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# Alternative proteins in APAC

2023 STATE OF THE INDUSTRY REPORT



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#### **Additional acknowledgments**

GFI would like to thank the rest of the GFI APAC team and other GFI colleagues for their insights and contributions, and give a special thanks to the external reviewers of this report.

#### **Note on methodology**

APAC as referred to in this report covers the countries/regions of Australia/New Zealand (data grouped together for the purposes of this report), Mainland China, Hong Kong SAR, Indonesia, Japan, Malaysia, the Philippines, Singapore, South Korea, Taiwan, Thailand, and Vietnam.

South Asia is not included in the data for this report (except when global figures are shown, in which case figures for South Asia are listed as a separate grouping under “South Asia”).

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# gfi / Good Food Institute APAC™



Headquartered in Singapore, the **Good Food Institute APAC (GFI APAC)** is part of a network of leading alternative protein think tanks located in six regions across the globe. We accelerate a shift towards a more secure, sustainable, and just food system through open-access R&D, corporate engagement, and public policy.

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Policy



Corporate Engagement



Science and Technology



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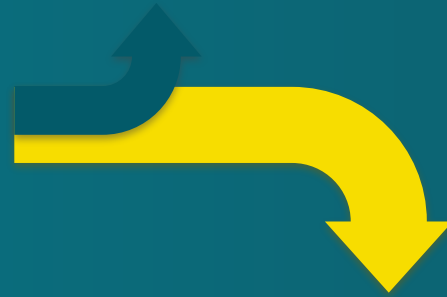
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Market growth

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# The road ahead



**The world has six years left to halve its emissions to avoid the worst effects of climate change. Research is clear that scaling up alternative proteins is among the best solutions we have to reduce the food sector's staggering climate externalities. APAC is at the centre of the challenges we face—as well as at the centre of the solutions we need.**

**APAC's net zero transition will be decisive for the world.** Countries in APAC have to adapt to climate change, but at the same time many of them need to rapidly develop so that low-income populations are given opportunities to improve their livelihoods. All of this has to be done without pushing the planet to the boiling point. At the present rate, emissions in the APAC region could "wipe out gains from emissions reductions elsewhere in the world." We need to find solutions that can get APAC to zero emissions while allowing for continued regional development.

**One of the transitions that will make or break the world's response to climate change is protein.** APAC is a leading animal protein producer and a growing animal protein consumer. But livestock emissions are already 11-20 percent of global emissions. APAC cannot scale the availability of conventional protein without worsening the effects of climate change. But APAC can meet climate targets with nutritionally adequate diets if it diversifies production to 50 percent alternative proteins by 2060.

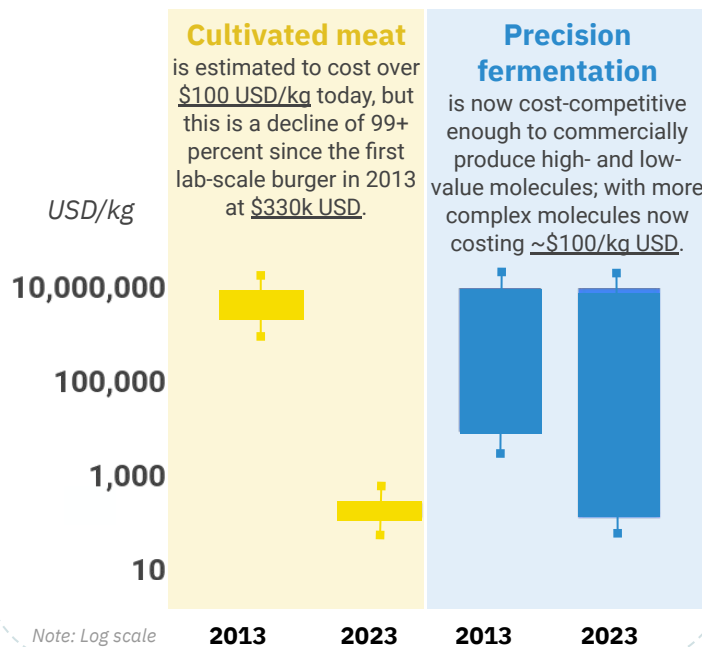
**The protein transition is also rich in opportunity.** APAC can leverage the assets that have made it a global leader in food and animal protein production, and use these to reap the rewards of the protein transition. The region is home to world-class R&D hubs, vast agricultural land, skilled talent, competitive food manufacturing, and a growing consumer base. South Korea, Japan, China, and Singapore are all in the top quartile of countries for spending on R&D. Just as it did for solar, China can become a scale-up hub for alternative proteins, along with Southeast Asia. Australia and New Zealand also offer significant capacity as suppliers of inputs and services like proteins and feedstocks.

