Good Food Institute

# Precision Fermentation Market Trends, Applications, and Opportunities

March 13, 2025


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# The Good Food Institute

**GFI is a 501(c)(3)nonprofit developing the roadmap for a sustainable, secure, and just protein supply. We focus on three key areas of work:**

### Science and Technology

Advancing foundational, open-access research in alternative proteins and creating a thriving research and training ecosystem around these game-changing fields.

### Corporate Engagement

Partnering with companies and investors across the globe to drive investment, accelerate innovation, and scale the supply chain—all faster than market forces alone would allow.

### Policy

Advocating for fair policy and public research funding for alternative proteins.

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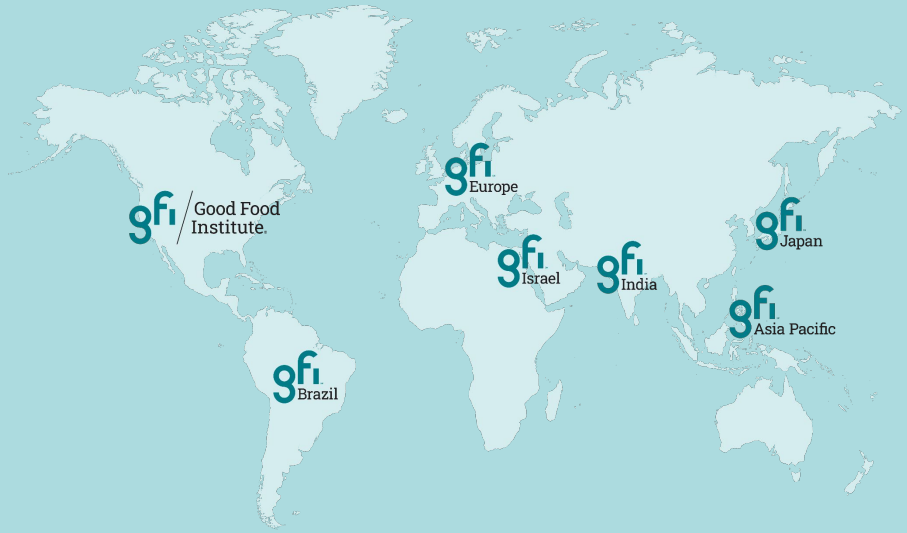
Platinum Transparency 2024 Candid.

GFI officially earned Candid's 2024 Platinum Seal of Transparency—obtained by less than 1% of nonprofits—reflecting our commitment to maximum impact, efficiency, and inclusion.

We work as a force multiplier, bringing the expertise of our departments to the rest of the world.




## 200+ staff in 7 regions

United States | Brazil | India | Europe
Asia Pacific | Japan | Israel

# The alternative protein landscape

## Plant-based

Photo courtesy of Beyond Meat

## Fermentation

Photo courtesy of Ecovative Design: Atlast Food Co.

