gfi / Asia Pacific

Regulating the plate: Policies in the age of innovative food technologies

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The Good Food Institute (GFI)

GFI is an **international network of nonprofit think tanks** developing the roadmap for a secure, sustainable, and just protein supply.

Our work spans three areas:

Science & Technology

Corporate Engagement

Policy

*We act as a **force multiplier**, bringing the expertise of our 200+ staff across six regions to the rest of the world*

GFI is funded by philanthropy.

The three pillars of protein diversification

Plant-based

Photo credits: TiNDLE, GOOD Meat, and

Cultivated

Fermentation

Cultivated meat and seafood


Photo courtesy of GOOD Meat

Cultivated meat and seafood is produced directly from animal cells.

Meat cultivation facilitates the same biological process that happens inside an animal by providing cells with the warmth and basic nutrients required to build muscle and fat.

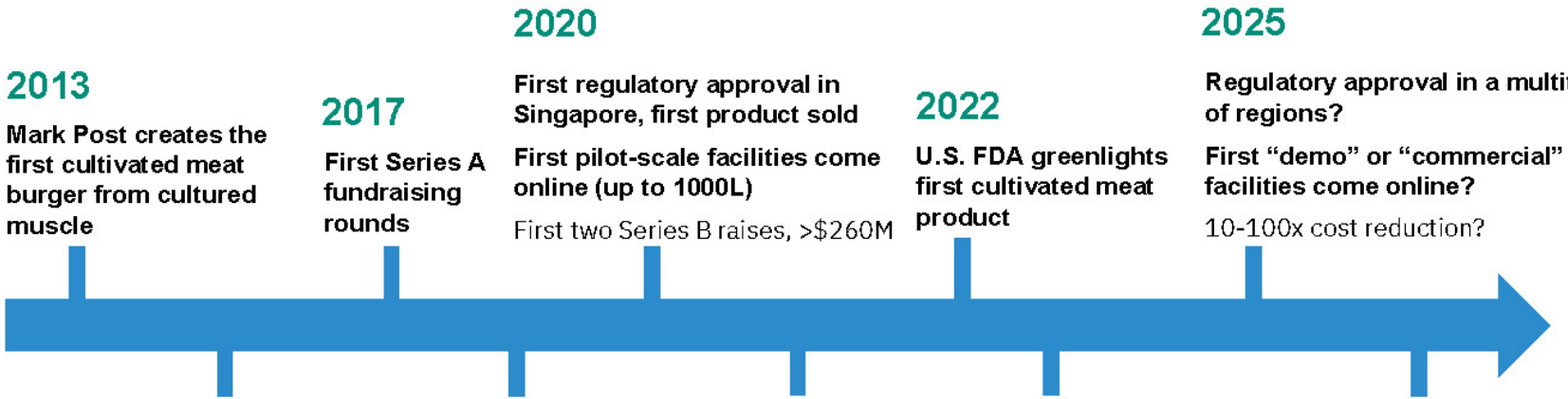
Why cultivated meat

- **Food security**
- **Climate mitigation**
  - Animal agriculture
  - Nature preservation
  - Co-benefits: decreased anti-microbial resistance & decreased pandemic risk
  - The global majority (smallholders, pastoralist, subsistence fishers)

- **Theory of change**
  - The one food systems solution that analogizes to renewable energy/EVs

- **Why government support is critical**
  - i.e., why can’t markets solve this?

