

2021 STATE OF THE INDUSTRY REPORT

Plant-based meat, seafood, eggs, and dairy



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The Good Food Institute (GFI) is an international network of organizations developing the roadmap for a sustainable, secure, and just protein supply. We identify the most effective solutions, mobilize resources and talent, and empower partners across the food system to make alternative proteins accessible, affordable, and delicious. This report, as well as all of GFI’s research, data, and insights, is made possible by gifts and grants from our global family of donors.

GFI’s **State of the Industry Report** series dives deep into the key technologies, business developments, and scientific advances driving the alternative protein industry forward:

- Cultivated meat and seafood
- Fermentation: Meat, seafood, eggs, and dairy
- Plant-based meat, seafood, eggs, and dairy
- Industry update: Alternative seafood

The Good Food Institute is not a licensed investment or financial advisor, and nothing in the state of the industry report is intended or should be construed as investment advice.

Introduction

Every year, we see new advancements in the alternative protein industry that are opening the door for a global shift to a far more sustainable, secure, and just food system. Like 2019 and 2020 before it, 2021 was the most active year yet for growth in the alternative protein industry, and many signs indicate that the world is on the cusp of a global race for alternative protein innovation.

By making meat from plants, through fermentation, or through cultivation of actual animal cells, we can reduce the harmful climate impacts of our food system, decrease the risk of zoonotic disease and antibiotic resistance, and feed more people with fewer resources. We can also slow biodiversity loss, reduce air and water pollution, and preserve our oceans. Indeed, alternative proteins are to meat production as renewables are to energy: the future. As the global community strives to mitigate climate risks, alternative proteins stand as an enormous opportunity that can help us reach net-zero emissions—but more investment and open-access R&D are needed.

Alternative proteins offer some of the most game-changing research opportunities with potential for global societal impact—stabilizing the climate and preserving biodiversity while eliminating food’s contribution to pandemic risk and antibiotic resistance. But to date, alternative proteins have not been appropriately prioritized. Investment in this nascent field is pennies on the dollar compared with investment in electric vehicles and renewable energy, yet livestock’s global greenhouse gas emissions are on a par with those from transportation (see [gfi.org/climate](https://www.gfi.org/climate)). Together, increased public and private investments in alternative proteins can write the next technological chapter for agriculture and spur economic growth while improving both environmental and global health outcomes.

For plant-based meat, eggs, and dairy, 2021 saw expansion, innovation, and visibility on the rise. Startups, large food companies, and retailers launched hundreds of new products, growing global retail sales. Plus, new technologies and novel crop protein sources emerged to enhance end products, the investor base grew by 40 percent, and regulatory wins helped move the industry toward a level playing field. With global retail sales of plant-based meat passing the \$5 billion mark in 2021, consumer interest in sustainable alternatives to conventional animal products continues to grow around the world.

As companies focus on creating products that match the taste, texture, and full sensory profile of animal-based meat, consumer demand is projected to increase. While plant-based alternative protein products have inched closer to price parity, a significant gap still exists. In 2021, progress was made to ultimately bridge that gap via improved production technologies, optimization of side streams, and capacity scaling. To meet growing demand and enable plant-based proteins to compete with conventional products on taste, price, and accessibility, greater investments from both the private and the public sectors will be needed. Such investments can simultaneously help feed billions of people, protect public health, and achieve global climate goals.

We present this state of the industry report, *Plant-Based Meat, Seafood, Eggs, and Dairy*, to highlight the sector’s key developments in 2021 and look ahead to what’s next.



Caroline Bushnell

VP of Corporate Engagement at the Good Food Institute

Executive summary



Executive summary

The Good Food Institute is pleased to offer our fourth annual state of the industry report on the global plant-based meat, seafood, egg, and dairy industry. This report covers key developments from 2021 across the business and regulatory landscapes, with a focus on the United States and, where data is available, global markets.

In 2021, steady momentum continued in the plant-based industry after rapid growth from 2019 to 2020. Brands in the U.S. market launched hundreds of new products, global retail sales of plant-based meat surpassed \$5 billion, new technology demonstrated its potential to advance the market, and regulatory wins on food labeling helped ensure a level playing field. Despite food industry disruptions caused by the pandemic, the growth of plant-based proteins signals an increasing global appetite for more sustainable alternatives to conventional animal products.

Products

In 2021, companies advanced applications of plant-based technology to produce new and enhanced products across categories. More than 250 new SKUs were added to shelves in U.S. retail.

Category expansion. Companies are innovating beyond the burgers that led the next-generation plant-based meat category. New products include plant-based bacon, sausages, and deli meats, in addition to an expanding range of chicken and seafood alternatives.

Price parity. Several plant-based meat companies moved closer to **price parity**—though the gap is still significant. For example, **OmniFoods** reduced prices of OmniPork by 22 percent, and **Impossible Foods** once again cut prices at wholesale and retail.

Sales

U.S. retail plant-based food sales metrics, 2021

| | Dollar sales | 1-yr. dollar growth | 3-yr. dollar growth | Dollar share | 3-yr. share growth | Unit sales |
|-------------------------|--------------|---------------------|---------------------|--------------|-----------------------------|------------|
| Total plant-based foods | \$7.4B | 6% | 54% | 4% | 79% | 1.9B |
| Plant-based meat | \$1.4B | 0% | 74% | 1.4% | 19%* *2-yr. share growth | 281M |
| Plant-based milk | \$2.6B | 4% | 33% | 16% | 20% | 788M |

Total U.S. retail plant-based food dollar sales grew three times faster than total food sales in 2021 to \$7.4 billion.

- **Almost every category grew**, even on top of a strong 2020 that experienced above-average activity owing to impacts of the pandemic.
- **Plant-based meat** sales remained steady in 2021 at \$1.4 billion.
- **Plant-based milk** sales grew 4 percent to \$2.6 billion.
- **Plant-based eggs**, the smallest but fastest-growing category, saw sales grow 42 percent to \$39 million.

Sources: SPINS Natural Enhanced Channel, SPINS Conventional Multi Outlet Channel (powered by IRI) | 52 Weeks Ending 12-26-2021. Panel data from NCP, All Outlets, 52 weeks ending 12-26-21. © 2022 The Good Food Institute, Inc. Note: The data presented in this table is based on custom GFI and PBFA plant-based categories that were created by refining standard SPINS categories. Due to the custom nature of these categories, the presented data will not align with standard SPINS categories.

Investments

Plant-based meat, egg, and dairy companies raised \$1.9 billion in 2021, bringing total investments in such companies to \$6.4 billion.

| Category | 2021 | 1980–2021 | Highlights |
|------------------------------------|--------------|-----------|---|
| Total invested capital | \$1.93B | \$6.36B | 2021 invested capital represents 30% of all-time investment. |
| Invested capital deal count | 140 | 621 | 2021's largest investment was \$500 million raised by Impossible Foods. |
| Unique investors | 312 (new) | 1,093 | The number of new unique investors grew by 40% in 2021. |
| Liquidity event capital | \$1.93B | \$25B | Oatly's IPO in 2021 raised \$1.43 billion. |
| Liquidity event count | 19 | 91 | |
| Other financing capital | \$31M | \$158M | The vast majority of other financing events are private investments in public equity (PIPEs). |
| Other financing count | 2 | 9 | |

Science and technology

2021 saw several developments in the realm of plant-based ingredients, including commercialization of new biodiverse ingredient sources and improved scalability of plant protein processing techniques. On the plant-based meat manufacturing side, advances were pioneered in alternatives to high-moisture extrusion technology, including **shear-cell technology**—which creates fibrous texture by applying shear force to plant-proteins between two cylindrical rotating plates—and **3D printing**, which can enable the fabrication of highly sophisticated products that mimic whole-muscle meat cuts.

Government and regulation

Government support. Governments including Denmark, Germany, the European Union, Norway, the United Kingdom, and the United States funded plant-based protein research.

Label censorship. In 2021, a federal court ruled that governments could not violate plant-based food companies' First Amendment right to free speech by citing government definition of food-related terms. Additionally, several state legislators introduced label censorship bills that would restrict the use of terms such as “meat,” “beef,” or “chicken” on plant-based products. Fortunately, no new label censorship laws were enacted.

Section 1

Commercial landscape



Section 1: Commercial landscape

Overview and major developments

Despite pandemic-driven supply chain interruptions and turbulent economic conditions, 2021 was a strong year for plant-based foods, as evidenced by developments across the commercial and cultural landscapes:

- **U.S. retail sales** of plant-based foods grew by 6.2 percent and at a rate three times faster than that of total food retail sales, with most plant-based categories outpacing their animal-based counterparts.
- Startups, large food companies, and retailers launched hundreds of new products across plant-based categories, driven by consumer demand for a wider range of options.
- Plant-based foods continued to expand across foodservice channels, with chains from McDonald's to Starbucks adding plant-based options to their menus both in the United States and around the world.
- Advances in the upstream supply chain continue to support efforts on improving sensory parity and reducing prices of plant-based products. 2021 brought multiple developments in seed and crop optimization, as well as intermediate ingredient processing and end-product manufacturing.

A note on Covid-19 in the United States

Telling the full story of plant-based meat, eggs, and dairy in 2021 (as in 2020) is impossible without accounting for the effects of Covid-19. Go-to-market strategies were thrown into uncertainty as the food system experienced significant shifts, including interruptions to supplies of key inputs, limited access to production spaces, and disrupted distribution of products. Despite these constraints, plant-based companies adapted and continued to launch new products and grow sales.

In 2020, shutdowns across the United States in response to Covid-19 led to disruptions in the food supply chain. Foodservice channel distribution was significantly impaired, and pantry stocking and panic buying led to a sharp increase in retail sales over the prior year. Many plant-based food categories performed particularly well during the initial pantry-stocking period.

For more information on Covid-19's effects on the U.S. plant-based meat category in 2020, read [this article](#) by Kyle Gaan, a former research analyst at GFI.

After record growth in 2020, plant-based meat sales remained steady and once again reached \$1.4 billion in 2021. Overall momentum of the category remains strong despite disruptions caused by the pandemic, with dollar sales growing 74 percent between 2018 and 2021. Additionally, global dollar sales of plant-based meat grew by 76 percent during this period, according to GFI analysis of Euromonitor data.

Retail product launches

2021 brought an impressive surge of retail product launches from brands operating across the plant-based meat, egg, and dairy categories, despite Covid-19 interruptions to retailers' category review and reset schedules that may have delayed planned product launches. Looking at the plant-based meat category, the last three years have all seen strong momentum, with new product launches increasing each year from 2019 to 2021, expanding variety and increasing consumer accessibility to the category.

While plant-based beef burgers continued to account for many of the new plant-based meat products in 2021, the year also saw a number of product launches across other plant-based meat formats and types, particularly chicken and sausage. This highlights how companies are innovating beyond the analogue burgers that established the next-generation plant-based meat category. Some notable product launches are detailed below.

Beef

- **Upton's Naturals** vegan hot dog Updog, which the company debuted at Expo West in 2020, became more widely available in stores in 2021. Described as a plant-based version of an all-beef hot dog, complete with classic hot dog "snap," the product is now showcased as the main ingredient at The Updog Stand, the Chicago-based company's latest plant-based foodservice venture, which opened in late 2021.
- Previously available only in the United Kingdom, **Wicked Kitchen** products **launched in the United States** in 2021 in Kroger and Sprouts stores. The brand offers a range of plant-based meat alternatives and ready meals, and new products include Jalapeño Burgers and Spiced Amazeballs.
- **Next Meats**, a food-tech venture based in Tokyo, announced the launch of their latest product, the **Next Yakiniku Short-Rib 2.0**. This new version follows the debut of the original last year and boasts a firmer texture and new shape to more closely mimic animal-based meat.



“We’re continuously expanding our plant-based seafood alternatives. Thanks to our expertise and global R&D network, we ensure that in addition to an authentic texture and flavor, plant-based alternatives have a favorable nutritional profile with a short ingredient list. Plant-based seafood alternatives also help to reduce overfishing and to protect biodiversity of the oceans.”

—Hagit Peretz, global plant-based R&D lead at Nestlé

Seafood

- **OmniFoods debuted a new plant-based seafood line.** Previously known for their plant-based pork mince, the Hong Kong-based company expanded their offerings to include six seafood products: two different fish fillets, an ocean burger, salmon, shelf-stable tuna, and crab cakes.
- Iglo’s plant-based brand, **Green Cuisine**, **added** fish fingers to their plant-based meat repertoire. Iglo is a UK-based frozen food company and sells products across Europe.
- **The Plant Based Seafood Co. announced a retail launch and partnership** with **Pod Foods** in early February.
- **Gathered Foods**, makers of **Good Catch**, **announced** a nationwide U.S. launch of their new breaded-product line in **Sprouts Farmers Market**. The national supermarket chain now carries Good Catch’s plant-based crab cakes, fish fillets, and fish sticks. Good Catch also **partnered** with America’s largest food redistributor, **Dot Foods**, and **launched** their frozen crab cakes at all **BJ’s Wholesale Club** stores nationwide.
- Fazenda Futuro (internationally branded Future Farm) launched Brazil’s first plant-based tuna made with soy, peas, chickpeas, olive oil, radish, and microalgae oil to provide omega-3s. Called Future Tuna, it is available in Brazil and Europe.
- **Hooked Foods**, a Swedish plant-based seafood company, **launched** plant-based tuna as their first product on the Swedish retail market.
- Kuleana’s **plant-based tuna was named one of TIME’s top 100 best inventions in 2021. Kuleana is also launching in Poké Bar restaurants** in North America.
- Finless Foods, known for their cultivated seafood innovation, expanded their portfolio to include a **plant-based tuna expected to be in restaurants and foodservice channels in 2022.**



GFI is a partner organization for the **EU Smart Protein Project**, whose key focus is developing sustainable food. Check out the project’s **highlight in Vegconomist** for its recent developments in next-generation plant-based fish.

For a comprehensive report of alternative seafood developments in 2021, see **GFI’s industry update on alternative seafood**.



“Plant-based chicken has now become a focal point. There are already a number of brands working on plant-based chicken. This healthy competition is pushing innovation and driving companies to improve textures and taste. Brands will need to compete for shelf space in grocery stores and partnership opportunities with fast-food restaurants. Ultimately, the people will inform the space of its performance with their spending patterns.”

—**GW Chew, aka “Chef Chew,” founder and CEO of Something Better Foods**

Chicken

- In late 2021, **Beyond Meat** launched their new **Beyond Chicken Plant-Based Breaded Tenders** in retail outlets, having debuted them in restaurants earlier in the year.
- **Impossible Foods** released **Impossible Chicken Nuggets** in both foodservice and retail.
- Plant-based chicken brand **Daring Foods** launched products at **Walmart stores** nationwide, as well as in several regional retailers.
- Portland-based **CHKN Not Chicken**, a plant-based brand created with flexitarians in mind, made their debut in 2021 after closing a Series A round with Stray Dog Capital. The pea-protein-based chicken alternatives are currently available in stores in the Portland area but are available direct to consumer through the brand’s website and through **GTFO It’s Vegan!**
- In April, Nestlé-owned **Sweet Earth** announced the expansion of their **Mindful Chick’n Strips** line with the addition of three new products, including Sweet Earth Shredded Seasoned Chick’n, with a classic carnitas-style marinade.
- **Lightlife** launched two new chicken products, Plant-Based Chicken Tenders and Plant-Based Chicken Fillets. In October, **Whole Foods Market** began featuring the fillets in recipes made by the **prepared foods departments** of locations nationwide.

- **Gardein released three new products** under the Ultimate Plant-Based Chick'n line—breaded tenders, nuggets, and fillets.
- **Better Chew** released several products, including Original Chicken Nuggets and a new iteration of the brand's Extra-Crispy Fried Chicken, reformulated for improved taste and texture.
- Singapore-based food manufacturer **Tee Yih Jia** released their plant-based **ALTN line**, which includes a variety of Asian and Western finger foods, ready-to-eat meals, and chicken nuggets.
- Rebellious Foods released new **plant-based chicken patties, tenders, and nuggets made from soy and wheat protein** in select grocery stores in the United States.
- LIVEKINDLY Collective launched two new **plant-based brands, Giggling Pig and Happy Chicken**, in mainland China.

Pork and other meats

- **Impossible Foods** launched **Impossible Pork** in both retail and foodservice channels in 2021, after having announced the product's debut in test markets in **2020**.
- **Hungry Planet**, a brand that offers a range of plant-based meats, including pork, debuted a plant-based **pork gyoza**. Hungry Planet's products are available through foodservice, retail, and e-commerce channels, and they recently secured funding from **Post Holdings**, a consumer-packaged-goods holding company.
- OmniFoods expanded its **OmniPork plant-based pork for use in Asian-inspired dishes** in the **United States, Japan, Australia**, and the **United Kingdom**.
- **Plantcraft**, a brand with roots in Hungary and New Zealand, **launched their plant-based pâtés in the United States** and plans to make their new plant-based pepperoni available soon.
- **Wicked Kitchen** launched Wicked Little Brats, pea-protein-based mini sausages paired with maple syrup and mustard.
- **Field Roast** extended their line with products including Classic Smoked Plant-Based Frankfurters and Mushroom and Balsamic Deli Slices.
- **Hooray Foods** expanded distribution of their plant-based bacon to **Canadian retail** following their U.S. launch in 2020.
- **Heura**, a Spanish brand expanding rapidly across Europe, launched their first plant-based pork products, sausage and chorizo.
- Black Sheep Foods released their **plant-based lamb product in San Francisco restaurants**.
- PlantMade launched their **vegan lamb seekh kebab alternatives in India**.

Plant-based meat works toward price parity

A significant price premium remains for plant-based products, and more scale-up is needed for plant-based products to compete on price.

In 2021, some plant-based meat companies made progress on reducing prices of high-fidelity plant-based meat products, shifting them closer to price parity with animal-based meat products.

- After increasing production capacity, OmniPork **reduced the prices of two signature products by 22 percent** to achieve price parity with pork in Hong Kong. The company also reported plans to extend price reductions internationally.
- In India, Amazon Fresh promoted plant-based products by Blue Tribe Foods at a **96 percent discount**, and popular snacks retailer Haldiram's offered plant-based keema samosa and keema pav at less than one dollar each, on par with conventional meat street snacks.
- Impossible Foods **lowered prices** in stores by 20 percent and for restaurant distributors by 15 percent.
- Beyond Meat announced plans to underprice animal protein in **at least one category by 2024**.

Inflation was a big story in the protein category—and across the entire food market—in 2021. Data from IRI shows that in 2021, the average price per pound of conventional meat was up 7 percent from 2020, while that of plant-based meat was up 1 percent over the same period.

Reaching price parity with animal-based meat is a critical step toward widespread adoption of plant-based meat. Consumers consistently highlight the high price of plant-based meat relative to animal-based meat as a major barrier to trial. Mintel's **U.S. Plant-based Proteins Market Report 2021** found price to be one of the top barriers to consumption for consumers who don't eat plant-based meat. By making the price of plant-based meat equal to or lower than that of animal-based meat, plant-based meat companies can overcome this barrier and earn a larger share of the total meat market.



For more on pathways to price parity, download GFI's white paper **Reducing the price of alternative proteins**.



For an analysis of expected ingredient volume and manufacturing facility needs for the plant-based meat industry to identify and mitigate future production bottlenecks, download **Plant-based meat: Anticipating 2030 production requirements**.

Eggs

The still nascent but emerging plant-based egg category grew even more in 2021, with several product releases:

- **Eat Just** introduced two varieties of **Sous Vide egg bites**. This follows the 2020 launch of the brand's **folded plant-based eggs** sold in the frozen section of retail stores.
- **Next Meats** expanded their offerings to include **Next Egg**, currently available in Japan through B2B channels and set to debut in retail across the company's international markets in the near future.
- Swiss retailer **Migros** launched a vegan **hard-boiled egg** complete with a realistic yolk. The product is the company's latest addition to their plant-based brand, V-Love.
- **Crafty Counter**, makers of lentil- and bean-based bites, developed a plant-based hard-boiled egg product called Wundereggs that the brand hopes to launch in 2022.
- Israel-based startup **Yo-Egg** developed a new format in the plant-based egg space, a **sunny-side-up egg substitute**.