## Cultivated

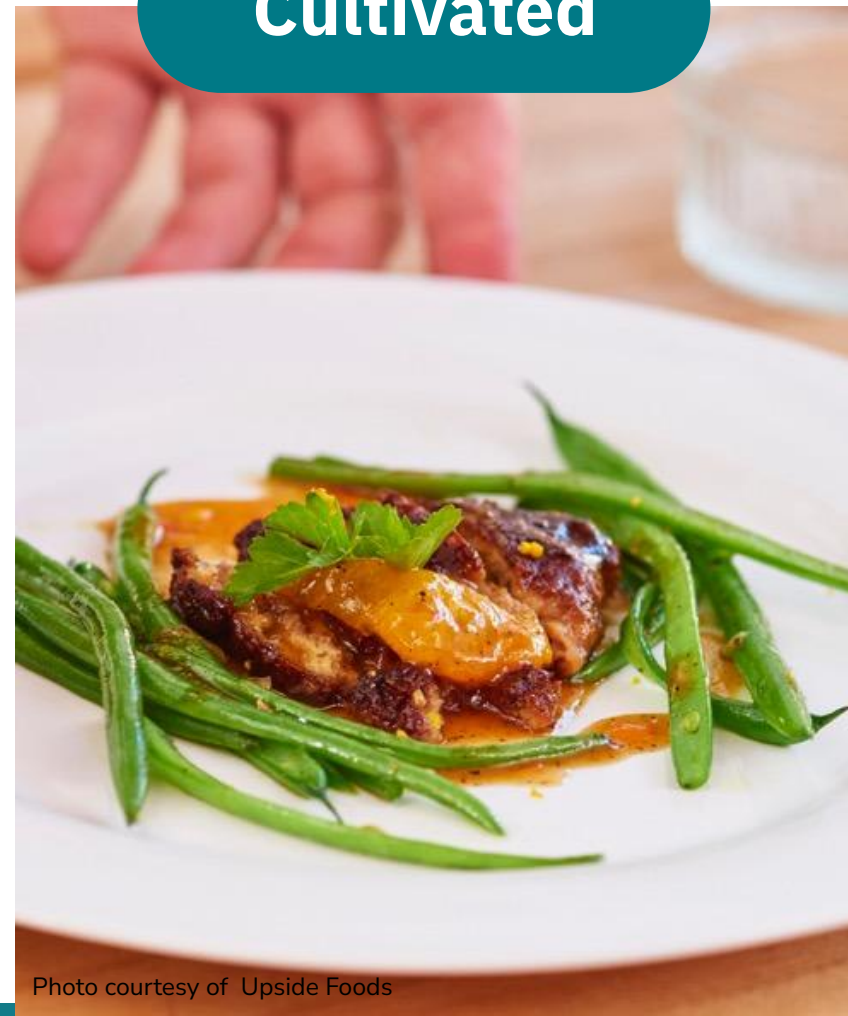


Photo courtesy of  Upside Foods

# Agenda

1. Precision fermentation grounding
2. Industry update
3. Regulatory landscape
4. Outlook

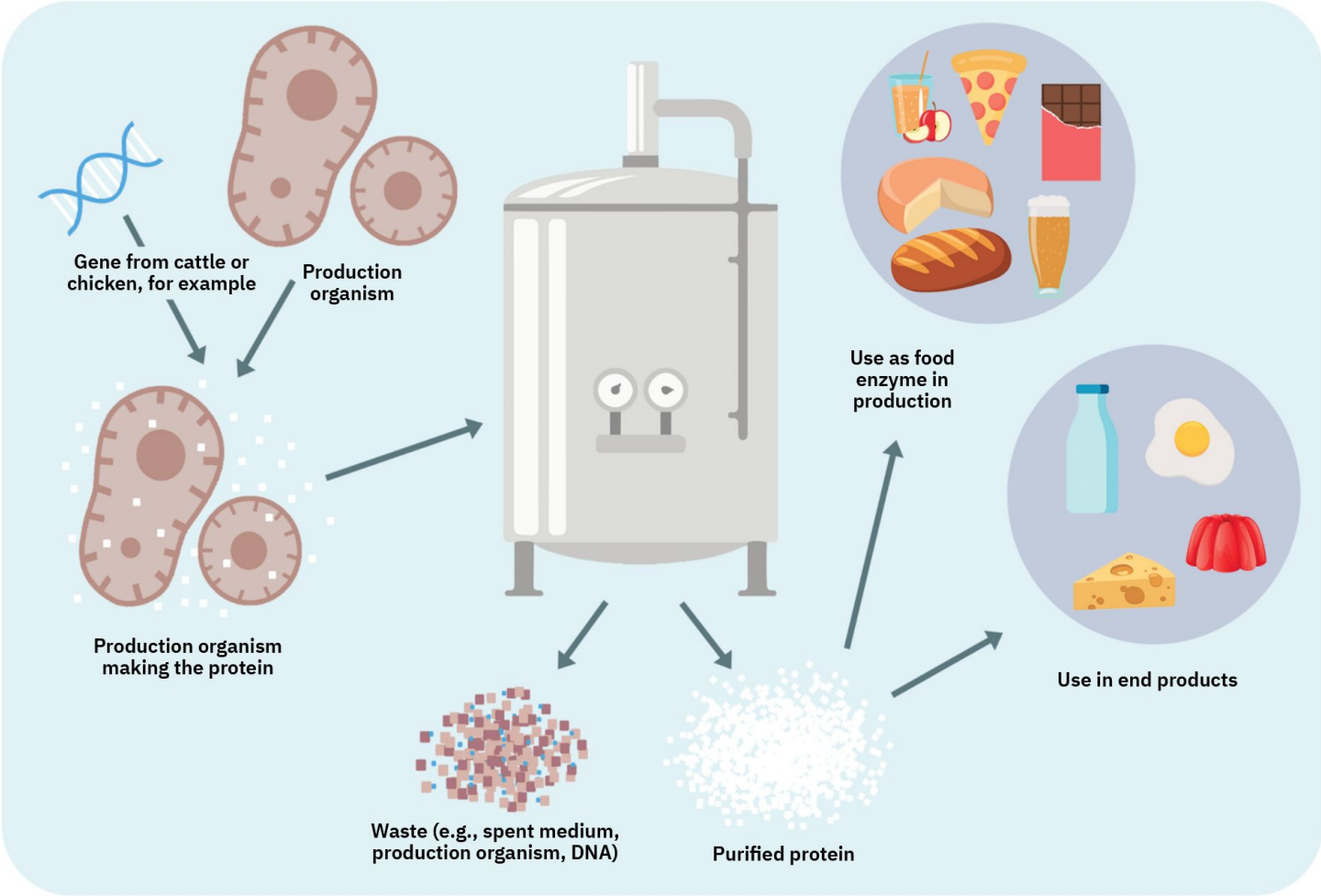
# Precision fermentation grounding

# What is precision fermentation?

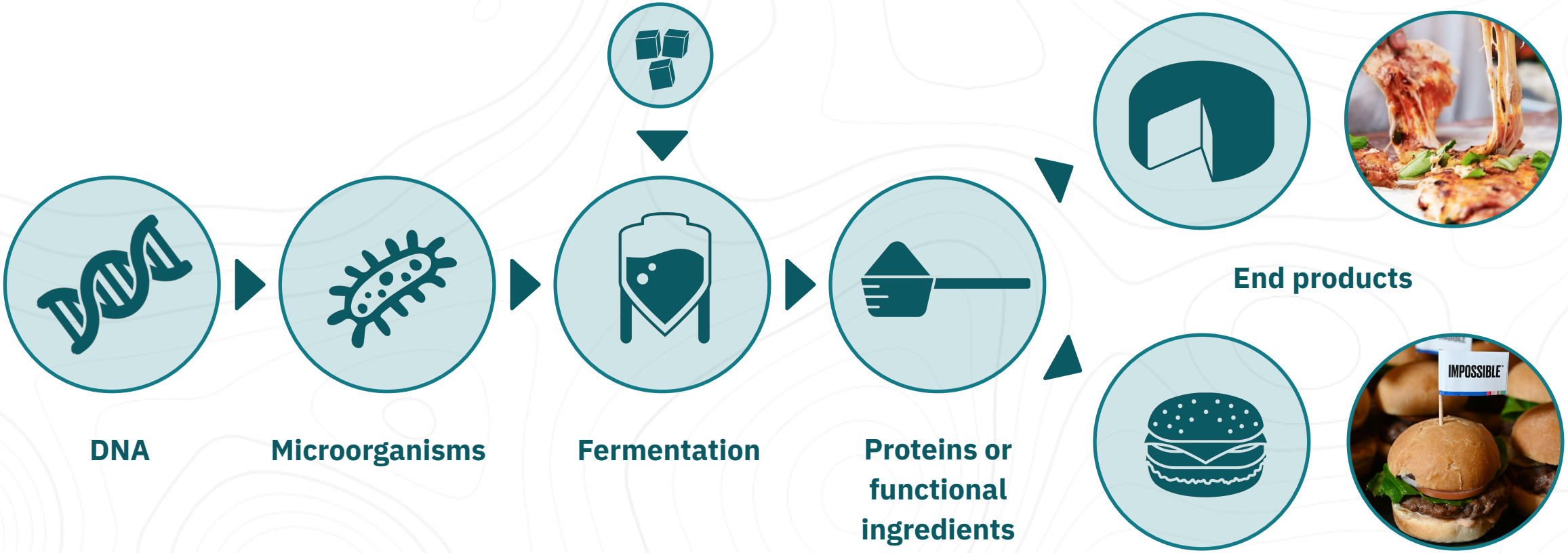
Precision Fermentation uses **microbial hosts to produce specific functional ingredients**.