**The industry needs to activate billions more in R&D funding to drive product innovation and invest hundreds of billions to scale new technologies.** While we can find short-term fluctuations in the alternative protein sector if we look for them, we can also look for the long-term need, the long-term progress, and the long-term potential. Just like other climate solutions, the path ahead is about learning which solutions will and won't work, so that by 2030 we can double down on a portfolio of technologies and get them on the best possible pathways to scaling as fast as possible. APAC has a game-changing role to play in transitioning our food system to one that is fit for the future.

# Powerful growth drivers are in place

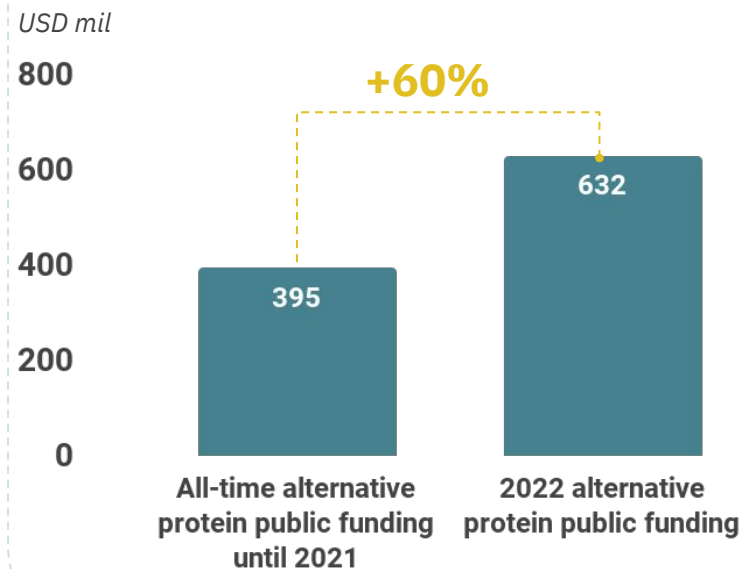
## Costs of novel technologies are falling

While there remains a price gap to close, prices of cultivated meat and precision fermentation are falling



## Governments are increasing support

2022 estimated global public sector investment increased by 60 percent over all-time funding levels



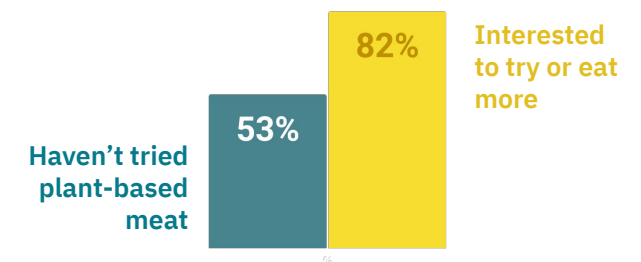
Source: Internal GFI analysis; based on year announced.

## The market opportunity resonates

There is unmet need for protein diversification among large segments of consumers

In a 2023 survey of six Southeast Asian markets, a population of over half a billion people, for plant-based meat...