“The egg alternative category is a white space, we see the massive demand in the market and the lack of good solutions. Zero Egg delivers on taste, texture and functionality so that also eliminates the skepticism that you can actually replace essential ingredients like eggs. I see this category growing significantly in the next few years and competition growing.”

—Liron Nimrodi, CEO and founder of Zero Egg

Milk

As in 2020, the plant-based milk category in 2021 saw companies branch out from familiar plant-based milk products with a variety of novel products released, including ones aimed at directly matching the sensory properties of conventional milk instead of positioning around specific plant bases such as oat or almond. These also included regional drink products that incorporate plant-based milk and plant-based milk products enhanced with additional nutrients:

- **Danone** pushed the envelope via new products from brands **Silk** and **So Delicious**.
 - The new So Delicious **Wondermilk** products are made with a blend of oat milk and coconut milk, and they have fat, vitamin, and mineral content similar to cow's milk.

- Silk launched **Next Milk**, which aims to meet the taste expectations of conventional milk consumers.
- Chile-based **NotCo**, makers of meat alternatives, launched their plant-based NotMilk in the United States in late 2020, and the products are now available in Whole Foods Market stores nationwide. The pea-protein-based milks are also an excellent source of calcium and vitamins B12 and D.
- Danish vegan brand **Naturli'** launched **Do Not! Call Me M_lk** in early 2022. The product aims to replicate the nutritional and sensory components of cow's milk.

Cheese

The plant-based cheese category saw several launches in 2021 that expanded consumer access across formats and flavors:

- In March, **Bel Brands** announced the launch of their first 100 percent plant-based cheese brand, **Nurishh**.
 - In April, Bel Brands' **Boursin** brand also entered the plant-based category with the launch of a plant-based garlic and herb spread, in partnership with **Follow Your Heart**. The spread is meant to mimic the brand's conventional spread.
 - In 2021, Bel Brands announced that a plant-based version of their **Babybel** product line would launch in the United Kingdom. The product launched in early 2022, and the company has since announced they would expand distribution to the United States.
- **Kite Hill** expanded their offerings with a new line of almond-milk-based spreads. The brand's **Soft Spreadable Cheese** products are currently available in two flavors—cracked black pepper and garlic and herb.
- After a delayed launch due to Covid-19, **Tofurky** plant-based dairy spinoff brand **Moocho** saw their first products hit shelves in 2021.
- In early 2022, Canadian plant-based dairy brand **Daiya** announced they would begin distributing products to the South Korean retail and foodservice market via a partnership with Hyundai Green Food.
- Swedish company **Stockeld Dreamery** launched their first product, a feta cheese with a pea and fava bean base, in retail.
- **HerbYvore** released their first product, a **pea-based paneer**, in Singapore.
- Indonesian plant-based startup Green Rebel launched a **cheddar cheese** made with rice, potato, and cashews.

Other dairy

- **Miyoko's Creamery** partnered with Seattle-based vegan ice cream brand Frankie & Jo's on a seasonal flavor offering called Miyoko's Butter Toffee & Chocolate, which features bite-size toffee bars made with Miyoko's signature European-style cultured vegan

butter. Founder and CEO Miyoko Schinner also launched **The Vegan Butter Channel** on YouTube, featuring a 12-episode series, *Making It Butter & Vegan*, in which expert chefs create recipes with Miyoko's butter products.

- **Oatly** expanded their frozen dessert offerings with a line of **ice cream bars**. The brand also began offering **soft serve at select baseball stadiums** across the United States.
- **Silk** launched a new protein-rich **Greek-style yogurt** line made with coconut milk and available in four flavors.

Plant-based retail product launches from large food companies, animal-based meat companies, and retailers

Retail product launches in 2021 came not only from dedicated plant-based companies but from large food companies, animal-based meat companies, and retailers. For the purposes of this report, we define “large food companies” as companies or their associated brands with more than \$10 billion in annual revenue. Some of the launches from these companies are detailed below.

Large food companies

- **PepsiCo** announced a joint venture with **Beyond Meat** to create a line of **plant-based snacks** and beverages, with a line of jerky said to be their first product for retail release in 2022.
- **Nestlé launched** Vrimp, their second plant-based seafood product. Offered in the shape of conventional shrimp, Vrimp is made from seaweed and peas.
- **Pulmuone**, a South Korean food corporation that is a leading producer of tofu and other soybean-based products, **announced the launch** of a plant-based meat line that will include a plant-based meat-crumble sauce and plant-based chicken tenders.
- **Kerry launched** multiple new plant-based meat products, including mince, meatballs, and bacon, under their Richmond brand.

Animal-based meat companies

- In June, Brazilian meat company **BRF** announced they would reduce their net carbon emissions to zero by 2040 and that their plant-based chicken line, Veg Chicken by Sadia Veg&Tal, is the first **carbon-neutral plant-based meat** on the Brazilian market. Emissions are offset from grain to table through forest conservation.
- In January 2021, **Tyson-owned Jimmy Dean** announced the launch of two new frozen **vegetarian breakfast sandwiches**.
- In May 2021, **Tyson** announced they would expand their **Raised & Rooted** line to include plant-based hamburger patties and grounds, bratwurst, and Italian sausages in

addition to their existing plant-based chicken nuggets and tenders. In 2020 the company announced they would reformulate Raised & Rooted **products to be 100 percent plant-based.**

- Irish meat company **ABP launched** the new plant-based brand Dopsu, with pea-based duck, lamb, pork, and beef.
- Brazil-based conventional egg company **Grupo Mantiqueira launched** a plant-based omelet powder through their subsidiary **N.OVO.**
- **JBS**, the world's largest meat company, **launched** a line of plant-based meat cuts under the brand **Incrível Seara.**

Animal-based seafood companies

- In March 2021, **Thai Union**, the world's largest producer of canned tuna, launched their own plant-based line called **OMG Meat**, which includes alternatives to pork and crab meat.
- One of Europe's largest canned seafood producers, **Karavela, launched** a plant-based canned seafood product under their new brand, **Fish Peas.** With yellow peas as its main ingredient, the product comes in three forms: salads, flakes, and spreads.



“We’ve seen the incredible growth in customer demand for plant based foods over the past couple of years. In order to position ourselves for this large growth, we’ve dedicated a destination in frozen where customers can find a curated assortment of our best offerings. As we continue to evaluate performance, we’ll look for ways to expand into other segments and categories within food.”

—Callie Acuff, merchant – frozen food at Walmart

Private-label launches and expansions by retailers

According to **Mintel Global New Products Database** (GNPD), the number of new private-label plant-based meat substitutes launched rose by 80 percent from 2019 to 2021. Additionally, private-label meat substitutes made up 23 percent of the total meat substitute launches recorded from 2017 to 2021. The following examples highlight companies contributing to this trend:

- In April 2021, **ALDI announced** the addition of 34 new plant-based products for their **ALDI Earth Grown** line, which debuted in 2018. The new offerings include plant-based meat and dairy products.

- In May 2021, **Target** expanded their **Good & Gather** line with more than 30 new plant-based products across categories, including Meatless Meatballs, Chick’n Tenders, seasoned cashew dips, and plant-based milk and creamers.
- **Trader Joe’s** launched their **Vegan Meatless Meat Eater’s Pizza** in August 2021. The pizza is topped with a combination of plant-based pepperoni, Italian sausage crumbles, and chorizo sausage crumbles.



“We see meat substitutes as a key growth driver, and initiatives such as these will meet growing consumer demands for a greater variety of alternative proteins. [BRF’S Veg Franco 100% plant-based chicken] was conceived from the beginning to have 100% neutralized emissions, from the cultivation of the grains needed to the end of the product packaging life cycle, which is recyclable.”

—**Marcel Sacco, global VP for innovation, R&D, and new business at BRF**

Top-selling plant-based meat and dairy brands in U.S. retail

Tables 1 and 2 provide alphabetized lists of the top 10 plant-based meat and dairy brands by U.S. retail dollar sales in 2021. GFI and the Plant Based Foods Association commissioned the sales data from SPINS and refined it using custom coding.

The set of top 10 brands in the plant-based meat category did not change from 2020 to 2021.

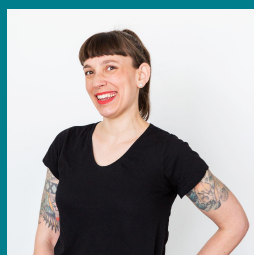
Table 1: Top 10 plant-based meat brands by dollar sales in U.S. retail (alphabetized)

| Brand | Parent company | Country | Year founded |
|--------------------------|--------------------------------|---------------|--------------|
| Beyond Meat | n/a | United States | 2009 |
| Boca | The Kraft Heinz Company | United States | 1993 |
| Dr. Praeger’s | n/a | United States | 1992 |
| Field Roast | Maple Leaf Foods | United States | 1997 |
| Gardein | Conagra | Canada | 2003 |
| Impossible Foods | n/a | United States | 2011 |
| Lightlife | Maple Leaf Foods | United States | 1979 |
| MorningStar Farms | Kellogg’s | United States | 1975 |

| | | | |
|----------------|---------------------|----------------|------|
| Quorn | Monde Nissin | United Kingdom | 1985 |
| Tofurky | n/a | United States | 1980 |

Sources: GFI analysis and SPINS Natural Enhanced Channel, SPINS Conventional Multi Outlet Channel (powered by IRI) | 52 Weeks Ending 12-26-2021. © 2022 The Good Food Institute, Inc.

Note: The data presented in this table is based on custom GFI and PBFA plant-based categories that were created by refining standard SPINS categories. Due to the custom nature of these categories, the presented data will not align with standard SPINS categories.



“The expansion in the meat alternatives space has shown that consumers do not have a singular vision on products and brands shouldn’t be limited to one idea about meat alternatives, either. In addition to the rise in plant based technologies, there is also a place and a demand for more traditional, minimally-processed, and even whole food alternatives. The white space is vast and there is a lot of room for brands to be bringing unique foods, ingredients, and formats to market to expand the product variety far beyond what it is today.”

—Nicole Sopko, vice president at Upton’s Naturals

Most brands in the top 10 for plant-based dairy dollar sales were consistent with those in 2020. New to the list in 2021 are Chobani and Country Crock—Country Crock appeared on the list in 2019.

Table 2: Top 10 plant-based dairy brands by dollar sales in U.S. retail (alphabetized)

| Brand | Parent company | Country | Year founded | Plant-based dairy product categories |
|----------------------|---------------------------------------|---------------|--------------|--|
| Blue Diamond | HP Hood LLC | United States | 1910 | Creamer, milk, yogurt |
| Califia Farms | n/a | United States | 2010 | Butter, creamer, milk, ready-to-drink beverages, yogurt |
| Chobani | n/a | United States | 2015 | Yogurt, milk |
| Country Crock | Upfield | United States | 1945 | Butter, cream |
| Daiya | Otsuka Pharmaceutical Co. Ltd. | Canada | 2008 | Cheese, dairy sauces, ice cream and frozen novelty, yogurt |
| Earth Balance | Conagra | United States | 2018 | Butter |
| Oatly | n/a | Sweden | 1994 | Ice cream, milk, ready-to-drink |

| | | | | |
|---------------------|--------------------|---------------|------|---|
| | | | | beverages, yogurt |
| Planet Oat | HP Hood LLC | United States | 2018 | Ice cream, milk |
| Silk | Danone | United States | 1978 | Creamer, milk, ready-to-drink beverages, yogurt |
| So Delicious | Danone | United States | 1987 | Creamer, milk, ice cream and frozen novelty, yogurt |

Sources: GFI analysis and SPINS Natural Enhanced Channel, SPINS Conventional Multi Outlet Channel (powered by IRI) | 52 Weeks Ending 12-26-2021. © 2022 The Good Food Institute, Inc.

Note: The data presented in this table is based on custom GFI and PBFA plant-based categories that were created by refining standard SPINS categories. Due to the custom nature of these categories, the presented data will not align with standard SPINS categories.



More information on these and other companies is available in GFI's [company database](#).

Foodservice growth, partnerships, and expansion

As pandemic restaurant restrictions have begun to lift,, foodservice operators continue to use plant-based proteins to drive growth and differentiate their menus. The following updates are a small sampling of new plant-based foodservice distribution across the world.

North America

Plant-based in U.S. foodservice by the numbers

- **According to NPD SupplyTrack data**, shipments of plant-based proteins from foodservice distributors to commercial restaurants increased by 60 percent in April 2021 compared with the same month in 2020 (when foodservice was severely affected by pandemic restrictions). Shipments increased by 19 percent from April 2019 to April 2021.
- Plant-based beef shipments (the largest share of plant-based protein shipments) increased by 45 percent from April 2020 to April 2021 and 82 percent from April 2019 to April 2021.
- Plant-based chicken shipments increased by 82 percent from April 2020 to April 2021 and 25 percent from April 2019 to April 2021.
- According to Grubhub's **State of the Plate report**, plant-based orders rose by 17 percent in the first half of 2021, with plant-based burger orders rising by 28 percent and vegetarian orders rising by 55 percent.
- **The fastest-growing food order** on Grubhub in 2021 was the Impossible Cheeseburger.

North America foodservice distribution updates

- **Good Catch** partnered with **Long John Silver's**, the largest quick-service seafood chain in the United States. Good Catch products can be found at five Long John Silver's locations in Georgia and California.
- In 2021, Starbucks turned one of their Seattle stores **into a test site for a 100 percent plant-based menu**. Across their U.S. locations, Starbucks also expanded their permanent menu to include a vegan protein box and **Oatly** oat milk as a drink option and as an ingredient in their Iced Brown Sugar Oatmilk Shaken Espresso.
- **Starbucks** tested Perfect Day's **animal-free milk** in Seattle.
- In April 2021, **Carl's Jr. announced** that one of their LA locations would go meatless on Earth Day (April 22) in partnership with **Beyond Meat**.
- In March 2021, California-based coffee chain **Peet's** announced they would offer the **Everything Plant-Based Sandwich**—a plant-based breakfast sandwich made with **JUST Egg**, **Beyond Sausage**, and **Violife** cheese—nationwide.
- **Rebelloys Foods** expanded their offerings with a new formulation of their original nuggets as well as the addition of patties and tenders. The brand also features a product called **Kickin' Nuggets** geared specifically toward K-12 school foodservice.
- Beyond Meat released plant-based chicken nuggets in **Canadian A&W locations** as well as **orange chicken in U.S. Panda Express locations**.

U.S. regional/independent expansion

The growing mainstream appeal of plant-based foods can also be seen regionally with the growth of independent restaurants and micro chains featuring exclusively plant-based foods:

- Highly acclaimed New York City restaurant **Eleven Madison Park** shifted to a **completely plant-based menu** when it reopened in May 2021, citing environmental concerns. The Michelin-starred restaurant had been closed since March 2020 because of the pandemic and has continued with a strictly plant-based menu into early 2022.
- Plant-based fast-food chain HipCityVeg **added eight locations**, nearly doubling in size. Two of the locations are ghost kitchens (delivery only), which is indicative of the brand's success online.



After 2020 validated consumer interest in the category, 2021 was a year of reckoning on the true growth potential of the plant-based industry. Late in the year signals from large plant-based meat makers prompted soap box stances from media on how **the category was at its ceiling**. Internal to the industry, though, true leaders saw it as a signal to look below the surface and assess and leverage the insights the year presented on what could hold back the growth potential of the industry: lack of product accessibility due to availability and price.

—Christie Lagally, Founder and CEO of Rebellious Foods

Asia Pacific

The plant-based foodservice market has rapidly grown in the Asia Pacific region as well. In 2021 GFI APAC launched its first-ever **Good Food Restaurant Scorecard**, which analyzed local menus at 20 of the largest food chains—both regional and international—across 11 Asian subregions.

- **Dicos**, one of mainland China's largest fast-food chains, announced they would use **JUST Egg** as the default on several sandwiches and plates—the first-ever replacement of chicken eggs with plant-based eggs at a major quick-service chain.
- **OmniFoods launched** OmniSeafood's Omni Crab Cakes in 170 Starbucks locations in Hong Kong, signaling a sea change in mainstream consumer demand in Asia. This marks the third collaboration between Starbucks and OmniFoods but the first focused on seafood. Starbucks has already included several OmniPork dishes in their Hong Kong and mainland China menus.
- **Burger King** launched a plant-based Whopper made with **The Vegetarian Butcher** patties in **Singapore** and **Indonesia**.
- **IKEA** Indonesia **added** four new plant-based dishes to their menu.
- **McDonald's** Australia **added** oat milk to their cafe options.
- **Unilever**-owned brand **The Vegetarian Butcher launched** six new plant-based meat products in the foodservice channel in mainland China.
- **Next Gen Foods** released their **TiNDLE chicken made from soy and wheat protein** in Singapore restaurants and plans to expand to additional APAC countries, the United States, Europe, and the Middle East.
- In addition to plant-based expansions in the United States, **Starbucks** also launched new plant-based collaborations in Hong Kong, Indonesia, and the Middle East.

Europe

Leading restaurant chains in Europe expanded their plant-based tests and permanent menu offerings in 2021.

- Danish vegan brand **Naturli'** partnered with leading Scandinavian animal-based chicken producer Scandi Standard to bring **plant-based Green Nuggets** to over 100 Q&S service stations across the country.
- After a successful test phase, **Novish's** plant-based seafood products are now available in all 370 Nordsee (conventional seafood) restaurants across Europe.
- **McDonald's UK** launched the **McPlant** plant-based burger.

Product and category expansion

After the success of plant-based milk, plant-based burgers were the next wave of plant-based products to attain mainstream appeal. But plant-based meat, dairy, and egg formats have expanded into multiple occasions, dayparts, and segments:

- **Plant-based meat**
 - **Chicken.** KFC launched Beyond Fried Chicken nationally after successfully testing the product in select locations since 2020.
 - **Beef.** In February 2021, both **Yum Brands and McDonald's** signed strategic partnerships with **Beyond Meat**. As part of a global strategic partnership, Yum Brands will launch exclusive plant-based menu items using Beyond Meat that will be available only at **KFC, Pizza Hut, and Taco Bell**. McDonald's confirmed that Beyond Meat would serve as their preferred supplier for the McPlant burger as terms of a three-year deal. Beyond Chicken has already launched in KFCs in Thailand and the United States. Meanwhile, in December 2021, McDonald's announced they would expand the McPlant offering to more than 700 U.S. restaurants in 2022 and soon after announced the expansion to the United Kingdom.
 - **Lamb.** In October, San Francisco "modern fast-fine Greek" restaurant chain **Souvla** began featuring plant-based lamb from **Black Sheep Foods** on their menu.
- **Plant-based dairy and eggs**
 - **Cheese.** After securing \$52 million in Series C funding in August 2021, **Miyoko's Creamery** applied some of those funds to support foodservice expansion. Founder and CEO Miyoko Schinner noted that she'd like to see the brand's direct-to-foodservice pourable mozzarella on the menus of every fine-dining restaurant and pizzeria and has invested in employees who will focus on restaurant distribution for the pizza-ready product.

- **Eggs.** 2021 built on recent developments for plant-based eggs in foodservice, including with **Eat Just’s partnership with foodservice management giant Sodexo** and the **U.S. foodservice launch of ZeroEgg**. JUST Egg **was added** to the menus of U.S.-based Peet’s and Dicos in China.

The increasing variety of plant-based foods in foodservice channels not only tracks with incremental segment growth but offers compounding benefits to the entire plant-based category. Increased plant-based product variety throughout menus helps to mainstream plant-based items so they don’t appear as individual outliers. Variety in plant-based menu items covering more occasions, dayparts, and needs enables consumers to easily fit plant-based foods into diverse contexts.



“Foodservice is incredibly important to emerging plant-based brands because it serves as a trial driver for curious consumers. Without trial there is no adoption—and that trial is the single most important moment for any new product. For new food offerings, the first question everyone wants answered is ‘What does it taste like?’”

—Chris Kerr, founding board chair and co-founder at Gathered Foods and chief investment officer at Unovis

Box 1: Co-branding in foodservice

One noteworthy foodservice trend that continued in 2021 was on-menu co-branding of plant-based meat suppliers and restaurants. Co-branded foods on restaurant menus are quite rare—beverage brands like Coca-Cola and Pepsi are the only widespread exceptions owing to the strength of their consumer branding. For the vast majority of other menu items, especially meats, the restaurant brand is primary.