The microorganisms are programmed to be little production factories.

Precision fermentation enables alternative protein producers to efficiently **make specific proteins, enzymes, flavor molecules, vitamins, pigments, and fats**.



# The precision fermentation process



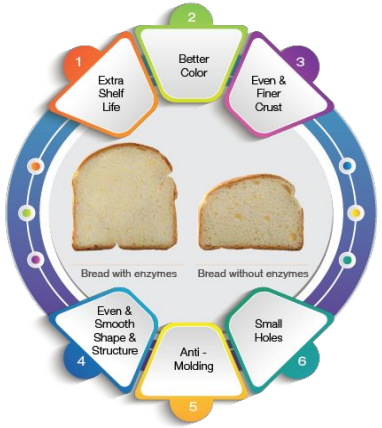
# These ingredients are already part of our everyday lives and common to many familiar foods

**Microbes have been harnessed to produce food, medicine, and materials found in everyday products**


## Rennet

## Flavorings


## Vitamins




## Enzymes

# Now the precision fermentation process is being used for new applications



EVERY

**Egg white proteins**

Perfect Day


**Milk proteins (casein, whey)**

IMPOSSIBLE™

**Heme proteins**

Melt & Marble

**Fats & oils**

ONEGO bio


# Leading CPGs are beginning to use precision fermentation in beloved B2C brands

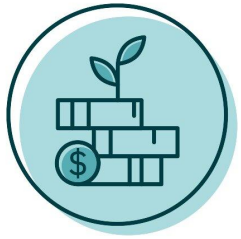
Unilever


Nestlé


bel brands USA

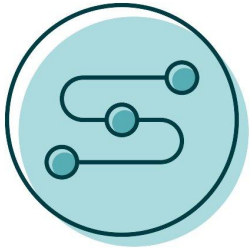
# Why consider precision fermentation ingredients?

## Economic



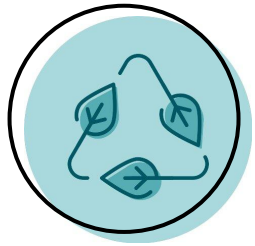
- Reduced supply chain volatility
- Reduced price volatility
- Cost-in-use

## Functional



- Cost-in-use
- Improved functionality
- Quality control
- Food safety

## Environmental

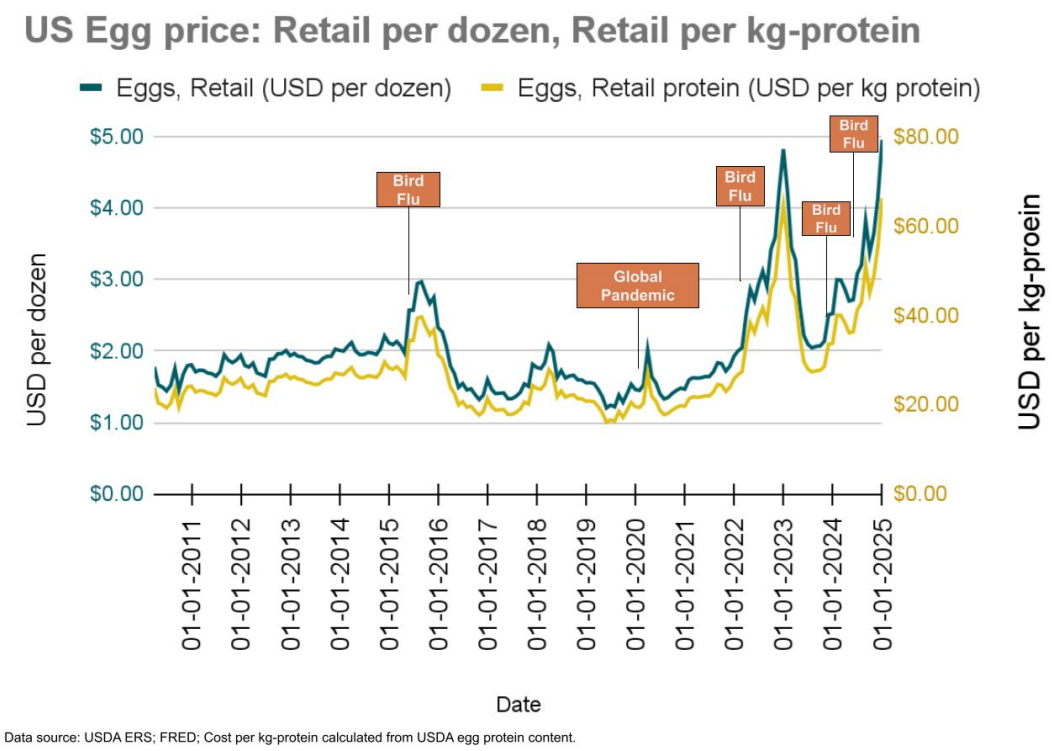


- Clean Energy Coupling
- Circularity and Carbon Utilization

**Securing a sustainable ingredient supply**

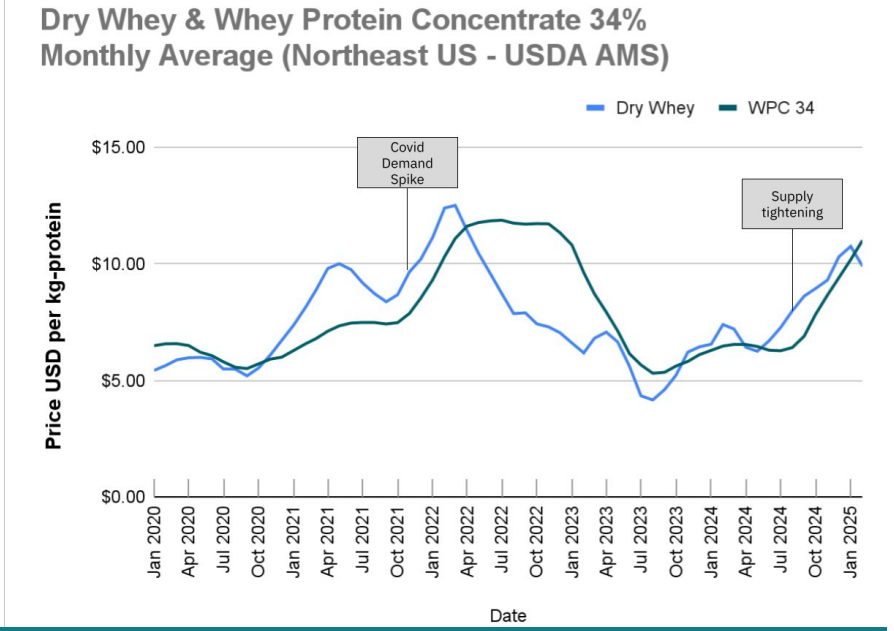
# Current egg & dairy supply chains are seasonal, volatile, and globally interconnected

Avian Flu has led to waves of culling which has induced overshoot/undershoot cycles in egg prices.