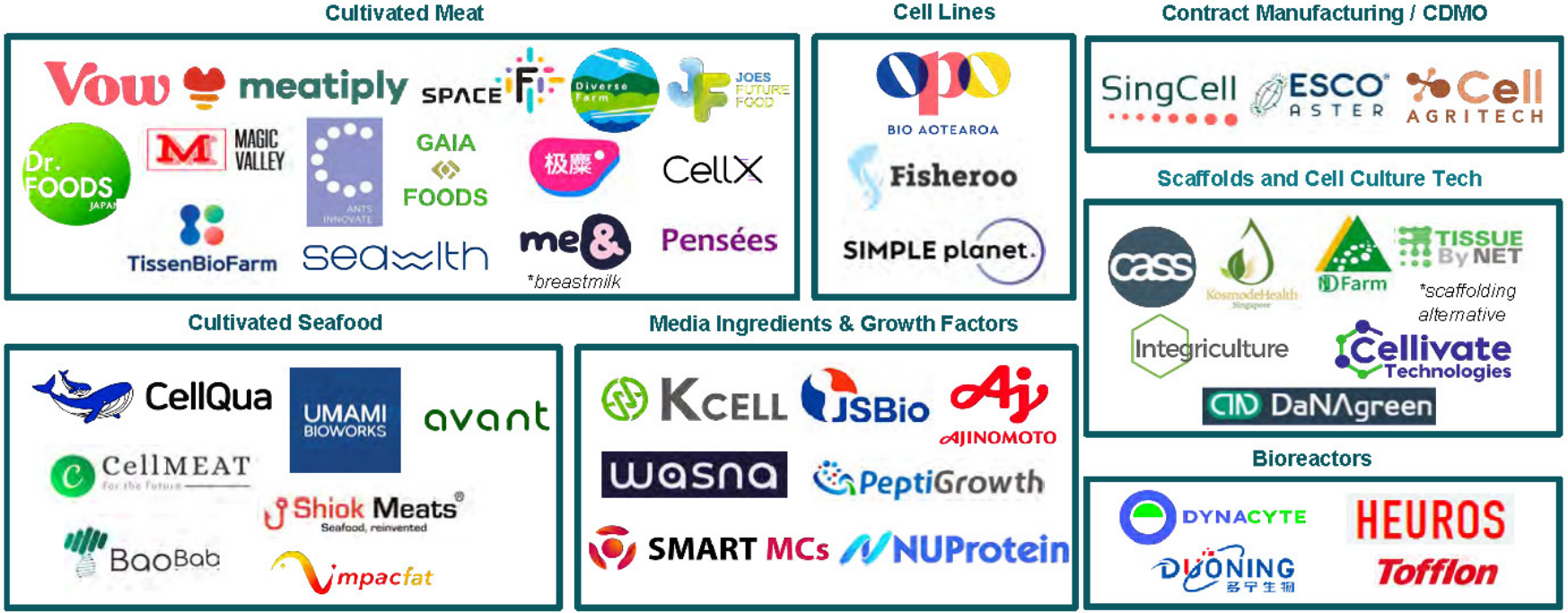
Where are we in the industry's trajectory?



Overview of novel foods regulations in the world

- Australia/NZ
- Brazil
- Canada
- China
- European Union
- India
- Israel
- Japan
- Singapore
- South Korea
- Thailand
- United Kingdom
- United States

The cultivated meat ecosystem in APAC is booming



Governments are implementing supportive policy frameworks

2021

In December 2021, China's Ministry of Agriculture and Rural Affairs included cultivated meat in its five-year plan. It provides a blueprint for strengthening innovation in "frontier and cross-disciplinary technologies" and clear guidelines for developing the protein industry and related technologies

The Singapore Food Agency (SFA) grants manufacturing firm Esco Aster a license to manufacture cultivated meat products that have received SFA approval, giving cultivated meat companies the option to contract their manufacturing to an approved facility rather than build their own.

Japan's Ministry of Agriculture, Forestry, and Fisheries (MAFF) launched the Food Tech Public-Private Council, a public-private group comprising over 150 companies to support the food industry and strengthen Japan's food security through technology.

2022

China's President Xi Jinping mentions protein diversification at the Two Sessions to support national food security, and the nation's first-ever five-year plan for the bioeconomy called for exploring alternative proteins as novel foods.

Singapore marks a world-first regulatory approval by giving the Finnish startup Solar Foods approval to sell its protein made from gas fermentation in Singapore, which went on to have the first tasting event in 2023.

South Korea's Ministry of Food and Drug Safety (MFDS) forms a discussion group with industry to understand the cellular agriculture production process. MFDS also publishes a draft regulatory framework for fermentation-derived meat, which is expected to be finalised in 2023.

The Food Ministers' Meeting (FMM) affirms the Food Standards of Australia and New Zealand's (FSANZ) view that existing Food Standards Code and labelling requirements can regulate cultivated meat and precision fermentation.