Supplier brand equity may be particularly salient in novel categories such as meat analogues, where trust, familiarity, and taste perceptions are critical drivers of initial consumer trial.

- In January 2022, **AMC Theaters** across the United States launched **Impossible Chicken Nuggets** as a plant-based option at their concession stands.
- Also in January 2022, **KFC** announced a national launch of **Beyond Fried Chicken**, which they had been testing in select locations since 2020.
- **OmniPork**'s plant-based luncheon meat (aka vegan SPAM) debuted at McDonald's locations in China.

Time will tell whether such co-branding will persist, though momentum continues to grow. If it does persist, it will likely be unique to plant-based categories. Most consumers have no idea who supplies animal meat to McDonald's and Burger King, for example, and co-branding could be a competitive, point-of-difference edge for alternative protein companies.

Developments in ingredients, processing, and production

Many of the improvements in sensory parity and price reduction of plant-based products reflect advances in the upstream supply chain. Suppliers across the value chain continue to innovate to develop ingredients with improved functional properties, enhanced nutritional attributes, and more efficient and scalable production processes to meet the growing demand from end-product manufacturers. Even crop breeders are catering to the plant-based space, developing bespoke cultivars that are well suited for these applications. However, some of these advances require time to implement on a large scale and permeate the market. Thus, there is an increased sense of urgency for innovation in crop and ingredient processing to keep up with demand and facilitate continued product quality improvement and cost reduction.

Seeds and crops

Historically, crops have not been optimized for their protein content or the functionality required by many plant-based meat, egg, and dairy products. The plant-based ingredient industry needs crops that are bred to exhibit lower levels of metabolites and enzymes that negatively impact taste, as well as higher protein content and functionality—such as improved solubility, water-binding capacity, and fat-binding capacity, all of which contribute to desirable sensory attributes in plant-based end products. 2021 brought multiple developments in seed and crop optimization:

- Seed breeding company Benson Hill **went public in May** by merging with special-purpose acquisition company (SPAC) Star Peak Corp II. Benson Hill also expanded their leadership team and closed debt-funded acquisitions of an **Indiana soybean-crushing facility** and an **Iowa manufacturing plant for food-grade soy white flake and flour**. On the product side, Benson Hill finalized the **first commercial harvest**

of their new “**ultra-high-protein**” soybean varieties, with 2022 contracted acreage commitments already exceeding the **70,000 acres** planted and harvested in 2021. If successful, these new varieties will be the first commercially available soybeans that could effectively and efficiently replace soy protein concentrate made through standard soybean crushing and bypass traditional dry and wet fractionation steps.

Leading restaurant chains in Europe expanded their plant-based tests and permanent menu offerings in 2021.

- Danish vegan brand **Naturli** partnered with leading Scandinavian animal-based chicken producer Scandi Standard to bring **plant-based Green Nuggets** to over 100 Q8 service stations across the country.
- After a successful test phase, **Novish’s** plant-based seafood products are now available in all 370 Nordsee (conventional seafood) restaurants across Europe.
- **McDonald’s UK** launched the **McPlant** plant-based burger.
- NuCicer announced an **ultra-high-protein chickpea crop variety** that has potential to make chickpea protein cost competitive with soy, wheat, and pea proteins.

The plant-based sector is also searching for novel crops that are not yet commercialized at commodity scale but may pose inherent advantages from the perspective of functionality, flavor, sustainability, or nutrition. Once novel crops with promising potential as alternative protein inputs are identified, multiple challenges will remain:

- Establishing the necessary agricultural infrastructure—seeds, agricultural inputs, farm equipment, crop insurance, storage, transportation—to enable efficient and scaled cultivation.
- Determining how to efficiently and profitably process harvested raw material into useful ingredients, such as oil and protein.
- Connecting with downstream food-product manufacturing customers.

Market mechanisms to address these challenges are needed to diversify the crops from which the plant-based industry can source ingredients. In addition to startups such as **Fieldcraft** and **Indigo Ag**, the nonprofit Foundation for Food and Agriculture Research is **establishing the Open Market Consortium**, an open-source blockchain system to connect farmers directly with institutional crop buyers.

2021 saw major developments from companies working to commercialize novel crops or expand the commercial uptake of specialty crops with promising attributes for alternative protein applications:

- Terviva, a U.S.-based startup commercializing oil and protein from beans harvested from pongamia trees, **raised \$45 million in funding** and announced

product-development partnerships with Danone and MISTA. Terviva plans to open a production facility in the United States in 2022.

- In September, Plantible Foods **closed a \$21.5 million Series A fundraising round** for their vertically integrated agricultural platform, which produces protein ingredients from lemna (also known as duckweed or water lentils), a fast-growing aquatic crop that can double its biomass every 48 hours. The company's inaugural Rubi Protein is initially targeted at the egg-replacement market.
- InnovoPro released a **textured vegetable protein (TVP) that combines chickpea and pea protein concentrates** and launched a **chickpea-based egg white replacement ingredient** targeted at the baking category.
- Nutriati began a **global partnership with Tate & Lyle to distribute their Artesa chickpea protein**, including a TVP made from chickpea flour and pea protein.
- In May, Israel-based startup ChickP **unveiled a new chickpea isolate as an egg alternative for mayonnaise and dressing applications** and **launched a new office in Singapore**.
- Proeon joined Scrum Venture's sustainable food global accelerator program to **advance their protein ingredients made from amaranth, hemp seeds, mung beans, fava beans, and chickpeas**.
- Green Boy Group developed **plant protein dairy-base ingredients from peas, mung beans, fava beans, and chickpeas**.



For more information about established and emerging crop sources of plant proteins, check out **GFI's Plant Protein Primer** and **GFI Asia Pacific's Asian Cropportunities report**.

Box 2: Developing plant protein supply chains for climate resilience

The climate change and biodiversity benefits of plant-based proteins cannot come soon enough. In 2021, Canada's worst drought in decades led to a **45 percent drop in pea production** in the country. Pea crops in France, another major producer, were damaged by unusually wet weather, leading to a doubling in pea prices from 2020. Pea isn't the only crop affected: **Soy concentrate and isolate prices have also risen** over the past year. Moreover, GFI's report **Plant-based meat: Anticipating 2030 production requirements** highlights that consumer demand for pea and soy proteins will outpace the industry's supply chain capabilities.



Crop development and ingredient processing solutions that create more resilient plant-based ingredient supply chains are increasingly necessary. Companies such as **Equinom** are creating disease-resistant crops relevant to the alternative protein industry. Other companies are focused on improving

intermediate ingredient processing, where higher output quality and quantity improves crop utilization, which in turn creates a more durable global supply for plant-based ingredients.



“Dietary change in regions with excess consumption of calories and animal-sourced foods to a higher share of plant-based foods with greater dietary diversity and reduced consumption of animal-sourced foods and unhealthy foods (as defined by scientific panels such as **EAT-Lancet**), has both mitigation and adaptation benefits along with reduced mortality from diet related non-communicable diseases, health, biodiversity and other environmental co-benefits.”

—Intergovernmental Panel on Climate Change in **Climate Change 2022: Impacts, Adaptation, and Vulnerability (5.12.6/p. 942)**

Intermediate ingredient processing

Ingredient processing (separating raw materials into fractions enriched for proteins, fats, fibers, and starches) is typically scale-dependent, relying on high volumes to make up for low margins. Even as demand for new protein flours, isolates, and concentrates grows rapidly, the cost and complexity of building processing facilities can make ingredient production capacity slow to materialize. Repurposing is difficult since facilities are often optimized for one commodity and even for highly specific cultivars and traits. One of the highest priorities for alternative protein scaling is identifying new chemical, mechanical, and biological processing methods that offer high output quality and functionality benefits and are inexpensive, more efficient, compatible with diverse crop inputs, and less scale-dependent than current processes.

2021 brought developments from notable startups and ingredient processing companies:

- PURIS, a Minnesota-based breeder and processor of non-GMO yellow pea and soy, **opened their new pea protein facility in Dawson, Minnesota**, more than doubling their pea protein production capacity. The Dawson facility was formerly an animal-dairy processing facility that produced cheese sauce and other dairy products.
- **Ingredion opened** a new pulse processing facility in Saskatchewan, Canada.
- Burcon NutraScience, a Canadian startup commercializing a variety of plant protein crops and processing technologies, **completed the first phase of a \$130 million planned three-phase plant protein processing facility** for the joint venture Merit

Functional Foods and **began commercial sales of pea and a 98 percent pure canola protein.**

- Government-funded Protein Industries Canada recently announced a **major co-investment in a project that will utilize some of Canada's most widely grown crops** in the development of new plant-based foods and ingredients. Merit Functional Foods, TWC Nutrition, Daiya, and Grand River Foods together invested half of the project's \$7.9 million. The companies will utilize Merit Functional Foods' pea, canola, and blended pea-canola protein ingredients in new plant-based products.
- With support from Protein Industries Canada, Lupin Platform Inc., Hensall Co-op, plant-based brand Lumi Foods, and PURIS **partnered to expand lupin cultivation and processing in Canada.** The \$7.3 million initiative will help build out a full value chain from farm to finished product for lupin ingredients.
- Canadian ingredient giant Roquette **completed commissioning of the world's largest pea protein facility** in Portage la Prairie, Manitoba. The plant is expected to reach full capacity in early 2022 and process more than 125,000 metric tons of yellow peas annually. Roquette also **opened a new R&D facility** in Vic-sur-Aisne, France, dedicated to plant protein innovation.
- Kerry **added multiple new ingredients** to their Radicle brand of plant proteins, including pea, rice, and sunflower proteins. The company **created an online tool** to support product developers across various categories, including plant-based meat, eggs, and dairy.
- French agri-food company Avril and Netherlands-based ingredient supplier DSM **continued their collaboration to produce plant protein**, initially canola protein. Production is slated to begin in 2022.
- In November, **FrieslandCampina Ingredients and collaborator AGT Foods launched two new plant-based dairy ingredients utilizing pea protein and fava bean isolates.**
- Ingredient launched **Prista, a line of pea and fava bean concentrates and flours**, and opened a new **protein manufacturing facility for peas, lentils, and fava beans** in Vanscoy, Saskatchewan.
- St. Louis-based EverGrain, an AB InBev-backed startup upcycling brewers' spent grain (which is often sold as animal feed) into a barley protein that can be used for plant-based dairy and other food applications, **launched a product development partnership with Post Holdings subsidiary Bright Future Foods and began construction on a \$100 million production facility** for barley protein and fiber that is slated to open in 2022.



“The most significant challenge for the plant-based supply chain is keeping up with the segment’s growth. Today we already see shortages of high-quality raw materials being available. This shortage is partly due to the global supply chain issues and partly due to the capacity shortage for proteins due to the fast growth in recent years driven from Europe and America. As Asia is catching up on the plant-based trend, this will increase the shortage further.”

—Dominique Kull, founder of SGProtein

End-product manufacturing

Given the enormous scale required to produce meat, egg, and dairy products for billions of people, production technology and capacity scaling remain key areas for future innovation and investment in the alternative protein industry. Top priorities include the following:

- Optimizing production equipment, including scalable tools for protein texturization.
- Developing manufacturing equipment with increased throughput.
- Increasing availability of contract manufacturing and pilot plant capacity.
- Repurposing manufacturing capacity from other sectors.
- Expanding access to infrastructure capital, such as project financing, working capital facilities, debt funding, grant funding, loan and purchase guarantees, and advance market commitments.

Related resources and reports

- GFI maintains a [directory of plant-based contract manufacturers, private labelers, and pilot plants](#) to connect scaling alternative protein brands with outsourced manufacturing partners.
- GFI’s [Plant Protein Primer](#) helps manufacturers compare plant protein sources on key attributes like nutrition, functionality, price, and sourcing.
- In 2021, GFI APAC launched the [APAC Alternative Protein Ecosystem Database](#), a rapidly expanding directory of ingredient and equipment suppliers, pilot plants, consultants, and other critical B2B partners in Southeast Asia.
- In January 2022, GFI released a [scenario-driven analysis](#) that quantitatively forecasts expected ingredient volume and manufacturing facility needs for the plant-based meat industry to identify and mitigate future production bottlenecks.

Multiple companies in end-product manufacturing made substantial progress in 2021:

- Denmark-based Source Technology **announced a North American distribution partnership with PreciPak for their PowerHeater technology**, a low-pressure extrusion platform that transforms TVP into fibrous, whole-muscle cuts of plant-based meat.
- ICL, an Israel-based specialty minerals company, **opened a new 10,000-square-foot production facility for plant-based meat** in their existing St. Louis, Missouri, production campus that is expected to produce over 15 million pounds of product annually once it reaches full capacity.
- Slovenia-based Juicy Marbles **raised a \$4.5 million seed round** to scale their new manufacturing technology for making whole-cut plant-based steaks. They debuted their platform and proprietary fat-marbling technology to launch a plant-based filet mignon earlier in 2021.
- Plant-based contract manufacturer Plant & Bean, a joint venture of Breck Foods and Thailand-based NR Instant Produce, expanded operations at **Europe's largest plant-based meat factory, obtained additional financing from HSBC UK, and opened a new R&D center** in York, United Kingdom.
- Plant-based fried chicken startup Atlas Monroe acquired a **10,000-square-foot manufacturing plant in San Diego**. Founder Deborah Torres noted the facility was expected to produce one million pounds of chicken by the end of 2021.



To learn more about the innovations needed to drive progress throughout the plant-based protein supply chain, check out **GFI's Advancing Solutions initiative**. To meet the scientists leading open-access plant-based research in crop development, ingredient processing, and end-product formulation and manufacturing, see this report's **section on GFI's research grants**.

View more plant-based ingredient innovators in **GFI's company database**.

*Are we missing your company? Did we get something wrong? We'd appreciate your feedback via **this form**.*

Section 2

Sales



Section 2: Sales

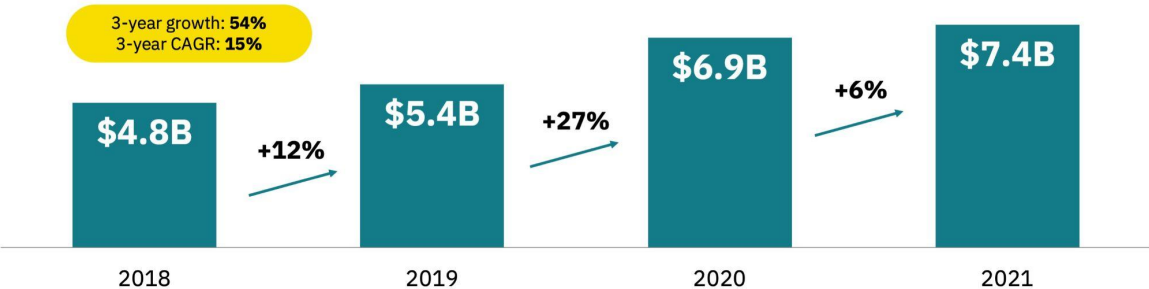
U.S. retail sales overview

Plant-based foods in the United States are a \$7.4 billion market. Plant-based products are a key driver of sales growth at grocery retailers nationwide, and in 2021 plant-based food sales grew three times as fast as overall food sales. SPINS retail sales data released on March 22, 2022, shows that grocery sales of plant-based foods that directly replace animal products have grown 6 percent in the past year—and 54 percent in the past three years—to \$7.4 billion.

Key insights:

- **Plant-based milk is the most developed of all plant-based categories.** Plant-based milk dollar sales were \$2.6 billion in 2021, and the category continues to experience steady long-term growth.
- **After a strong 2020 to pass the billion-dollar mark for the first time, plant-based meat sales remained steady in 2021.** Plant-based meat dollar sales have grown 74 percent since 2018 to \$1.4 billion.
- **Almost every category grew, even on top of a strong 2020 that experienced above-average activity owing to pandemic impacts.** The fastest-growing categories were plant-based eggs; plant-based creamer; plant-based ready-to-drink beverages; and plant-based dairy spreads, dips, sour cream, and sauces—all putting up strong double-digit dollar sales growth in 2021.
- **The least developed category, although the fastest-growing, is plant-based eggs.** At \$39 million in sales in 2021, the plant-based egg category is modest but growing exceptionally, with more than 1,000 percent growth since 2018.

Figure 1: Total plant-based food dollar sales, U.S. retail (2018–2021)



Note: The data presented in this graph is based on custom GFI and PBFA plant-based categories that were created by refining standard SPINS categories. Due to the custom nature of these categories, the presented data will not align with standard SPINS categories.
Source: SPINS Natural Enhanced Channel, SPINS Conventional Multi Outlet Channel (powered by IRI) | 52 Weeks Ending 12-26-2021



Pandemic impacts

To contextualize the sales performance of plant-based categories in 2021, we should note that 2020 was an unusual year with particularly strong growth—not only across the food market but especially for plant-based categories—given the above-average activity the retail sector saw owing to pandemic impacts. Lapping such a high-growth year with significant noise in the data makes comparisons challenging and may be particularly difficult for an emerging industry that is still scaling production capacity. This, compounded with ingredient shortages and continued supply chain disruptions, may have resulted in plant-based meat sales falling short of the industry’s expectations for further rapid growth in 2021.

Ingredient shortages and supply chain disruptions

As one notable example, Canada, the world’s largest producer of yellow peas (commonly used in plant-based meat products), recorded a **45 percent decrease in yellow pea production** as of September 2021. Because of the relatively small size of plant-based categories, even modest supply chain issues like this could contribute to declines in growth. According to FMI’s 2022 *The Power of Meat* report, 38 percent of consumers surveyed reported seeing increases in lack of stock in the meat department. Market conditions resulted in changed meat and poultry purchasing patterns for 58 percent of consumers surveyed.

Comparing plant-based meat and conventional meat performance

Another factor that adds complexity to comparing the sales performance of plant-based meat with that of conventional meat is inflation. Inflation was a big story in the protein category—and across the entire food market—in 2021. Examining dollar sales growth alone can lead to the conflation of increased consumer demand and increased prices. Unit sales and average price per unit can help tell a more complete story. Despite experiencing slightly lower dollar sales growth than total food and conventional meat, plant-based meat saw comparable—or fewer—unit sales declines and markedly more-modest price increases.

| Category | Dollar sales (1-year change) | Unit sales (1-year change) | Average price per unit (1-year change) |
|--|---------------------------------|-------------------------------|---|
| Total food | 2% | -3% | +5% |
| Frozen and refrigerated conventional meat* | 1% | -4% | +6% |
| Plant-based meat | 0% | -3% | +3% |

*In most of this report, plant-based meat products (including refrigerated, frozen, and shelf-stable types) are compared with the total conventional category (which had 0 percent dollar sales growth). Owing to limited data availability for shelf-stable conventional meat units, this table compares plant-based meat with a conventional meat category that does not include shelf-stable products.

Although short-term data is subject to noise, evidence in the past few months shows that plant-based meat continues to experience flat or declining dollar and unit sales. Despite the growth seen in the past decade, the success of the plant-based meat category is not inevitable. For the category to meet and further stimulate consumer demand and create plant-based proteins that compete with conventional products on the table stakes of consumer choice—taste, price, and accessibility—it will need greater investments from both the private and the public sectors. Such investments can ensure we realize the potential of plant-based meat to help sustainably and efficiently feed billions of people, protect public health and

lessen the risk of future pandemics, and mitigate the global climate impact of our meat production—all while giving consumers more options for tasty, affordable proteins.

Box 3: U.S. retail market data collection

Point-of-sale data

To size the U.S. retail market for plant-based foods, GFI and PBFA commissioned retail sales data from the market research firm SPINS. The firm built the dataset by first pulling in all products with the SPINS “plant-based positioned” product attribute. The dataset was further edited by adding plant-based private-label categories and subcategories and refining the plant-based eggs category. Inherently plant-based foods, such as chickpeas and kale, are not included. **Because of the custom nature of these categories, the retail data presented in this report may not align with that of standard SPINS categories.** SPINS obtained the data over the 52-week, 104-week, 156-week, and 208-week periods ending December 26, 2021, from the SPINS Natural Enhanced and Conventional Multi Outlet (powered by IRI) grocery channels. SPINS defines these channels as follows:

- **Conventional Multi Outlet (MULO):** More than 104,000 retail locations spanning grocery, drug, mass, dollar, military, and club.
- **Natural Enhanced:** More than 1,800 full-format stores with \$2 million+ in annual sales and 40 percent or more of UPC coded sales from natural/organic/specialty products.