Data source: USDA ERS; FRED; Cost per kg-protein calculated from USDA egg protein content.

Demand spikes and supply tightening have impacted whey prices.

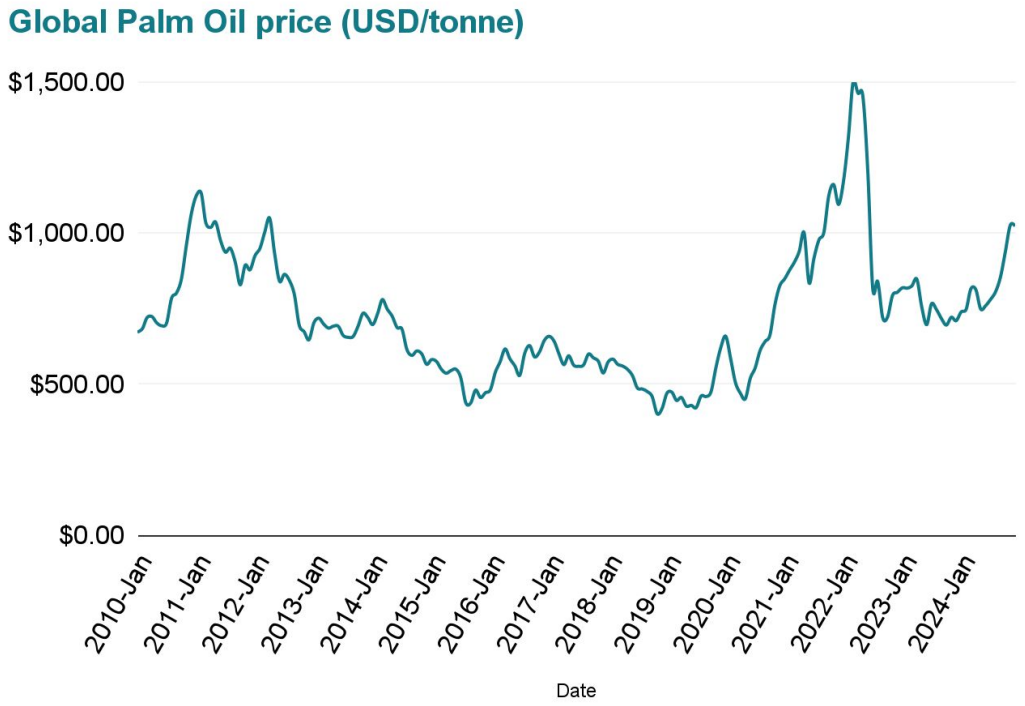


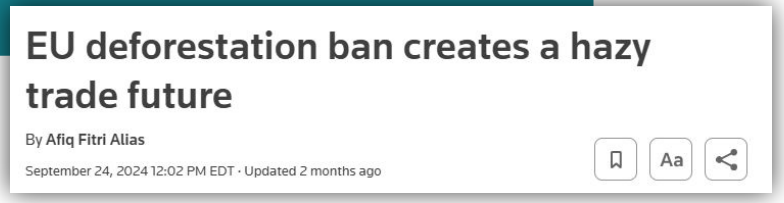

Milk production forecasts for 2024 & 2025 were reduced due to lower forecast cow inventories and a slower growth rate of milk per cow for the remainder of 2024 and is carried into 2025. (WASDE)

Sources: FRED, USDA ERS, USDA AMS

# Global supply chains and regulations impact many ingredients - Palm oil supply chain volatility

Palm Oil—like other commodities—undergoes seasonal variation in pricing, but **volatility also comes from harvest lost to lower productivity and pathogens,** as well as **deforestation supply restrictions.**





EU deforestation ban creates a hazy trade future

By Afiq Fitri Alias

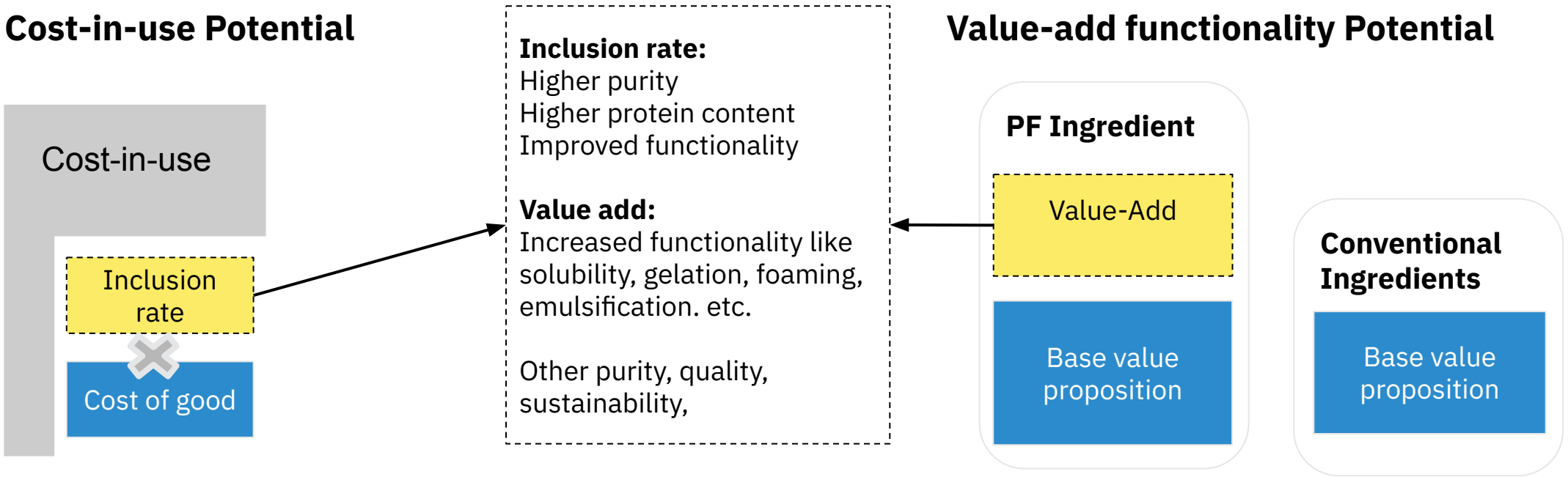
September 24, 2024 12:02 PM EDT · Updated 2 months ago