- **Half** of all respondents have not yet tried it
- **Over three-quarters** want to try or eat more
- **Health** is the main motivator for consumption

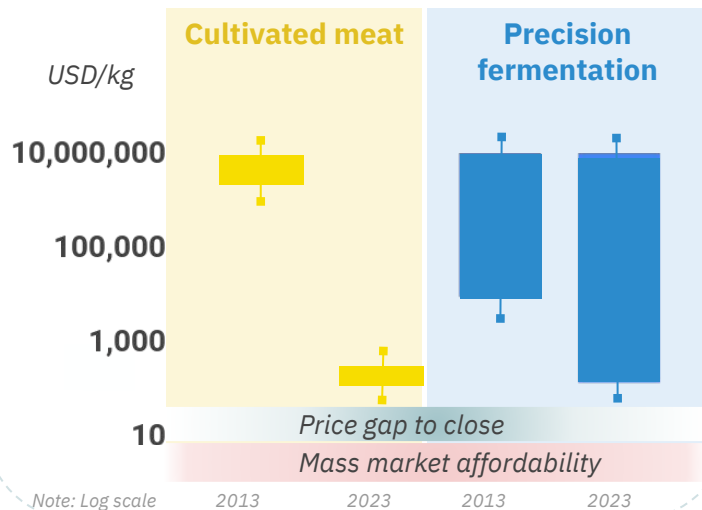


Source: Survey of 5,971 respondents across six SE Asian countries

# But significant progress needs to be made

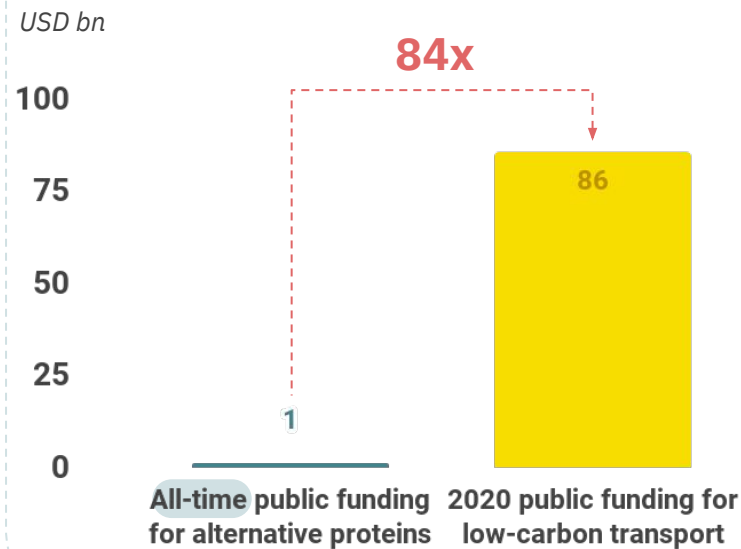
## Costs still have to drop considerably

Food products made from novel technologies will likely need to fall in the region of under \$10/kg to be competitive in the mass market



## Much more public funding is needed

Livestock and transport each contribute over 14 percent of global GHG, but public funding for low-carbon transport is drastically higher