SPINS is generally considered to offer the broadest available view of retail food sales, although not all retailers are represented. Some companies, such as Whole Foods Market, Trader Joe’s, and Costco, do not report their scan data to SPINS or IRI.

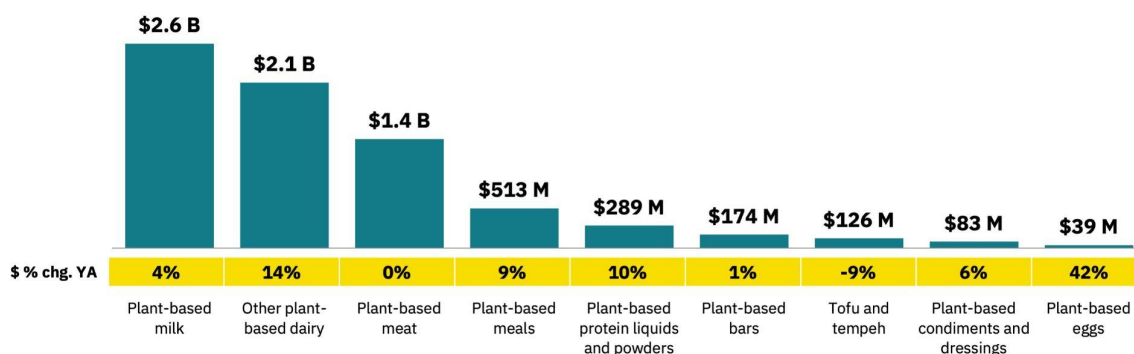
Consumer panel data

To understand consumer purchasing dynamics and demographics, GFI and PBFA also commissioned consumer panel data from SPINS based on the same custom plant-based categories. SPINS acquires its panel data through the National Consumer Panel, a Nielsen and IRI joint venture composed of roughly 100,000 households. SPINS obtained the data from all U.S. outlets over the 52 weeks ending December 26, 2021, and the 52 weeks ending December 27, 2020.

Categories

Plant-based food categories are in various stages of development. Notably, most categories are growing faster than their animal-based counterparts.

Figure 2: Plant-based food dollar sales and dollar sales growth by category (2021)



Note: The data presented in this graph is based on custom GFI and PBFA plant-based categories that were created by refining standard SPINS categories. Due to the custom nature of these categories, the presented data will not align with standard SPINS categories.

Source: SPINS Natural Enhanced Channel, SPINS Conventional Multi Outlet Channel (powered by IRI) | 52 Weeks Ending 12-26-2021

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Table 3: Plant-based category dollar sales summary

| Category | 2021 dollar sales | 1-year dollar sales growth (2020–2021) | 3-year dollar sales growth (2018–2021) | 2021 unit sales |
|---|-------------------|--|--|-----------------|
| Plant-based milk | \$2.6B | 4% | 33% | 788M |
| Plant-based meat | \$1.4B | 0% | 74% | 281M |
| Plant-based creamer | \$516M | 33% | 134% | 121M |
| Plant-based meals | \$513M | 9% | 83% | 113M |
| Plant-based ice cream and frozen novelty | \$458M | 3% | 41% | 92M |
| Plant-based yogurt | \$377M | 9% | 76% | 170M |
| Plant-based cheese | \$291M | 7% | 85% | 59M |
| Plant-based protein liquids and powders | \$289M | 10% | 29% | 19M |
| Plant-based butter | \$214M | 9% | 92% | 56M |
| Plant-based ready-to-drink beverages | \$202M | 22% | 87% | 51M |
| Plant-based bars | \$174M | 1% | -7% | 50M |
| Tofu and tempeh | \$126M | -9% | 28% | 44M |
| Plant-based condiments, dressings, and mayo | \$83M | 6% | 20% | 16M |
| Plant-based dairy spreads, dips, sour cream, and sauces | \$65M | 20% | 280% | 13M |
| Plant-based eggs | \$39M | 42% | 1,076% | 8M |
| Total | \$7.4B | 6% | 54% | 1.9B |

Source: SPINS Natural Enhanced Channel, SPINS Conventional Multi Outlet Channel (powered by IRI) | 52 Weeks Ending 12-26-2021. © 2022 The Good Food Institute, Inc.

Note: The data presented in this table is based on custom GFI and PBFA plant-based categories that were created by refining standard SPINS categories. Due to the custom nature of these categories, the presented data will not align with standard SPINS categories.



For a comprehensive overview of U.S. retail sales data, including coverage of all plant-based categories and additional detail on the plant-based meat and plant-based milk categories, as well as consumer purchase dynamics, check out [GFI's market data page](#).

U.S. consumer dynamics and research

Mainstream consumer awareness of and interest in plant-based foods is a critical factor in growing this emerging market. Plant-based meat, eggs, and dairy—product categories formerly most familiar to vegans and vegetarians—continue to gain mainstream status by appealing to a broader swath of consumers on key consumer drivers like taste and price.

Consumer demographics for overall plant-based foods

Increasing plant-based food consumption is a trend among young and diverse consumer groups. These consumers are also more likely to express an **interest in eating more plant-based foods** in the future. Compared with the average consumer, purchasers of plant-based products tend to be younger and from higher income brackets and tend to have college or graduate degrees.

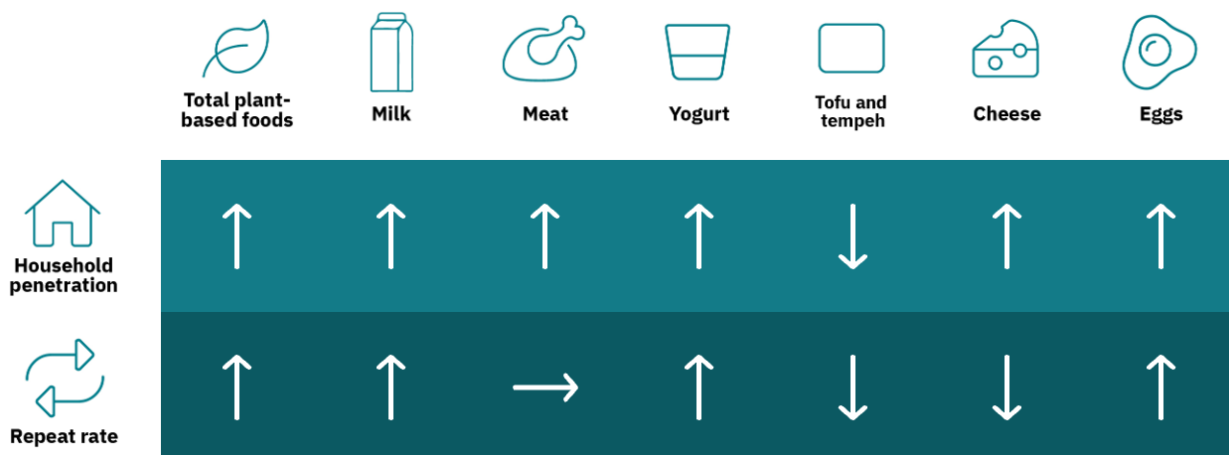
| Cohort | | Dollar index | Buyer index | Cohort | | Dollar index | Buyer index |
|--------------|---------------------------------------|--------------|-------------|---------------------|----------------------|------------------|-------------|
| HH age | HH Age 18-34 | 116 | 113 | Income | HH Earning Under 20K | 81 | 87 |
| | HH Age 35-44 | 124 | 111 | | HH Inc \$20k-\$24.9k | 73 | 85 |
| | HH Age 45-54 | 116 | 107 | | HH Inc \$25k-\$34.9k | 82 | 90 |
| | HH Age 55-64 | 92 | 96 | | HH Inc \$35k-\$44.9k | 88 | 93 |
| | HH Age 65+ | 69 | 81 | | HH Inc \$45k-\$49.9k | 87 | 96 |
| HH education | HH Educ-Graduated High School or Less | 68 | 85 | | HH Inc \$50k-\$59.9k | 94 | 97 |
| | HH Some College | 96 | 98 | | HH Inc \$60k-\$69.9k | 90 | 101 |
| | HH Graduated College | 113 | 107 | | HH Inc \$70k-\$99.9k | 101 | 103 |
| | HH Post Graduate School | 123 | 109 | | HH Inc \$100k+ | 127 | 112 |
| Ethnicity | White | 97 | 97 | | Kids | HH with Children | 113 |
| | Asian | 100 | 124 | HH without Children | | 94 | 95 |
| | African American | 116 | 105 | | | | |
| | Other Race | 102 | 106 | | | | |

Source: NCP, All Outlets, 52 weeks ending 12-26-21.

Note: Buyer index measures the importance of buyers within the demographic relative to the panel composition. Dollar index represents the proportion of product dollars accounted for by a given demographic segment divided by the proportion of total households within the demographic segment. The index indicates low interaction (<80, red) or high interaction (>120, green).

In addition to strong sales growth, plant-based categories are seeing growth on other key metrics such as household penetration and repeat purchase rate.

Purchase dynamics of plant-based foods—change from 2020 to 2021



Source: NCP, All Outlets, 52 weeks ending 12-26-21.

- Household penetration of plant-based foods continues to increase.** Six out of ten U.S. households purchase plant-based foods, up slightly since 2020.
- Plant-based milk is a major entry point for households trying products across plant-based categories.** Plant-based milk leads in household penetration at 42%, followed by plant-based meat which has grown to 19%, indicating that the success of plant-based milk has laid the groundwork for consumer adoption of other plant-based categories.
- Repeat rates also continue to grow across plant-based categories.** Seventy-nine percent of buyers purchased multiple times in the total plant-based foods category in 2021. Again, plant-based milk leads the way, with a category repeat rate of 76%, followed by plant-based meat at 64%.
- Not only are there more buyers shopping in these categories, but dollar sales per buyer purchasing total plant-based foods are also increasing.** Plant-based yogurt is the leading category for growth in dollar sales per buyer, up 8% from 2020.

Global trial and demand

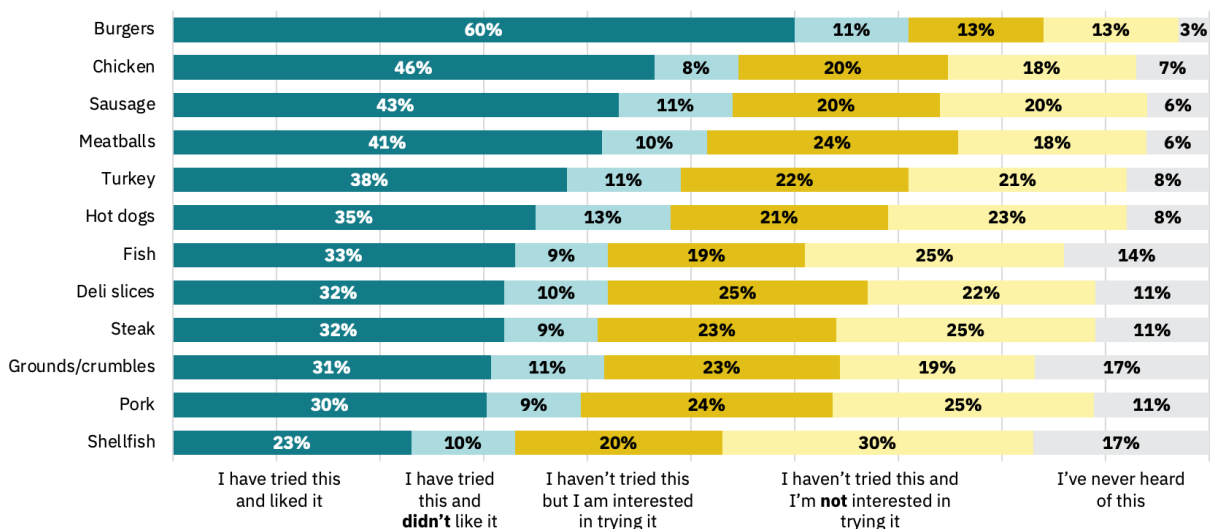
According to a [survey from UBS](#), 54 percent of consumers in the United States, the United Kingdom, and Germany have now tried plant-based protein, with 47 percent now consuming it at least once a week—the highest reading since the survey series began in 2019.

Positive global trends in consumer interest are also predicted in a research report conducted by DuPont Nutrition & Biosciences and IPSOS, a global market research firm. The [study](#) shows a significant increase in demand for plant-based meat alternatives in key Asia Pacific markets.

Spotlight: Plant-based meat formats

While plant-based burgers mimicking beef have driven category growth, consumers are showing interest in plant-based alternatives to a wide variety of meat and seafood products. Mintel’s *U.S. Plant-based Proteins Market Report 2021* found that, among U.S. consumers who eat plant-based proteins, the level of interest in lesser-consumed formats, such as turkey, seafood, pork, and deli slices, reveals potential to push trial of these products above fifty percent.

Figure 3: Use of or interest in various meat alternative formats among U.S. consumers of plant-based proteins (February 2021)



Source: Kantar Profiles/Mintel – Mintel Reports US, Plant-Based Proteins, 2021.

Note: The survey base was 1,610 internet users aged 18+ who eat plant-based proteins (including from sources such as tofu and beans, in addition to meat alternatives). Participants were asked, “Which of the following formats/types of plant-based meat alternatives have you tried or would you be interested in trying?”

Taste and price

Taste and price remain major drivers of—and barriers to—plant-based meat consumption.

- Data from UBS Evidence Lab shows that taste curiosity is the primary driver behind trial in the U.S. and Europe—71% of consumers say they’re interested in trying plant-based meat because of taste.
- But only 30% of consumers believe that plant-based meat tastes as good as or better than conventional meat. Of consumers who plan to buy plant-based meat less often, 64% say it’s because they prefer the taste of conventional meat.
- Meanwhile, price parity with conventional meat remains a significant opportunity, as plant-based meat, on average, is twice as expensive per pound (according to GFI’s analysis of *The Power of Meat 2022*).

- According to Mintel research, 20% of consumers who don't eat plant-based proteins say it's too expensive, as do 26% of consumers who are eating plant-based proteins less often.

Consumer motivations

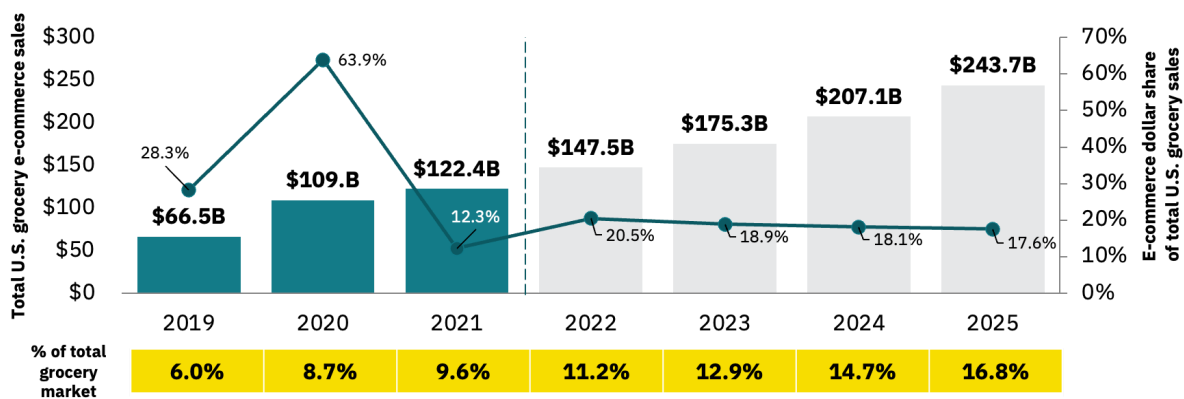
Recent consumer studies reveal important additional findings about consumer motivations:

- Consumer studies consistently find that the primary motivation for eating plant-based foods is health, although we know that the products must compete on price, taste, and convenience to be viable choices for the health-motivated. Mintel research on plant-based proteins reveals motivations among participants who are eating more plant-based proteins today than they were in 2020:
 - Fifty-eight percent are doing so because they feel it is healthier than animal-based meat.
 - Forty-six percent are doing so for variety in their meals.
 - Forty-five percent are actively trying to eat less meat.
- Meanwhile, among those who don't eat plant-based proteins, consumers report preferring conventional meat as the primary reason (66 percent), followed by plant-based proteins being too expensive (20 percent), and not having enough appetizing options (18 percent). Only 7 percent of these consumers said that their perception of animal-based protein as healthier is a reason for not eating plant-based proteins.
- Mintel research also shows that consumers who purchase plant-based proteins are seeking not only price parity but cleaner labels and convenient meal solutions:
 - Sixty-two percent would buy more meat alternatives if they were less expensive.
 - Sixty percent would eat more meat alternatives if they were less processed. (Still, 40 percent agree that processed meat alternatives are healthier than animal-based meat.)
 - Fifty-five percent would like to see more prepared foods made with meat alternatives.
- Data from Mattson indicates that, for consumers who are choosing to eat plant-based foods more often, **environmental concerns are rising in importance**. This suggests that environmental concerns may help to drive additional consumption in the future. As time goes on and concerns around climate change grow, the sustainability aspect of plant-based foods may become an increasingly important driver of consumption.

Online sales

As the Covid-19 pandemic disrupted foodservice and retail distribution channels, many brands turned to online distribution, an option that will likely continue to appeal to consumers. Online grocers or delivery services such as Amazon, InstaCart, Whole Foods, Thrive Market, PlantBelly, GTFO Its Vegan!, and Vegan Essentials continue to make plant-based products more accessible to consumers regardless of where they live.

Figure 4: Total U.S. grocery e-commerce dollar sales and share of total: Historical and projected (2019–2025)



Source: eMarketer, August 2021.

An **eMarketer forecast** reveals that U.S. digital grocery sales in 2020 grew 63.9 percent over 2019 and another 12.3 percent in 2021, reaching \$122.39 billion. Sales are predicted to nearly double by 2025, reaching \$243.67 billion.

eMarketer predicts that nearly 161 million people will be online grocery buyers by 2023. While the trend toward online sales was already underway, Covid-19 certainly hastened the shift. While consumption of plant-based proteins has increased across all generations in the past year, younger consumers are the **most likely** to purchase plant-based products. Younger consumers are also **more likely** to shop for groceries online, making online discoverability a key opportunity for plant-based brands to attract new customers.

Global retail sales overview

The plant-based food industry has established itself around the globe, with plant-based meat and milk products accessible to consumers on every continent. We are providing global sales

data from Euromonitor International for a perspective on the growth of global plant-based sales.

Global dollar sales of plant-based meat grew 17 percent in 2021 to \$5.6 billion, and global dollar sales of plant-based milk grew 14 percent to \$17.8 billion. Below are more details on plant-based meat and plant-based milk dollar sales and dollar share at global and regional scales.

Box 4: Global retail market data collection

Euromonitor is one of few providers of standardized retail sales data across global regions. The company assembles data through a combination of desk research, store checks, and trade surveys. Desk research relies on data and insights from a variety of sources:euromonitor

- Governmental and official sources
- National and international trade press
- National and international trade associations
- Industry study groups and other semiofficial sources
- Company financials and annual reports
- Broker reports
- Online databases
- Financial, business, and mainstream press

Store checks are used to gather data on these key factors:

- **Place:** products tracked in all relevant channels—selective and mass, store and non-store
- **Product:** innovations in products, pack sizes, and formats
- **Price:** brand price variations across channels and comparison with private-label pricing
- **Promotion:** marketing and merchandising trends, offers, discounts, and tie-ins

Trade surveys supply additional or missing data:

- Fill gaps in available published data per company
- Generate a consensus view of the size, structure, and strategic direction of a category
- Access year-in-progress data where published sources are out of date
- Evaluate expert views on current trends and market developments

Combined, these methods enable Euromonitor to assemble a rigorous dataset that provides a global perspective on plant-based meat and plant-based milk sales.