Walmart's Transition to RSPO Certified Sustainable Palm Oil

Sustainable Products at Walmart | Our Pledge to Customers

Source: FRED

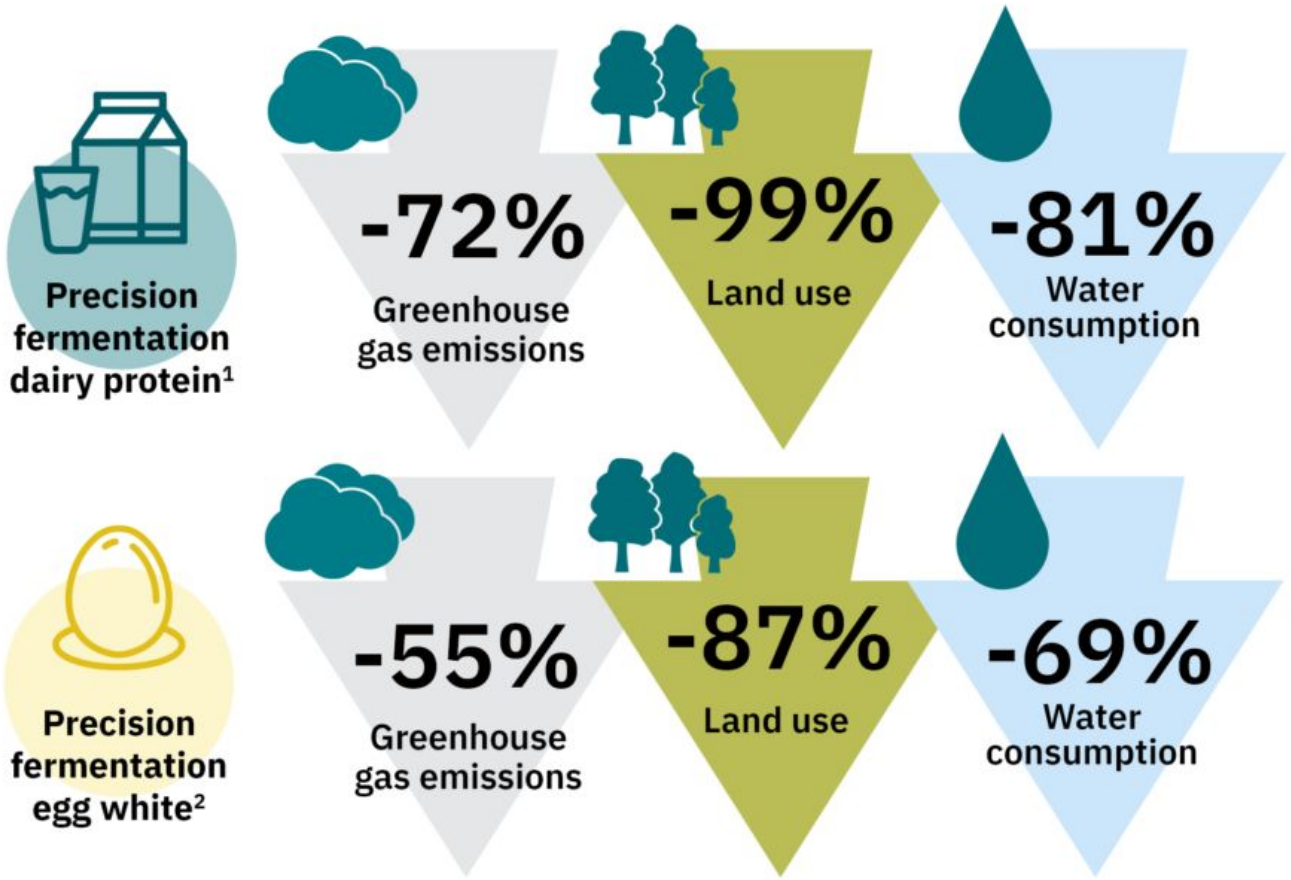
# Precision fermentation ingredients can drive down cost-in-use




Inclusion rate: proportion of the cost of ingredient within the total cost or price of a product.

# Precision fermentation provides protein ingredients significantly more sustainably

**Environmental impact savings of dairy and egg proteins made using precision fermentation compared to conventional production**




Sources: 1. Bon Vivant (2024). GHG assumptions based on using standard French energy mix. 2. Järviö, N.et al. *Nature Food* (2021) [supplemental material]. GHG assumptions based on standard energy mix in Germany.

# Industry update

# Precision fermentation is utilized in a wide range of applications



## Fats & Oils

- C16 Biosciences
- nourish INGREDIENTS
- NO Palm Ingredients
- yali bio
- Corbion
- Zero Acre

## Eggs

- ONEGO bio
- EVERY ALL PROTEIN. NO ANIMAL.
- eggmented reality
- OTRO

## Dairy

- PERFECT DAY
- Those Vegan Cowboys
- NEW CULTURE
- Formo

## Chocolate/ Coffee

- FOOD BREWER
- California CULTURED
- COMPOUND FOODS

## Sweet

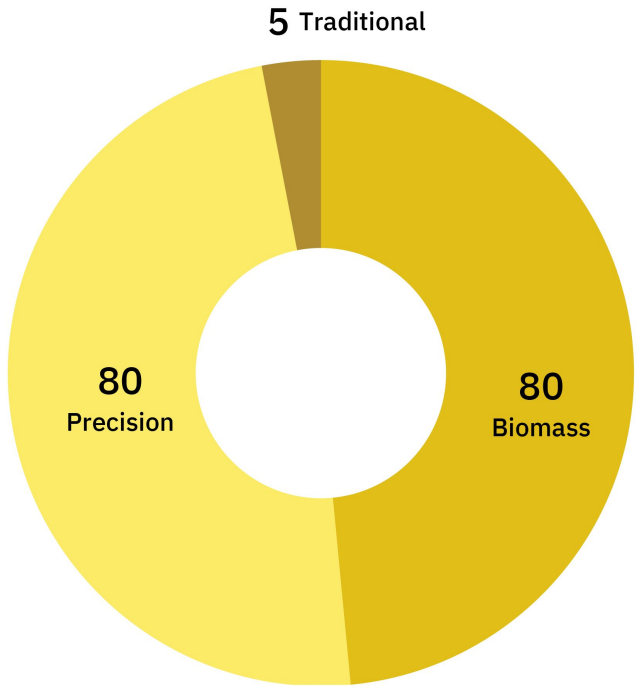
- Cargill
- Oobli
- MeliBio
- MYCO TECHNOLOGY™

