CEO of Protein Industries Canada, in "*Why alternative proteins are good for business and the environment*" by Invest in Canada**

Public support

Protein Industries Canada (PIC), established in 2018, works to position Canada as a global source of plant protein production. PIC, one of Canada's five innovation superclusters, co-invests with private industry in plant-based protein projects encompassing R&D, infrastructure, and commercialization. Through the end of 2022, they have invested CAD 173 million ($127 million) into 55 projects spanning proof of concept, technology scaling, and commercial development. For example, the supercluster invested CAD 1.4 million ($1 million) to help a British Columbia-based plant-based food producer increase the production capacity of their tofu made from 100-percent Canadian-grown chickpeas, as well as CAD 5.4 million ($4 million) to enhance the Canadian plant-based cheese market by developing new products and testing grocery store placement strategies.

> *"In the first tranche of funding from 2018 to 2023, Protein Industries Canada co-invested [CAD] $173 million [$127 million] into 55 projects. The initial investment leveraged [CAD] $304 million [$223 million] in private investment, created 303 IP assets, helped companies leverage a further [CAD] $234 million [$171 million] in follow-on investment, and is expected to contribute [CAD] $15 billion [$11 billion] in GDP and create 10,800 direct and indirect jobs by 2031—meeting or surpassing every target set out by the program."*
>
> – News release from Protein Industries Canada, February 2023

In 2022, Canada expanded their public support for alternative proteins to include cultivated meat and precision fermentation for the first time. Ontario Genomics, a government-funded nonprofit, collaborated with German bioengineering company The Cultivated B. to develop a 130,000-square-foot bioreactor manufacturing facility. The new facility will provide a domestic supply of bioreactors, an essential component of alternative protein manufacturing capacity. As a term of the collaboration, the company will set aside 20,000 square feet of the facility for an open-access innovation hub. Ontario Genomics also collaborated with the Canadian Food Innovation Network in administering AcCELLerate-ON, a CAD 900,000 ($660,000) competition for cellular agriculture-focused food and beverage projects, in which three of the 2022 winners focused on cultivated meat and seafood, and the fourth seeks to achieve pilot-scale precision fermentation capabilities for heme, an alternative meat ingredient.

Regulation and labeling

Protein Industries Canada has also worked to promote the development of a domestic plant-based food industry by influencing the regulatory field. A 2022 investment of CAD 1.6 million ($1.17 million) will fund a Regulatory Centre of Excellence to promote evidence-based regulatory policy for plant-based foods. PIC simultaneously announced plans to create a virtual resource to help plant-based companies navigate Canada's policies and access funding opportunities. This assistance is well warranted, given that the Canadian Food Inspection Agency's guidelines require certain plant-based meat labels to use the phrase "simulated" followed by the meat or poultry type and the phrase "contains no meat" or "contains no poultry" in close proximity to the common name, using a similar text size or having the same prominence.

Canada currently characterizes cultivated meat and seafood as novel foods and requires the submission of detailed information in an application for premarket approval. The submission requires evidence that the food is safe for consumption, including molecular characterization, nutritional composition, toxicology and allergenicity, and types and levels of chemical contaminants. A three-part approval is required: (i) a letter of no objection for human food use through the novel food assessment process, (ii) a premarket assessment for new animal feed (due to the possibility of

supply chain crossover and regardless of whether the product is intended for use as animal feed), and (iii) an environmental assessment under the New Substances Notification Regulations. Companies may not market their products in Canada until they have all three approvals.

Fermentation-derived ingredients that do not have a history of safe use are also regulated as novel foods in Canada. Some fermentation-derived products, such as protein extracted from *Fusarium venenatum* fungi, do not meet the regulatory definition and are not considered novel.

In September 2022, Canadian company Rawesome Raw Vegan won a legal battle against the city of Montreal after being sued for using the word "cheese" on their plant-based cream cheese labels. The city alleged that the company violated provincial and national regulations, including a regulation that sets forth a definition for cream cheese. The municipal court initially agreed with the city, but the order was overturned on appeal. The appellate court held that the regulatory definition for "cream cheese" applies to animal dairy products, but does not restrict labeling of plant-based products like those sold by Rawesome.

United States

In 2022, the United States became the second nation to complete an evaluation of the safety of cultivated meat, with the U.S. Food and Drug Administration (FDA) completing their first premarket consultation of a cultivated chicken product (but not their last; see "A look at 2023"). The United States shares jurisdiction between FDA and the USDA over livestock and poultry meat and catfish, which means that those forms of cultivated meat were left with more regulatory processes to complete, but American consumers—who are among the highest per capita meat purchasers in the world—are much closer to seeing cultivated meat on menus and store shelves. This likelihood makes American investment in facility construction and infrastructure support all the more important as startups prepare to sell in the mass market.

The United States boasts the highest market share of the alternative proteins industry, with many major international producers based in the country. An impressive slate of both domestic and foreign companies announced expansion plans stateside, from Israel-based Believer Meats opening a cultivation facility in North Carolina to Colorado-based Meati constructing a "Mega Ranch" in Denver. Though the United States is currently the preeminent hub of alternative protein innovation and production, other countries have increased their investments in research and development and commercialization projects at a far greater rate. As outlined below, President Joe Biden's executive order on biotechnology, which highlights "cultivating new foods," could lead to a turnaround in this trend.

Public support

American strengths in agriculture, food processing, and biomedical technology, together with exceptional research and development capabilities, give the United States a natural advantage to lead in alternative proteins. However, by the end of 2022, the United States federal and state

governments combined had invested only $35.4 million in alternative protein R&D and commercialization.

In September 2022, the Biden Administration released the Executive Order on Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy, in which the president directed relevant agencies to develop bold goals for the American biotechnology sector to kick off a whole-of-government approach to advancing the bioeconomy. The executive order explicitly instructed USDA to report on "cultivating alternative food sources" (for the resulting report, see "A look at 2023"). Later in the year, the U.S. Congress appropriated nearly $6 million for alternative protein research to the USDA's Agricultural Research Service, representing a $1 million increase over the previous year.

The federal government continued to fund research on alternative proteins through the USDA's National Institute of Food and Agriculture (NIFA), including multiple new projects at universities nationwide. Cultivated meat research continued at the Tufts University Center for Cellular Agriculture, which was funded in 2021 with a $10 million NIFA grant, the largest public funding package for alternative proteins from the U.S. government to date. In 2022, the U.S. government made a futuristic move by funding alternative protein research in outer space. With a contract from NASA in partnership with Montana State University, biomass fermentation company Nature's Fynd sent a bioreactor to the International Space Station aboard a SpaceX rocket to test the capabilities of producing edible protein in zero gravity. While the overall increase in research funding is not on track with the much more notable global acceleration in funding, the continued efforts mark a hopeful sign that Congress and the Agricultural Research Service will continue to prioritize alternative proteins.

On the state level, California became the first U.S. state to invest in cultivated meat research, funding $5 million of alternative protein research at three public universities. The University of California, Los Angeles lab that received a portion of these funds (which is also a GFI grantee) announced an open-access breakthrough in meat cultivation this year, showcasing the benefits of publicly funded research. California's budget also made over $700 million available for climate action research, which opens the door to increased funding for these California researchers in 2023 and beyond.

> *"To continue improving food safety, and food accessibility, and food supply chain resilience, advanced manufacturing processes must fully leverage new technologies and accelerate new fields such as cellular agriculture, alternative proteins, and personalized nutrition."*
>
> **– National Strategy for Advanced Manufacturing, published by the White House National Science and Technology Council**

As for product commercialization, in October 2022, the National Strategy for Advanced Manufacturing called for more support for alternative proteins, claiming “advanced manufacturing processes must fully leverage new technologies and accelerate new fields such as cellular agriculture, alternative proteins, and personalized nutrition.” The Utah Governor’s Office of Economic Opportunity provided U.S. precision fermentation company Perfect Day with a tax credit to build a production facility in Salt Lake City, with the mayor citing the growing life sciences ecosystem as a valuable asset to the city. Perfect Day plans to add 60 permanent jobs at the location over the next four years. North Carolina offered tax incentives to Israel-based cultivated meat company Believer Meats to build what the company calls “the world’s largest cultivated meat facility” in Wilson, NC. Indiana offered the same to New York-based Liberation Labs to scale up their precision fermentation operations in Richmond, Indiana, announced in early 2023.

Regulation and labeling

In November 2022, the United States became the second country in the world to complete an evaluation of the safety of a cultivated meat product, paving the way for cultivated meat to reach American consumers in 2023. FDA completed their first premarket consultation for UPSIDE Foods’ cultivated chicken, announcing they had “no questions” about the safety of the production process and formulation. UPSIDE is the first company to complete FDA’s rigorous consultation process, demonstrating that their product is as safe as conventional chicken.

UPSIDE’s successful completion of the consultation process paved the way for consumers to access cultivated meat in U.S. restaurants and through retail sales. However, there were additional regulatory steps before the company could sell their cultivated chicken (See "A look at 2023" for news on UPSIDE's and GOOD Meat's successful completion of these steps.) All cultivated meat producers must register their facilities with FDA, and companies producing cultivated terrestrial meat or catfish must also obtain a grant of inspection from USDA. USDA inspectors will oversee the processing, packaging, and labeling of these products and will verify that cultivated meat products are safe, wholesome, and unadulterated (free from contamination). FDA will retain jurisdiction over the processing, packaging, and labeling of cultivated seafood.

FDA has regulatory authority over fermentation-enabled alternative proteins. In recent years, multiple fermentation companies have obtained “no questions” letters from FDA for their ingredients, meaning FDA does not object to the companies’ statement that their ingredients are generally recognized as safe. In April 2022, ENOUGH (formerly 3F BIO Ltd.) received a no questions letter from FDA regarding their ABUNDA mycoprotein.

Labeling

Neither FDA nor USDA has rules or guidance for labeling cultivated meat and seafood, but both agencies have sought public comment on the subject. In the meantime, USDA committed to review and pre-approve labels for cultivated terrestrial meat, poultry, and catfish on a case-by-case basis (see "A look at 2023" for information about their first pre-approved cultivated meat labels). FDA

does not pre-approve labels for any foods, but rather exercises their enforcement authority when regulators become aware of improperly labeled foods.

In 2022, FDA transmitted draft guidance on labeling plant-based milk alternatives to the Office of Information and Regulatory Affairs (OIRA), a department of the Office of Management and Budget that reviews significant regulatory actions. In early 2023, FDA issued said draft guidance on plant-based milk labels. (See "A look at 2023.")

> *"GFI supports commonsense labels that use terms consumers understand and themselves use. The government's role is to ensure a level playing field. FDA should not impose de facto labeling requirements on plant-based milks while giving cow's milk a free pass."*
>
> **– GFI senior regulatory attorney Madeline Cohen**

Label censorship

Several states have passed laws censoring conventional meat and dairy terms on plant-based and cultivated food labels, though many have been challenged in court or amended to include safe harbor provisions that allow the use of meaty terms along with an appropriate qualifier (e.g., "meatless" or "plant-based"). In 2022, such bills were introduced in New York, Kansas, Washington, and Wisconsin. Kansas was the only state to pass a bill: theirs requires a phrase like "vegan" or "meatless" in close proximity to any meaty terms.

GFI and other organizations have pushed back against laws that unconstitutionally censor plant-based and cultivated food labels in the courts, bringing several cases with cocounsel Animal Legal Defense Fund (ALDF) on behalf of Tofurky. In March 2022, a federal district court granted Tofurky's motion for summary judgment and enjoined the state of Louisiana from enforcing a label censorship law, concluding that it "impermissibly restricts commercial speech." In 2023, an appeals court heard the state's appeal of that decision. (See "A look at 2023" below.) In Arkansas, a federal district court judge granted Tofurky a permanent injunction in October 2022, preventing the state from enforcing their label censorship law against the company on the grounds that it violates Tofurky's First Amendment right to free speech. The court also held that one provision of the law is unconstitutionally vague on its face and may not be enforced against any company. In Missouri, plaintiffs continue their legal challenge to the nation's first label censorship law after losing their bid for a preliminary injunction in previous years.

Asia

China

As China's population grows and its middle class develops, meat consumption is increasing significantly, incurring numerous challenges from resource constraints and environmental degradation to public health concerns. In response to these challenges, the world's leading funder of agricultural research has shown a growing interest in alternative proteins, including plant-based, cultivated, and fermentation-derived products. The government has identified alternative proteins as a strategic industry and has likely committed significant, if largely undisclosed, resources to research and development. Chinese companies are also investing in the development of alternative proteins, with several startups emerging in the space.

> *"Widening China's range of protein sources to include those harnessed from plants, microbes, and animal cells allows the nation to further bolster food security and nutrition...Just as similarly ambitious plans paved the way for huge investments into clean energy, electric vehicles, and smartphone technologies, China's food security goals are creating fertile soil for the nation's alternative protein sector to thrive."*
>
> – Grace Liu, Strategic Partnerships Manager at GFI Consultancy

Public support

During the 2022 "Two Sessions," China's most important annual political conference, President Xi Jinping explicitly called for protein diversification, emphasizing the need to obtain alternative sources of protein from plants and microorganisms. Alternative proteins recur elsewhere in China's various high-level documents and speeches, mostly in the name of protein diversification and biotechnology development. These mentions highlight the industry's role in China's food security blueprint guided by the "Greater Food Approach," an important national policy that emphasizes improving self-sufficiency, quality, and diversity of food sources.

The 2021 agricultural five-year plan included cultivated meat and other "future foods," indicating that China plans to further develop cell cultivation technology. In May 2022, the National Development and Reform Commission (NDRC) released the "14th Five-Year Plan" bioeconomy development plan, China's first development plan that advocates for protein diversification. The plan aims to "develop synthetic biology technology, explore new foods such as synthetic protein, realize iterative upgrading of the food industry, and reduce the pressure on environmental

resources brought about by traditional animal agriculture."[2] Under the plan, it is expected that China will increase support for and investment in alternative protein research projects and the industry, as well as accelerate the establishment of a regulatory framework for "future food," including "new food raw materials, additives, and microorganisms" in line with international standards, and build a policy environment conducive to bioeconomy innovations.

The funding for alternative protein research and development that China has publicly announced also speaks to the country's interest in the sector. In 2021, China's Ministry of Science and Technology announced funding for a Green Biological Manufacturing R&D program, which includes an alternative protein project funded under a CNY 20 million ($2.9 million) program. In Hong Kong, a grant of HKD 2 million ($255,000) was offered to a startup that derives a plant-based protein ingredient from microalgae.