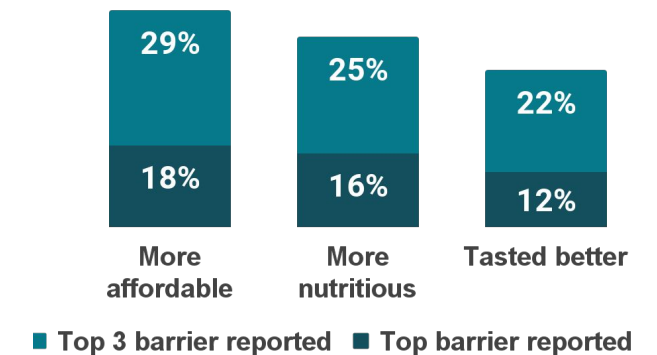


Source: Based on most recent datasets from *Climate Policy Initiative*

## Product quality must improve

Consumers are not satisfied enough with products to become repeat buyers

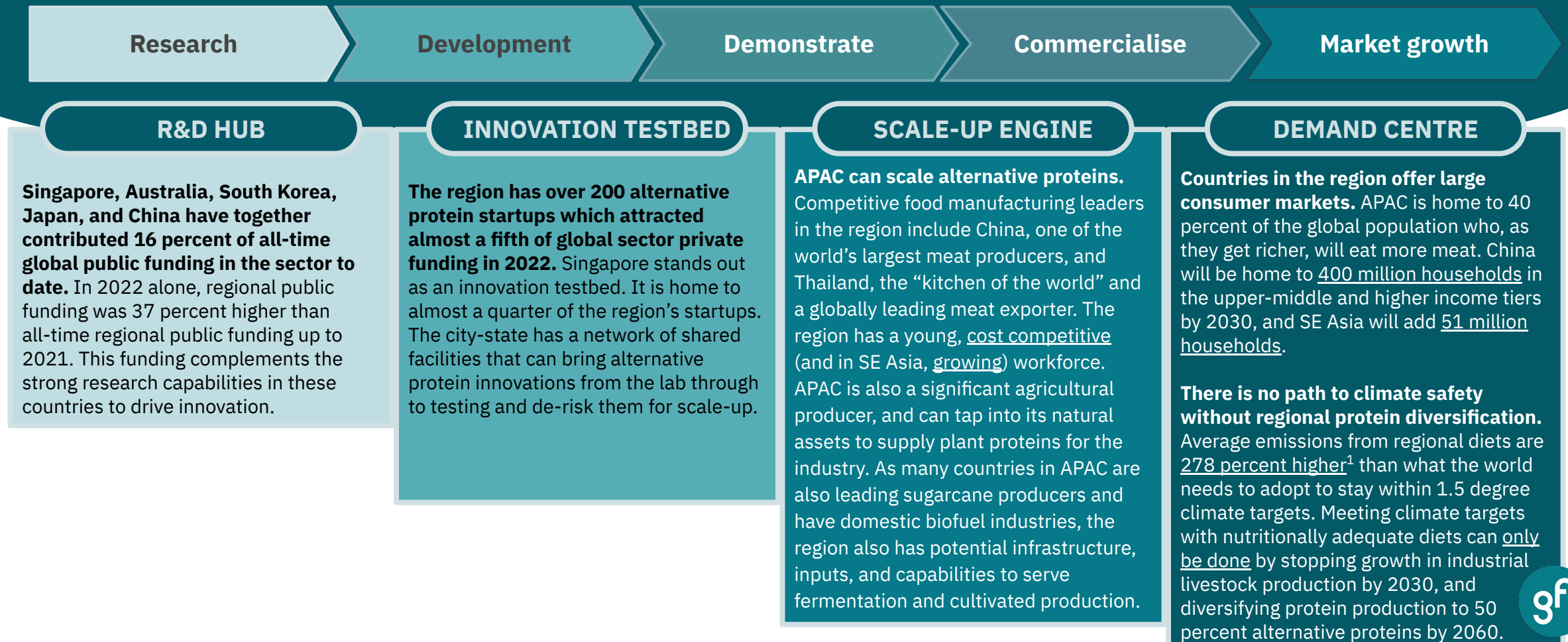
In a 2023 survey of six Southeast Asian markets, consumers are waiting for improvements before increasing plant-based meat consumption...