Note: Data is based on Euromonitor’s “meat and seafood substitutes” category, which includes chilled, frozen, and shelf-stable products.

Note that data may differ from previous reports. In previous reports, this Euromonitor category also included tofu (now a standalone subcategory) and previous reports refined graphs to display only estimated plant-based meat sales.

Figure 5: Estimated global plant-based meat retail market overview

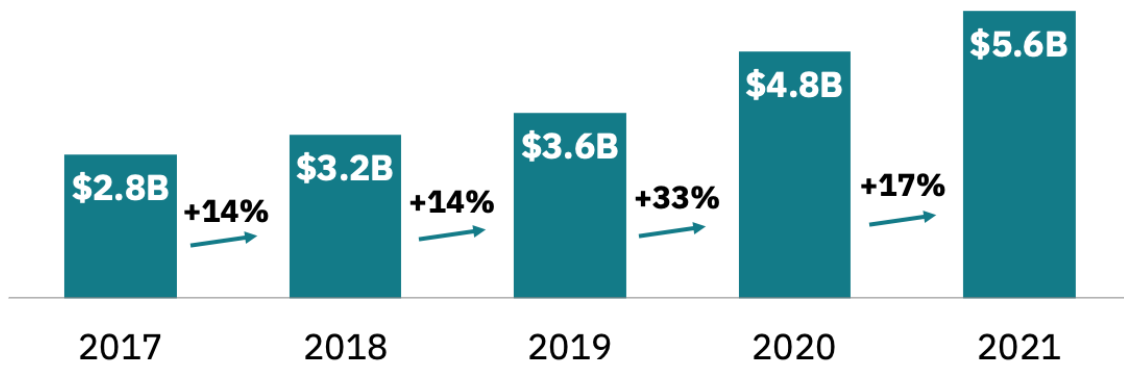


Figure 6: Estimated global plant-based meat retail dollar sales and dollar sales growth by region (2021)

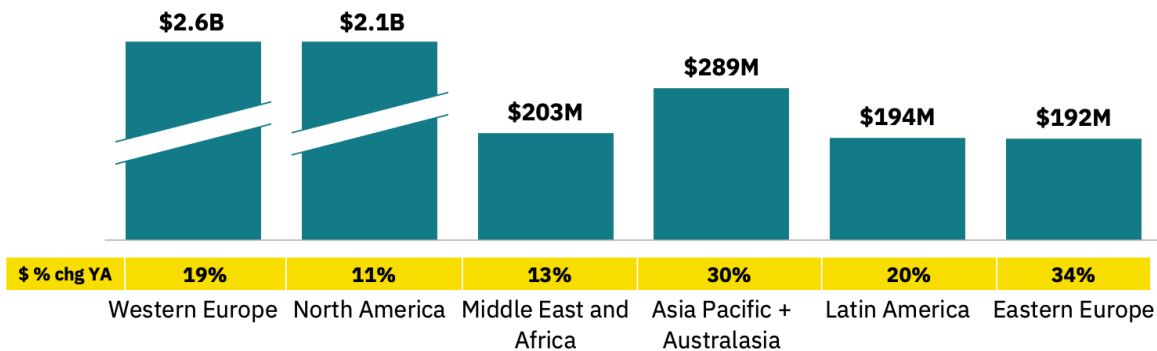


Figure 7: Global plant-based milk retail market overview

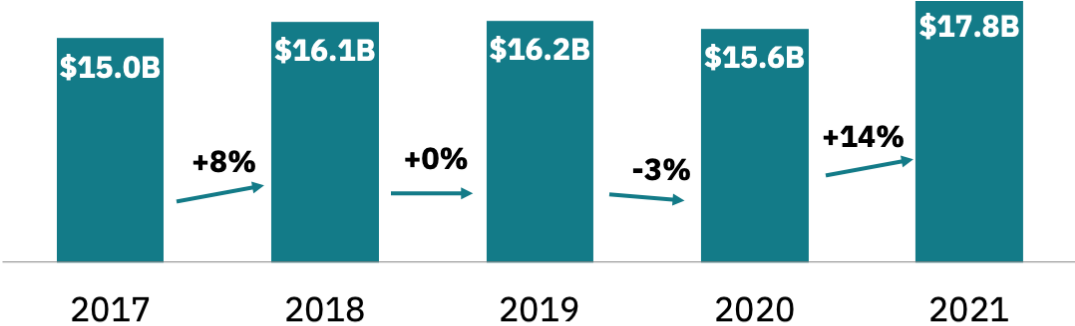
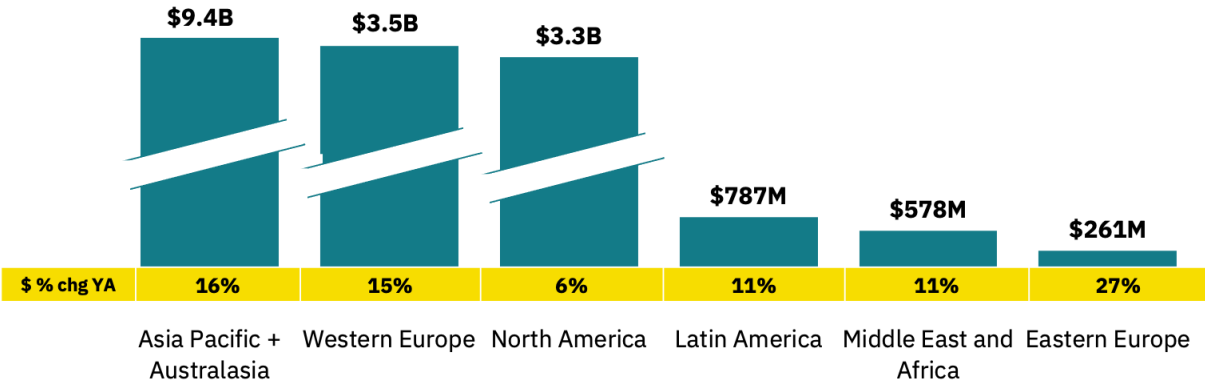


Figure 8: Global plant-based milk retail dollar sales and dollar sales growth by region (2021)



Source for Figures 5–8: Euromonitor Passport, GFI analysis.

Did we get something wrong? We'd appreciate your feedback via [this form](#).

Section 3

Investments



Section 3: Investments

Overview

Plant-based meat, egg, and dairy companies raised \$1.9 billion in 2021, bringing total investments in such companies since 1980 to \$6.4 billion. Unlike in the past, plant-based companies' invested capital did not increase from the prior year, though there was an uptick in liquidity events. With momentum growing for the entire alternative protein sector and total alternative protein investments increasing by 60 percent in 2021, investors are diversifying their allocations among alternative protein segments, with both fermentation and cultivated meat companies seeing large increases in investment in 2021. In addition, as plant-based companies continue to mature, some are electing to undergo liquidity events rather than seeking large private capital raises. Plant-based companies saw \$2 billion of liquidity events in 2021, compared with \$15 million in 2020. These included Oatly's initial public offering (IPO) and the acquisition of Vivera by JBS.

2021 brought many standout funding rounds:

- **Impossible Foods** met their record raise from 2020, raising another \$500 million in November, bringing their total invested capital to \$2 billion.
- **NotCo**, a Chilean plant-based company that leverages AI algorithms to craft plant-based dairy and meat, raised **\$235 million** in a Series D round at a valuation of \$1.5 billion.
- Australian plant-based food company **v2food** secured **\$110 million** in a Series B round, which they intend to use to accelerate their global expansion, particularly in China.
- Singapore-based **Next Gen Foods**, maker of the TINDLE plant-based chicken, raised a record-breaking \$30 million seed round, nearly tripling the size of the next-largest seed round raised by an alternative protein company.
- Plant-based seafood continued to gain momentum, with **Gathered Foods**, maker of Good Catch, securing \$26 million in a bridge funding round, and **New Wave Foods** raising an \$18 million Series A round.
- **Fazenda Futuro** (internationally branded **Future Farm**), a Brazilian plant-based food company, raised about \$58 million (300 million Brazilian reais) in a Series C round. The company reached a market value of about \$418 million (2.2 billion reais) with the investment.

While plant-based companies continued to raise sizable equity rounds, nondilutive financing was nearly absent. Only \$2.5 million of publicly disclosed debt was raised by such companies in 2021. While this may be partially due to less frequent disclosure of debt financing, as well as the relative nascency of the industry's life cycle, nondilutive capital is a critical type of financing

that companies may need to turn to in coming years. As companies shift into commercial-scale production by building or leasing manufacturing facilities and equipment, nondilutive capital—including various forms of debt, project financing, and infrastructure and equipment leasing—will offer benefits over dilutive equity financing.

Funding alternative proteins as a climate solution

While alternative protein investments have grown at an impressive rate, they remain a miniscule fraction of the trillions of dollars that have been invested globally in climate technology companies as a whole. In 2021 alone, private capital in earlier stage climate technology companies amounted to \$47 billion.



Alternative proteins are only just beginning to see a much-needed diversification of funding types and sources. As climate technology industries like renewable energy and electric vehicles have matured, they have attracted a wide array of investment beyond venture and private equity capital, including government funding, funding raised through public equity and debt markets, and project finance, that is not captured in the \$47 billion private capital total. Indeed, renewable energy and electric vehicle investments significantly overshadow alternative protein investments relative to the climate mitigation potential of each of these industries, which illustrates the underinvestment in alternative proteins as a climate solution.

Table 4: Plant-based food company investment (1980–2021) (U.S. and global)

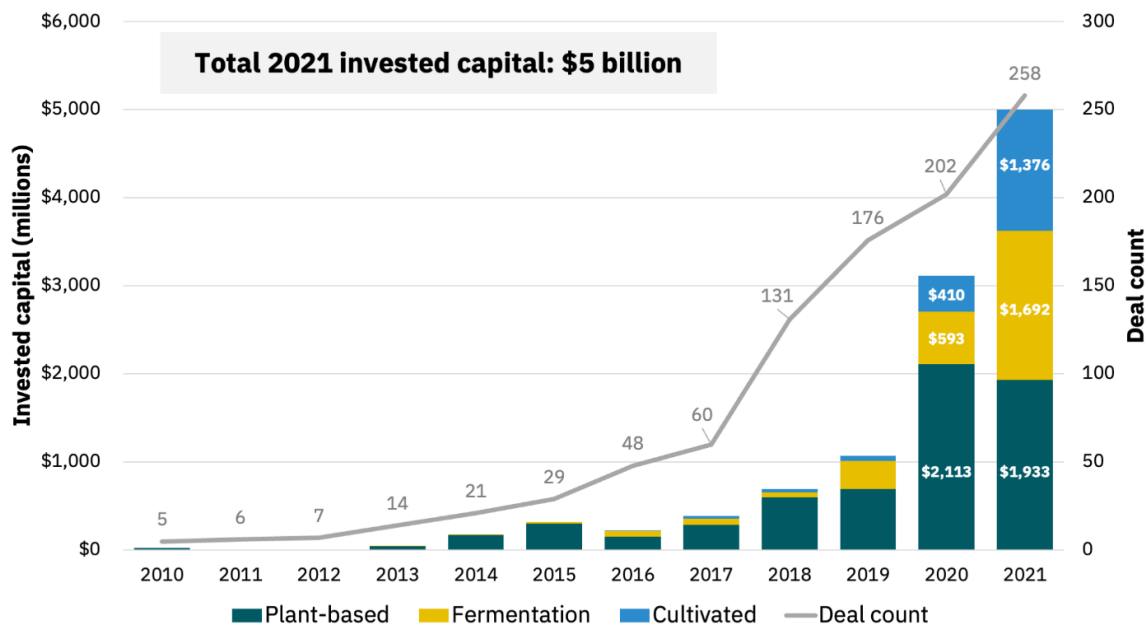
| | 2021 | 1980–2021 | Highlights |
|------------------------------------|---------|-----------|---|
| Total invested capital | \$1.93B | \$6.36B | 2021 invested capital represented 30% of all-time investment. |
| Invested capital deal count | 140 | 621 | 2021’s largest investment was \$500 million raised by Impossible Foods. |
| Unique investors | 312 new | 1,093 | The number of active unique investors grew 40% in 2021 from 2020. |
| Liquidity event capital | \$1.93B | \$25.0B | Oatly’s IPO in 2021 raised \$1.43 billion. |

| | | | |
|--------------------------------|-------|--------|---|
| Liquidity event count | 19 | 91 | |
| Other financing capital | \$31M | \$158M | The vast majority of other financing events are private investments in public equity (PIPEs). |
| Other financing count | 2 | 9 | |

Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts. See Box 5 for GFI’s data collection methodology and definitions of “invested capital,” “investment,” “liquidity event,” and “other financing.”

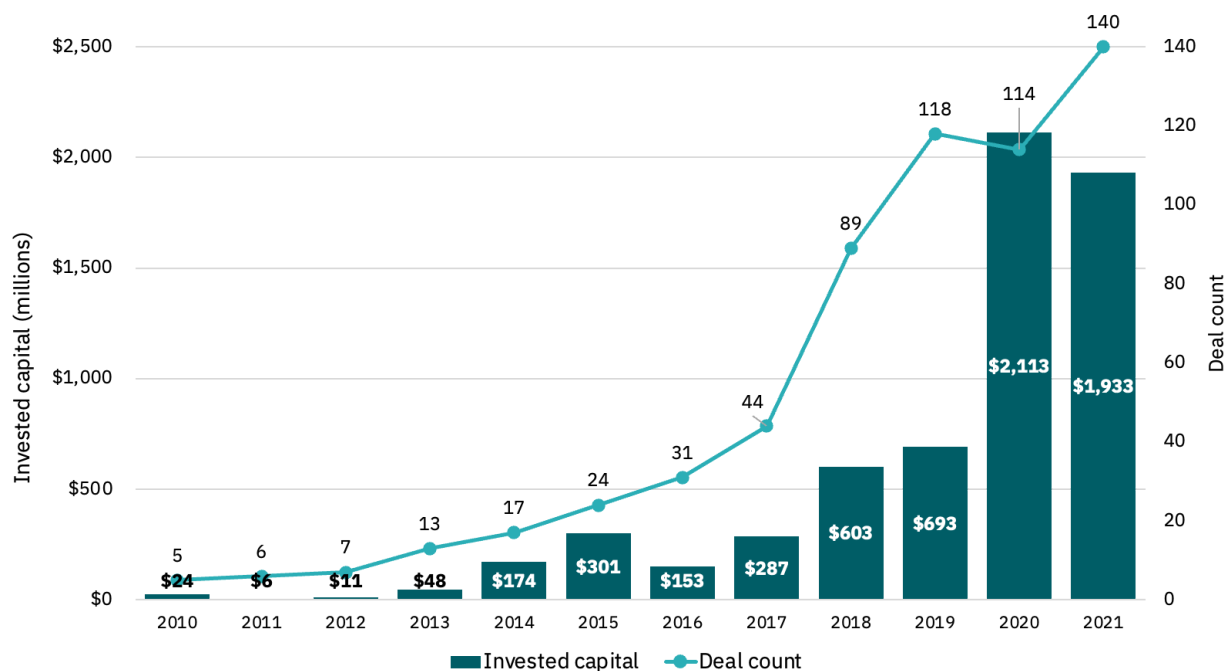
Figure 9: Annual global alternative protein investment trend (2010–2021)



Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts.

Figure 10: Annual global investment in plant-based companies (2010–2021)



Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts.

Box 5: Data collection methodology

GFI conducted a global analysis of plant-based meat, egg, and dairy companies using data from PitchBook. Our analysis uses a list we custom-built in PitchBook of companies that focus primarily on plant-based meat, egg, or dairy products or providing services to those who produce them. Our analysis excludes companies involved in plant-based products but not as their core businesses and companies using plant-based ingredients other than to create or enable alternative meat, egg, and dairy products. Some companies included in our list may also offer products or services that apply to another protein category. For example, the \$200 million **Eat Just** raised in March 2021 for use across their product lines and the \$267 million raised for their GOOD Meat division in the funding round completed in September 2021 are categorized under cultivated meat. All other Eat Just funds raised are

categorized under plant-based. Companies focused primarily on plant molecular farming are excluded.

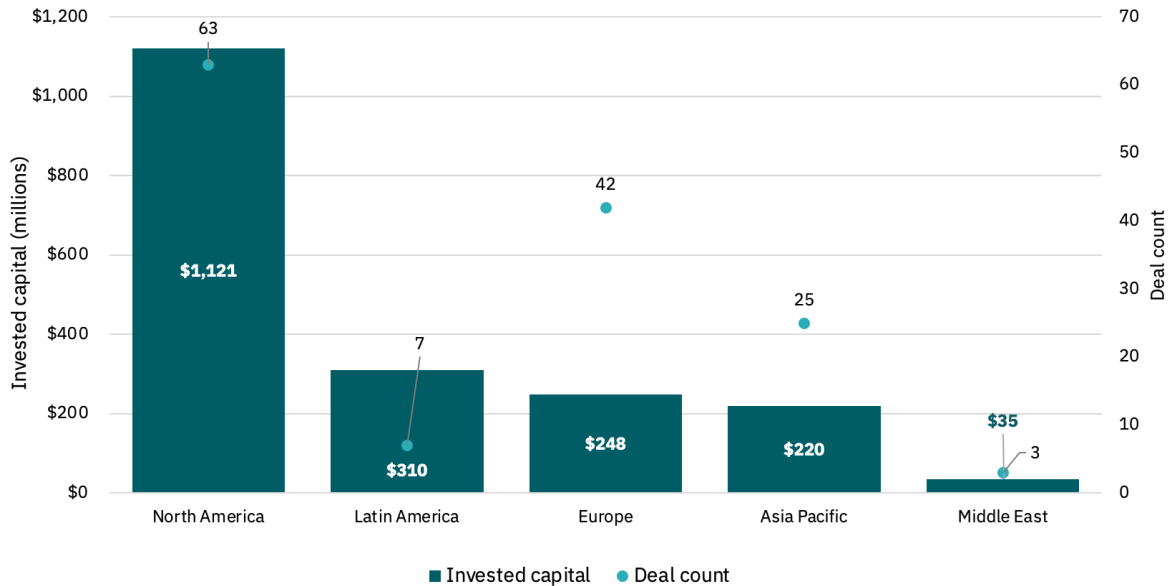
PitchBook profiled 567 plant-based companies, of which 251 have disclosed deals. Of these 251 companies, 213 have deals with publicly disclosed amounts. Because these aggregate calculations account for only companies with deals and deal sizes disclosed to PitchBook, they are conservative estimates.

For the purposes of this report, *invested capital/investment* refers to accelerator and incubator funding, angel funding, seed funding, equity and product crowdfunding, early-stage venture capital, late-stage venture capital, private equity growth/expansion, capitalization, corporate venture, joint venture, convertible debt, and general debt completed deals. *Liquidity events* refers to mergers, acquisitions, reverse mergers, buyouts, leveraged buyouts, and IPOs, while *other financing* refers to subsequent public share offerings and private investment in public equity. We do not include capital raised through a SPAC IPO until the entity has merged with or acquired a target company.

Please note that the figures published in this report may differ from prior figures published by GFI as we continually improve our dataset.