Regulation and labeling

In April 2022, the China Cellular Agriculture Forum held their first event, inviting experts and cultivated meat producers to discuss a number of issues including the regulation and labeling of cultivated meat. This forum indicated cell agriculture technology's strong foothold in China and set the foundation for more dialogues on the country's regulatory mechanism.

In June 2022, the Chinese Academy of Engineering published a book, *Research on the Development Strategy of Biologically-Cultivated Meat*, based on the results of a strategic consulting project started in 2020. The book put forward an overall strategy for developing cultivated meat in China based on a review of global progress and trends, juxtaposed with the current situation in China.

In October 2022, the China International Food Safety & Quality Conference included an alternative proteins panel called "Alternative Protein: Cellular and Plant-Based Meat," hosted by the chief scientist and director of the China National Center for Food Safety Risk Assessment (CFSA). At the panel, representatives from CFSA discussed how regulatory agencies can assess the safety and quality of alt proteins with representatives from Singapore Food Agency (SFA) and regulators and researchers from the United Kingdom. International and Chinese experts exchanged ideas on regulatory coordination through keynote speeches on "New Food Sources and Production Systems" and "Regulatory Issues on Alternative Protein" and agreed on the necessity of a collaborative approach.

In December 2022, government officials from CFSA and the U.S. FDA discussed cultivated meat regulation at an online event. In addition to attending global meetings and communications on regulating cultivated meat, the regulatory authority is actively working on determining how best to assess the safety of cultivated meat, including by forming a working group of cultivated meat experts to understand current progress in the industry.

[2] The term "synthetic proteins" includes foods produced from animal cell culture technologies and fermentation.

India

Public support

India's government has supported plant-based and cultivated meat initiatives in policy, research, and commercialization at the national and state levels. India's Office of the Principal Scientific Adviser has included cultivated meat as one of the areas under their Emerging Technologies Initiative, which identifies technologies of importance to India and forms policy initiatives to support their development. The Atal Incubation Center, one of several incubation facilities supported by the Atal Innovation Mission, provides resources to help cultivated meat startups research, develop, and commercialize their products.

In July 2022, India's Department of Biotechnology and the Biotechnology Industry Research Assistance Council conducted a brainstorming session to discuss key research priority areas within biotechnology, such as precision fermentation and cell cultivation. The department plans to provide government support for capacity building, infrastructure development, and tech transfers over the next five years.

To support the growing alternative protein sector in India, in August 2022 the Ministry of Skill Development and Entrepreneurship approved the creation of a dedicated job role called "Plant-Based Food Technologist." This is the first of its kind globally and can be found on the government's National Qualifications Register.

Regulation and labeling

In India, fermentation-derived and cultivated protein products are regulated under the Approval of Non-Specified Food and Food Ingredients Regulations. In October 2022, India's food regulatory body, the Food Safety and Standards Authority of India (FSSAI) issued an amendment to the Approval of Non-Specified Food Regulations. The amended regulations modified the procedure for grant of prior approval/premarket approval for novel foods (including novel plant-based ingredients) and set timelines for the initial scrutiny by the FSSAI as well as additional requirements that include conducting post-market surveillance on relevant safety and efficacy parameters and supporting health benefit claims with evidential data, including results of in-vitro and in-vivo (animal) testing. In 2022, Perfect Day received regulatory approval through this process for their animal-free milk proteins.

Notably, in November 2022, FSSAI proposed new regulations for foods derived from genetically modified microorganisms. The proposed regulations address both premarket approval and labeling. They include a list of enzymes derived from genetically modified microorganisms already being used by food producers within the regulatory framework and allow their use as processing aids in limited quantities as per Good Manufacturing Practices without any separate approval process.

Japan

The Japanese government has said that it aims to shift Japan's traditional agriculture industry toward "smart agriculture," which includes alternative proteins, by leveraging innovation to increase food security. Japan's aging population, increasing urbanization, and immigration policies have resulted in labor shortages that have affected the productivity of their agricultural sector, thereby increasing their reliance on food imports. In recent years, meat from land animals has displaced fish as the main protein source in Japanese diets, and demand will likely continue rising. Protein innovation could be a key solution to meet protein demand and ensure economic competitiveness of the Japanese agricultural industry.

Public support

The Japan Association for Cellular Agriculture (JACA), an official working group on cultivated meat, provides an opportunity for industry, government, and academia to collaborate on guidelines and recommendations for laws applicable to cultivated meat, egg, and dairy products to contribute to their commercialization in Japan. JACA also leads the Cellular Agriculture Working Team under a public-private partnership for food-tech, hosted by the Ministry of Agriculture, Forestry and Fisheries. Japan's Ministry of Economy, Trade, and Industry has also funded several cultivated meat research projects, though funding amounts are unknown and no new funding was announced in 2022.

> *"Foodtech, including cellular foods, is an important technology from the perspective of realizing a sustainable food supply. We have to support efforts that contribute to solving the world's food problems."*
>
> **– Fumio Kishida, Prime Minister of Japan, at a meeting of the House of Representatives Budget Committee in February 2023**

Regulation and labeling

Japan's regulations allow plant-based companies to use terms such as meat, milk, and eggs on their labels, provided that they use a modifier such as plant-based, dairy-free, or the ingredient name (e.g., oat milk).

In 2022, the Japanese government announced that the Ministry of Health, Labor, and Welfare will assemble a team of subject matter experts to study the food safety aspects of cultivated meat to help determine the best regulatory path. The Cabinet Office's Food Safety Committee commissioned Tokyo University of Agriculture to examine risk assessment methodologies for cultivated meat.

JACA submitted an industrial guideline and policy recommendation to relevant ministries and politicians in November 2022. The document covers current legal definitions of cultivated foods, food labeling, and food safety. Additionally, it proposes relevant Japanese nomenclature for cultivated food and suggests setting up an intellectual property framework for sourcing cells from branded foods like "Wagyu." JACA established a legal entity in November 2022 to accelerate activity toward achieving social consensus on Japan's needs in preparation for the emerging cellular agriculture industry.

Singapore

One of the most population-dense countries on the planet, Singapore currently imports more than 90 percent of their food. Policymakers see alternative proteins as a potential solution to meeting the government's "30 by 30" goal of domestically producing at least 30 percent of the country's nutritional needs by 2030 and boosting resilience to global food supply shocks.

As a result, Singapore has become a world leader in alternative protein research and infrastructure funding. Temasek, an investment fund that is wholly owned by the Singapore government,[3] has been one of the top investors in alternative protein companies. While the exact amount is unknown, the fund's investments are believed to be in the hundreds of millions of dollars, and the fund is an active booster of alternative proteins. Though the government's funding totals are also largely undisclosed, Singapore may surpass all other nations in public support for alternative proteins. Singapore's leadership is cementing their reputation for food safety and their status as a leading innovation hub while simultaneously driving economic competitiveness and enhancing food security.

Public support

Singapore is a global test-bed for alternative protein R&D, producing scientific solutions that can be exported to the region and the world. Singapore dedicated SGD 144 million ($107 million) to the Singapore Food Story R&D program, which was established in 2019 by the Singapore Food Agency (SFA) and Singapore's top science and tech agency, the Agency for Science, Technology, and Research (A*STAR), which funds R&D for alternative proteins. Under their "Future Foods: Alternative Proteins" program and "1st Alternative Protein Seed Challenge," Singapore has funded dozens of alternative protein projects. In October 2022, fresh funding of SGD 165 million ($123 million) was allocated to further the second phase, known as SFS 2.0, where key funding areas were stated to be "developing future foods with improved nutrition, taste and texture, and establishing faster non-animal-based analytical methods to support the safety assessment of novel foods."

Additionally, Singapore has forged partnerships with other countries to collaborate on alternative protein R&D, including research partnerships with the governments of New Zealand and Australia, the Netherlands' Wageningen University, and the United Kingdom's University of Bath. In 2022, the

[3] Temasek drives many alternative protein research and development projects in Singapore. Because Temasek is a Singapore-incorporated company and operates under the provisions of the Singapore Companies Act, Temasek investments are not the same as public investments. While Temasek is neither a statutory board nor a government agency, their close ties to the Singaporean government indicate government support of the alternative protein industry by proxy.

Singapore Israel Industrial R&D Foundation, a collaboration between the two countries' entrepreneurial development agencies established in 2019, awarded a joint grant to Israel-based Steakholder Foods and Singapore-based Umami Meats to develop 3D-printed cultivated fish (for the resulting product, see "A look at 2023").

The Singapore government has also been active in building alternative protein infrastructure by partnering directly with startups to fund the construction of shared laboratory and production spaces. On the heels of Temasek's 2021 launch of Nurasa (formerly Asia Sustainable Food Platform) and co-investment with A*STAR's Singapore Institute of Food & Biotechnology Innovation on a SGD 30 million ($21 million) Food Tech Innovation Centre, Nurasa entered into a joint venture in 2022 with food distribution giant Archer Daniels Midland to launch food tech company ScaleUp Bio. The new company will operate a precision fermentation lab in the Centre and offer end-to-end contract development and manufacturing organization services in microbial fermentation from lab to pilot scale. ScaleUp Bio's first lab facility is scheduled to open in mid-2023 with a 100-liter capacity, while a second facility geared toward co-manufacturing services will open in late 2023 and have a capacity of 10,000 liters.

To keep up with the rapid pace of Singapore's investments, in July 2022, GFI APAC launched a new "one-stop shop" database identifying all relevant funding schemes and programs offered by the Singapore government. This crucial new resource was developed in collaboration with FoodInnovate—a joint initiative launched by Enterprise Singapore, the Agency for Science, Technology, and Research (A*STAR), Economic Development Board (EDB), IPI Singapore, JTC Corporation, and the Singapore Food Agency (SFA).

Regulation and labeling

Singapore treats cultivated meat as a novel food requiring premarket authorization. In 2020, the Singapore Food Agency (SFA) became the first regulatory body to green-light the sale of a cultivated meat product, approving GOOD Meat's cultivated chicken as an ingredient in the company's chicken bites. SFA has since approved additional cultivated meat products from GOOD Meat, and in early 2023, approved the use of serum-free media in the production of GOOD Meat's existing products, which will allow the company to further scale up production and reduce costs.

SFA approves cultivated meat on a case-by-case basis, based on safety assessments that companies submit that describe potential food safety risks, information on inputs and manufacturing processes, and risk management procedures. Cultivated meat must comply with composition, microbiological, and labeling requirements under Singapore's broader food regulations and must also include qualifying terms on the label to differentiate it from conventional meat. This framework places Singapore at the global forefront of food regulation and can provide a blueprint for other regions to develop cultivated meat regulatory frameworks.

NOVEL POLICY: In 2021, SFA granted scientific manufacturing firm Esco Aster a license to manufacture any cultivated meat products from cells that have gone through the regulator's safety assessment review, giving cultivated meat companies the option to contract out their manufacturing to a facility that has already received approval from regulators rather than constructing and applying for approval of their own. Esco Aster is now constructing another, much larger facility in Singapore.

In September 2022, SFA updated their guidance on novel food safety assessments, which outlines the information cultivated meat and fermentation companies must submit to the regulator when seeking product approval. The updated document contains specific guidance for cultivated meat, foods produced by biomass fermentation, and functional ingredients produced through precision fermentation. SFA strongly encourages companies interested in selling alternative protein products in Singapore to contact the agency early in the R&D and commercialization planning process. Companies should be aware that SFA's regulatory approvals take approximately nine to 12 months once all required information is submitted to the agency.

> *"The Singapore Food Agency (SFA) adopts a science-based risk assessment and management approach to food safety consistent with international standards. Food safety is SFA's principal consideration and it must also be a principal consideration when companies develop food products."*
>
> – Tan Lee Kim, CEO, Singapore Food Agency

In October 2022, Singapore became the first nation to grant approval for microbe-based protein ingredient Solein, created by Finnish startup Solar Foods. SFA will sample and test the food products containing Solein when the products are ready to be imported into Singapore, likely in 2024.

South Korea

Public support

South Korea's national business plan in 2021 focused on food security and sustainability, emphasizing reducing reliance on imports and the agricultural sector's greenhouse gas emissions, laying the groundwork for increased public support for alternative protein research. The country's

$13.5 million Green Bio Fund, announced later in 2021, mentions plant-based and cultivated meat companies as a key program component, but the amount of support is not yet public.

In 2022, South Korea selected Intake, a startup specializing in plant-based pork belly, for technology commercialization support. The two-year project will bring together researchers from three South Korean universities in search of more exact plant-based replications of the local staple. South Korea also awarded a $15 million grant to Space F, a cultivated meat startup, in partnership with Seoul National University, CJ Group, Daesang Corporation, and Lotte Corporation as part of the Ministry of Trade, Industry and Energy's Alchemist Project for high-level technologies. The grant will focus on scaling and perfecting the equipment needed for cultivated meat commercialization. Thyssen Biopharmaceuticals, a company making plant-based and cultivated meat using 3D printing, also received an unspecified amount of support from the Korea Health Industry Development Institute's Health Industry Innovation and Startup Center.

Regulation and labeling

In late 2022, the Korean Ministry of Food and Drug Safety released technical amendments to their food standards code for public comment, covering "alternative meat" products. Under the current regulatory structure, cultivated meat R&D and tasting events are allowed, but commercial production and sale are not. A forthcoming official definition for cell culture meat —whether it is an "agricultural product" or a "processed food"—will determine which ministry will oversee industry policy.

Australia

Australia leaped ahead in their support for alternative proteins in 2022, putting serious public funds behind the production of plant-based, cultivated, and fermented protein. Recognizing that plant-based proteins can boost the country's strong agricultural sector, Australia's federal and state governments invested in infrastructure for processing protein-rich crops, noting the benefits to the job market, farmers, and Australia's export economy. Altogether, the country has provided over AUD 183 million ($119 million) in research and commercialization support for alternative proteins in 2022, a 2,700-percent increase over their prior support.