The Japan Association for Cellular Agriculture (JACA) submits guidelines and recommendations covering legal definitions of cultivated foods, food labelling, and safety. The Ministry of Agriculture, Forestry and Fisheries also announces an initiative to support the development of alternative proteins, including fermentation-based meat.

2023

Malaysia selects cultivated meat as a 'core strategic: prime program & future technology' as part of an update to Malaysia's National Biotechnology Policy 2.0 (NBP 2.0) for 2022-2030 under the remit of the Ministry of Science, Technology and Innovation, and the Bioeconomy Corporation.

Thailand holds its first cultivated meat regulatory roundtable coordinated by the National Center for Genetic Engineering and Biotechnology (BIOTEC) to support the Food and Drug Administration to develop a national regulatory framework for the sale of cultivated meat, targeted for 2024.

The Prime Minister of Japan announces plans to develop a cultivated meat industry as an important part of reducing the country's carbon footprint.

The Asia-Pacific Society for Cellular Agriculture (APAC-SCA) and Japan Association for Cellular Agriculture (JACA) sign an MOU to coordinate regional regulatory development.

An MOU to form a national cellular agriculture cluster is led by the North Gyeongsang Province in South Korea with 28 signatories including city governments, academia, and corporates. The region also has a Cell-Ag Industry Promotion Strategy to link the vaccine, drug, cosmetics, and bio industries.

Singapore makes another world-first regulatory approval, with GOOD Meat receiving approval from SFA for serum-free media for cultivated meat.

Cultivated Meat: New & Existing Frameworks

- Several countries, such as **Singapore, Canada, Israel, Australia, New Zealand, and the U.S.** already have some regulatory provisions or guidance applicable to cultivated meat

- Some countries will regulate cultivated under existing novel food frameworks, others plan to create new regulatory frameworks

Photo courtesy of UPSIDE Foods

The cultivated meat regulatory landscape is progressing globally and in APAC

Singapore Food Agency

- First country to approve the commercial sale of a cultivated meat product by GOOD Meat (2020)
- SFA granted Esco Aster a food processing licence to manufacture cultivated meat (2021)
- SFA has published and constantly updates guidelines for bringing products to market: "The Requirements for Safety Assessment of Novel Foods"

식품의약품안전처 Ministry of Food and Drug Safety

- MFDS has called for official guidance to establish a management system to monitor the manufacturing process and safety evaluation of cultivated meat
- MFDS is also working to accelerate the development of new food additives recognition standards that apply to foods produced using novel technologies, including alternative proteins

厚生労働省 Ministry of Health, Labour and Welfare

- The Ministry of Health, Labour and Welfare assembled a team of subject matter experts to study the food safety aspects of cultivated meat to help determine the best regulatory path (2022)
- The Japan Association for Cellular Agriculture (JACA) is currently working towards formalised guidance for cultivated meat within the existing regulatory framework

The cultivated meat regulatory landscape is progressing globally and in APAC

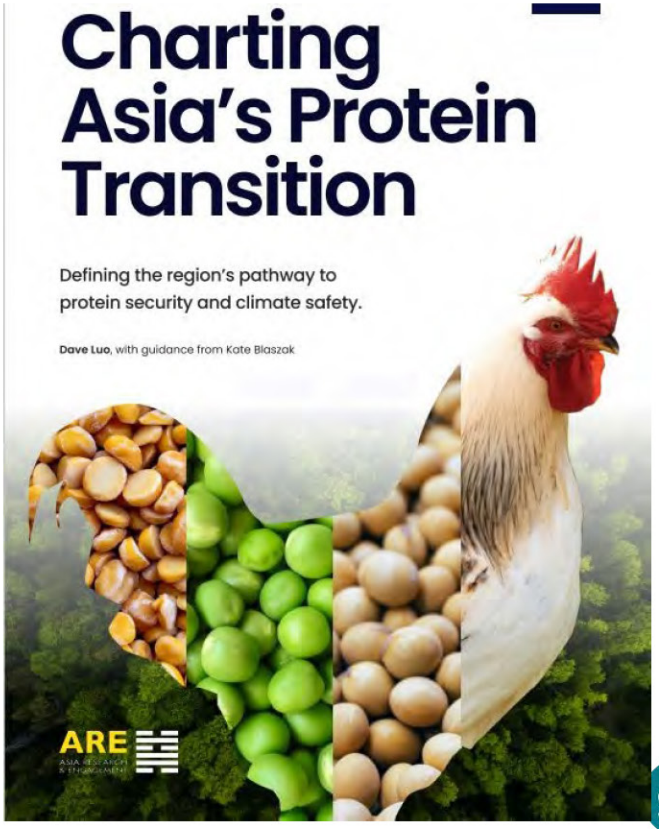
- FSANZ is responsible for drawing up the standards for the regulation of food ingredients/additives
- Current Food Standards Code does not include specific requirements or permissions for cultivated meat. It is covered by existing novel foods standards and products require pre-market approval