Geographical distribution

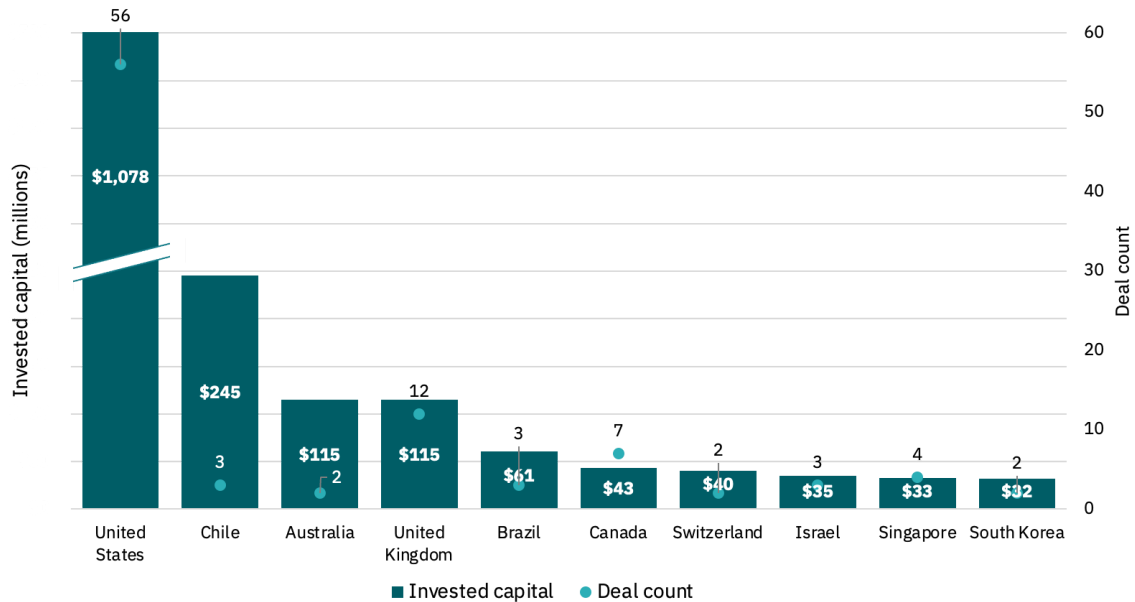
Figure 11: Investments in plant-based companies by region (2021)



Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts. North America includes Canada and the United States only. Latin America includes Mexico, South America, and Central America.

Figure 12: Investments in plant-based companies: Top 10 countries (2021)



Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts.

Deal types and key funding rounds





Table 5: Deal type summary statistics (2010–2021)

| Deal type | Median | Minimum | Maximum | Count |
|--|--------|---------|---------|-------|
| Angel | \$280K | \$10K | \$6M | 42 |
| Seed | \$2M | \$50K | \$30M | 94 |
| Early-stage VC (uncategorized) | \$2M | \$30K | \$23M | 84 |
| Series A/A1/A3 | \$5M | \$350K | \$29M | 69 |
| Series B/B1/B2/B3 | \$18M | \$250K | \$335M | 26 |
| Series C/C1 | \$46M | \$10M | \$90M | 12 |
| Series D | \$104M | \$56M | \$235M | 5 |
| Series E/E1 | \$57M | \$17M | \$300M | 5 |
| Series F/G/H | \$55M | \$23M | \$500M | 5 |
| Late-stage VC (uncategorized) | \$5M | \$50K | \$500M | 47 |
| PE growth/expansion (uncategorized) | \$15M | \$130K | \$200M | 30 |
| Corporate | \$5M | \$160K | \$75M | 12 |
| Equity and product crowdfunding | \$80K | \$10K | \$6M | 39 |
| General debt | \$3M | \$20K | \$80M | 17 |

Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts. These figures represent summary statistics of invested capital rounds with disclosed deal amounts. Deal count includes rounds with undisclosed amounts. Due to their limited number and/or size, this table excludes accelerator and incubator, capitalization, convertible debt, Series 1, Series 2, and joint venture rounds. It also excludes uncategorized rounds.

Figure 13: 2021 key funding rounds

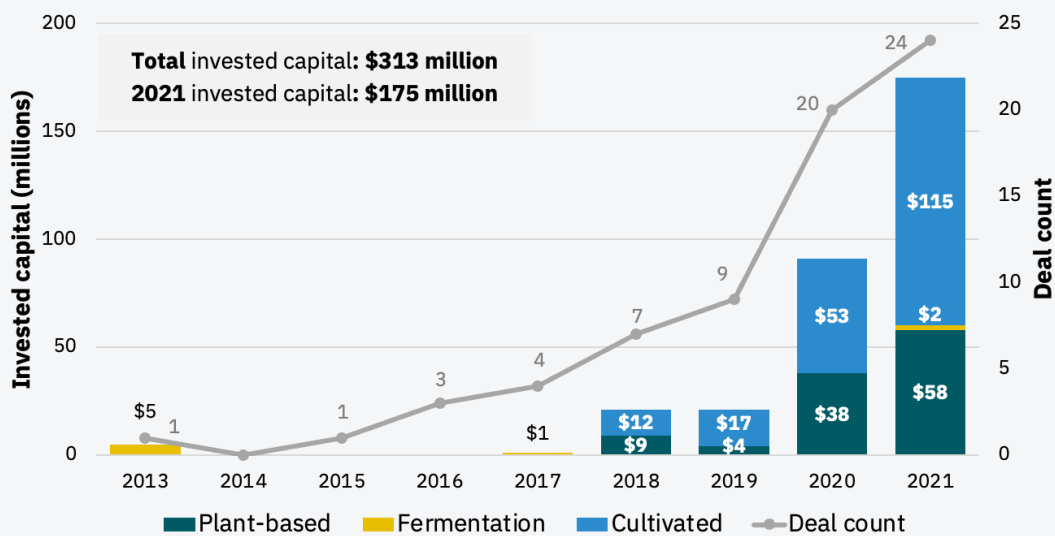
| Late-stage VC | | | Private equity | | Series E |
|--|--|---|--|---|--|
|  \$500M |  \$75M |  \$29M |  \$31M |  \$23M |  \$57M |
| Series D | | Series C | | | |
|  \$235M |  \$65M |  \$58M |  \$52M |  \$24M | |
| Series B/B2 | | | | | |
|  \$110M |  \$50M |  \$40M |  \$26M |  \$21M |  \$17M |
| Series B/B2 (continued) | | Series A | | | |
|  \$10M |  \$9M |  \$29M |  \$27M |  \$25M |  \$21M |
| Series A (continued) | | | | | |
|  \$19M |  \$19M |  \$19M |  \$18M |  \$16M |  \$15M |
| Series A (continued) | | Seed | | | |
|  \$14M |  \$11M |  \$30M |  \$6M | | |
| Early-stage VC | | General debt | | | |
|  \$23M |  \$7M |  \$2.5M | | | |

Source: GFI analysis of data from PitchBook Data, Inc.
 Note: Data has not been reviewed by PitchBook analysts.

Box 6: Alternative seafood catching a wave

Despite their relative nascency, plant-based and cultivated seafood companies are increasingly prominent on investors' radars. Investment activity in alternative seafood companies has seen steady growth over the past four years. To learn more about the alternative seafood industry, please refer to GFI's [Industry Update: Alternative Seafood](#).

Figure 14: Annual investment in alternative seafood companies (2013–2021)



Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts. Invested capital includes accelerator and incubator funding, angel funding, seed funding, equity and product crowdfunding, early-stage venture capital, late-stage venture capital, private equity growth/expansion, capitalization, corporate venture, joint venture, convertible debt, and general debt completed deals.

In 2021, alternative seafood companies saw record investments, raising \$175 million, nearly double the total investment in 2020. This brought total investments to \$313 million. Cultivated seafood companies accounted for the majority of raises, both in 2021, when they summed to \$115 million and accounted for 66 percent of alternative seafood investments, and from 2013 to 2021, when cultivated seafood company investments accounted for 63 percent of total alternative seafood investments. We expect investments to continue to rise in years to come.

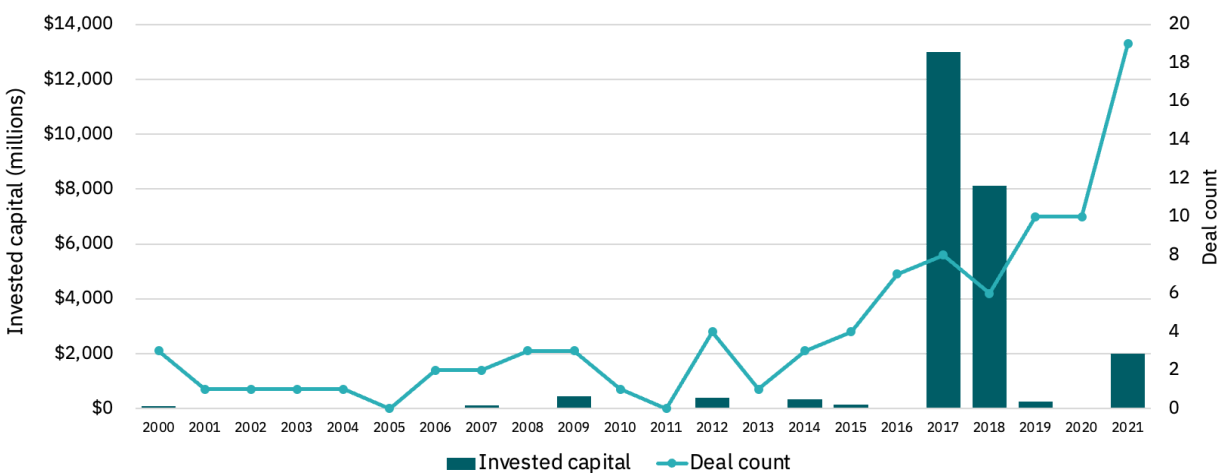
Liquidity events

Several meaningful liquidity events, also known as exits, took place in 2021 among plant-based companies. In total, there were 19 disclosed liquidity events, five of which had disclosed deal sizes summing to \$2 billion. Overall, five companies went public via an IPO and two did so via reverse mergers. Ten companies underwent a merger or acquisition.

Notable liquidity events included the following:

- Swedish plant-based milk company **Oatly** raised \$1.4 billion through an **IPO** on the Nasdaq Stock Market.
- Plant-based meat company **Vivera**, Europe’s third-largest plant-based food company, was **acquired** for \$415 million by **JBS**, which provides further evidence that major meat companies recognize and are capitalizing on the consumer shift to alternative proteins.
- Plant-based dairy company **Follow Your Heart** was acquired for an undisclosed amount by **Danone**, which is also responsible for the largest disclosed plant-based liquidity event to date. Danone acquired WhiteWave Foods, a plant-based milk market leader that operated the Silk brand, for \$12.5 billion in 2017.
- **Dr. Praeger’s Sensible Foods** was acquired by Vestar Capital Partners and Constitution Capital Partners through a leveraged buyout for an undisclosed amount.
- German company **Veganz** raised \$55 million through their IPO on the Deutsche Boerse AG Stock Exchange.

Figure 15: Plant-based food liquidity events (2010–2021) (U.S. and global)



Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts.

Other financing

In addition to more traditional financing methods, some public companies pursue financing paths such as subsequent public share offerings and private investment in public equity (PIPE). Plant-based meat, seafood, egg, and dairy companies raised a disclosed \$158 million across nine deals between 2019 and 2021, including a disclosed \$31 million across two deals in 2021.

Table 6: Plant-based food other financing events (2019–2021) (U.S. and global)

| Company | Year | Amount (\$M) | Financing type |
|--------------------------------|------|--------------|-----------------------------------|
| Else Nutrition Holdings | 2019 | \$56 | PIPE |
| Beyond Meat* | 2019 | \$40 | Public investment second offering |
| The Very Good Butchers | 2020 | \$10 | PIPE |
| The Very Good Butchers | 2020 | \$9 | PIPE |
| Modern Meat | 2020 | \$3 | PIPE |
| Else Nutrition Holdings | 2020 | \$4 | PIPE |
| Else Nutrition Holdings | 2020 | \$6 | PIPE |
| Modern Meat | 2021 | \$1 | PIPE |
| The Very Good Butchers | 2021 | \$30 | PIPE |

Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts.

*Of the total \$520 million raised by Beyond Meat through a public investment secondary offering in 2019, the total proceeds to the company were \$40 million and to the selling shareholders \$480 million. We have used only proceeds to the company in this table.

Investors

Table 7: Most active investors in plant-based food by deal count (2021) (U.S. and global)

| Investor | Investor type | Headquarters | 2021 deal count | Total deal count |
|----------------------------|-----------------------|------------------------|-----------------|------------------|
| Big Idea Ventures | Venture capital | New York, USA | 10 | 27 |
| SOSV / IndieBio | Venture capital | Princeton, USA | 10 | 26 |
| Unovis Asset Management | Venture capital | New York, USA | 9 | 34 |
| Kale United | Venture capital | Stockholm, Sweden | 7 | 22 |
| Stray Dog Capital | Venture capital | Leawood, USA | 6 | 29 |
| VegInvest | Venture capital | New York, USA | 6 | 19 |
| Capital V | Venture capital | | 5 | 12 |
| Lever VC | Venture capital | Brooklyn, USA | 5 | 8 |
| Siddhi Capital | Venture capital | Cherry Hill, USA | 5 | 14 |
| Sustainable Food Ventures* | Venture capital | Raleigh, USA | 5 | 5 |
| Alwyn Capital | Impact investing | Brooklyn, USA | 4 | 5 |
| Blue Horizon Corporation | Venture capital | Zurich, Switzerland | 4 | 27 |
| Brinc | Accelerator/incubator | Hong Kong, Hong Kong | 4 | 8 |
| Clear Current Capital | Venture capital | Hutchinson Island, USA | 4 | 16 |
| AgFunder | Venture capital | San Francisco, USA | 3 | 5 |
| Astanor Ventures | Impact investing | London, United Kingdom | 3 | 5 |
| CPT Capital | Venture capital | London, United Kingdom | 3 | 18 |
| Good Seed Ventures | Venture capital | Rheine, Germany | 3 | 5 |
| K3 Ventures* | Venture capital | Singapore, Singapore | 3 | 3 |
| Sand Hill Angels | Angel group | Mountain View, USA | 3 | 8 |

Source: GFI analysis of data from PitchBook Data, Inc.

Note: Data has not been reviewed by PitchBook analysts. “Most active investors in 2021” includes any organization that made three or more publicly disclosed investments in a plant-based food company during the calendar year 2021.

*Indicates funders that made disclosed investments in plant-based meat, eggs, and dairy for the first time in 2021.



“Helping set a path to net zero will require the development and advancement of more sustainable solutions to meet the world’s needs, from energy to food. Shifting diets requires both capital to fund new companies and technologies, and an improved supply chain infrastructure to enable the scaling of the industry. Given the relatively nascent nature of other protein solutions, innovation and infrastructure to support the plant-based sector is one of the most promising near-term paths to reducing food and agriculture-related emissions.”

—Erik Oken, global chairman, investment banking, at J.P. Morgan

The Good Food Institute is not a licensed investment or financial advisor, and nothing in the state of the industry report is intended or should be construed as investment advice.

*Are we missing your company? Did we get something wrong? We’d appreciate your feedback via **this form**.*

Section 4

Science and technology



Section 4: Science and technology

The past few years have ushered in a new era of plant-based meat, seafood, eggs, and dairy with a focus not on vegetarians and flexitarians but on all consumers. Such a shift in consumer focus requires reconceptualizing the entire endeavor. Now, most plant-based meat companies are focused on creating products that match the taste, texture, and full sensory profile of animal-based meat.

Recent advancements in protein sourcing, ingredient optimization, and manufacturing methods have significantly improved plant-based products:

- Crop breeding specifically for plant varieties with high protein content and functionality.
- Development of biodiverse plant protein supply chains for specialty crops, such as fava beans and chickpeas.
- Scaled facilities and equipment for protein fractionation and functionalization to meet consumer demand.
- Optimized texturization through high-moisture extrusion, shear cell, and 3D printing.



For a comprehensive overview of the current state of the science, including a deep dive into key opportunities for technological development, check out GFI's primer on [the science of plant-based meat](#) and a [recent review by McClements and Grossman](#).



For resources specific to plant-based dairy, please refer to [GFI India's plant-based dairy webinar](#), [GFI's seminar on colloid approaches to plant-based milk](#), and a review on [plant-based milks by McClements and colleagues](#).



For information about applications of egg alternatives and optimizing functional properties, please see GFI's technical paper on [plant-based egg alternatives](#).



For more technical details about plant-based seafood, see the [recent review by Kazir and Livney](#).

Ingredient innovation and optimization: Advances in crop development and processing techniques

Historically, accessibility and convenience of functional ingredients have driven formulation decisions for plant-based meat, egg, and dairy products—in particular, the availability of side streams from other food industries, such as soy protein left over from soy oil harvesting. But if plant-based meat, eggs, and dairy are to reach taste and texture parity with conventional products, current plant protein sources must be improved and new plant protein sources explored. Optimization of current plant protein sources includes breeding specifically for

protein content and functionality, while exploration of new plant protein sources can help increase biodiversity and expand formulators' inventories with diverse protein functionalities.

Crop breeding for higher protein yield and improved functionality

Traditional crop breeding aims to enhance yield and resilience to pests, disease, or drought. Efforts that instead emphasize the content and functionality of ingredients, especially proteins, have advanced plant-based meat, egg, and dairy categories. Improving nutrient density and ingredient functionality significantly reduces downstream processing, costs, and energy use. To read about companies that made advancements in crop breeding and genetics optimizing in 2021, see the **Seeds and crops** section of this report.

Crops are also being bred to produce proteins not native to plants, including animal proteins like casein. "Molecular farming," as the technology is dubbed, uses crop plants as recombinant protein production hosts to offer the benefits of minimal processing, less expensive equipment, and fewer downstream purification costs. Molecular farming saw the following advances in 2021:

- Nobell Foods (formally Alpine Roads) is creating **casein with genetically engineered soybean crops**.
- Moolec Science is using **genetically engineered oat and wheat to produce whey and ovum proteins** that will be used to make dairy and egg alternatives, respectively.
- Tiamat Sciences is leveraging **molecular farming to make animal-free growth factors for cultivated meat media**.






For more information about molecular farming and the advantages of producing food ingredients with it, refer to GFI's concept solution on using **plants as a recombinant protein expression platform for functional foods** or GFI's **fermentation state of the industry report**.

Novel crops used as alternative protein inputs

Until recently, the vast majority of plant-based products relied on proteins from commodity crops, such as soy, wheat, or pea—crops that historically have not been optimized for protein content and functionality. Novel protein sources expand the protein toolbox for formulators to create innovative products and diverse food supply chains. Unilever announced their focus on exploring **plant proteins beyond soy, pea, and wheat to expand their portfolio**. To read about companies that made advancements in novel protein sources in 2021, see the **Seeds and crops** section of this report.

There were a number of advances in creating consumer products from less commonly used and novel protein sources. Table 8 shows diverse protein sources used to develop analogue plant-based products in 2021.

Table 8: Company updates for plant-based products made with novel protein sources

| Protein source | Product use | Company update in 2021 |
|-------------------|---|--|
| Seaweed |  | New Wave, Maverick, Akua |
| |  | LIVEKINDLY with The Dutch Weed Burger |
| Duckweed |   | Plantible |
| Rice |  | Birds Eye |
| Peanut |  | HaoFood |
| Mung bean |  | WTH Foods |
| |  | JUST |
| Lentil |  | Evo Foods |
| Lupin |  | Nabati Foods |
| Fava bean |  | Perfeggt |
| Chickpea |  | InnovoPro, Peggs |
| |  | Wellme |
| Sesame |  | The Planting Hope Co. |
| Sorghum |  | alt foods (with millet, amaranth, and oats) |
| Bambara groundnut |  | WhatIF Foods BamNut Milk |
| Potato |  | Loca Food, So Delicious |
| Hemp |  | Sustainable Foods, Sweet Earth Foods (with fava bean and pea proteins) |
| |  | Grounded Foods |
| Spent grain |  | Terra Bio |
| |   | AB InBev with EverGrain |
| Sunflower |   | Planted |

Legend of product uses



Seafood



Meat



Dairy



Eggs



Byproduct (e.g., from the side stream of a large production)

Aquatic crops such as seaweed, microalgae, and duckweed have become increasingly popular owing to their sustainable cultivation, high protein content, good protein functionality, and nutrient content. While aquatic plants such as seaweed are covered in this report, microalgae that are grown more similarly to other microbes, like fungi and bacteria, are covered in GFI's **fermentation state of the industry report**.

Additionally, a number of plant-based egg products emerged this year leveraging unique protein sources, such as lentil, lupin, mung bean, and chickpea. All the companies listed in Table 8 developed liquid egg products used for scrambles, quiches, and other dishes, except for InnovoPro, which developed a chickpea-based egg white replacement. In 2021, other companies aimed to replicate a whole hard-boiled egg, such as **Migros**, **OsomeFood**, and **Crafty Counter**, or a whole fried egg, such as **Float Foods** and **YO-Egg**.