Public support

Australia's Department of Industry's Modern Manufacturing Initiative grants program specifically identifies alternative proteins as a manufacturing priority, and in 2022 made an AUD 113 million ($74.5 million) grant to a project that will construct three new plant-based protein production facilities in collaboration with Australian Plant Proteins, Australian Milling Group, and Thomas International–one of the country's largest meat companies. The three facilities, all located in the heavily agricultural state of South Australia, are expected to generate up to 8,500 jobs, supply 25,000 tons of pulse protein per year, generate up to AUD 5.2 billion ($3.5 billion) in GDP over 12 years, and help local farmers value-add their crops up to eight times over. The state government of

South Australia also contributed AUD 65 million ($42.8 million) to the project, bringing the total government support for this one project to AUD 178 million ($117.4 million)—more than the grand total of most other countries in this report.

> *"While traditional animal protein will continue to be a significant source, alternative sources may be needed to keep up with demand. Protein is an important requirement for a healthy diet, and there is room to create a diverse protein industry if manufacturers take a unified market approach. As a major producer and exporter of protein, Australia's food industry is well placed to tap into this opportunity. It can develop novel, differentiated protein products derived from animal, plant, and non-traditional sources."*
>
> **— Australia's Department of Industry's Modern Manufacturing Initiative**

In 2021, the Federal Government's Advanced Manufacturing Growth Center Commercialization Fund awarded AUD 1 million ($660,000) to Harvest B, a plant-based meat company, which in December 2022 unveiled Australia's first plant-based meat ingredients manufacturing facility west of Sydney. Sydney also boasts Australia's first cultivated meat production facility with Vow Food's Factory 1, which received AUD 25,000 ($16,500) in support from the state government of New South Wales in 2019 as a start-up grant. The 2022 opening of the factory will allow Vow Food to supply their cultivated quail product to Singapore, where they have applied for regulatory approval, as well as Australia.

> *"We were originally going to move the company to San Francisco and then manufacture in Singapore, but the team in Australia works really fast and efficiently. And Australia's becoming a more and more interesting place to scale up applications. We have really good export connections, a good food reputation, strong talent pool, many of the raw ingredients are here and growing access to renewable power. With the right political will and the right training systems, Australia could potentially be a really powerful base in the long term."*
>
> **– George Peppou of *Vow Food***

In 2022, The University of Queensland secured AUD 50 million ($33 million) in funding to boost food tech, "potentially creating thousands of new jobs." The UQ-led Food and Beverage Accelerator (FaBA) will be funded over four years and is supported by many of Australia's leading alternative protein startups. Precision fermentation startup Change Foods was awarded two grants totaling AUD 4.1 million ($2.7 million) from FaBA for a research partnership with Queensland University of Technology to develop precision fermentation facilities that use inedible sugarcane fibers as feedstock for producing dairy proteins.

Regulation and labeling

All foods in Australia and New Zealand are covered by the binational Food Standards Code (FSC), which details requirements for food safety, identification, labeling, handling, and treatment. Foods that meet all FSC requirements, including a range of plant-based meats, do not require premarket approval. Otherwise, organizations can seek premarket approval via an application to change the FSC to permit new foods or processes. Food Standards Australia New Zealand (FSANZ) provides guidelines on what information needs to be provided for different types of premarket approval.

Australia and New Zealand have affirmed that their bilateral and joint food regulatory system is equipped to deal with new foods produced through cellular agriculture, including cultivated meat, under the existing Novel Foods Standard. To gain premarket approval for a novel food, a company must apply to FSANZ. The approval process is expected to take at least 14 months. In early 2023, Vow Food announced that they had applied to FSANZ for approval of the company's cultivated quail and received a "precise" timeline for approval from the regulator. If approved, it would be the first cultivated meat product available in Australia and New Zealand.

Additionally, Australia and New Zealand regulate genetically modified foods in ways that could apply to cultivated meat products or fermentation-derived ingredients if they are produced using certain technologies. FSANZ and Health Canada, Canada's food regulator, are collaborating on genetically modified food safety assessments. One agency will take the lead, while the other acts as a peer reviewer, streamlining the process and saving costs for both the applicant and the agencies. These are encouraging signs that regulatory processes can be simplified while maintaining each regulator's independence to provide the final approval. This process culminated in regulatory approval for Impossible Foods in 2021, when the agency approved using the GMO-sourced soy leghemoglobin ingredient in their products. Impossible subsequently expanded to Australia and New Zealand in January 2022.

Europe

Food security drew into focus across Europe in 2022, significantly increasing public investments and commitments to transforming food systems. As the colliding crises of Covid-19, the war in Ukraine, and deadly animal-borne diseases prompted governments to reevaluate vulnerabilities in their supply chains, some policymakers turned to alternative proteins as a key solution to food security woes and a potential boon to their local economies. Investments spanned the full suite of alternatives and

stages of development, from research on cultivated meat in Spain to commercialization support for plant-based protein production in Sweden. Denmark and the Netherlands set the world records for plant-based and cultivated meat investments, respectively, while a broad array of countries invested in the sector, from Switzerland to the United Kingdom to Norway. More governments began to deliver on their pledges to prevent climate change and reduce emissions from methane by reevaluating their domestic animal agriculture industries and making moves to produce more protein from low-carbon sources through research, commercialization, and education.

However, governments in Europe differed in their treatment of alternative proteins. While Germany celebrated Oktoberfest with plant-based bratwurst and Weißwurst, Türkiye banned outright the production or sale of any plant-based cheeses. France—traditionally protective of their local foods—balanced both cultural and economic concerns, attempting to ban any meat-like terminology on plant-based food labels, while at the same time providing funding to scale up plant-based meat production as part of their "First Factories" program for future technologies. In Italy, which is also protective of their local culinary traditions, a worrying increase in hostility toward alternative proteins from some voices in the agricultural sector was galvanized by the new government. (See "A look at 2023" for more recent developments, particularly Italy's proposed ban on cultivated meat.) As citizens and politicians debate how to preserve cultural traditions and a food-secure, climate-conscious future, GFI continues to advocate for alternative proteins to be freely available in marketplaces across Europe to provide consumers with the food experience they expect at a lower social and environmental cost.

European Union

In 2022, the European Union continued to fund alternative protein research and commercialization efforts, supporting several major R&D and construction projects in 2022 that will advance the sector and protect the continent's domestic supply of food. Much of this funding is aimed at helping the EU and Member States reach ambitious greenhouse gas reduction goals, while food security is also becoming a key concern. There continue to be wide differences in support and investment across European countries, depending on cultural and economic factors.

Public support

Recognizing that taste and price are the main drivers of alternative protein uptake, in June 2021, the EU Horizon Europe Framework Programme for Research and Innovation announced up to €12 million ($13.2 million) in dedicated funding to improve the sensory properties and availability of alternative proteins as part of their larger initiative for a "healthier, greener, and more digital Europe." In 2022, that funding commitment was expanded to €25 million ($27.6 million) for sustainable proteins, primarily cultivated meat, fermentation, and algae, through the 2023/2024 Work Package.

The first of those two pledges was realized in the €11.9 million ($12.4 million) LIKE-A-PRO project, which will develop 16 new alternative protein products from seven local protein sources to facilitate sustainable and healthy diets by mainstreaming alternative proteins and products. By

focusing on local plant protein sources, the project will ensure that farmers within the European Union can value-add their crops and that producers of plant-based products will not have to rely on imported crops for their products.

Much of the remaining €25 million will go to the €13.1 million ($14.3 million) HealthFerm project, which investigates the nutritional benefits of plant-based fermented foods, with Horizon Europe providing €11.3 million ($12.4 million) toward the project and the government of Switzerland funding the remaining €1.8 million ($2 million). (GFI Europe serves on the HealthFerm advisory board.)

Further, EIT Food, an independent platform funded by the EU and focused on innovation in the food sector, has set protein diversification as one of six core focus areas and distributed €1.8 million ($2 million) to plant-based meat, cultivated meat, and fermentation projects in 2022, as well as co-funding a €400,000 ($441,000) call for cultivated meat projects with GFI.

The European Union has also made funds available for alternative protein production and commercialization. In September 2022, Scottish food-tech company ENOUGH celebrated the completion of "one of the world's largest protein facilities" in the Netherlands, which received €16.9 million ($18.65 million) in EU funding through the Bio-based Industries Joint Undertaking. The plant has begun creating mycoprotein through biomass fermentation using sidestream products from a nearby starch plant operated by Cargill. The European Union also provided "an eight-digit figure" in commercialization funds to Mushlabs, a German company pioneering a fermented mycelial mushroom product, through the European Innovation Council's (EIC) highly competitive Accelerator program. The EIC stated, "[t]he jury believes that the European Union needs to support companies with unique and strategic technology to produce sustainable alternative protein."

> *"The jury believes that the European Union needs to support companies with unique and strategic technology to produce sustainable alternative protein."*
>
> **– European Innovation Council**

Regulatory approval

Alternative proteins requiring premarket approval in the European Union follow specific regulatory frameworks for novel foods and, in some limited cases, genetically modified foods. In addition, some alternative protein ingredients might require additional regulatory approval as a food additive or flavoring. The time frame for approval can range from 18 months to about three years, though the clock can be stopped during the process at Member States' requests, introducing a degree of uncertainty for companies seeking to operate in Europe.

The EU novel foods process includes a risk assessment of the safety and nutritional value of the product conducted by the European Food Safety Authority (EFSA). Once EFSA publishes a positive scientific opinion, the European Commission proposes under what conditions the product is allowed to be on the market. A committee of delegates from all 27 EU Member States makes the final decision. Once EU regulators approve a novel food product, it can be sold across all EU countries plus Iceland, Liechtenstein, Norway, and Switzerland. Any company wishing to enter the UK market must apply separately to the UK Food Standards Agency.

The EU has approved several novel plant-based and fermentation-derived ingredients, but as of April 2023, no company has applied to the European Commission for approval of a cultivated meat product. Although the EU did not see any regulatory milestones in the past year, in July 2022, Members of the European Parliament Tilly Metz and Ulrike Müller held a panel discussion on cultivated meat, indicating policymaker interest in the space and the potential for systemic change to the jurisdiction's regulatory process.

Labeling

On labeling, the European Union and Member States have also attempted to censor alternative protein labels, trying to build on a 2017 decision that terms such as "milk" or "cream" cannot be used by plant-based dairy producers. In October 2020, the European Parliament voted to reject a proposal that would have prohibited plant-based meat products from using conventional meat terms on their labels across all 27 EU countries. Fifty businesses and nonprofits sent an open letter to the members of the European Parliament opposing the proposal, arguing that it contradicted the EU's sustainability initiatives. In May 2021, the European Parliament withdrew a legislative amendment that would have severely restricted the use of dairy-related terms such as "buttery" and "creamy" on plant-based products, going beyond the 2017 ruling. No changes to labeling requirements were proposed in 2022.

Denmark

Denmark has ambitions to be a leader in plant-based foods, and 2022 marked a continuation of their efforts in this space. In late 2021, Denmark announced over 1.25 billion kroner ($185 million) over nine years to advance plant-based foods, recognizing that plant-based foods are a "central element in the green transition." This funding was, and remains, the largest known investment in plant-based research and development by any country. This investment was split into three main programs:

- 675 million kroner ($99.4 million) for The Fund for Plant-based Food Products, which will support plant-based foods processing and product development, seed development, marketing and export promotion, and knowledge dissemination. The money comes directly from an existing fund that otherwise supports animal production and animal-sourced food products.
- 580 million kroner ($85.9 million) for a five-year "eco-scheme" to pay bonuses to Danish farmers who grow plant-based protein crops for human consumption. With 70 percent of

Denmark's agricultural land currently used for growing animal feed, this will increase the domestic food supply and reduce input costs for plant-based food manufacturers.

- 260 million kroner ($38.5 million) over five years to develop a "green proteins" strategy. In addition to plant-based foods, this fund might also support fermentation-derived proteins and cultivated meat, as well as animal feed.

In 2022, Denmark's Ministry for Food, Agriculture and Fisheries made good on their promise to invest DKK 675 million ($99.4 million) into their Plant Fund to support creating a market for plant-based foods. In the words of Danish Minister for Food, Agriculture and Fisheries Rasmus Prehn, Denmark's ongoing investment in plant-based foods puts the country on track to be "an absolute world leader" in plant-based foods.

> *"Climate bells have been ringing for a long time. We must do something about our food production if we are to achieve the goal of the green transition. Therefore, Denmark must lead when it comes to plant-based foods. ...There is both a market in mass development and a great climate gain to be had if we in Denmark start to produce more plant-based foods. Never has so much money been spent on plant-based foods as there will be with the Plant Fund."*
>
> **– Danish Minister for Food, Agriculture and Fisheries Rasmus Prehn**

Finland

Business Finland, a government entity for innovation funding and trade, travel, and investment promotion, began investing in alternative protein sources in late 2020 with €2.1 million ($2.3 million) for a consortium between industry and academia to develop plant proteins from domestic Finnish crops like fava, rapeseed, and oats. Then, in 2021, Business Finland provided a €4.3 million ($4.7 million) grant to Solar Foods, a Finnish startup making edible protein from a microbe that needs only carbon, hydrogen, oxygen, and nitrogen—in short, air—to grow. Business Finland's grant supporting the startup's commercialization and construction of a demonstrator facility was followed by a €10 million ($11 million) subordinated loan from The Finnish Climate Fund, more than doubling Finland's total investment in a domestic, low-carbon food supply.

While Finland had already supported alternative protein development before 2022, their precarious geopolitical position and reliance on animal feed imported from Russia and Ukraine precipitated an increase in funding for alternative ways of making protein. Finnish startup Onego Bio, which spun off from VTT Technical Research Centre of Finland, was awarded a €4.5 million ($5 million) grant

from Business Finland for R&D on precision fermented egg white proteins. Business Finland turned again to Solar Foods in late 2022 with a €34 million ($37.3 million) grant, singlehandedly doubling the nation's investment in alternative proteins. The grant will allow Solar Foods to accelerate progress on their first production facility, currently under construction in Vantaa and projected to begin operations in 2024, and also to plan construction of a second facility. While Solar Foods' flagship product Solein is subject to the EU's novel foods process, the Finnish company announced in October 2022 that it had received regulatory approval in Singapore.

As of the end of 2022, Finland's total investment in developing plant-based and fermented domestic sources of protein totals over $60 million, an outsized investment for a small nation.

France

France's engagement with alternative proteins has been mixed, with 2022 bringing developments both in favor of and against plant-based meat products. Early in 2022, the French legislature passed a decree banning the use of many meat terms on plant-based labels, including "sausage" and "chicken," even when accompanied by descriptors clarifying the product's composition. Fortunately, the country's highest court temporarily suspended enactment of the ban in July 2022 on the grounds that the ban is "unjustified in terms of providing consumer information," per observer Proveg International.