Source: Survey of 5,971 respondents across six SE Asian countries

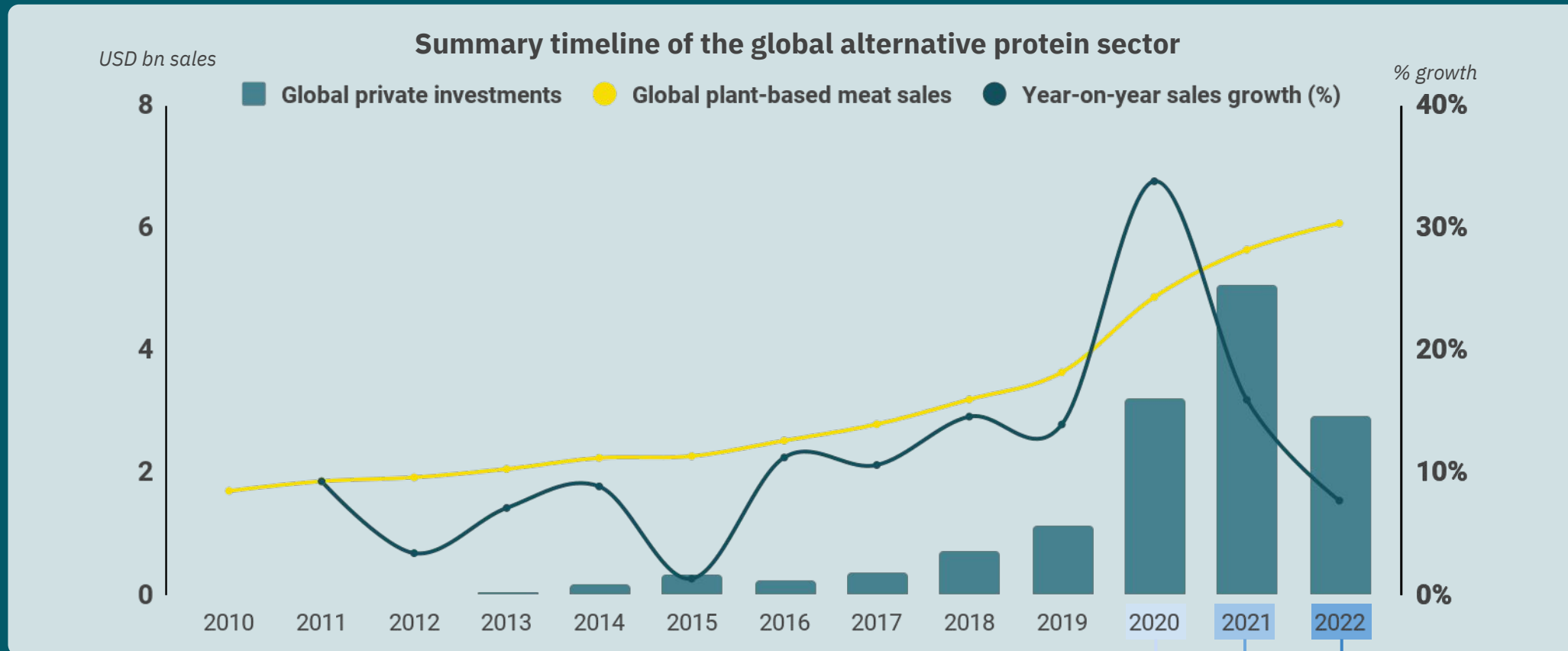
# APAC has capabilities to fuel sector growth from lab to scale

**The sector needs to fund R&D while de-risking the journey to large-scale production.** Countries in APAC have capabilities to help the sector scale. Important alternative protein R&D is being led by Singapore, Japan, South Korea, and Australia. Singapore has created a world-class startup hub and shared testing facilities, and other countries in APAC can bring technologies to scale with competitive manufacturing. APAC is also a significant consumption market.