## Colorings/Dyes

- kalsec
- michroma

# The fermentation sector continues to expand globally

## Number of companies by technology focus




7 additional precision fermentation companies have launched in 2024.

## Distribution of fermentation companies by country and region

1–9 companies | 10–19 companies | 20+ companies

| | | | | | |
|---|---|---|---|---|---|
| **Africa and Middle East** *Count 19* | | | | | |
| Egypt | 1 | Israel | 15 | | |
| Ethiopia | 1 | South Africa | 2 | | |
| **Asia Pacific** *Count 27* | | | | | |
| Australia | 5 | India | 3 | Singapore | 9 |
| China | 5 | New Zealand | 4 | Thailand | 1 |
| **Europe** *Count 70* | | | | | |
| Austria | 4 | Germany | 11 | Sweden | 3 |
| Belgium | 5 | Luxembourg | 1 | Switzerland | 2 |
| Denmark | 2 | The Netherlands | 7 | Turkey | 1 |
| Estonia | 2 | Norway | 2 | United Kingdom | 13 |
| Finland | 3 | Scotland | 1 | | |
| France | 7 | Spain | 6 | | |
| **Latin America** *Count 5* | | | | | |
| Brazil | 3 | Chile | 2 | | |
| **Canada and U.S.** *Count 44* | | | | | |
| Canada | 4 | United States | 40 | | |

# Large food companies are showing interest in fermentation

| | Nestlé | Unilever | AB InBev | General Mills | DANONE | MAPLE LEAF | Tyson | bel for all for good |
|---|---|---|---|---|---|---|---|---|
| | CPG companies | | | | | Meat & dairy companies | | |
| **Investment** | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| **Acquisition** | | | | | | | | |
| **Partnership** | | ✓ | ✓ | ✓ | | ✓ | | ✓ |
| **R&D and manufacturing** | ✓ | | ✓ | ✓ | ✓ | | | |

# Strategic partnerships are accelerating sector growth

Global Dairy Ingredients Supplier Leprino Foods Company is partnering with Fooditive Group to commercialize Fooditive's PF-derived animal-free **casein protein**. Source.

DSM and Fonterra partnered to create Vivici, which announced they are able to supply commercial quantities of **whey protein** from fermentation to the US market. Source.

U.S.-based precision fermentation dairy company New Culture is partnering with Korean food producer CJ CheilJedang Corp. to work on reducing the production cost of New Culture's **casein protein**. Source.

Oobli and Grupo Bimbo have partnered to introduce **sweet proteins** into Grupo Bimbo's baked goods portfolio, marking a major step toward global adoption of innovative sugar replacements. Source.

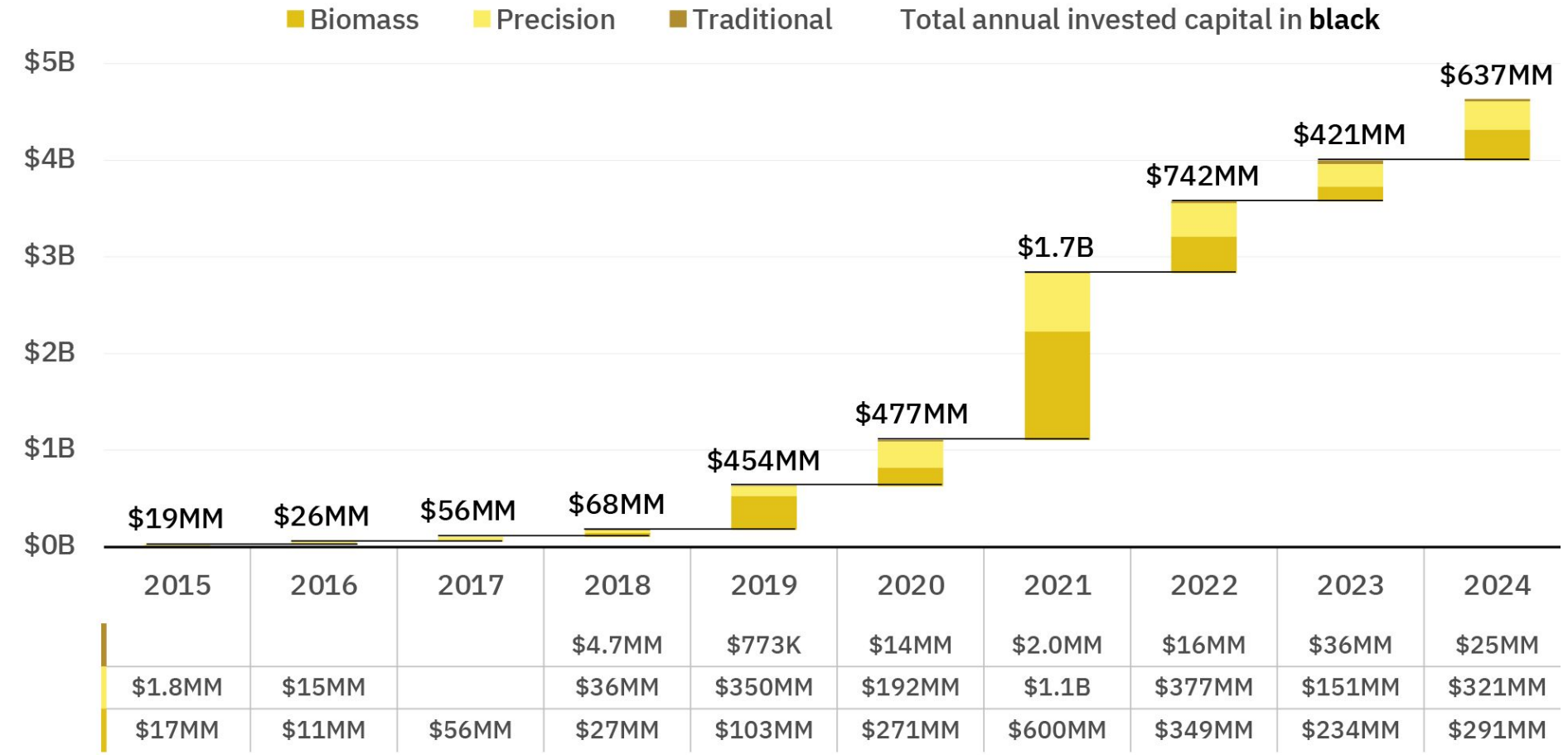
Spanish food company, Grupo Empresarial Palacios Alimentación, is partnering with U.S.-based PF **egg protein** producer The EVERY Company to use the EVERY egg in their Spanish omelets. Source.