But while the French government may have their reservations about plant-based food in the marketplace, they recognize new protein sources as a key part of developing a "healthy, sustainable, and traceable" food system.[4] ANR, France's research agency, announced €55 million ($60 million) for research on alternative protein production and functionality, comprising €7.8 million ($8.5 million) across three ongoing plant-based protein projects and two open calls for projects of €22 million ($24 million) to address pulse crop production, processing, consumption, and optimization, and €25 million ($27.2 million) on protein diversification of food sources, which includes new plant foods, microorganisms, and algaes.

The French government also recognized plant-based meat's potential to stimulate the economy and create jobs with a €7.4 million ($8.1 million) grant to French plant-based food manufacturer Umiami. As part of the French government's "Première Usine" ("First Factory") program, which helps pioneers of new technologies establish viability at a commercial scale, the grant helped Umiami acquire and retrofit a former Unilever production facility near Strasbourg. The project, which the government expects to create 200 jobs, also received €3 million ($3.3 million) in incentives from France's Grand Est region.

[4] Translated from French "saine, durable et traçable": https://anr.fr/fr/france-2030/france2030/call/developper-les-proteines-vegetales-et-diversifier-les-sources-de-proteines-volet-2-proteines-de/

Germany

Germany is Europe's most populous country and largest market and, despite the prominence of animal products in their local cuisine, has experienced a steady rise in flexitarianism over the past few years. German meat consumption declined 16.7 percent from 2007 to 2022, with meat consumption lower in 2022 than in any year since calculations began in 1989, while sales of plant-based meat doubled in the past few years alone. At Munich's world-famous Oktoberfest, known for copious meats and beer, attendees could opt for plant-based bratwurst, goulash, and Weißwurst. As the country's citizenry turns toward alternative proteins to reduce their climate impact, the government has also taken steps to produce more and better products.

Public support

Germany's federal government, which took office at the end of 2021, committed in their coalition agreement to support alternative proteins and plant-based options. Although discussions on how to achieve this are ongoing, the government is already funding research projects on alternative proteins. However, these projects are currently low in volume and lack a coherent overall strategy for sector development.

In 2022, the German Bundestag commissioned an expert report on the opportunities and challenges of cultivated meat. The report, handed to parliament in early 2023, emphasizes the need for public research funding to reap the benefits of cultivated meat.

In addition, the Federal Ministry of Education and Research is funding four bioeconomy innovation spaces, including NewFoodSystems, which involves over 50 partner organizations working on projects related to alternative protein sources, particularly plant- and algae-based approaches. However, it is unknown how much of the eight-digit sum is going into alternative proteins versus other projects, such as insect-based proteins.

The Federal Ministry of Education and Research is also funding the Cellzero Meat research network, which aims to advance meat cultivation using animal-free and GMO-free growth media. This project will be funded with €1.1 million ($1.2 million) from 2022 to 2024 and involves partners such as the Research Institute for Farm Animal Biology and the Leibniz Institute for Plasma Research and Technology.

The Federal Ministry for Economic Affairs and Climate Protection launched a funding program for the industrial bioeconomy in 2021 which funds projects that are close to the market, particularly scaling up biobased processes, procedures, and products to industrial scale, and constructing pilot plants. The program has funded alternative proteins projects to the tune of €1.76 million ($1.9 million), with a particular focus on scaling biomass and precision fermentation.

Since Germany is a federal state, a large part of research and business funding is at the state level. One example of this is the funding of a project on the acceptance and communication of cultivated meat at the University of Vechta by the Lower Saxony Ministry of Science and Culture as part of the "Zukunftsdiskurse" ("Future Discourse") program, which amounts to around €120,000 ($131,000).

The Netherlands

The Netherlands, Europe's leading agricultural exporter, has quickly become Europe's leading investor in alternative proteins, especially cellular agriculture, with massive fiscal and ideological commitments to the sector announced in 2022. Though the country had invested in alternative protein research as early as 2005, supporting Mark Post's groundbreaking creation of the world's first cultivated hamburger with a $2.3 million research grant, their continued attention to the sector had been minimal until 2020. In 2022 the country recommitted to developing cellular agriculture with €60 million ($66.2 million) in funding for an initiative, discussed below, combining research, commercialization support, workforce development, and more, instantly making the Netherlands the world leader in known commitments to cellular agriculture.

In 2020, the Dutch Government published their National Protein Strategy, which concluded that the Netherlands' dependence on imported soy to support their expansive animal agriculture sector not only made the country a driver of climate change and biodiversity loss but also exposed them to geopolitical and economic instability. In light of these risks—and the country's growing demand for plant-based alternative proteins—the strategy committed to the following goals (among others) for the subsequent five to ten years:

- "Selective focus on the cultivation of typical Dutch protein-rich crops, including potatoes, grass and leguminous plants, such as field beans."
- "Innovation and development of alternative protein sources for humans and animals, such as microbial proteins and cultured meat."

The government acknowledged the importance of developing "the range of tasty, healthy and sustainable vegetable and innovative protein sources."

To prove that point, the war in Ukraine in 2022 prompted a sharp increase in food prices around the globe, due not only to Ukraine's substantial exports of grain for animal feed but also Russia's exports of fertilizer, depressing yields worldwide. This resulted in plant-based alternative proteins briefly becoming less expensive than animal-sourced options in the Netherlands, despite the former's lack of broad commercialization and the latter's heavy subsidization. Because plant-based alternative proteins require far less commodity-grade crops to produce than animal agriculture due to trophic loss, sudden shocks to food prices had accordingly far less of an effect on prices.

In response to all of the above, the Netherlands burst out of the gates in 2022 with a world-record-breaking €60 million ($66.2 million) investment toward building a full cellular agriculture ecosystem. The new program, Cellulaire Agricultuur Nederland, includes vitally important R&D and commercialization efforts, workforce transition programs, and education. By working to scale cultivated meat and precision fermentation infrastructure and ensure a socially just and well-paid workforce transition, the program claims it will generate billions per year in earning capacity for the Netherlands by 2050. This is the single largest public investment in cellular agriculture to date and a massive leap forward for the Netherlands' innovative agricultural sector.

However, the government's attempts to reduce agricultural emissions have led to a coalition of farmers and right-wing populists, who protested against plans to reduce livestock numbers and buy out farms, winning a shock victory in the 2023 Dutch local elections and threatening to put the country's progress on sustainable agriculture in jeopardy. GFI advocates for the need to include all stakeholders in the policymaking process, forging a future of sustainable food production while ensuring incumbent producers are included and empowered through new food systems.

Norway

As with Finland and the Netherlands, Norway responded to the impact of geopolitical instability on European food systems with an important investment in alternative proteins. Citing the country's lack of self-sufficiency in food production, the Research Council of Norway announced they will fund a five-year, €2 million project entitled "The Arrival of Cellular Agriculture — Enabling Biotechnology for Future Food Production." The project will research how to scale up domestic production of cultivated meat and precision-fermented foods in partnership with the Norwegian Institute of Food, Fisheries and Aquaculture Research, Oslo Metropolitan University, the Norwegian Board of Technology, and dairy company Tine AS.

> *"We can increase self-sufficiency in food in Norway, and we do not have to kill animals to produce the necessary protein in the form of meat. In Norway, we have both the expertise and the money needed to develop new technical solutions for food production."*
>
> **— Sissel Rønning, lead researcher on ARRIVAL**

Spain

Spain funded important research on cultivated meat over the past two years, primarily in collaboration with Spanish biotechnology startup BioTech Foods. In 2022 the Spanish Foreign Trade Institute, an agency of Spain's Ministry of Industry, Tourism and Trade, announced a €750,000 grant to help fund the startup's investMEAT project, which is studying cultivated meat industrialization, including cell line development, in order to bring down production costs and expand to commercial markets. While Spain's 2022 grant is significantly smaller than their 2021 investment of €5.2 million, the focus on improving production capabilities addresses a critical concern as the sector looks to serve a mass market.

Sweden

In 2014, the Swedish government granted SEK 1,600,000 ($154,831) to a prescient study investigating the potential of plant-based foods to reduce environmental impacts, improve nutrition, and valorize sidestreams from Swedish domestic products. Though investment in alternative proteins had been light since, in 2022, the government recommitted to the findings from that study as the country invested SEK 150 million ($14.5 million) to support a large-scale farmer-owned pea protein processing facility as part of their Klimatklivet ("The Climate Leap") program. The investment underscores the benefit of investing in domestic food sources amid a chaotic geopolitical climate and the capacity for a transition to alternative proteins to center and support the existing agricultural workforce.

Switzerland

In 2021, Switzerland attempted to ban the use of meat-related terms on the packaging of plant-based foods, ordering Planted, a popular Swiss plant-based food producer, to remove the terms "chicken" and "pork" from the labels on their pea-based products. Planted challenged the order, and in December 2022, the Zurich Administrative Court held that Planted's labels were not deceptive because the labels as a whole clearly indicated that the products were meatless. In addition, the court indicated that using species names like "chicken" or "pork" on plant-based labels can provide consumers with the information they need to understand the nature of the product. The Swiss regulator appealed the decision, however, and the case will head to the nation's highest court in 2023.

Meanwhile, the Swiss State Secretariat for Education, Research and Innovation partially funded the HealthFerm project in collaboration with the EU (see above), granting €1.8 million ($2 million) to a consortium of academics and industry partners studying the nutritional benefits of plant-based fermented foods. Among the 22 project partners is Swiss startup Planted.

Türkiye

Türkiye took a major step backward in 2022 by banning the production or sale of plant-based cheese, stating that "products that give the impression of cheese cannot be made using vegetable oil or other food ingredients." The nation had already banned plant-based alternatives from using the word "cheese" on their labeling but took their restrictions a step further in July 2022 with an outright ban on the products. Popular plant-based cheese purveyors were forced to pull products from shelves in response.

United Kingdom

Public support

Following 2021, in which the independent National Food Strategy advised that the government invest £50 million ($62 million) in an alternative protein innovation cluster and £75 million ($93 million) in alternative protein startups, 2022 marked an important year for alternative proteins as the United Kingdom began making investments and commitments in line with these goals.

The UK unveiled their Government Food Strategy in June 2022, pledging at least £120 million ($150 million) in "research across the food system," including on alternative proteins, though the exact amount devoted to alternative proteins remains unclear. As part of this research push, in September 2022, the United Kingdom's Biotechnology and Biological Sciences Research Council (BBSRC) committed to spend £20 million ($25 million) in conjunction with Innovate UK toward "capacity building, research, innovation, and business-led commercialization" in the alternative protein industry, including for biomass and precision fermentation. This sizable investment will support the development of a domestic plant-based protein industry and cellular agriculture ecosystem around the UK's powerful knowledge centers.

As part of this investment, at the end of 2022, the BBSRC and Innovate UK issued a £16 million ($20 million) competitive funding call for feasibility studies and industrial research exploring novel low-emissions food production systems, including novel plant-based products or production systems, precision fermentation (and other acellular foods), and cultivated meat, biomass fermentation, and other cellular food production. This represents one of the most promising steps forward in funding alternative protein R&D in the United Kingdom to date.

> *"This funding will enable UK companies to partner with our world-leading science-base to develop innovative, low emission food production systems that meet rising consumer demand for products like alternative proteins. Producing food in new environments can help take pressure away from traditional land-based systems while also supporting our transition towards net zero."*
>
> **— Dr. Tom Jenkins, Deputy Challenge Director for the Transforming Food Production Programme at Innovate UK**

Regulation and labeling

Although the United Kingdom is no longer part of the European Union, they have thus far retained the same regulatory processes for novel foods and genetically modified food and feed. As in the European Union, novel plant-based, fermented, and cultivated meat products require premarket

authorization, and companies must apply for authorization from the UK Food Standards Agency (FSA) using these guidelines.

Outlined in January 2022, the Benefits of Brexit white paper pledged to review the novel foods regulatory framework. This was widely welcomed and presents an opportunity for the United Kingdom to establish a clearer, more streamlined route to market for alternative proteins that both prioritizes food safety and drives innovation. As of early 2023, the review is being conducted by an independent consultancy commissioned by the FSA.

The future of plant-based dairy labeling remains uncertain in the United Kingdom. In 2022, UK trading standards enforcement officers presented draft guidance to the Department for Environment, Food, and Rural Affairs (known as Defra) recommending that plant-based products should be banned from using deliberate misspellings and plays-on-words to get around existing restrictions on the use of protected dairy nomenclature. As of early 2023, Defra was still considering the draft guidance, which, if enforced, would make restrictions more hardline than those in the European Union.

Middle East and Africa

Countries in the Middle East and North Africa, which import much of their staple crops and fertilizer, were especially hard hit by shocks to the global food system in 2022. Though grain prices have returned to pre-2022 levels, the message for Middle Eastern governments was clear: amid an unpredictable geopolitical order and a changing climate, increasing domestic food production is a critical concern.

> *"Besides increasing food insecurity, the global food emergency has exacerbated national security threats including conflict, unrest, and political instability. Ukraine's exports alone feed 400 million people each year, and, together, Russia and Ukraine supply half of Lebanon and Tunisia's cereal supply, two-thirds of Libya's and Egypt's, and nearly all of Somalia's wheat. As a result, global wheat prices rose 56 percent in a year, and it has pushed Somalia to the brink of famine. High food prices were among the many concerns that drove protesters into the streets at the beginning of the Arab Spring (2011). It is hardly far-fetched to think they might soon do so again."*
>
> – The Good Food Institute and Climate Advisors in "*Why the United States Should Champion Alternative Proteins As A Food and National Security Solution*"

In response, the governments that can act are incentivizing the growth of cultivation and fermentation facilities especially, which can use various human-inedible feedstocks—customized based on domestically available resources—to create highly nutritious food with minimal production requirements. Governments in the region took different approaches based on their individual strengths. While Israel remains a global leader in alternative protein research and development as the "startup nation," many of their cultivated meat startups opted in 2022 to locate their commercial-scale facilities abroad due to the country's lack of regulatory approval and support for scaling up (though there has been important progress in this area). Israel's peers in the Gulf, such as Qatar, Oman, and the United Arab Emirates, have adopted a different tactic, passing on research and development and instead partnering with foreign alternative meat startups, primarily U.S.-based companies, to build commercial-scale production facilities and potentially fast-track regulatory approval. Altogether, the alternative protein industry improved its public support in the Middle East among diverse governments adopting a range of policies, setting the stage to form a robust transnational alternative protein ecosystem.