Proteins obtained from the byproducts of other food productions can reduce food waste and food production costs. Accordingly, companies are creating plant-based products with proteins from spent brewing grain, cashew fruit, and sunflowers.

- Some companies are using plant-based food waste to create fermentation-derived meat, such as **Luya Foods** (from tofu waste) and **Arbiom** (from wood waste).
- Other companies or organizations, such as **ReGrained** and **Nanyang Technological University**, are using byproducts from alternative protein or grain production to create high-value upcycled foods.

Innovations in protein fractionation and functionalization

Protein fractionation and functionalization (the process of enriching raw plant materials for protein content and optimizing protein properties through downstream processing) are underexplored areas for innovation, especially for unconventional plant protein sources. Some companies made advancements in process technologies for these unconventional sources, enabling them to be produced at scale:

- Meelunie announced plans to open a **facility in 2022 that applies a breakthrough technology to produce fava bean protein isolate and other fava bean ingredients**.
- Branston built a **factory with equipment that creates functional, clean-label potato protein from low-value potatoes**.

Commercial scalability of plant protein fractionation saw vast improvements in 2021, especially for pea protein, paving the way toward affordable and readily available alternative proteins. To read about companies that made advancements in ingredient processing in 2021, see the **Intermediate ingredient processing** section of this report.

A common theme among these large factories is that companies are including sustainable technology, such as renewable energy, methods that reduce resource use, and valorization of side streams to mitigate food waste.

Structuring innovations to create whole-muscle products

Whole-muscle products are challenging to mimic because of their fibrous textures and integrated pockets of fat. In 2021, several companies launched or announced new whole-muscle products, demonstrating progress toward overcoming this challenge:

- Lightlife launched a **whole-muscle plant-based chicken** at Whole Foods.
- Top Tier Foods announced that their **plant-based wagyu beef** would be available in the United States at trial locations.
- Green Rebel Foods launched their **plant-based whole-cut steak** in Indonesia.
- Juicy Marbles created a **whole-cut plant-based filet mignon** using a technology that aligns and layers soy and wheat protein fibers from the bottom up and applies sunflower oil to achieve a marbled texture.
- Wamame Foods announced a collaboration with Merit Functional Foods, Wismettac Asian Foods, and Winecrush Technology to launch Wamame's **plant-based Waygu beef** globally.
- Sundial Foods announced plans to release a **whole-cut plant-based chicken wing with skin, meat, muscle, and bone** in the United States by 2022.
- Alfred's FoodTech developed a new platform to **make continuous, fibrous tissue from emulsions that can be used for whole-cut plant-based meat** containing chickpea, pea, and soy proteins.
- Planted announced expanding their portfolio to include **vegan schnitzel and whole-cut meats from oat, pea, and sunflower proteins**.
- Umiami started pilot-scale production of **whole-muscle plant-based cod and chicken fillets** using soybean and pea proteins and the company's proprietary texturization technology.

Extrusion technology

A number of companies claim proprietary technologies that achieve whole-muscle texturization. While new technologies emerge, extrusion is still a predominant method for

texturizing plant-based meat products (see **GFI's plant-based meat manufacturing guide** for more information). 2021 saw several advances in wet and dry extrusion technology:

- Givaudan launched a **new protein hub in Switzerland equipped with a development kitchen and a pilot plant with a high-moisture extrusion machine**.
- Givaudan also collaborated with Bühler Group to open a **plant-based protein innovation center in Singapore that uses dry and wet extrusion technologies** to produce 40 kilograms of plant protein per hour.
- Nestlé launched a **plant-based tuna alternative, Vuna, made with wet extrusion technology**.
- THIS revealed plans to launch a line of **plant-based meats made with high-moisture extrusion technology**.
- Chinese startup Hey Maet advanced development of **plant-based meats using pea, soy, and rice proteins and high-moisture extrusion**.
- Hooked Foods announced plans to launch their **plant-based shredded salmon product developed using wet extrusion technology** and containing omega-3 fatty acids.
- Bühler and food technology research institute Deutsches Institut für Lebensmitteltechnik **opened** the new Technology Center Proteins of the Future in Germany, which will provide state-of-the-art research, testing, and production infrastructure for the development of plant-based protein products.

While extrusion is effective for producing ground meat products, such as plant-based burgers, grounds, and sausages, its capacity to produce longer fibers—such as those required for whole-muscle products like plant-based steak or chicken breast—is limited. Novel methods for texturizing and structuring plant-based proteins are being developed as improvements to extrusion. These novel methods include shear-cell technology and 3D printing.

Shear-cell technology

Shear-cell technology creates fibrous texture by applying shear force to plant proteins between two cylindrical rotating plates. The commercialization of shear-cell technology has been spearheaded by the **Plant Meat Matters Consortium** at Wageningen University & Research in the Netherlands, with collaboration from strategic food industry players Avril, Ingredion, Givaudan, The Vegetarian Butcher, and Unilever, among others.

The only company currently deploying commercial shear-cell technology is **Rival Foods**, a 2019 spinoff from Wageningen University & Research. Rival Foods recently entered into a **partnership with LIVEKINDLY Collective** to create plant-based chicken through **shear-cell technology**.

Learn more about Rival Foods and their technology in GFI's *Science for Alt Protein* **webinar series**.



“Rival Foods investigates and develops all ways of scaling up Shear Cell Technology. Batchwise processing of plant-based ingredients, which can be designed in a semi-continuous throughput, provides numerous advantages in product quality, flexibility and efficiency. Rival Foods unique products are distinctive in its high quality sensorial attributes such as mouthfeel and juiciness and can be created from a wide variety of sustainable proteins.”

—Birgit Dekkers, co-founder of Rival Foods

3D printing

3D printing can improve manufacturing precision and flexibility, enabling the fabrication of highly sophisticated products that mimic whole-muscle meat cuts. Several startups are exploring 3D printing for applications in plant-based meat:

- SavorEat, an Israel-based company, is producing **plant-based eggs using 3D-printed cellulose-derived ingredients**. SavorEat also plans to test their **robot chef system that 3D-prints vegan burgers on demand** at U.S. universities in 2022.
- Redefine Meat launched **five new 3D-printed plant-based meat products** in Israeli restaurants, and their **whole cuts of vegan beef and lamb flank** were served in high-end restaurants in Germany, the Netherlands, the United Kingdom, and Israel.
- Revo Foods launched their **3D-printed plant-based salmon in Austrian supermarkets** and plans to release plant-based tuna and smoked salmon spread products in 2022.
- Cocuus is developing **3D-printing technology to create plant-based or cultivated ingredients** and created prototype 3D-printed ribeye and salmon.

Scaling end-product manufacturing to meet demand

To keep pace with consumer demands, companies are expanding their end-product manufacturing operations to include commercial-scale plant-based production factories as well as innovation hubs focused exclusively on improving end-product organoleptic properties and cost. In 2021, the following innovation hubs were announced:

- Growthwell Foods completed their new **innovation and R&D center in Singapore** with a **fully automated production line**, enabling scaled production and outreach into global markets.
- ADM opened a **plant-based innovative lab in Singapore** in response to consumer demand in Asia Pacific.
- Beyond Meat announced plans to create an **innovation hub in Shanghai**, expanding outside the United States for the first time.

Innovation hubs such as these will ramp up research and development with cutting-edge lab facilities and subject-matter experts. They will provide in-house resources that can quickly create and test new products with lab-, pilot-, and commercial-scale equipment; flavor-testing capabilities; and development innovations, such as automated production. To read about other companies that made advancements in scaling end-product manufacturing in 2021, see the **End-product manufacturing** section of this report.

Box 7: Development of plant-based fat alternatives in 2021

Animal fat is difficult to replicate with nonanimal lipids because of inherent differences in their molecular structures. In 2021, there were several notable advances to transform plant lipids into fats that more closely mimic animal fat:

- Motif FoodWorks announced their **extrudable plant-based oleogels that create marbling and texturing fats in plant-based meats**.
- Cargill partnered with Bflike, which uses **patent-pending vegan fat and blood platforms**, to create plant-based meat and fish alternatives.
- Time-Travelling Milkman, a spinoff of Wageningen University & Research and StartLife alumnus, revealed plans to scale their **plant-based dairy fat, a creamy unsaturated fat ingredient made from seed-extracted fat droplets**.
- Epogee, makers of a fat alternative derived from rapeseed oil that eliminates up to 92 percent of the calories from fat without taste or functional trade-offs, **announced a commercial release with Gatsby Chocolate** and expanded their product development and marketing efforts to provide solutions for the plant-based meat category.

Hybrid products, such as those made by Mission Barns and Melt&Marble, that combine fermentation-derived or cultivated fats with plant-based ingredients are also becoming more widely explored. See the **“Emergence of hybrid products”** subsection for more information.

Emergence of hybrid products

Alternative protein products are generally categorized as plant-based, cultivated, or fermentation-derived. However, a growing number of products are created through a combination of ingredients and processes across these three production platforms. The Impossible Burger, for example, is made from soy and other plant-based ingredients, as well as **fermentation-derived heme** protein (soy leghemoglobin) initially isolated from soy root nodules but now made through precision fermentation. Precision fermentation, the use of specially designed microbial hosts as “cell factories” for producing specific functional ingredients, is used increasingly by alternative protein companies such as Perfect Day and The EVERY Company (formerly Clara Foods) to produce ingredients including whey, casein, and egg proteins. New generations of hybrid products show immense promise at scale to decrease costs, increase end-product functionality and nutrition, and improve the organoleptic properties of alternative proteins. As companies strive to better deliver on desired sensory, nutritional, and functional attributes, we expect to see increasing hybridization of alternative protein products.

2021 saw the addition of several of these next-generation hybrid products:

- Cultivated fat producer Mission Barns partnered with plant-based startup **HEROTEIN in China** and **Silva Sausage in California** to launch hybrid meat products with cultivated and plant-based ingredients.
- Melt&Marble secured investment to develop **fermentation-derived fats for plant-based beef, pork, and other meat analogues**.
- Nestlé announced plans to create **cultivated meat with plant-based ingredients** in collaboration with cultivated meat startup Future Meat Technologies.
- Seawith, which uses **seaweed scaffolding to grow bovine cells for cultivated steak**, set a goal to have their product cost as low as \$3/kg by 2030.

GFI’s research grant program is catalyzing plant protein R&D

Additional scientific research is needed for plant-based meat to compete with conventional meat on taste, price, and accessibility. GFI works to close this gap through its research grant program and targeted outreach to policymakers, companies, scientists, and students. Since 2019, GFI has funded more than 30 projects spanning the core technology opportunity areas in plant-based product development. However, a strong need for substantially more research funding, infrastructure, and technical training programs remains.

The 2021 Competitive Research Grant Program focused on funding solutions for creating structured whole-cut meat and seafood products. With this program, six new grantees joined GFI’s plant-based projects: Dr. Xiaonan Sui, Dr. Luciano Paulino Silva, Dr. Harry Yu, Dr. Lutz Grossmann, Dr. Jay Park, and Dr. Fabiana Perrechil Bonsanto. The 2021 white space collaboration program focused on producing plant-based and fermentation-derived fats for use in plant-based meat, and grantees for this program will be announced in 2022.

The table below lists the open-access plant-based research projects funded by GFI within three key categories: crop optimization, ingredient processing, and end-product formulation and manufacturing.

Table 9: Plant-based research grants funded through GFI grant programs in 2021

| Focus area | Project | Principal researcher |
|-----------------------|--|----------------------------------|
| Crop development | Breeding peas and sorghum for plant-based meat | Dr. Dil Thavarajah |
| | Characterizing quinoa protein | Dr. Ofir Benjamin |
| | Valorizing agricultural side streams | Dr. Marieke Bruins |
| | Exploring cassava leaf proteins | Dr. Ana Carla Kawazoe Sato |
| | Scaling the cashew apple supply | Dr. Ana Paula Dionísio |
| Ingredient processing | Identifying pea protein off flavors | Dr. Jian Li |
| | Using red seaweed protein for plant-based meat | Beth Zotter Dr. Amanda Stiles |
| | Fermenting oat proteins | Mari-Liis Tammik |
| | High-pressure processing for plant proteins | Dr. Regine Stockmann |

| | | |
|--|--|-----------------------------|
| | Fermenting flavor bases | BZ Goldberg |
| | Characterizing bean proteins | Dr. Caroline Mellinger |
| | Improving plant protein functionality by germination and ultrafiltration: A case study on hemp seed protein | Dr. Martin Liu |
| | Development of standardized tests to facilitate plant-based meat creation | Dr. D. Julian McClements |
| End-product formulation and manufacturing | Integrating sensors into plant-based meat extrusion | Dr. Filiz Koxsel |
| | Engineering plant-based meat's microstructure | Dr. Mario Martinez |
| | Adding encapsulated fats to plant-based meat | Dr. Ricardo San Martin |
| | Developing functional protein fractions | Ms. Miek Schlangen |
| | Improving textured protein | Dr. Girish Ganjyal |
| | Developing shear-cell technology | Dr. Birgit Dekkers |
| | Making plant-based meat without extrusion | Dr. David Julian McClements |
| | Creating muscle-like structures from pulse proteins | Dr. Zata Vickers |
| | Texturizing proteins from red seaweed | Dr. Yoav Livney |
| | Connective tissue from plant fibers | Dr. Xiaonan Sui |
| | 3D printing pulses into fish | Dr. Luciano Paulino Silva |
| | Stacking plant protein sheets | Dr. Hanry Yu |
| | Self-aggregating proteins | Dr. Lutz Grossmann |
| | Melt-spinning marbled meat | Dr. Jay Park |
| Rice bran oil oleogels for plant-based meat | Dr. Chris Gregson | |

Section 5

Government and regulation



Section 5: Government and regulation

Regulatory overview

As consumer interest in plant-based foods continues to rise, companies must keep pace with the evolving laws and regulations that govern their products. Several states have passed laws censoring conventional meat and dairy terms on plant-based food labels, though many have been challenged, and no new laws were enacted in 2021. At the federal level, the U.S. Food and Drug Administration (FDA) is considering how to modernize food labels and how to label plant-based dairy and other plant-based foods. GFI continues to advocate clear, fair, and sensible regulations that put plant-based foods on a level playing field.

FDA updates

By the end of June 2022, FDA plans to issue draft guidance on the labeling of plant-based milk alternatives. In 2018, FDA issued a request for information (RFI), inviting comments on the use of terms such as “milk,” “yogurt,” and “cheese” on plant-based products. FDA received tens of thousands of comments in response to the RFI. GFI submitted a comment asserting that FDA should not prohibit the use of these terms on plant-based product labels so long as the label clearly conveys the nature of the product. GFI explained, “Terms such as ‘soy cheese’ and ‘almond milk’ have become well-established through continued and wide-ranging use by consumers, producers, and the government.” GFI also argued that these terms do not confuse consumers and restricting their use on plant-based product labels would violate the First Amendment. Although FDA has sought comment on dairy terms generally, the agency’s 2022 guidance is expected to address only plant-based milk products. Once FDA issues its draft guidance on plant-based milk labels in 2022, stakeholders will once again have the opportunity to submit comments to the agency. In addition, FDA announced in January 2022 that it plans to begin working on draft labeling guidance for a broader category of “plant-based alternatives to animal-derived foods.”

U.S. state regulation

In 2021, several state legislators introduced label censorship bills that would restrict the use of terms such as “meat,” “beef,” or “chicken” on plant-based products. Fortunately, no new label censorship laws were enacted.

Various groups continue to oppose label censorship laws, including GFI, the Plant Based Foods Association (PBFA), conservative think tanks such as the **Heritage Foundation**, and free speech groups. 2021 saw a renewed **legal challenge** to label censorship in **Oklahoma**, as well as continued litigation in **Louisiana**.

- In **Louisiana**, GFI and co-counsel the Animal Legal Defense Fund (ALDF) brought suit on behalf of Turtle Island Foods (d/b/a Tofurky), arguing that the state’s label censorship law violates First Amendment free speech principles and the Fourteenth Amendment right to due process. In March 2022, the court granted Tofurky’s motion for summary judgment. The court concluded that Louisiana’s law “impermissibly restricts commercial speech.”
- In **Oklahoma**, PBFA and Tofurky, represented by ALDF, brought a new suit challenging the state’s label censorship law after a judge denied PBFA’s motion for an injunction in a prior suit. The new complaint argues that Oklahoma’s law is vague, overly burdensome, and preempted by federal law.
- In **Arkansas**, a federal district court judge granted Tofurky a preliminary injunction, preventing the state from enforcing its label censorship law against the company on the grounds that the law likely violates constitutional free-speech protections. Tofurky has since asked the court to enjoin the state from enforcing the law against anyone, arguing that the law is invalid on its face. The court has yet to rule on that motion.
- In **Missouri**, a federal district court declined to grant Tofurky and GFI a preliminary injunction on the grounds that Missouri’s label censorship law was not likely to apply to Tofurky’s product labels. In 2021, a federal appeals court upheld the ruling, agreeing with the lower court’s determination that the law does not apply to Tofurky’s labels.

Challenging label censorship in California

In 2019, the California Department of Food and Agriculture notified plant-based dairy company **Miyoko’s Kitchen** that the labels the company used for their vegan butter violated California and federal law. The state instructed Miyoko’s to stop using a number of terms and phrases on the product label, including “butter,” “lactose free,” “cruelty free,” and “revolutionizing dairy with plants.” The state argued that use of the term “butter” was prohibited on the grounds that “butter” is already defined under federal law and the company’s product does not meet that definition. The state also claimed that use of the other terms improperly implied that the vegan butter was a bovine dairy product. In response to the warning, Miyoko’s sued the state in federal court in California. Miyoko’s argued that the state’s actions violated the First Amendment’s commercial speech protections.

In August 2021, the court determined that the state could not prohibit Miyoko’s from using these terms on their vegan butter. The court held that use of the term

“butter” on Miyoko’s product is not inherently misleading just because federal law has given “butter” a specific definition. The First Amendment, the court explained, protects speech regardless of whether it has been defined by the government. The court further held that the terms “lactose free” and “cruelty free” and the phrase “revolutionizing dairy with plants” on Miyoko’s vegan butter label are not misleading and are protected by the First Amendment.

Label censorship in Europe

In May 2021, the European Parliament withdrew a legislative amendment that would have severely restricted the use of dairy-related terms on plant-based products. The amendment would have banned terms such as “buttery” and “creamy,” imagery that “evokes” dairy, and packaging forms that resemble existing dairy packaging (such as a carton of milk or a tub of margarine). In less positive news from 2021, the French and Belgian national governments moved forward with introducing further restrictions on the labeling of plant-based meat and seafood within their own jurisdictions. GFI Europe has been working with allied organizations at both the EU and national levels to remove these damaging proposals.

Government support

The U.S. government is signaling its interest in plant-based and other alternative proteins with increased support for research. GFI has asked for more federal funding, leading a coalition of 61 companies, nonprofits, research institutions, and trade associations [calling on Congress](#) to prioritize alternative protein research in the FY22 budget.

In Congress, House Appropriations Committee chair Rosa DeLauro has become a champion for alternative proteins, including plant-based products. She has said that alternative proteins “can play an important role in combating climate change and adding resiliency to our food system.” She is not the only one in Congress supporting the development of alternative proteins.

- In March 2021, 15 House members, led by Representatives Blumenauer (D-OR-3), Deutch (D-FL-22), and Schiff (D-CA-28), and three senators, Senators Blumenthal (D-CT), Booker (D-NJ), and Duckworth (D-IL), called on John Kerry, presidential envoy for climate, to set forth alternative proteins as a key climate solution.
- In August, House Rules Committee chair Jim McGovern, House Education Committee chair Julia Brownley, and 44 other members of Congress asked the House Agriculture

Committee to include funding for alternative protein research in the budget reconciliation bill.

- In December, Rep. Ro Khanna and 10 other members of Congress sent a letter to Secretary of Agriculture Tom Vilsack urging USDA to include alternative protein research funding in the agency’s FY 2023 budget request.