Germany dairy company Hochland is partnering with Belgian PF company Those Vegan Cowboys to test their **casein protein** in a variety of hard and soft cheeses on a larger scale. Source.

# Fermentation investments top $4.8B through 2024, leading all of alternative protein investments

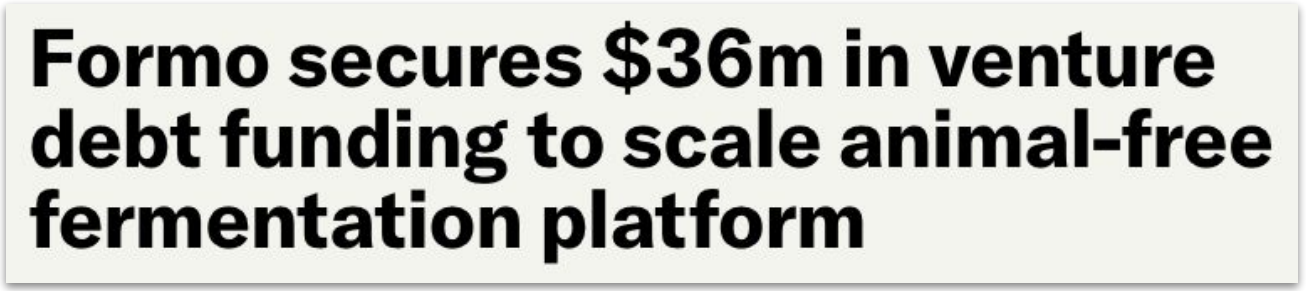
## Annual investment by type of fermentation