- FDA established a joint agreement with the USDA to regulate cultivated meat (2019)
  - FDA oversees the process until "harvest" and USDA oversees processing & labeling
- FDA issued a "no questions" letter to UPSIDE Foods (2022) and GOOD Meat (2023)
- USDA approved the sale of cultivated chicken by UPSIDE Foods and GOOD Meat (2023)

- The EU plans to regulate cultivated meat under its existing "Novel Food Regulation"
- For products made with genetic modifications (GM) or gene editing (GE), the Regulation on Genetically Modified Food and Feed may apply instead
- Companies must apply to EFSA for premarket authorisation. Currently no submissions received

Thailand's Protein Overview:

"Thailand's animal production is largely industrialised. Total consumption will decline with the population. Thailand imports its soy (for animal feed) primarily from Brazil, Argentina, and Paraguay, contributing to deforestation. We project that Thailand will not be able to decarbonise its protein sector without ending growth in industrial animal production ASAP, ending supply chain deforestation by 2030 and boosting alternative proteins to 30% of protein volume by 2060."

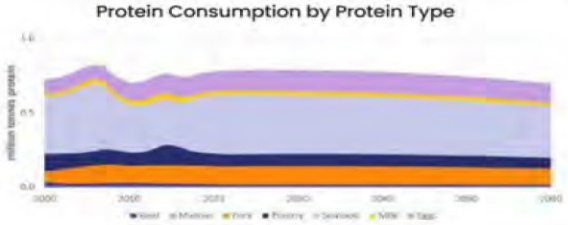


Need For Protein Transition In Thailand

BUSINESS-AS-USUAL (BAU)

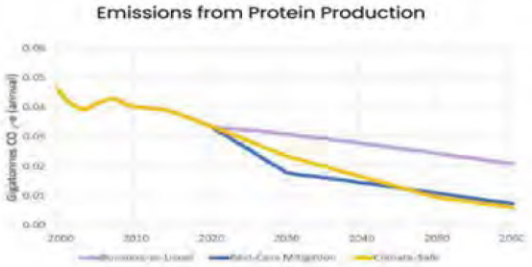
0.4 Gt CO_2-e in excess of climate-safety

	2020	2060	% Change
Population Size (millions)	71	63	-11%
GDP per Capita (constant thousand USD)	16.8	52.1	+209%
Protein consumption per capita(kg / year)	10.9	10.9	-0.0%
Total Protein Consumption (million tonnes / year)	0.78	0.69	-12%



BEST CASE MITIGATION

0.5 Gt CO_2-e mitigated



	Mitigation Target (Year / %)	Potential Mitigation (Gt CO_2-e)
Zero-Deforestation	2030	0.34
100% Clean Energy	2060	0.09
Enteric Fermentation Emissions	40%	0.01
Manure Emissions	40%	0.00
Feed (non-LULUC*) Emissions	40%	0.03
Food Waste Reduction	30%	0.04