Israel

Israel has long been a leader in their national support for alternative proteins, especially cultivated meat—24 percent of global investment ($637 million total) in cultivated meat is in Israel—and alternative proteins enjoy frequent and explicit support from government leadership. With help from GFI, in 2022, Israel celebrated their 74th Independence Day with a United Nations event focused on the country's leadership on alternative proteins. A few months later, GFI Israel partnered with the Israeli Ministry of Foreign Affairs to host the Jewish new year in an event attended by 60 global ambassadors that called for other countries to promote their own alternative protein strategies.

In December of 2022, the Israeli embassy hosted the Future of Food event in Berlin. A formal reception at the ambassador's residence was dedicated to Israeli Innovation in Alternative Proteins. Local participants included the director general of the German Ministry of Food and Agriculture, parliament members, diplomats, civil society representatives, industry stakeholders, investors, entrepreneurs, and local opinion leaders. The Israeli companies Redefine Meat, More Foods, Yofix, and Innovopro provided products for sampling. The companies were offered a tailored schedule of business meetings organized by the economic mission.

GFI Israel's national policy plan on alternative proteins leverages the Israeli alternative protein ecosystem to develop an industry capable of local production and exports as an economic engine for growth and for strengthening Israel's national food security. The plan, parts of which have already been put into practice, urges the government to invest $350 million over 10 years for alternative protein research, research center establishment, pilot and scaleup infrastructure, and regulation. It identifies opportunities and barriers for global leadership in this field, estimating that Israel could generate over 55,000 jobs in the sector, more than NIS 25 billion ($9 billion) in tax revenue, and more than 300 new startups.

Public support

Between 2011 and 2022, the Israeli Innovation Authority (IIA) granted or committed $54 million across the country to aid research in alternative proteins, establish alternative protein startups, and support more mature startups in building pilot facilities, including committing $18 million to fund a cultivated meat consortium established in 2022. In addition, new funding commitments from the IIA in 2022 totaled $25.2 million as the agency announced funding for knowledge infrastructure, startup and seed funding, product development, and pilot facility construction.

In addition to investments from the IIA, GFI Israel helped secure $1.2 million for 15 research grants, with $950,000 provided by the Ministry of Innovation, Science and Technology, the Ministry of Agriculture and Rural Development, and GFI Israel, bringing Israel's total investment in alternative proteins to over $81 million. This surge in investment places Israel securely in the top tier of countries embracing alternative proteins as a key industry of the future.

Israel has also recognized that open-access research and collaboration are vital to develop the industry as a whole and has taken intentional steps to serve as a facilitator and catalyst of collaboration between organizations. The National Council for Civilian Research and Development named food-tech, with an emphasis on alternative proteins, one of Israel's top five research priorities. The Ministry of Science and Technology's research grants fund, which distributes NIS 180 million a year, will emphasize the priority areas, with national programs to be established in these areas. In April 2022, the IIA began funding an $18 million cultivated meat consortium (announced in 2021) consisting of 14 companies and 10 academic labs led by Israel's largest food company, Tnuva. The consortium aims to develop more efficient, cost-competitive production methods and pilot scale-up opportunities over three years. Later in 2022, the agency funded a grant for Israeli company SuperMeat to develop an open-access, high-throughput screening system for cultivated meat inputs like cell culture media and growth catalysts. Once established, this system will allow the entire industry to quickly determine ingredient viability without duplicative research.

The commitment to open-access knowledge crosses international borders as well: the Singapore Israel Industrial R&D Foundation, a collaboration between the two countries' entrepreneurial development agencies, awarded a joint grant to Israel-based Steakholder Foods and Singapore-based Umami Meats to develop 3D-printed cultivated fish. (See "A look at 2023" for the finished product and its high-profile taste-tester). This collaboration resulted in open-access findings regarding cultivated seafood production and deepened the knowledge-sharing networks between the two companies and their distant biotech research hubs. Likewise, Israel's Ministry of Foreign Affairs and multiple Israeli embassies have worked to advance alternative protein global collaborations, including with Japan, Singapore, and China. Israeli diplomats use a "diplomat toolkit" developed by GFI Israel to present Israeli alternative protein technology as an asset that could support Israel's diplomatic global mission.

In November 2022, the Israeli delegation to COP27 worked with GFI Israel to advance alternative proteins as a climate solution, with the Israeli government's pavilion advertising the country as "the land of alternative milk, alternative honey, and alternative meat" and putting forth their goal of "making alternative proteins no longer alternative." (See the "Global coordination" section for more.)

Finally, Israel began to address the flight of commercialization-ready startups from the country. Throughout 2022, seven Israeli alternative protein startups announced plans to scale up production but only three intended to do so in Israel. Toward the end of 2022, the IIA launched a NIS 50 million ($13.8 million) request for proposals for precision fermentation infrastructure, citing the importance of locating factories in Israel, with the hope that increasing test facility space would speed the regulatory process and increase confidence in the sector's market growth potential. They stated, "Creating R&D infrastructures of this type in Israel will allow many projects to continue the necessary research and development here, and in the future, to establish local manufacturing plants. It will also assist in obtaining regulatory food certifications for the nutrients manufactured using fermentation technologies."

Regulation and labeling

Israel's National Food Service under the Ministry of Health has maintained that cultivated meat and fermentation-derived foods would come under the regulatory definition of novel foods. However, because the existing novel foods framework is generic, the Israeli Innovation Authority and the Food Safety Authority collaborated on a joint pilot program with four alternative protein companies from 2021 to 2022 to determine what additional safety criteria should be required for regulatory approval. This research will equip the National Food Control Service—the Ministry of Health department that oversees food production—to evaluate future applications from alternative protein companies. (For a product approval resulting from this pilot, see "A look at 2023.") In September 2022, Israel's Ministry of Health and the UN FAO convened researchers and developers to discuss various aspects of cultivated meat and dairy, including food safety and regulation.

Oman

In Oman, which produces far more dates than they can consume or export, the nation's sovereign wealth fund partnered with MycoTechnology, a Colorado-based mycelium fermentation company, to develop a production facility that will use dates as a feedstock for protein-rich biomass fermentation. The new venture will allow Oman to produce more of their own food, relying less on imports that are vulnerable to geopolitical and economic shocks, and jumpstart an industry that can serve as a higher-paying buyer for Omani date producers.

Qatar

Public support

In 2021, Qatar's sovereign wealth fund, the Qatar Investment Authority, led a $200 million investment round for leading plant-based egg and cultivated meat company Eat Just. Later that year, Doha Venture Capital, a state-backed investment fund, and the Qatar Free Zones Authority, an

independent authority that oversees and regulates the country's free zones,[5] announced plans to construct a $200-million Eat Just cultivated meat production facility in Doha. No new investments occurred in 2022.

> *"We're particularly focused on companies shaping the future of their industries, and Eat Just's team is doing just that. Our free zones are characterized by innovation, technology, accelerated growth, and environmental awareness, and Eat Just is a natural partner across all four of these areas. Our food, agri-tech, and biomedical sectors continue to grow rapidly, supported by the world-leading cold chain storage capabilities of our airport and port, and we look forward to working with Eat Just as they establish and scale in the region and worldwide."*
>
> **– Qatar Free Zones Authority CEO Lim Meng Hui on their partnership with Eat Just**

Regulation and labeling

Qatar's Ministry of Public Health and the Qatar Free Zones Authority granted GOOD Meat cultivated chicken an export license in 2021 as part of their collaboration on Eat Just's new facility, allowing the company to produce and sell their product abroad despite it not being approved for domestic consumption. The ministry simultaneously announced plans to fast-track regulatory approval, prompting speculation that the nation would be the first Middle Eastern country to approve a cultivated meat product. Those plans have not yet materialized. A 2022 report from the United Nations Food and Agriculture Organization (FAO) on "Food Safety Aspects of Cell-based Food" highlighted Qatar's regulatory system in a case study, noting that international guidance regarding the food safety assessment of cultivated meat would be especially beneficial to the country.

South Africa

South Africa joined Türkiye and France in attempting to ban plant-based meat products from using terms like "meatball" and "nugget" on their labeling, though as in France, the initial order was quickly halted by the courts. In June 2022, South Africa's Department of Agriculture, Land Reform, and Rural Development issued Regulation No.R.1283 against using "product names prescribed and reserved for processed meat products," arguing that such terms confuse consumers even when accompanied by language making the plant-based nature of the food clear. Seizures of noncompliant products were due to begin in August 2022, but a halt on enforcement from

[5] Free zones generally refer to areas in which corporate taxes and duties are minimal or nonexistent to encourage economic activity.

Johannesburg High Court—eventually extended until May 2023—has allowed plant-based producers to continue to operate.

> *"Plant-based foods play a vital role in making our food systems more sustainable. Enforcing a regulation like this not only undermines the important work South African meat analogue manufacturers are doing in the fight against climate change, it also makes no sense in terms of how many other governments and food regulators from around the world are responding to the data."*
>
> – Tammy Fry, *co-founder of South Africa-based plant-based business Fry's Family Foods*

United Arab Emirates

The United Arab Emirates responded to global food insecurity with investments in precision fermentation capabilities, enabling the small, arid country to produce more food within their borders despite the growing demand for meat and dairy products. In October 2022, U.S. company Change Foods announced plans to open a regional headquarters in Abu Dhabi and begin constructing a 1.2 million-liter (327,000-gallon) precision fermentation facility through the UAE's NextGenFDI program. The facility will create animal-free casein, the key protein in cheese, using 1/10th of the water and 1/5th of the energy compared to conventional dairy farming, and takes advantage of the government program's incentives and benefits for establishing infrastructure and attracting investment.

The United Arab Emirates has also led efforts to promote alternative proteins on the international stage through Minister of Climate Change and Environment Mariam Almheiri, who has ensured alternative proteins were included in the United States' and United Arab Emirates' Agricultural Innovation Mission for Climate and the upcoming 2023 COP28 conference in Dubai.

> *"This is about creating dairy in the desert."*
>
> **– David Bucca, CEO and founder of Change Foods, on building a new precision fermentation facility in Abu Dhabi**

Global coordination

Adapted from GFI's State of the Industry Report series

The importance of alternative proteins as a scalable solution for global problems including the climate crisis, biodiversity loss, public health risks, and food insecurity is not lost on various multilateral organizations. A number are beginning to work on the global regulation and trade of alternative proteins and have expressed increasing support for continued protein innovation.

COP27

More than ever before, food, agriculture, and alternative proteins seized the spotlight at the 2022 United Nations Climate Change Conference (COP27) in Sharm El-Sheikh, Egypt.

GFI Asia Pacific (APAC) co-organized a historic, first-of-its-kind cultivated meat dinner for global leaders. Current and former senior officials from 10 nations joined GFI APAC managing director Mirte Gosker and Singapore Minister for Sustainability and the Environment Grace Fu for the meal. GFI also served as a cohost of the first-ever Food Systems Pavilion at COP27, and worked to ensure alternative proteins were highlighted in panels on smart protein policy and financing, climate investment, food security, deforestation, and sustainable diets. Throughout the entire two weeks of the conference, the Israel pavilion championed alternative protein innovation as a key climate solution and "taste of the future."

Near the end of COP27, the UN FAO issued a new report on bioeconomies, with a solid nod toward the role of food in humanity's future: "In addition to climate mitigation gains, new food sources could reduce pressure on forests and land used for feed, support the preservation of biodiversity and planetary health, and contribute to preventing forms of malnutrition in developing countries."

FAO/WHO

The UN FAO and the World Health Organization (WHO) convened an expert consultation on cultivated food products and food safety considerations, attended by two GFI scientists, in Singapore in November 2022 to collect the most up-to-date information and best practices available on cultivated meat (and other cultivated products) with a focus on food safety. The report, "Food Safety Aspects of Cell-Based Food," was released early in 2023 and will help food regulators determine where work is needed to support global regulation of these foods. FAO also released resource papers on terminologies, regulatory frameworks, and the general cultivated meat production process.

Codex Alimentarius Commission

The Codex Alimentarius Commission is an international body run jointly by the UN FAO and WHO. It includes 188 member countries, the European Union, and several official observer organizations, including GFI. The Commission promulgates voluntary standards and guidelines for food safety, trade, and regulation in a publication called the Codex Alimentarius.

In March 2022, the Codex Secretariat issued a circular letter seeking comments from member countries and observers on developments related to new food sources and production systems (NFPS), which includes alternative proteins. Members and observers, including GFI, submitted comments outlining the regulatory status of alternative proteins worldwide while raising potential regulatory and trade issues. The topic of NFPS was discussed at the 45th convening of the commission (CAC45) in November 2022. The Codex Secretariat issued a second circular letter in April 2023 soliciting comments identifying possible issues related to NFPS that the current Codex structure and procedures cannot address, and this topic will be discussed again at CAC46 later in the year.

Agriculture Innovation Mission for Climate (AIM for Climate)

AIM for Climate is a joint initiative of the United States and the United Arab Emirates that seeks to address climate change and global hunger by encouraging participants to significantly increase investment in, and other support for, climate-smart agriculture and food systems innovation over five years (2021-2025). GFI joined AIM for Climate as a non-governmental partner in 2022, and had two alternative proteins-focused "innovation sprints" accepted and published by the AIM for Climate team, alongside a $40 million R&D sprint submitted by cultivated meat company Aleph Farms. Additionally, these alternative protein sprints were featured as part of the official AIM for Climate roadshow series at COP27 in Sharm el Sheik, Egypt.

A look at 2023

Australia and New Zealand

Vow Food, who received a $16,500 grant from the government of New South Wales in 2019 and opened Australia's first cultivated meat production facility in 2022, submitted a novel food application to FSANZ, Australia and New Zealand's joint regulator. FSANZ also accepted recommendations to keep cultivated meat products under the existing novel foods premarket approval process, stating that no additional requirements are necessary to ensure consumer safety.

Canada

Government funding for Protein Industries Canada (PIC) was renewed with CAD 150 million ($110 million) for another five years, bringing Canada's total committed funding for the supercluster to CAD 353 million ($260 million) from 2018 to 2028. PIC committed to turning Canada's plant-based food sector into a CAD 25 billion ($18 billion) industry by 2035.