*2015–2024*



# 2025 Investment Outpacing 2023 & 2024

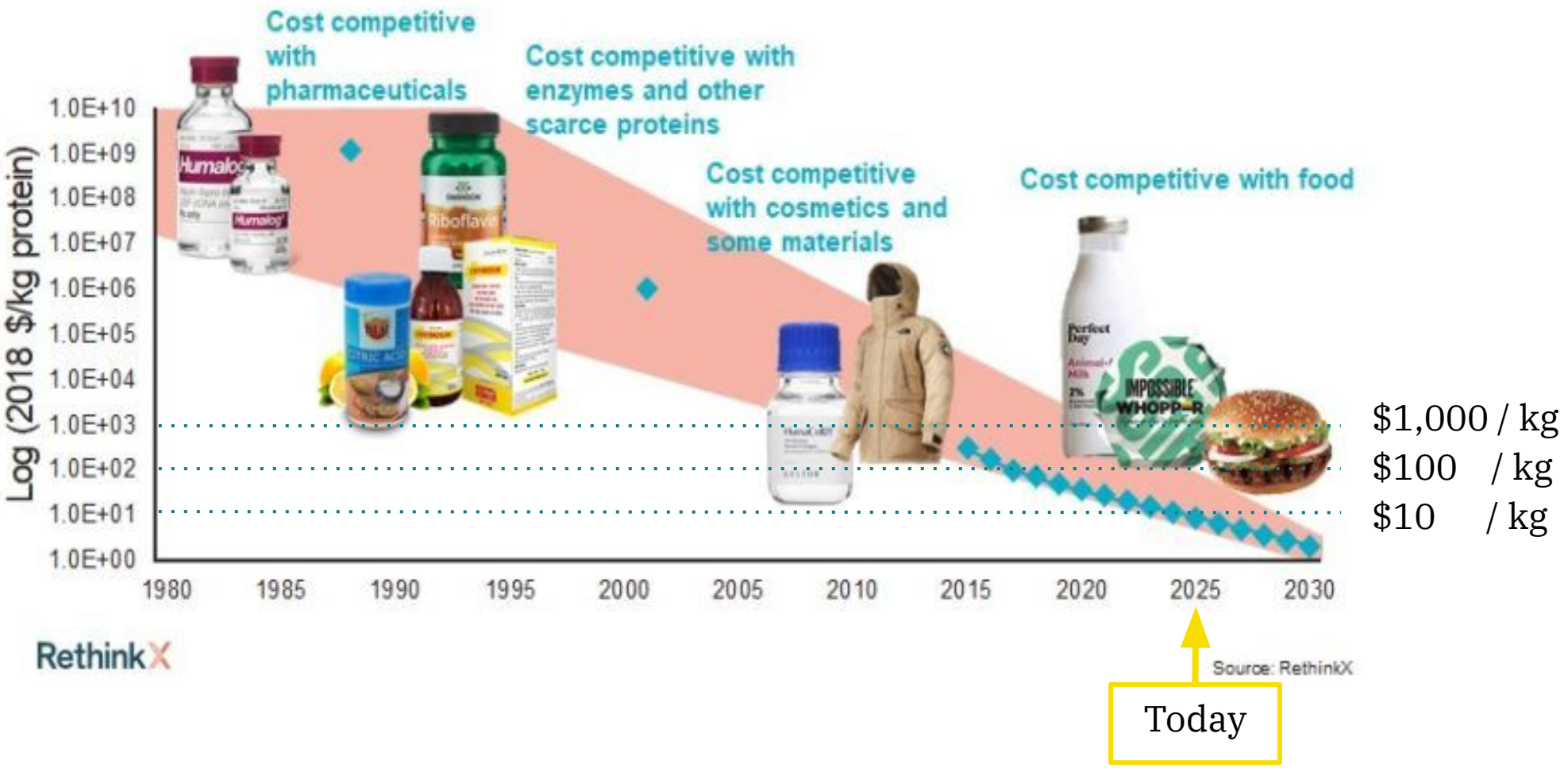

February 2025




January 2025


January 2025

# The cost of precision fermentation has decreased significantly over the past 50 years

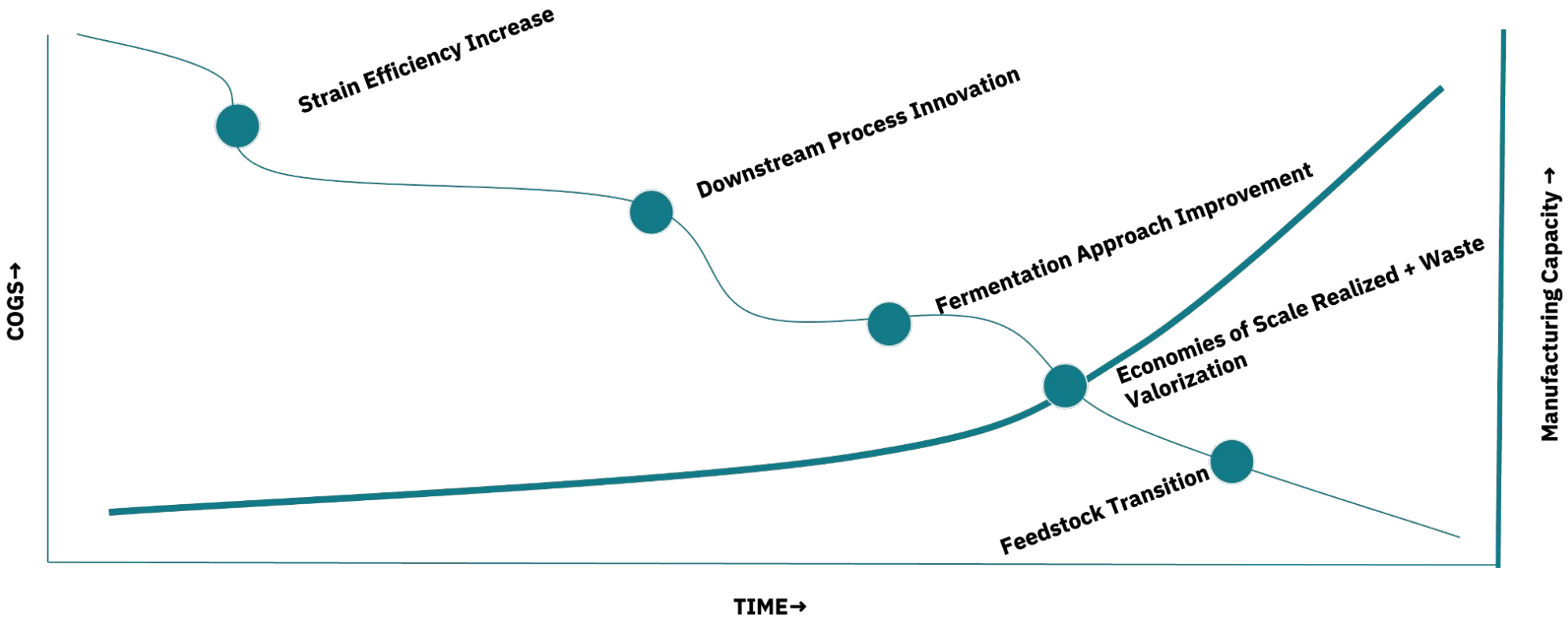



Credit: RethinkX report: Rethinking Food & Agriculture, 2020-2030

# Companies are working on a range of ways to further bring costs down



## Cost March to <10$/kg



# Regulatory landscape

# Regulatory landscape

In the U.S., the FDA has regulatory authority for precision fermentation-derived foods. There are two regulatory pathways: 1) **Food additive petition application**, evaluated by FDA and approval codified in regulation and 2) **Generally Recognized as Safe (GRAS) process**. **Multiple companies have obtained "no question" letters from the FDA to their GRAS notification.**

In Canada, Health Canada is the Canadian federal department responsible for national health standards and policy. Health Canada evaluates precision fermentation products as **novel foods**, requiring manufacturers to submit detailed scientific data for review before such foods are authorized for sale. **In 2024, Remilk was the first company to receive a "Letter of No Objection".**

In the EU, the **Novel Foods Regulation** governs pre-market authorizations for animal cell or tissue culture based foods. If genetic engineering is used, the **Regulation on genetically modified food and feed** might apply. The entire process can take 18 months to 3 years. **A number of companies have started the Novel Foods Regulation process but none have yet received approval.**

In Singapore, new foods created via fermentation as novel foods must be approved by the Singapore Food Agency (SFA) before they are allowed for sale. **Singapore had some of the first precision fermentation approvals in the world with Impossible's soy leghemoglobin and Triton Algae's Chlamydomonas reinhardtii algae in 2019.**

# Outlook

# The big picture

1. Fermentation-derived products have a long history of use, with **leading CPG brands already incorporating precision fermentation ingredients** into consumer-facing products.
2. **Precision fermentation proteins are highly versatile**, offering a sustainable and effective replacement for conventional protein ingredients like egg whites, milk proteins (casein and whey), heme, and collagen.
3. Precision fermentation ingredients combine exceptional **functionality**, a **reduced environmental footprint**, and **strong economic potential**, setting a new standard for ingredient innovation.
4. The precision fermentation sector has witnessed rapid growth in recent years, with 2024 a **landmark year for investment** and industry expansion which is continuing in early 2025.

# Join us on April 1st for the next webinar!

GFI's consumer research lead Taylor Leet-Otley will provide an overview of GFI's original **consumer research findings relevant to GTM strategy, on-pack messaging, and what to call these novel ingredients**.

We'll cover:

- Awareness & familiarity
- Willingness to try and buy
- Which demographic is most likely to try
- Perceptions and hesitations
- Nomenclature preferences

# Thank you!

Good Food Institute