*LULUC refers to Land Use, Land Use Change

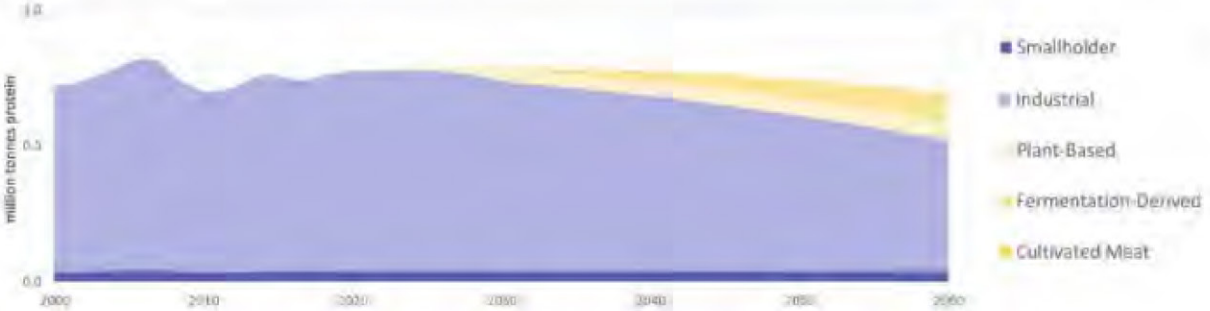
Source: Charting Asia's Protein Transition, ARE report, 2023

Protein transition scenario

PROTEIN TRANSITION

0.1 Gt CO_2-e further mitigated with alternative proteins

Protein Production by Source



PRIORITY ACTIONS FOR CLIMATE-SAFETY AND PROTEIN-SECURITY

- Eliminate Deforestation in Supply Chains by 2030
- No New or Replacement Industrial Production ASAP
- 30% Alternative Protein by 2060

Source: Charting Asia's Protein Transition, ARE report, 2023

Cultivated Meat: Thailand

- Thailand's Food and Drug Administration (FDA) is responsible for regulating food safety, including the safety of novel foods such as cultivated meat. The FDA is currently in the process of developing a regulatory framework for cultivated meat.
- In 2016, the FDA issued an informal notification and framework on novel foods, which outlined the requirements for companies to submit applications for pre-market approval of novel foods. The framework also established a panel of experts to review applications and provide recommendations to the FDA.
- In February 2023, the FDA met with representatives from the Israel Embassy to discuss cooperation in the development of novel food industries, including cultivated meat. The FDA is committed to working with international organizations, such as the Codex Alimentarius Commission, to develop harmonized standards for cultivated meat.

Current Status

- The FDA has not yet set a timeline for when it will approve cultivated meat for sale in Thailand. However, the FDA is actively engaging with stakeholders and working to develop a regulatory framework that is both science-based and risk-based.

Photo courtesy of Getty Images

Fermentation

Photo courtesy of Perfect Day

Fermentation is an enabling technology for the alternative protein industry that allows the production of standalone protein sources or functional ingredients.

Microorganisms, such as filamentous fungi and bacteria, can be programmed to express specific proteins or fats. Alternatively, their entire protein biomass can be harvested to produce alternative protein products.

The fermentation ecosystem in APAC is growing

Regional and global regulatory landscapes are adapting to advancements in fermentation technology

Singapore Food Agency

- SFA has published and constantly updates guidelines for bringing products to market: "The Requirements for Safety Assessment of Novel Foods"
- The framework in this guidance document steered the approval of Impossible's *leghaemoglobin* and *Triton Algae's Chlamydomonas reinhardtii algae* (2019)

Ministry of Agriculture, Food and Rural Affairs

- South Korean Ministry of Agriculture, Food and Rural Affairs (MAFRA) announced a new initiative to support the development of alternative protein products, including fermentation-based meat (2020)
- MFDS published a draft regulatory framework for fermentation-derived meat products. This framework is currently under public consultation and is expected to be finalized in 2023

MAFF 農林水産省

- The Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) announced a new initiative to support the development of alternative protein products, including fermentation-based meat (2022)
- MAFF has also established a new research center to focus on the development of alternative protein technologies

Regional and global regulatory landscapes are adapting to advancements in fermentation technology