France

The French government contributed €8.3 million to "AlinOVeg: Innovating in Plant-Based Food," a five-year collaborative project to develop dairy alternatives from pea and fava proteins. Among the collaborators are the National Research Institute for Agriculture, Food, and Environment and Eurial, a major player in the dairy industry.

Israel

The Israeli regulator approved its first precision fermentation food: Remilk's cow-free milk made with precision-fermented whey. Remilk already has the green light from Singapore and FDA. The Prime Minister's Office also established a nationwide plan on alternative proteins in collaboration with the Israel Innovation Authority and GFI Israel. "Israel is a global leader in the field of alternative protein and we will see to it that we continue to lead."

Israel and Singapore

A joint grant from the Singapore Israel Industrial R&D Foundation to two cultivated meat startups, announced late in 2022, yielded the first 3D-printed cultivated fish filet in April 2023. The product, made from grouper cells, was a joint effort between Israel's Steakholder Foods and Singapore's Umami Meats.

Italy

In March 2023, Prime Minister Giorgia Meloni's government put forward a bill that would ban the production and placing on the market of cultivated meat in Italy. If brought to pass, this law would shut Italians out of cultivated meat's economic and climate benefits, while limiting consumer choice and holding back scientific progress. Italy is alone in proposing such a measure and risks being left behind while the rest of Europe progresses toward a more sustainable and resilient food system.

Japan

In February 2023, Japan's Ministry of Agriculture, Forestry and Fisheries announced a three-year "road map" for food-tech promotion, which includes a section on cultivated food. At a meeting of the House of Representatives Budget Committee later that month, Prime Minister of Japan Fumio Kishida announced: "Foodtech, including cellular foods, is an important technology from the perspective of realizing a sustainable food supply. We have to support efforts that contribute to solving the world's food problems."

The Netherlands

The Dutch Research Council awarded €1 million ($1.1 million) to a group of companies and academics, including cultivated meat company Meatable, to research the scalability and cost-effectiveness of producing non-animal derived collagen and elastin.

Singapore

- In the first days of 2023, Singapore granted regulatory approval for GOOD Meat to use animal-free cell growth media to create their already-approved cultivated chicken products. Once considered a major hurdle to cultivated meat development, the consumer debut of fully animal-free cultivated meat products allows the company to scale up production and lower costs. Mirte Gosker of GFI APAC expressed hope that other nations will also soon embrace "this smarter way of making meat."
- New work visa rules will prioritize applications from alternative protein food scientists. "As Singapore moves to capture new economic opportunities, firms will require access to skilled talent to fill these jobs."
- Enterprise Singapore, a government agency focused on small and medium businesses, is launching the Food Technology Program to help alternative protein startups enter the market in mainland China.

South Korea

- In February 2023, 28 parties signed a Memorandum of Understanding led by South Korea's North Gyeongsang Province to establish a cellular agriculture cluster to address climate and food crises. The cluster aims to establish a regulation-free zone in Uiseong where companies can showcase proof-of-concept prototypes. The 9 billion won ($6.7 million) facility opened in March 2023 with a ceremony at which the world's largest meat prototype, weighing in at 10 kilograms (22 lbs), was unveiled by Tissen Biofarm, a cluster member.

Sweden and Austria

- Following the example of Israel and Singapore's joint grant for cultivated fish research, two research agencies from Sweden and Austria (Vinnova and the Austrian Research Promotion Agency, respectively) and the EU's Eurostars program are jointly funding a €1.5 million ($1.6 million) grant to Austria's Revo Foods and Sweden's Mycorena to develop a 3D-printed mycoprotein product.

United Kingdom

- The UK Engineering and Physical Sciences Research Council (EPSRC) announced £12 million ($14.9 million) in funding for a new Cellular Agriculture Manufacturing Hub (CARMA), a sustainable protein research center led by the University of Bath. This funding represents the UK government's largest single investment in alternative protein R&D to date. Over the next seven years CARMA will investigate ways to scale cultivated meat production and develop protein sources using fermentation technology.

- Multus, a startup producing cultivation media, received £2.15 million ($2.6 million) from Innovate UK to build a facility for the large-scale production of food-safe, animal-free cell growth media.

United States

- On June 21, 2023, UPSIDE Foods and GOOD Meat, a division of US-based Eat Just, simultaneously became the first cultivated meat companies cleared to sell their cultivated chicken in the United States. After FDA issued a green light for GOOD Meat's cultivated chicken in March 2023, USDA followed soon after by pre-approving both companies' labels and issuing grants of inspection for both production facilities, clearing the last remaining regulatory hurdles. In both cases, USDA approved labels that refer to the products as "cell-cultivated chicken." As of publication, UPSIDE was planning to debut their cultivated chicken at chef Dominique Crenn's restaurant Bar Crenn in San Francisco while GOOD Meat was planning to do so at José Andrés' China Chilcano in Washington, D.C.

- In a major step forward, the White House released a report detailing their vision for the future of biotechnology and biomanufacturing that prominently features alternative proteins. The new guidelines include "bold goals" for innovation, workforce development, and regulation. In the report, the Department of Agriculture and Department of Energy call for more research on alternative proteins, public-private partnerships, and an ecosystem of agriculture-focused biomanufacturing facilities. Federal agencies will subsequently work to develop implementation plans, expected in July 2023.

- In early 2023, FDA issued draft guidance on plant-based milk labels. The agency affirmed GFI's longtime position that plant-based milks should be permitted to keep the word milk in their names. However, the agency also urged companies that use the word on their labels to disclose nutritional differences between their products and cow's milk on the front of their labels, even though FDA has never set nutritional requirements for cow's milk. FDA has also stated that they intend to draft guidance on labeling plant-based alternatives to other animal-derived foods.

- The Fifth Circuit Court of Appeals overruled a lower court's ruling about a Louisiana label censorship law. The court found that Tofurky's First Amendment rights had not been violated because the law does not prohibit Tofurky's current labeling practices. Circuit Judge Edith Brown Clement said, "Everyone agrees that Tofurky does not intentionally misrepresent its products as meat and does not intend to start." (Reuters)

Conclusion

GFI's last State of Global Policy Report characterized 2021 as a banner year for alternative proteins—but only because 2022 had not happened yet. Though the world economy faced intense headwinds that hit the global food system especially hard, in 2022 governments of all sizes responded with moves to innovate, diversify, and modernize their food sources through alternative proteins.

This forward momentum, however, needs to be understood in the context of the urgent issues that alternative proteins address and the massive scale-up necessary to unlock their potential to create good jobs and drive economic growth.

Countless reasons demand public investments in alternative proteins:

From reducing greenhouse gas emissions to protecting against antimicrobial resistance and pandemics to providing a cheaper and more abundant source of dietary protein for a growing global population. However, 2022 revealed that governments found a particular set of motivations most compelling. In light of the rippling effects of Covid-19 and geopolitical instability, governments recognized that cultivating domestic food sources is an effective response to a globalized food system especially vulnerable to shocks far beyond their control. As the alternative protein industry continues to increase crop end-uses, factory construction, and export potential, governments are taking notice and are committed to developing knowledge, facilitating scale up, and supporting an industry that could create millions of jobs and trillions of dollars in economic value globally.

A 2021 Global Innovation Needs Assessment found that the alternative protein industry could support 9.8 million jobs and $1.1 trillion in economic activity by 2050.

However, the report considered that goal attainable only if governments worldwide scaled their support to $10.1 billion annually, split between R&D and commercialization support. While 2022 was the best year yet for public investment in this space, with an aggregate global investment of only about a half-billion dollars, the world has more distance to cover before the industry's full economic, climate, and food security potential can be reached.

Countries should work together to demonstrate leadership in meeting that $10.1 billion investment, which will generate returns many times over.

The report finds that governments worldwide will need to allocate $4.4 billion per year for alternative protein R&D. This means that the United States and China, who combined conduct the majority of global agricultural research and who have made major statements regarding the future of alternative proteins, should each contribute roughly $1 billion of the annual sum. That R&D will not only yield breakthroughs in alternative protein quality and production, but also lucrative intellectual property, thriving research centers, and countless benefits for the study of biotechnology, food science, medicine, industrial engineering, and nutrition. Though the United States and China stand to leap ahead with their immense resources and capabilities, it would be unwise to count out smaller nations with a higher level of commitment, especially as Singapore, the Netherlands, and Israel are actively cultivating domestic biotechnology knowledge hubs. As countries compete for the brightest minds in a world with fewer barriers to collaboration, even a small head start and a slight funding edge could yield downstream advantages for any government ready to capitalize on it.

The same dynamic exists for the second piece of the $10.1 billion total: the $5.7 billion annually for commercialization. Research and development can yield lucrative and strategic benefits, but the global nature of the economy and supply chain means that governments will also compete for the businesses that arise from breakthroughs in alternative proteins, including the resulting jobs, tax revenue, and domestic food security from new production. Funds to support new product development and facility construction, from industrial-scale microbial fermentation in Finland to strategically located plant protein processing facilities in Australia, will have outsized benefits down the line for the governments that invest now.

Finally, while alternative proteins certainly promise benefits to individual governments and their constituents, they also provide the entire world with a sustainable, secure, and prosperous path to the future.

Governments can do their part to bring about a world with fewer greenhouse gas emissions, stronger food security, more biodiversity, and much lower risks for antimicrobial resistance and pandemics by investing in open-access research and development, cultivating local knowledge hubs and global connections, catalyzing commercialization and facility development, and ensuring that alternative proteins face a level playing field in the regulatory arena and in the marketplace.

In that respect, 2022 has been one of the best years yet, and we look forward to what the rest of 2023 will bring.

About the Good Food Institute

As a nonprofit think tank and international network of organizations powered by philanthropy, GFI works alongside scientists, businesses, and policymakers to make alternative proteins as delicious, affordable, and accessible as conventional meat. In Asia Pacific, Europe, Brazil, India, Israel, and the United States, our teams are mobilizing the international community to use markets and technology to replace harmful practices with ones that are better for the climate and biodiversity, food security, and global health.

We focus on three programmatic priorities:

Cultivating a strong scientific ecosystem

GFI develops open-access research and resources, educates and connects the next generation of scientists and entrepreneurs, and funds research that benefits alternative protein development.

Influencing policy and securing government investment

GFI's policy teams ensure that alternative proteins are a part of the policy discussion about climate change mitigation and global health. In every region where we have a presence, we advocate for government investment in alternative proteins and are paving the way for the approval of novel proteins such as cultivated meat.

Supporting the industry to advance alternative proteins

GFI's corporate teams are replicating past market transformations and partnering with companies and investors across the globe to drive investment, accelerate innovation, and scale the supply chain—all faster than market forces alone would allow.

Appendix 1

GFI's positions

Adapted from GFI's 2021 State of Global Policy Report

Public support for alternative proteins

To compete with conventional products in the marketplace, alternative proteins must taste as good or better and cost the same or less. Public support, including research in various areas such as diversifying inputs, improving manufacturing equipment, and optimizing cell lines, is needed to help alternative proteins reach taste and cost parity. Likewise, public support of the private sector, such as infrastructure funding, job training programs, and other financial support, is also needed to help the industry scale.

A Global Innovation Needs Assessment funded by the ClimateWorks Foundation and the UK's Foreign, Commonwealth and Development Office articulates why public investment is needed in this sector at this point in its development:

> *"To unlock the full benefits of alternative proteins, global public spending on R&D and on commercialization needs to increase to at least US$4.4 billion and US$5.7 billion per year, respectively. Additional enabling factors would also speed adoption. Targeted public efforts are required to accelerate diet shifts to alternative proteins, which will result in substantial socioeconomic and environmental benefits. Public support should be focused on creating an environment in which the private sector can invest with greater confidence and at a lower cost. Cost, affordability, regulatory and consumer acceptance barriers add extra risks to investor decisions, which can prevent the investment landscape from reaching its full potential. Regulatory and consumer acceptance barriers are particularly salient for some protein sources. For proteins that are closer to commercial viability, cost and affordability barriers can prevent full market uptake. Though the public sector needs to ensure that it does not crowd out private investment, it has a role to play in ensuring technologies have sufficient access to finance to scale at the required pace to achieve climate targets."*

Public research enables industry-wide advances in areas that individual private companies would not find profitable. Collaborative, open-access research often leads to unanticipated advances on decades-long time scales. Private funding, on the other hand, tends to focus on applied science and commercialization, seeking a short timeline for a return on investment for a small group of shareholders. Government research enabled the development of the internet, GPS, hard drives, touchscreens, and voice-activated virtual assistants like Siri.

Public research can also elevate the baseline from which everyone starts, addressing industry-wide issues that would otherwise result in research duplication. (For example, both Beyond Meat and Impossible Foods spent unspecified amounts of money to get an unwanted flavor out of peas.)

As the alternative protein industry grows, government support beyond research funding will become increasingly important for the industry to scale. Public investment helps companies scale by enabling them to build facilities, commercialize products, and purchase or lease expensive processing equipment or manufacturing facilities for a lower cost of capital than is available for private equity financing. Some governments have already invested in infrastructure, including pilot plants or large-scale research facilities. Others also support alternative proteins through startup funding, debt financing, and job training programs.

Regulation and labeling

The importance of sound alternative protein regulation cannot be overstated. Science-based frameworks that prioritize safety can build consumer trust, and fair administration can encourage innovators and investors to enter a market and willingly comply with consumer protections.

Many plant-based meats use familiar ingredients and fall readily within existing food regulations. However, cultivated meat and some other alternative proteins (such as heme, an ingredient in the Impossible Burger made via fermentation) require regulators to adapt existing regulatory frameworks. Governments often have broad regulatory frameworks that apply to all novel foods, which usually encompass some alternative proteins. In Singapore, for example, novel foods are defined as “foods and food ingredients that do not have a history of safe use.” Ingredients made through new production methods may also be considered novel foods, even if they are chemically identical to naturally occurring foods, and be regulated under a novel foods framework.

Many countries still have a long way to go to produce robust and efficient regulatory frameworks, but early signs in many regions are promising. Singapore, the United States, and several other countries are leading regulatory innovation to ensure that cultivated meat products can come to market safely, and Canada, Israel, Australia, and the European Union have all indicated that cultivated meat can be regulated under their novel food frameworks. The United States, India, the European Union, and Israel have also approved fermentation-derived ingredients.