Public funding for alternative proteins

For the same reasons governments fund renewable energy and global health research, they should fund alternative protein research in order to achieve a more sustainable, secure, and resilient food system. [Learn more.](#)

In Europe, 2021 saw some promising commitments from governments to provide R&D funding to diversify crop ingredient inputs and further innovate plant-based products:

- **The Danish government announced over 1.25 billion kroner (\$190 million) in funding to advance plant-based foods, as part of an unprecedented climate agreement for food and agriculture.** This funding is the largest investment in support of plant-based research and development by any EU country to date.
- In Germany, the Fraunhofer Society, an organization of research institutes funded by both public and private sources, announced the lighthouse project **FutureProteins**, a four-year project across six individual institutes focusing on creating novel alternative protein ingredients, including from potatoes, wheatgrass, and alfalfa.
- EIT Food, an EU-funded innovation initiative, announced funding to a consortium-based project titled “**From side streams to tasty meat alternatives and hybrids (TASTE2MEAT)**,” which will identify and assess new alternative protein ingredients from underutilized plant sources, such as legumes and oilseed press cakes.
- The UK government awarded two PhD studentships to research **ingredient optimization (in collaboration with Motif FoodWorks)** and **optimizing plants for molecular farming**. Similarly, the government awarded a **£109,589 (\$140,000) grant to Plant Meat Limited in collaboration with the University of Leeds** to develop a plant-based liquid egg product and **£159,978 (\$217,000) to SPG Innovation Limited** to identify crop alternatives to soy for plant-based ingredients.
- The Swedish government funding agency Vinnova announced various grants for plant-based research, including for developing products utilizing **legume and cereal proteins, wheat, pea, potato, and fava beans**.
- The Research Council of Norway announced funding for a four-year project titled “**Green technology for plant-based food**,” which will identify and develop new, healthy, and appealing plant-based food products derived from pulses and cereals grown in Norway.

Brazilian regulatory framework is on its way

In 2021, Brazil's regulatory impact analysis (RIA) for alternative proteins moved forward three steps after a seminal workshop was held in December 2020, organized by the Ministry of Agriculture, Livestock and Supply (MAPA). The RIA is a 10-step systematic process for regulators to assess the potential impacts of available regulatory alternatives for action, such as creating a regulatory framework for a specific industry/segment, which may or may not be deemed necessary. GFI anticipates 8 of these steps will occur in 2022. Once the RIA is completed, draft standards will be disclosed for public consultation (anticipated in 2023).

The Department of Inspection of Plant Products at the Ministry of Agriculture and the General Food Office at the National Health Agency are co-leading the process. In July, the former released a public request for comments that received more than 300 responses. In October, the General Food Office promoted a workshop hosting all stakeholders from academic, industry, and government sectors to gather their insights on regulatory issues around plant-based products.

Finally, GFI Brazil hired the Food Technology Institute, a renowned research center in Brazil, to develop an analysis to guide the Brazilian government's approach to regulation. It is examining food safety issues, how the regulatory framework for animal products can be adapted for plant-based products, including plant-based meat, egg, and dairy products, and how other countries are regulating the sector. The study was **released in March 2022** to support the Brazilian government with science-based arguments and a comparative analysis of regulatory experiences abroad.

Plant-based regulation and government support in India

Food safety regulation

The Indian food safety regulator, Food Safety and Standards Authority of India (FSSAI), set up a task force on "vegan foods" in 2020. It subsequently issued draft rules for food products seeking an endorsement under Food Safety and Standards (Vegan Foods) Regulations in 2021. The final regulation will be published after a review of public comments on the draft rules.

Government support

The Ministry of Food Processing Industries (MoFPI) aims to promote agro-food processing and modernization/capacity enhancement of food processing units through policy incentives and schemes, such as the Pradhan Mantri Kisan Sampada Yojana (PMKSY). In a **statement**, the union minister of state for MoFPI specified that the production of alternative protein and plant-based meat is eligible for financial assistance under PMKSY. The Indian government has

also supported the growth of the plant-based dairy segment with financial assistance and incentives offered for production of **soy milk** and **coconut milk**.

Key institutions in India are involved in R&D of plant-based meat, including the following:

- The National Institute of Food Technology Entrepreneurship and Management (NIFTEM) Sonapat and Thanjavur (under Ministry of Food Processing Industries, Government of India).
- Central Food Technological Research Institute Mysore (under Council of Scientific and Industrial Research, Ministry of Science and Technology, Government of India).
- Defense Food Research Laboratory Mysore (under Defense Research and Development Organisation, Ministry of Defense, Government of India).

GFI India also has MOUs with the Council of Scientific and Industrial Research and NIFTEM Sonapat to promote R&D in the sector.

Nonprofit organization Food Industry Capacity & Skill Initiative, under the aegis of the Ministry of Skill Development and Entrepreneurship, entered a collaboration with GFI India to develop the job role and training curriculum for a plant-based innovation specialist.

Product approvals

In December 2020, Impossible Foods received **approval** for their heme from the regulatory agency Food Standards Australia New Zealand. The approval became final in February 2021, opening up another large market for the company's products.

In **October 2021**, the European Food Safety Authority (EFSA) published its scientific opinion concluding that Eat Just's mung bean protein, the key ingredient in the company's plant-based egg, is safe for consumption. In **April 2022**, the European Commission approved mung bean protein as an authorized novel food, which paves the way for product launch in the European Union, expected in late 2022.

In December 2021, Motif FoodWorks received a **no questions letter** from FDA in response to their GRAS notice for a heme protein derived from yeast, which the company calls HEMAMI™. The ingredient is expected to be used in plant-based meat products.

Did we get something wrong? We'd appreciate your feedback via [this form](#).

Section 6

Conclusion and forecast



Section 6: Conclusion and forecast

Capturing even a fraction of the global meat market—estimated at **\$1.7 trillion**—is a colossal opportunity. Doing so will require a remarkable deployment of scientific innovation, infrastructure development, investment, and—crucially—a robust ecosystem to support the industry’s growth.

Despite ongoing impacts from the pandemic, 2021 was the most active year yet, with strong commercial development in addition to global plant-based meat sales passing the \$5 billion mark for the first time. Across the supply chain, researchers explored new ingredients and technologies for plant-based food production, startups developed new high-fidelity products, large food and meat companies expanded their investments, and retailers and foodservice companies added new products to shelves and menus.

But there is more work to do. To maximize the category’s potential, plant-based meat must compete with conventional meat products on the table stakes of consumer choice—taste, price, and accessibility. Few consumers today believe that plant-based meat tastes as good as or better than conventional meat. Of consumers who plan to buy plant-based meat less often, 64 percent say it’s because they prefer the taste of conventional meat, according to UBS Evidence Lab. Meanwhile, price parity with conventional meat remains a significant opportunity, as plant-based meat, on average, is twice as expensive per pound (according to GFI’s analysis of *The Power of Meat 2022*).

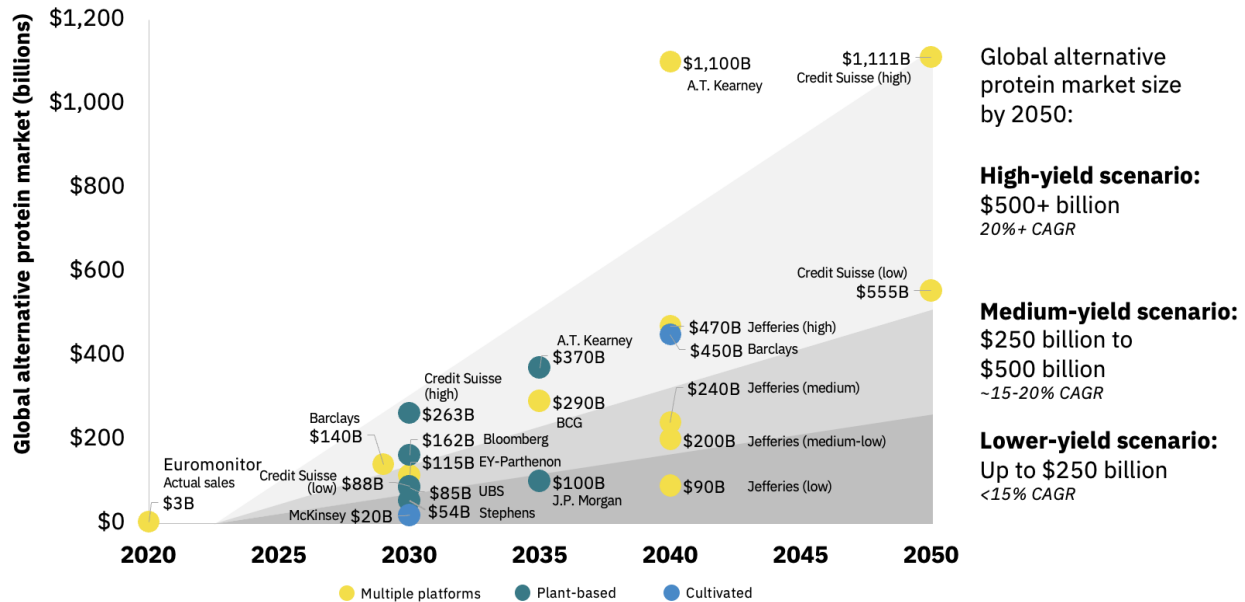
Successfully capturing the massive opportunity that alternative proteins present will require greater R&D investments from both the private and the public sectors. Global demand for meat is rising—by 2050, **meat consumption is estimated to increase by 70 to 100 percent** over 2005 levels. For governments, NGOs, scientists, companies, and consumers who want to achieve net-zero emissions and keep climate change below 1.5 degrees (or even 2.0), the call to action is clear—elevate investments in plant-based proteins. Plant-based meat production leads to between **30 and 90 percent less emissions** (in CO₂-eq) than conventional meat, demonstrating alternative proteins can be a key tool for climate mitigation.

Investments in plant-based meat can ensure we realize the potential alternative proteins provide to help sustainably and efficiently feed billions of people, protect public health and lessen the risk of future pandemics, and mitigate the global climate impact of meat production—all while giving consumers more options for tasty, affordable proteins.

Alternative protein industry forecasts

We expect the alternative protein industry to grow meaningfully over the coming decades. And this view is supported by numerous research organizations, investment firms, and consultants that have published forecasts of the industry’s growth, many of which are mapped in the chart below.

Figure 16: Projections of market size



Source: GFI synthesis of multiple reports.

Forecasts range from lower-growth scenarios of up to \$250 billion in annual sales to high-growth scenarios of \$500+ billion in annual sales of alternative proteins by 2050. A couple of key factors could account for the wide range of these estimates:

- The inherent uncertainty of making predictions early in an industry’s life cycle.
- The path-dependency of industry growth based on a range of drivers across the areas of scientific and technological innovation, commercial and consumer trends, and regulatory and government action.

Factors that would drive sales growth include the following:

- **Supportive government and regulatory action.** Governments have incredible power to help the industry grow exponentially by investing in open-access R&D, supporting the private sector, and creating a clear regulatory path to market for cultivated meat.

- **Investment and innovation** that allow scaled production of a wider variety of products that are both organoleptically equivalent to conventional animal products and competitively priced.
- **Product development** to produce key formats like whole-muscle cuts and hybrid products that combine cultivated, fermentation-derived, and plant-based ingredients to enhance sensory and functional attributes.
- **Scientific advancement** in areas of cell culture media, scaffolding, cell lines, and bioreactors and bioprocessing technologies.
- **Scaled production capacity** that achieves greater economies of scale and a resilient supply of alternative proteins.
- **Greater consumer adoption** that builds on existing momentum to shift to alternative proteins, driven by a variety of motivators, such as public health risks, animal welfare, and environmental impacts like climate change.

Other factors would nudge alternative proteins onto a slower growth path:

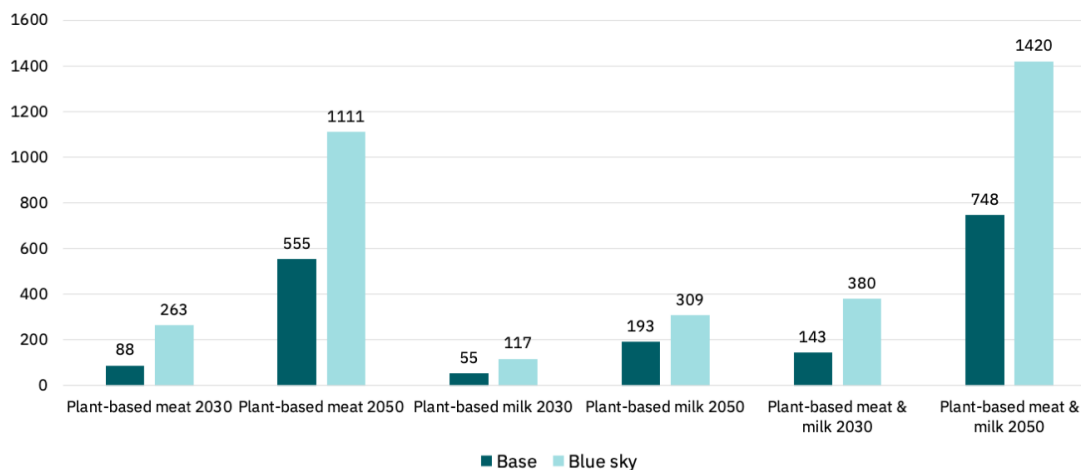
- A lack of public and private investment in innovation and production.
- Persistent technical challenges.
- Climate change risks stymieing ingredient availability or commercial viability.
- A lack of clear regulation impeding innovation.
- Government censorship of labels or other roadblocks to the technological or consumer progress of alternative proteins.

Plant-based market forecasts

For plant-based sales specifically, forecasts of annual global sales in 2030 range from \$54 billion (**Stephens**, plant-based meat) to \$380 billion (**Credit Suisse**, plant-based meat and milk, high estimate). **J.P. Morgan** forecasted \$100 billion in global plant-based meat sales in 2035.

Both **Credit Suisse** and **Bloomberg Intelligence** derived annual dollar sales forecasts by first forecasting the future total meat and milk markets and then the plant-based meat and milk market shares.

Credit Suisse projections for plant-based meat and milk markets globally (in billion USD)



Credit Suisse’s base-case forecast for the plant-based meat market share in 2030 is 5 percent (amounting to \$88 billion in annual sales), increasing to 25 percent by 2050 (\$555 billion), and their “blue sky” (high) scenario assumes a 15 percent market share in 2030 (\$263 billion) and a 50 percent market share by 2050 (\$1.1 trillion).

In the bank’s view, sales of plant-based meat may increase relatively slowly in the near term owing to its higher price compared with that of conventional meat, but sales will later begin accelerating.

For the milk market, Credit Suisse predicts that in a base case, plant-based milk’s market share will reach 20 percent by 2030 (\$58 billion) and 50 percent by 2050 (\$193 billion). In their “blue sky” (high) scenario, this figure could reach 40 percent by 2030 (\$117 billion) and 80 percent by 2050 (\$309 billion). These forecasts, especially the longer-term ones, take into account that plant-based milk has a 14 percent market share in the United States (as of 2020), and Credit Suisse sees “no reason to believe that a market share for alternative meat would be lower than this.”



In addition, Credit Suisse views consumer drivers such as reaching health targets and a “strong awareness of the environmental footprint of food” and a desire to “make a change” as important determinants of growth.

Bloomberg Intelligence projections for the plant-based market globally in 2030

| Category | Base-case scenario | | Higher-growth scenario | |
|---------------------------|--------------------|--------------|------------------------|---------------|
| | Market share | Dollar sales | Market share | Dollar sales |
| Plant-based meat and fish | 5% | \$74 billion | 8% | \$118 billion |
| Plant-based dairy | 10% | \$62 billion | 13% | \$81 billion |

Meanwhile, Bloomberg Intelligence predicts a base case of the plant-based market reaching \$162 billion of annual sales by 2030, driven by a market share of 5 percent of plant-based meat and fish (\$74 billion), a 10 percent market share of plant-based dairy (\$62 billion), and \$26 billion in sales of other plant-based products, such as eggs, condiments, and dressings. The combined base-case prediction of \$136 billion for annual sales of plant-based meat and milk aligns closely with Credit Suisse’s base-case prediction of \$146 billion for sales of such products in 2030.

Bloomberg Intelligence also includes a higher-growth scenario of an 8 percent market share for plant-based meat (\$118 billion of annual sales) and a 13 percent market share for plant-based milk (\$81 billion) by 2030. The company states that several demographic and industry catalysts should help accelerate growth in the sector, with their relative strength differentiating between lower- and higher-growth paths. These catalysts include “expansion of retail distribution points, growing consumer interest in healthier lifestyles, more consistent supply as companies improve forecasting and manufacturing capabilities, greater raw material availability, achieving price parity with conventional productions, and ongoing trials at restaurants.”

While the plant-based market has seen steady growth in recent years, long-term continued growth will require further investment. Industry stakeholders—startups and established food companies, consumers, investors, and global governments—are already charting that path and pointing it in the direction of a more sustainable and secure food future.

Expert predictions

Looking to the year ahead, we asked a group of industry experts for their predictions for the plant-based food industry.



“Plant based is still a very nascent space globally, and it is a trend that is accelerating strongly over the last decade. I foresee that the next year will be a strong continuation of such long term trends, and interesting technologies, relevant funding, wider adoption and product improvements will all be major drivers of bigger and better demand.”

—**Andre Menezes, CEO at Next Gen Foods**



“Cost-equivalency for plant-based ground beef, which will be a significant milestone and driver of mainstream growth, and the introduction of new ingredients and processing technologies that will enable the improvement of existing products and launch of new product applications.”

—**Chris Bryson, founder and CEO of New School Foods**



“We’re expecting to see continued momentum through plant based innovation, as well as improvements to quality, texture, and taste. With these enhancements, we expect more customers to engage with plant based lifestyles while exceeding their expectations on the offerings available.”

—**Callie Acuff, merchant – frozen food at Walmart**



“Plant-based will be a key growth driver for the food industry moving forward and Nestlé is investing across our portfolio to grow this strategic segment. We’re also looking to what’s next by exploring other alternative protein technologies that provide sustainable solutions.”

—**Melissa Cash, chief strategy officer at Nestlé**



“I think that what will be significant is the development of new technologies that will enable better texture and overall eating experience to plant based products and better ingredients profile, cleaner and healthier products. As an R&D company, we are looking at our product pipeline in that aspect.”

—**Liron Nimrodi, CEO and founder of Zero Egg**



“The broader investor community is waking up to the enormous potential of alternative proteins to transform the food system as well as meet their target returns and ESG goals. As more investors acknowledge that climate risk is market risk, we’ll continue to see investments in alternative proteins grow.”

—**Sharyn Murray, CFA**, senior investor engagement specialist at the **Good Food Institute**



“Agriculture research is as important now as it has ever been. I believe that research holds the key to making agriculture a solution to the climate crisis. We ought to advance regenerative agriculture practices that capture carbon by building soil organic matter. And we should pursue parity in research funding for alternative proteins. The United States can continue to be a global leader on alternative protein science and these technologies can play an important role in combatting climate change and adding resiliency to our food system.”

—**Representative Rosa DeLauro (D-CT-3)**, Appropriations Committee chair, **U.S. House of Representatives**, in a **statement** at the **USDA**

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Additional acknowledgments

GFI would like to thank these additional contributors for their insights:

Jessica Almy, Marika Azoff, Renee Bell, Caroline Bushnell, Raquel Casselli, Zavier Chavez, Kelli Cromsigt, Varun Deshpande, Rachel Faulkner, Bruce Friedrich, Vinicius Gallon, Mirte Gosker, Ryan Huling, Carlotta Lucas, Heather Mount, Aviv Oren, Erin Rees Clayton, Acacia Smith, Liz Specht, Guilherme Vilela

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About GFI

The Good Food Institute is a nonprofit think tank working to make the global food system better for the planet, people, and animals. Alongside scientists, businesses, and policymakers, GFI's teams focus on making plant-based and cultivated meat delicious, affordable, and accessible. Powered by philanthropy, GFI is an international network of organizations advancing alternative proteins as an essential solution needed to meet the world's climate, global health, food security, and biodiversity goals. To learn more, please visit www.gfi.org.



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