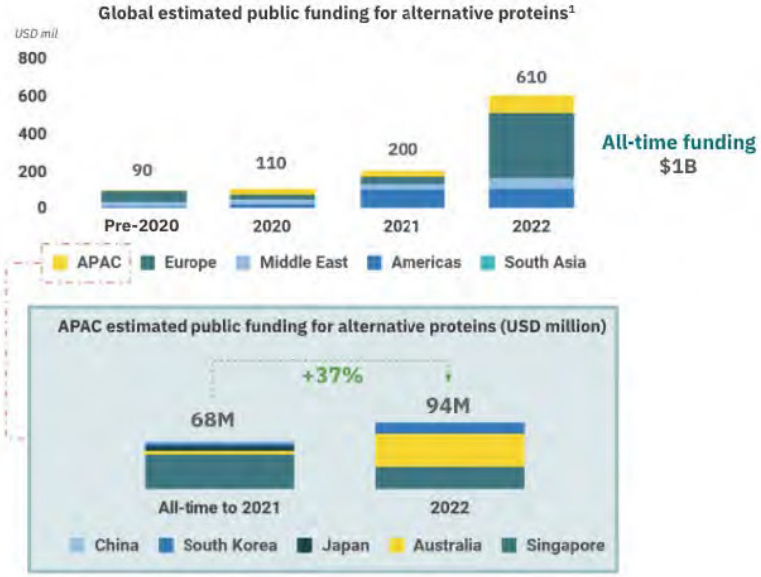
- FSANZ approved the use of soy leghaemoglobin by Impossible Foods in meat analogue products (2021)
- Similar to cultivated meat, precision fermentation-derived products are covered by the existing Food Standards Code

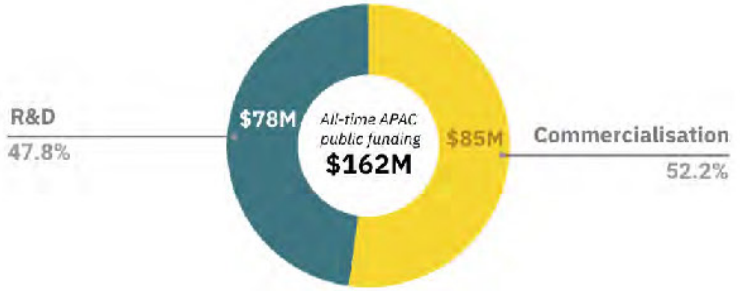
- FDA has issued a number of "no question" letters for purified fermentation-derived ingredients in response to "generally recognised as safe" (GRAS) notices filed by companies
- Perfect Day (beta-lactoglobulin; 2020), Nature's Fynd (fermented microbial protein; 2021), Motif Foodworks (myoglobin; 2022)

- Most fermentation-derived proteins require pre-market authorisation by the EU under the Novel Food Regulation or as genetically modified foods.
- Several companies have applied for regulatory approval and their ingredients are currently being assessed, including Impossible Foods, Perfect Day, Solar Foods, Remilk and Nature's Fynd.

Charting growth and progress in APAC

Government support and public funding for alternative proteins is rising in APAC





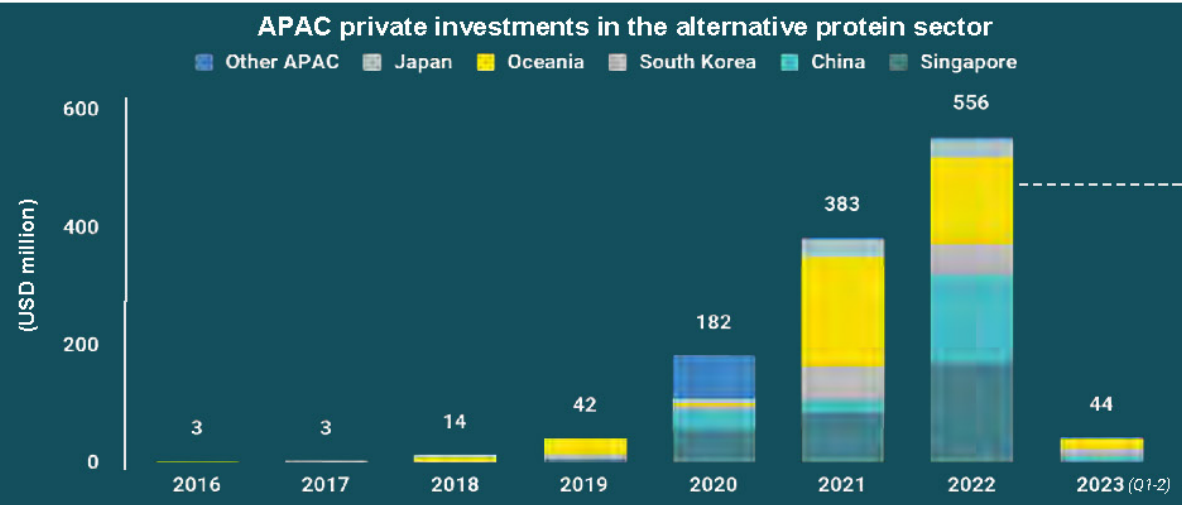
APAC public investment in the single year of 2022 was **37 percent higher** than all-time invested capital up to 2021