In addition to safe and efficient regulations, consumers deserve alternative protein labels that reflect the language they use and understand. Companies should be able to choose their preferred terminology and use descriptive terms like “plant-based meat” and “soy milk.” Labeling restrictions

on alternative proteins may cause unnecessary economic harm if companies are forced to produce new and unappealing or confusing labels (e.g., “plant-based disc” and “soy drink”).

In many regions, sometimes driven by conventional agriculture producers, the government has acted to censor labels on alternative proteins to prohibit the use of conventional meat and dairy terms. Canada, India, and several U.S. states have implemented restrictive labeling policies for plant-based foods; however, several censorship attempts have been overturned or blocked, such as in Spain, the European Union, and some U.S. states. At the same time, Japan released preemptive regulations allowing plant-based companies to use conventional terms.

The food industry has long used microbial fermentation as a processing method and to create ingredients derived from microbial cultures. The technology is also used to create natural flavorings and sweeteners found in many foods and beverages. Given this history, most governments have well-established regulatory systems to ensure the safety of innovations in this platform. Some countries evaluate new fermentation products under novel food regulations, which usually require premarket authorization, while others like the United States apply a more nuanced regulatory framework.

Appendix 2

Research funding tables

The tables below capture global public funding for alternative protein research and private sector incentives across all three alternative protein production platforms from the earliest known projects through the end of 2022. The tables include research grants for universities, companies, and consortia, as well as in-house research conducted by government agencies.

While the information here is as comprehensive as possible, some funding is likely missing. State-owned investment funds and enterprises, especially relevant to Asia and the Middle East, can be opaque. For instance, the total amount Singapore's government has set aside for alternative proteins is not public. Likewise, smaller amounts of local and state-level funding (across different German or Chinese regions, for example) are not widely reported.

Americas

Brazil					**Total funding: $1,308,000**
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $1,308,000**
Federal Innovation Agency (FINEP)	Unknown	Research grants	Unspecified	2022	$500,000*
State Government of Paraná	Cultivation	University	Federal University of Paraná	2022	$808,000*

**Figures provided to GFI Brazil.*

Canada					**Total funding: $204,041,826**
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $36,046,626**
Natural Sciences and Engineering Research Council of Canada	Plant-based	University	University of Alberta	2016	$132,641

Natural Sciences and Engineering Research Council of Canada	Plant-based	University	University of Guelph	2018	$22,517
Natural Sciences and Engineering Research Council of Canada	Plant-based	University	University of Alberta	2018	$36,393
Natural Sciences and Engineering Research Council	Plant-based	University	University of Saskatchewan	2019	$1,279,506
Saskatchewan Agricultural Development Fund	Plant-based	University	University of Saskatchewan	2020	$165,000
Saskatchewan Agricultural Development Fund	Plant-based	University	University of Saskatchewan	2020	$176,000
Saskatchewan Agricultural Development Fund	Plant-based	Government Agency	Agriculture and Agri-Food Canada	2020	$198,000
Saskatchewan Agricultural Development Fund	Plant-based	University	University of Saskatchewan	2020	$239,000
Protein Industries Canada	Plant-based	Company	Sightline Innovation; DL Seeds; SeedNet	2020	$1,410,000
Western Economic Diversification Canada; Government of Alberta; Industry partners	Plant-based	Government Agency	Food Processing Development Center	2020	$2,727,000
Protein Industries Canada	Plant-based	Company	Mera Food Group; Mera Developments; Benson Farms	2020	$2,867,000
Protein Industries Canada	Plant-based	Company	AGT Food and Ingredients; ulivit	2020	$4,545,000
Protein Industries Canada	Plant-based	Company	Avena Foods; Big Mountain Foods; Daiya Foods; Bakenology; The Village Bakery	2020	$5,074,000
Saskatchewan Agricultural Development Fund	Plant-based	University	University of Saskatchewan	2021	$198,768
Saskatchewan Agricultural Development Fund	Plant-based	University	University of Saskatchewan	2021	$201,949
New Frontiers in Research Fund	Cultivated	University	McMaster University	2021	$202,212
Protein Industries Canada	Plant-based	Consortium	Saskatchewan Food Industry Development Center (Food Center); University of Saskatchewan; Global Agri-Food Advancement Partnership (GAAP); Ag-West Bio	2021	$545,475
Protein Industries Canada; New School Foods; Liven	Plant-based	Company	New School Foods	2021	$759,667
Protein Industries Canada	Plant-based	Consortium	YoFiit; Avena Foods Limited;	2021	$1,324,725

			Roquette Canada		
Protein Industries Canada	Plant-based	Company	Wamame Foods; Merit Functional Foods; Wismettac Asian Foods; Winecrush Technology	2021	$2,961,150
Protein Industries Canada	Plant-based	Company	Ingredion Inc.; Ingredion Plant Based Protein Specialties (Canada) Inc.; Verdient Foods Inc.; T Base 4 Investments; O.M.D. Food Products	2021	$10,320,000
Canadian Food Innovation Network, Ontario Genomics	Cultivation, fermentation	Startups, universities	Ardra Inc, Cell Ag Tech, Evolved (formerly Caro Meats), The University of Toronto & MyoPalate	2022	$660,623
Natural Sciences and Engineering Research Council of Canada	Plant-based	University	University of Alberta	2016	$132,641
Commercialization					**Total: $75,493,372**
Farm Credit Canada, Export Development Canada, Agri-Food Innovation Fund	Plant-based	Repayable contributions and debt financing	Merit Functional Foods	2021	$70,000,000
Protein Industries Canada	Plant-based	Center of Excellence	Regulatory Centre of Excellence	2022	$1,170,000
Protein Industries Canada	Plant-Based	Consortium	Lumi Foods; Winecrush Technology; Save-On-Foods	2022	$4,323,372
Mixed					**Total: $92,501,828**
Protein Industries Canada	Plant-based	Research and commercialization	55 projects	2018-2022	$92,501,828*

**Calculated by subtracting the itemized Protein Industries Canada project totals from the CAD $173 million published.*

United States — Total funding: $35,409,418

Funder	Platform	Recipient Type	Recipient	Start Year	Amount
R&D					**Total: $30,759,418**
Department of Energy					
Advanced Research Projects Agency-Energy Small Business Technology Transfer (ARPA-E STTR)	Cultivated	Company & University	Mori (MA-07) & Tufts University (MA-05)	2020	$249,999
ARPA-E STTR	Cultivated	Company	Mori (MA-07) & Tufts University (MA-05)	2021	$250,000

NASA					
EPA, NASA, USDA, NSF	Fermentation	Company	Nature's Fynd (IL-04)	2013, 2014, 2015, 2018, 2020	$2,144,308
SBIR - STTR	Cultivated	Consortium	North Star Research (NY-01)	1999	$61,639
NASA Established Program to Stimulate Competitive Research (EPSCoR)	Fermentation	Space flight	Nature's Fynd (IL-04), Montana State University (MT-01), BioServeSpace Technologies (CO-02)	2022	$100,000
National Science Foundation (NSF)					
SBIR (Small Business Innovation Research)	Fermentation	Company	Meati Foods (CO-02)	2019	$750,000
NSF	Cultivated	University	Tufts University (MA-05)	2021	$19,999
SBIR	Cultivated	Company	Novel Farms, Inc. (CA-12)	2021	$256,000
SBIR	Fermentation	Company	Fybraworks Foods (MN-04)	2021	$256,000
SBIR	Cultivated	Company	Tender Foods (MA-07)	2021	$256,000
NSF	Cultivated	University	University of California, Davis (CA-04)	2021	$3,549,236
NSF	Cultivated	University	University of California, Los Angeles (CA-36)	2022	$995,498
Department of Agriculture (USDA)					
NIFA (National Institute of Food and Agriculture)	Plant Based	University	University of Missouri (MO-03, MO-04)	2005	$319,999
NIFA	Cultivated	Company	Modern Meadow (then MO-04, now NJ-11)	2012	$92,488
NIFA	Crop Development	Company	Arvegenix (now CoverCress Inc.) (MO-01)	2021	$106,489
NIFA	Plant-based	University	Purdue University (IN-04)	2021	$476,270
NIFA	Plant-based	University	University of Massachusetts Amherst (MA-02)	2021	$476,270
NIFA	Plant-based Milk	University	Mississippi State University (MS-03)	2021	$481,910
NIFA	Cultivated	Universities	Tufts University (MA-05)	2021	$10,000,000
NIFA-AFRI	Plant-Based	University	University of Massachusetts Amherst (MA-02)	2022	$269,960
NIFA-AFRI	Plant-Based	University	Iowa State University (IA-04)	2022	$727,929
NIFA-AFRI	Plant-Based	University	Virginia State University (VA-04)	2022	$274,500
NIFA-AFRI	Plant-Based	University	Washington State University	2022	$595,120

			(WA-05)		
NIFA-AFRI	Plant-Based	University	University of Massachusetts Amherst (MA-02)	2022	$596,050
NIFA-AFRI	Cultivated	University	University of California Los Angeles (CA-36)	2022	$604,907
NIFA-AFRI	Cultivated	University	Kansas State University (KS-01)	2022	$605,600
State Governments					
Washington State Department of Agriculture	Plant-Based	University	Washington State University (WA-05)	2018	$243,247
California State Budget	Cultivated	University	University of California Berkeley (CA-12)	2021	$1,000,000
California State Budget	Various	Universities	UCLA (CA-36), UC Davis (CA-04), UC Berkeley (CA-12)	2022	$5,000,000
Commercialization					**Total: $250,000**
State Governments					
Colorado Office of Economic Development	Cultivation	Startup	Bond Pet Foods, Inc. (CO-02)	2020	$250,000
Mixed					**Total: $4,400,000**
North Carolina	Plant-based	Consortium	North Carolina Food Innovation Lab (NC-12)	2017	$4,400,000

Asia Pacific

Australia					**Total funding: $126,129,293**
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $1,185,791**
Australian Research Council	Plant-based	University & company	University of Queensland; Motif Foodworks	2021	$476,576
Australian Commonwealth Government	Fermentation-derived	Private Company	Change Foods; Queensland University of Technology	2022	$709,215
Commercialization					**Total: $124,943,502**
Government of New South Wales	Cultivated	Startup funding	Vow Food	2019	$16,590

Advanced Manufacturing Growth Center (AMGC) Commercialisation Fund	Plant-based	Startup funding	Harvest B.	2021	$680,000
Clean Energy Innovation Fund		Startup funding	University of Sydney; All G Foods	2021	$3,400,000
Australian Commonwealth Government Federal Securing Raw Materials Program	Fermentation	Commercialization support	Change Foods	2022	$663,614
University of Queensland Food and Beverage Accelerator	Fermentation	Commercialization support	Change Foods	2022	$2,060,000
Government of South Australia	Plant-based	Commercialization support	Australian Plant Proteins, Australian Milling Group, and Thomas International	2022	$43,134,912
Australia Department of Industry Modern Manufacturing Initiative	Plant-based	Commercialization support	Australian Plant Proteins, Australian Milling Group, and Thomas International	2022	$74,988,386

China — Total funding: Undisclosed – at least $254,785

Funder	Platform	Recipient Type	Recipient	Start Year	Amount
R&D					**Total: $254,785+**
Ministry of Science and Technology, National Key Research and Development Program of China	Plant-based, Cultivated, Fermentation	University	Jiangnan University (project lead)	2020	Undisclosed*
Hong Kong Innovation and Technology Fund (ITF)	Fermentation	Startup funding	Geb Impact Technology	2021	$254,785

**Each of the funded projects is estimated to receive $3.1 million, which was calculated by averaging the total budget allocated for the "Green Biological Manufacturing" National Key R&D Program.*

India — Total funding: $801,000

Funder	Platform	Recipient Type	Recipient	Start Year	Amount
R&D					**Total: $801,000**
Science and Engineering Research Board, Department of Science & Technology	Cultivated	University	Sanjay Gandhi Postgraduate Institute of Medical Sciences	2019	$67,000
Department of Biotechnology, Ministry of Science and	Cultivated	University	CCMB	2019	$600,000

Technology					
Department of Biotechnology, BIRAC, BIG (Biotechnology Ignition Grant)	Cultivated	Company	Myoworks	2020	$67,000*
Department of Biotechnology, BIRAC, BIG (Biotechnology Ignition Grant)	Fermentation	Company	FemtoFarad	2021	$67,000*

**Funding amounts are internal figures provided to GFI India.*

Japan — Total funding: estimated $7,708,342

Funder	Platform	Recipient Type	Recipient	Start Year	Amount
R&D					**Total: Undisclosed**
Japan Science and Technology-Mirai Program (2018-2021)	Cultivated	University	Juntendo University Graduate School of Medicine	2018	Unknown
Japan Science and Technology-Mirai Program	Cultivated	University	The University of Tokyo	2020	Unknown
Commercialization					**Total: up to $7,708,342**
Real Tech Fund A-FIVE	Cultivated	Company	IntegriCulture	2018	Up to $2,670,000*
Japan Ministry of Economy, Trade and Industry	Cultivated	Pilot plant	IntegriCulture	2020	$2,200,000
A-FIVE	Plant-based	Company	DAIZ	2020	$2,838,342

**Real Tech Fund and A-FIVE are government funds that led the JPY 300 million seed funding round for cultivated meat company Integriculture, but the exact amounts of their contributions are not a matter of public record.*

Singapore — Total funding: Up to $253,812,122

Funder	Platform	Recipient Type	Recipient	Start Year	Amount
R&D					**Total: Up to $231,395,120**
Singapore Food Agency	Various	Research grants	Singapore Food Story R&D Programme	2020	Up to $107,601,609
Singapore Food Agency	Various	Research grants	Singapore Food Story 2.0 R&D Programme	2022	Up to $123,293,511
Commercialization					**Total: Up to $22,417,002**

Asia Sustainable Foods Platform and A*STAR's Singapore Institute of Food & Biotechnology Innovation (SIFBI)	Cultivation, fermentation	Infrastructure	Food Tech Innovation Centre (FTIC)	2021	$22,417,002

Sample of Singapore Food Story Research Projects Relevant to Alternative Proteins (funding amounts unknown):

- Production of High Purity Insect Protein Hydrolysate, Prof. Wang Yulan, NTU.
- Highly Efficient Microbial Methane Conversion for Single Cell Protein Production under High Pressure, A/Prof. Sanjay Swarup, NUS; NTU.
- A Systematic Approach to Species Selection and Serum-Free Growth Media and Hydrogel Refinement for Cultured Seafood, Dr. Mark Richards, NYP. Collaborator: Umami Meats Pte Ltd.
- Modification of Brown Rice Protein Isolate Using Microbial Transglutaminases: Functional Property Enhancement and Nutritional Evaluation, A/Prof. Du Juan, SIT; NTU. Collaborator: BTI.
- Engineering Manufacturable Growth Factors for Cultured Meats, A/Prof. Bernard Loo Liat Wen, SIT; BTI.
- Marine Algae Proteins: Isolation, Assessment & Optimisation for Direct Incorporation in High Value Foods, Dr. Michael Voigtmann, Wintershine Asia Pte. Ltd; SIT; SIFBI.
- Developing A Scalable Method for Fiber-Directed Differentiation of Muscle Cells, Dr. Andrew Wan Chwee Aun, SIFBI.
- Functionalisation of Plant Proteins by Physicochemical Methods to Improve Food Applications, Dr. Shaun Sim, SIFBI. Collaborator: Massey University.
- Decellularized Plant and Fungi Scaffolds for Structured Meat Production, Dr. Deepak Choudhury, BTI; NTU. Collaborator: The Moscow Sechenov Medical University.
- Develop a Platform for Immortalized Cell Line Media Development for the Production of More Affordable Cultured Meat, Dr. Lu Hao Kim, BTI.
- Food Protein from Algae – Integrated Bioprocess Approach to Sustainable Living, Dr. Yvonne Chow Yoong Sien, SIFBI; ICES; BII; Sophie's BioNutrients Pte Ltd.
- Low-cost, Edible Fibre Supports, for the Expansion and Differentiation of Myoblasts in Suspension Bioreactors, Dr. William Birch, IMRE; SIFBI.
- Creating a Commercially Feasible Platform for Cultured Meat Production, Prof. Teh Bin Tean, IMCB
- Characterization and Evaluation of Protein Hydrolysate Supplements as Serum Alternatives in Cultured Meat Production, Dr. Ho Yin Ying, BTI.
- A Multidisciplinary Screening Platform for Functional Proteins for Alternative Foods, Dr. Prakash Arumugam, SIFBI; BII.
- GRAS Platform for Food Protein Production and Screening: A Sweet Concept, Dr. Wong Han Teng, IMCB; SIFBI.
- Alternative Culture Media Components for Fish-derived Fat Cells, Dr. Shigeki Sugii, IBN; NTU; RP.

South Korea					Total funding: Up to $28,500,000
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: Up to $15,000,000**
South Korea Ministry of Trade, Industry and Energy	Cultivated	Consortium	Space F; Daesang Corporation; Lotte Fine Chemicals; Seoul National University; Sejong University	2022	$15,000,000
Commercialization					**Total: Up to $13,500,000**
Ministry of Agriculture, Food and Rural Affairs		Startup funding	The Green Bio Fund investments	2021	Up to $13,500,000
Korea Health Industry Development Institute's Health Industry Innovation and Startup Center	Cultivated	Startup funding	Thyssen Biopharmaceuticals	2022	Undisclosed
Ministry of Agriculture, Food, and Rural Affairs	Plant-based	Commercialization support	Intake, Seoul National University, Kyonggi University, Ewha Womans University	2022	Undisclosed

Europe

European Union					Total funding: Up to $130,587,244
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: Up to $98,900,012**
Horizon 2020 - PROTEIN2FOOD	Plant-based	University	University of Copenhagen, Denmark	2015 (start date)	$10,777,005
Bio-Based Industries Joint Undertaking (co-funded by European Commission and industry)	Fermentation	Consortium	PLENITUDE - various entities	2019 (start date)	$17,862,367
Horizon 2020	Cultivated	Consortium	Meat4All, Spain, France, Portugal	2020 (start date)	$1,562,140
Horizon 2020	Cultivated	Company	ORF Genetics, Iceland,	2020	$3,000,000
Horizon 2020 - Smart Protein	Plant-based	Universities	University College Cork, National University of Ireland, Cork, Ireland	2020 (start date)	$9,996,718

European Maritime and Fisheries Fund	Fermentation	Company	Algama Foods, France	2021	$2,271,810
React EU	Cultivated	Companies	Nutreco & Mosa Meat, The Netherlands	2021	$2,306,864
EIT Food	Plant-based and fermentation	Consortia	Various projects	2018- 2021	$12,254,697
EIT Food	Plant-based and fermentation	Consortia	Four projects*	2022	$2,216,180
European Commission Horizon Europe	Fermentation-derived	Consortium	DOMINO, Public and private partners	2022	Up to $11,871,463
European Union	Plant-based, Fermentation-derived	Consortium	LIKE-A-PRO, Public and private partners	2022	$12,380,768
Horizon Europe; Swiss Government	Fermentation-derived, Plant-Based	Consortium	HEALTHFERM, KU Leuven; public and private partners	2022	$12,400,000
Commercialization					**Total: $18,877,327**
European Innovation Council (EIC) Accelerator	Fermentation	Startup funding	Mushlabs	2022	$18,877,327

**The four projects are DADYGo -Dairy Alternative Drinks & YoGhurt based on rapeseed ingredients; PROSEED - Protein extraction from grape seeds; FROM SIDE-STREAMS TO TASTY MEAT ALTERNATIVES AND HYBRIDS (TASTE2MEAT); Precision Fermentation: From Biotechnology to Sustainable Nutrition; Prize Based Innovation Challenge on Cultivated Meat (co-funded with GFI Europe.*

Belgium — Total funding: $4,191,138

Funder	Platform	Recipient Type	Recipient	Start Year	Amount
Mixed R&D and Commercialization					**Total: $4,191,138**
Flanders' Food	Cultivated	Company & consortium	Peace of Meat & others	2020	$4,191,138

Denmark — Total funding: $99,405,022

Funder	Platform	Recipient Type	Recipient	Start Year	Amount
Mixed R&D and Commercialization					**Total: $99,405,022**
Ministry for Food, Agriculture and Fisheries	Plant-based	Market Development	Plant Fund	2022	$99,405,022

Finland					Total funding: $60,767,592
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $2,720,000**
Business Finland	Plant-based	Consortium & university	VTT Research & University of Helsinki	2020	$2,720,000
Commercialization					**Total: $58,047,592**
Business Finland	Fermentation	Company	Solar Foods	2020	$4,529,892
Finnish Government Climate Fund	Biomass Fermentation	Pilot plant	Solar Foods	2021	$11,277,700
Business Finland	Fermentation	Private Company	Onego Bio	2022	$4,940,000
Business Finland	Fermentation	Company	Solar Foods	2022	$37,300,000

France					Total funding: Up to $70,535,593
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: Up to $59,117,745**
ANR (French National Research Agency)	Plant-based	Consortium	SoySustainable	2022	$3,165,828
ANR	Plant-based	Consortium	Jack	2022	$2,054,508
ANR	Plant-based	Consortium	LETSPROCEED	2022	$3,135,828
ANR	Plant-based	Undesignated	Various projects	2022	Up to $23,728,581
ANR	Plant-based, Microorganisms	Undesignated	Various projects	2022	Up to $27,033,000
Commercialization					**Total: $11,417,848**
Government of France	Plant-based	Construction	Umiami	2022	$8,124,238
Government of Grand Est	Plant-based	Construction	Umiami	2022	$3,293,610

Germany				Total funding: At least $2,891,682	
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: At least $1,131,682**
The Federal Ministry of Education and Research (BMBF)	Cultivated	Non-profit	The Research Institute for Farm Animal Biology	2020	$1,000,000
The Federal Ministry of Education and Research (BMBF)	Various	Innovation space	NewFoodSystems	2020	Undisclosed
Lower Saxony Ministry of Science and Culture	Cultivated	University	University of Vechta	2022	$131,682
Commercialization					**Total: $1,760,000**
Federal Ministry for Economic Affairs and Climate Protection	Various	Commercializati on support	Various recipients	2021- 2022	$1,760,000

Ireland				Total funding: $2,986,592	
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $2,986,592**
Irish Department of Agriculture, Food and the Marine	Various	Consortium	Teagasc; academic and industry partners	2020	$2,986,592

Norway				Total funding: $2,066,530	
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $2,066,530**
Research Council of Norway	Cultivated, Fermentation Derived	Private Company	Nofima, Sintef Industry, OsloMet, Ruralis, The Norwegian Board of Technology, Nortura AS, Norilia AS, TINE AS.	2022	$2,066,530

Spain					Total funding: $5,707,403
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $5,707,403**
Center for the Development of Industrial Technology	Cultivated	Company	Nova Meat	2021	$307,500
Center for the Development of Industrial Technology	Cultivated	Company	BioTech Foods	2021	$4,490,000
Government of Catalonia	Fermentation-derived	Private Company	Real Deal Milk	2022	$83,358
Spanish Foreign Trade Institute (ICEX)	Cultivated	Private Company	BioTech Foods	2022	$826,545

Sweden					Total funding: $14,716,225
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $172,000**
Vinnova	Plant-based	Consortium	SP Food & Bioscience	2014	$172,000
Commercialization					**Total: $14,544,225**
Klimatklivet	Plant-based	Processing facility	Lantmännen	2022	$14,544,225

Switzerland					Total funding: $1,980,000
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $1,980,000**
Horizon Europe; Swiss Government	Fermentation-derived, Plant-based	Consortium	KU Leuven; public and private partners	2022	$1,980,000

The Netherlands					Total funding: $76,927,950
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $10,385,464**
SenterNovem	Cultivated	Consortium	Various entities	2005	$2,325,486
Dutch Ministry of Economic Affairs	Plant-based	University	Wageningen University	2017	$3,406,000
ELECTRIFIED	Plant-based	Consortium	Wageningen University, academic and industry partners	2022	$1,551,326
NWO, Dutch Research Council - Epi-Guide-Edit	Cultivated meat and fermentation	Consortium	University Medical Center Groningen, public and private partners	2022	$1,551,326
Protein Transition 2.0	Cultivated meat and precision fermentation	Consortium	Wageningen University, academic and industry partners	2022	$1,551,326
Commercialization					**Total: $689,786**
Delft municipality and the MRDH (Metropole Rotterdam-TheHague)	Cultivated meat and precision fermentation	Company grant	Planet B.io	2022	$554,045
Province of South Holland - Protein Port	Any	Company grant	Planet B.io and Innovation Quarter	2022	$135,741
Mixed					**Total: $65,852,700**
National Growth Fund	Cultivated	Consortium	Cellular Agriculture Netherlands	2022	$65,852,700

The United Kingdom					Total funding: Up to $29,290,421
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: Up to $23,088,494**
UK Research and Innovation (UKRI) under the Transforming Food Production programme	Cultivated	Company	Roslin Technologies	2021	$1,300,000
UKRI	Plant-based egg	University	University of Leeds	2021	$134,043*
UKRI	Cultivated	University	Aston University	2021	$123,876*
UKRI	Cultivated	University	University College London	2021	$123,876*
UKRI	Fermentation	University	University of Nottingham	2021	$123,876*
UKRI	Plant-based	University	University of Reading	2021	$123,876*

	milk				
UKRI	Plant-based	University	Imperial College London	2021	$123,876*
UKRI	Plant-based	Consortium	SPG Innovation, Baker Perkins and the University of Leeds	2021	$113,936
Biotechnology and Biological Sciences Research Council (BBSRC), Innovate UK	Various	Research grants	To be determined	2022	Up to $19,862,080
BBSRC	Fermentation	Research grant	National Institute of Agricultural Botany, Knowledge Transfer Network	2022	$935,179
Commercialization					**Total: Up to $6,201,927**
Biotechnology and Biological Sciences Research Council (BBSRC), Innovate UK	Various	Commercialization support	To be determined	2022	Up to $5,000,000 in addition to BBSRC funding above
Innovate UK + Beechers Group (VC funding)	Fermentation	Company grant	Adamo Foods	2022	$774,631
Innovate UK	Cultivated meat	Company grant	Hoxton Farms	2022	$427,296

**Funding amounts for individual UKRI studentships are not publicly available, but projects are generally awarded £100,000 each per a contact familiar with the funding structure.*

Middle East

Israel					**Total funding: $80,796,920**
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
R&D					**Total: $56,027,000**
Israeli Innovation Authority	Cultivated	Consortium	Israel Cultivated Meat Consortium (10 companies and 10 academic institutions)	2021	$18,000,000
Israeli Innovation Authority	Plant-based, Cultivated, Fermentation	Research grants	Various scientists	2021	$1,000,000*
Israeli Innovation Authority	Plant-based, Cultivated, Fermentation	Bilateral research grant	International research programs	2021	$500,000*
Ministry of Agriculture, Chief Scientists Office	Cultivated	Research grant	Volcani Center	2021	$77,000*

Israel Innovation Authority	Plant-based, cultivated, fermentation	Research grants	Various researchers & companies	2022	$6,000,000*
Israel Innovation Authority	Plant-based, cultivated, fermentation	Funding	Various companies	2022	$5,000,000*
Ministry of Innovation, Science and Technology, the Ministry of Agriculture and Rural Development	Plant-based, cultivated, fermentation	Research grants	Various researchers	2022	$950,000
Israel Innovation Authority via Singapore Israel Industrial R&D Foundation	Cultivation	Research grant	Steakholder Foods and Umami Meats	2022	$500,000
The Israeli Innovation Authority		Establishing startups and pilot plants	Various	2011-2020	$24,000,000*
The Israeli Innovation Authority	Cultivation	Research grant	SuperMeat	2022	Undisclosed
Commercialization					**Total: $24,769,920**
The Israeli Innovation Authority		Startup funding	Various	2021	$9,000,000*
The Israeli Innovation Authority		Pilot plants	Various	2021	$2,000,000*
Israel Innovation Authority	Fermentation	Pilot facility	To be determined	2022	$13,769,920

**Funding amounts are internal figures provided to GFI Israel.*

Oman					Total funding: Undisclosed
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
Commercialization					**Total: Undisclosed**
Oman Investment Authority	Fermentation	Production facility	MycoTechnology	2022	Undisclosed

Qatar					Total funding: Undisclosed
Funder	**Platform**	**Recipient Type**	**Recipient**	**Start Year**	**Amount**
Commercialization					**Total: Undisclosed**
The Qatar Investment Authority & Doha Venture Capital, Qatar Free Zones Authority	Cultivation	Pilot plant	Eat Just	2020	Unknown (up to $200,000,000)