All-time public investment in APAC is estimated at $162 million USD as of 2022 and is channeled towards both R&D and commercialisation efforts

With a decline in venture funding, the time has never been more important for governments to step up their long-term support for the sector

Source: [1] Based on GFI analysis of publicly announced government funding. Totals have been adjusted based on estimates where grant programmes have been multi-sector.

All-time private investments in APAC for alternative proteins surpassed $1 billion



Private investments in alternative proteins increased by **45 percent** in 2022 compared the previous year, to hit **$556 million USD** in APAC.

APAC investments for fermentation and cultivated meat in 2022 surpassed regional all-time totals for each.

The APAC region has captured a **9 percent share of global private alternative protein investments** in the first half of 2023.

South Korea saw the biggest deal in the region with $13.1 million USD in CellMEAT.

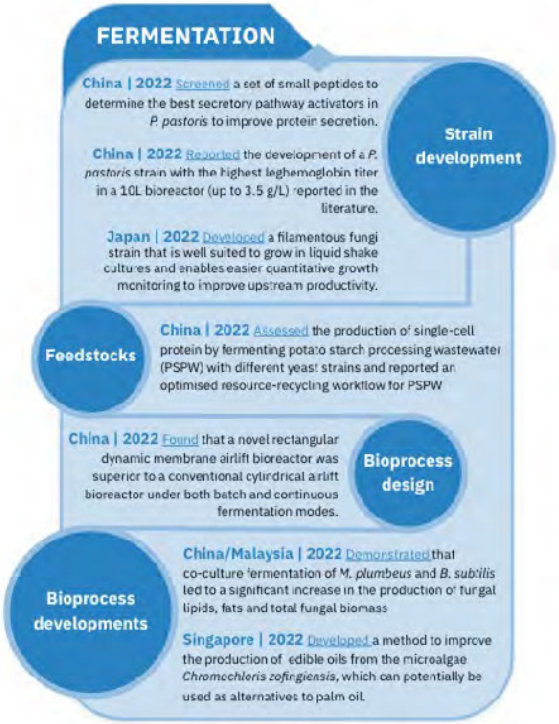
Australia & NZ	3	0	7	28	3	187	151	17	396
Singapore	0	0	0	6	56	85	170	3	320
Mainland China	0	0	0	1	36	24	152	8	221
South Korea	0	1	2	6	7	55	48	13	132
Other APAC	0	0	0	1	72	4	7	2	87
Japan	0	2	5	0	7	28	28	0	71

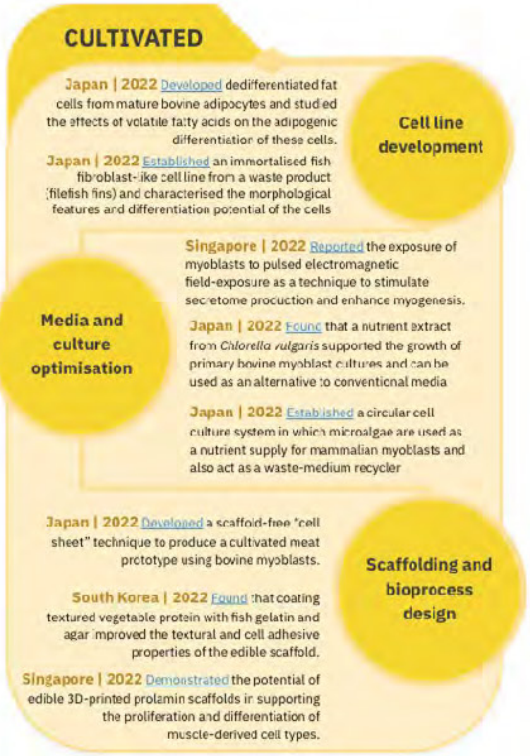
All-time APAC private investment

$1.2B

Academic research and public-private collaborations are gaining momentum

- There have been close to **400** alternative protein-related research publications in APAC since 2022
- **South Korea** leads in the number of publications for cultivated meat research
- **Singapore** has published the most in plant-based and fermentation sectors





Source: Based on targeted word search across multiple publication search engines

Corporate capabilities are being unlocked in B2B partnerships

In 2023, Solar Foods announced a partnership with Ajinomoto which is the startup's first partnership with a major global food brand to co-develop products made with Solein, a protein made using carbon dioxide and electricity.

Israeli cultivated meat startup SuperMeat entered a strategic partnership with Japan's food giant Ajinomoto in a partnership that marks Ajinomoto's first move into cultivated meat, which will have an initial focus on developing low-cost and effective cell growth media.

South Korean food company CJ CheilJedang entered the cultivated meat industry in 2022 through a partnership with cell culture media startup KCell Biosciences to construct a cell culture media facility in South Korea.

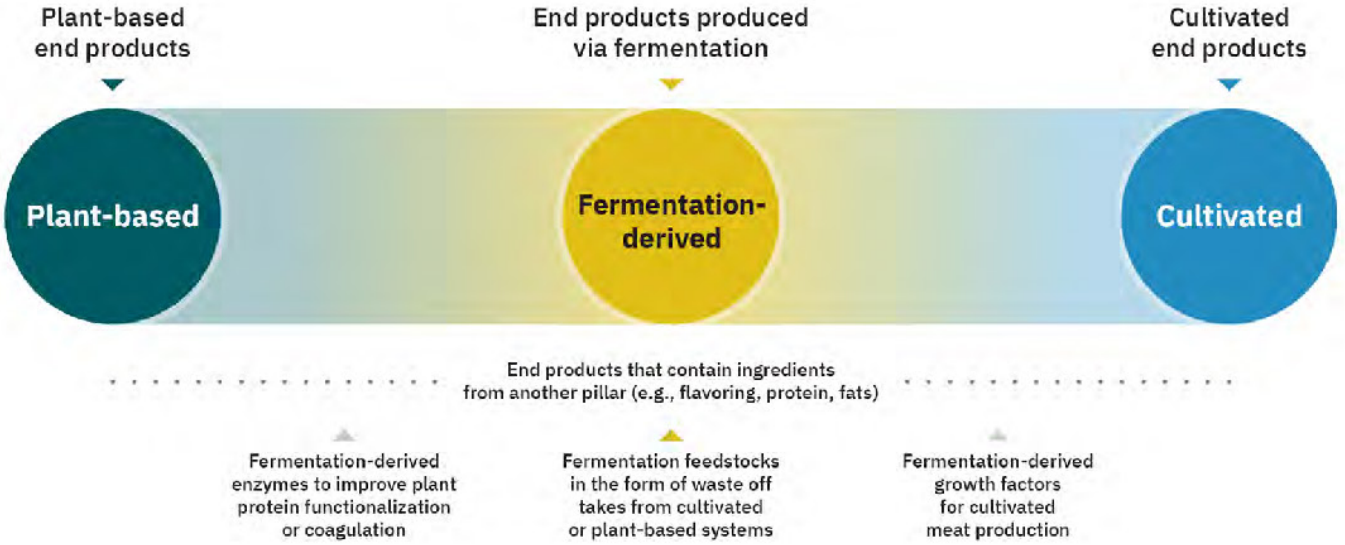
ADM and Singapore's Temasek-backed company Nurasa launched the joint venture ScaleUp Bio to provide contract development and manufacturing services for fermentation-derived ingredients in Singapore. Nurasa also partnered with the multinational Cremer to launch a plant-based co-manufacturing company with high-moisture extrusion.

South Korea's Daesang Corporation entered a strategic partnership with the domestic startup Xcell Therapeutics to supply animal serum-free cell culture medium.

In 2023, China's cultivated meat startup CellX signed a strategic partnership with the equipment company Tofflon to develop equipment for cultivated meat and build a pilot production plant.

Fermentation Cultivated

Continued funding and innovation will drive alternative protein development along a spectrum



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Q&A

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