# The global alternative protein sector has made huge progress

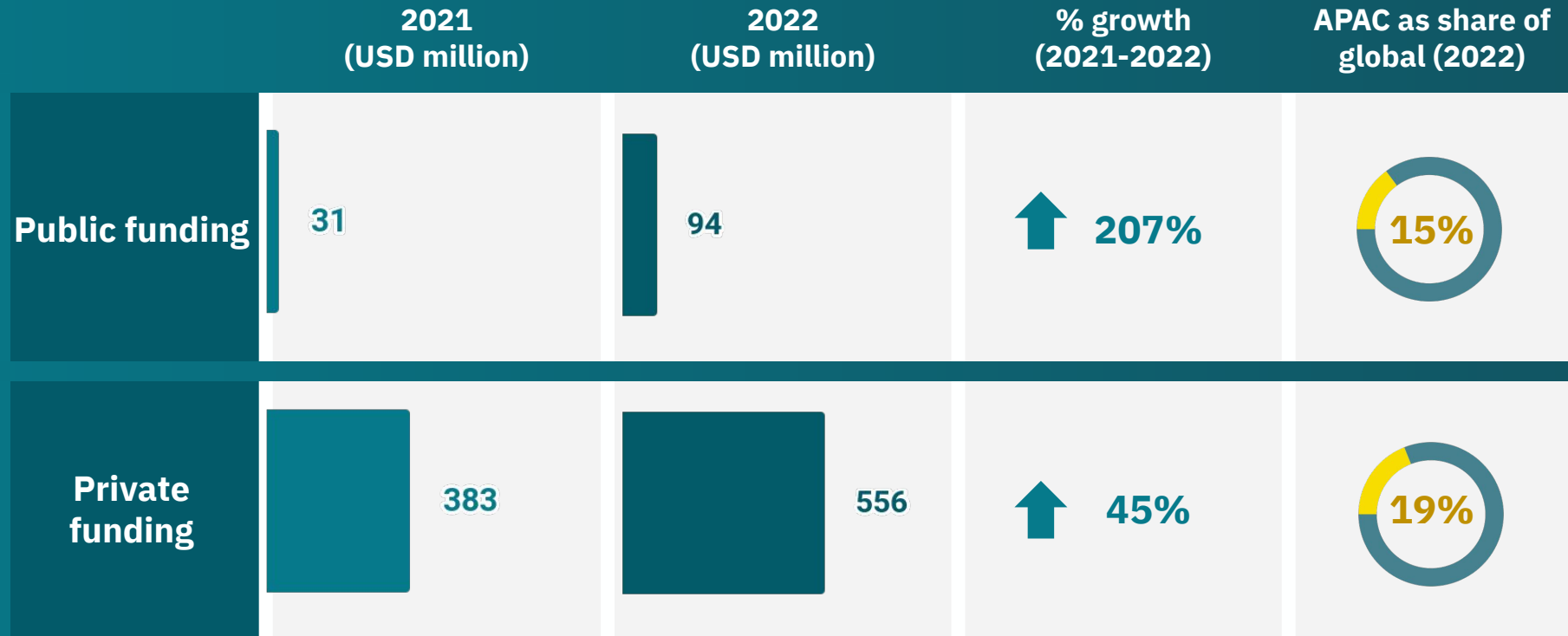


More private capital is invested in the year of 2020 than in the entire sector's history

Year-on-year sales rise by 16 percent in 2021 after record 34 percent growth in 2020

Private investment drops as capital markets wane, but governments triple y-o-y funding

# State of APAC's alternative protein sector



To date:

400+

sector research  
publications

20+

sector-dedicated  
shared facilities

200+

startups

15+

plant-based brands  
launched by major  
incumbents

# GOVERNMENT SUPPORT

**More public funding is needed for alternative proteins so products can improve and scale.**

An eight percent global market share of alternative proteins by 2030 would reduce GHG emissions equivalent to decarbonising 95 percent of aviation. In 2022, all-time global public funding in the sector was about \$1 billion USD. We need an estimated \$10.1 billion USD *per year* to unlock the full benefits of alternative proteins.

**The time has never been more important for governments to step up their sector support.**

Venture funding has continued its precipitous fall for all sectors including alternative proteins in a challenging macro-environment. Global governments met this moment by ramping up sector funding commitments in 2022. APAC public funding increased by 207 percent compared to 2021, with Singapore, Australia, and South Korea all increasing their year-on-year investment. Singapore is one of the top five government funders of the sector globally, and Australia increased public funding by over 900 percent in 2022 compared to all funding up to 2021. Despite this progress, public funding is nowhere near the level it needs to be.

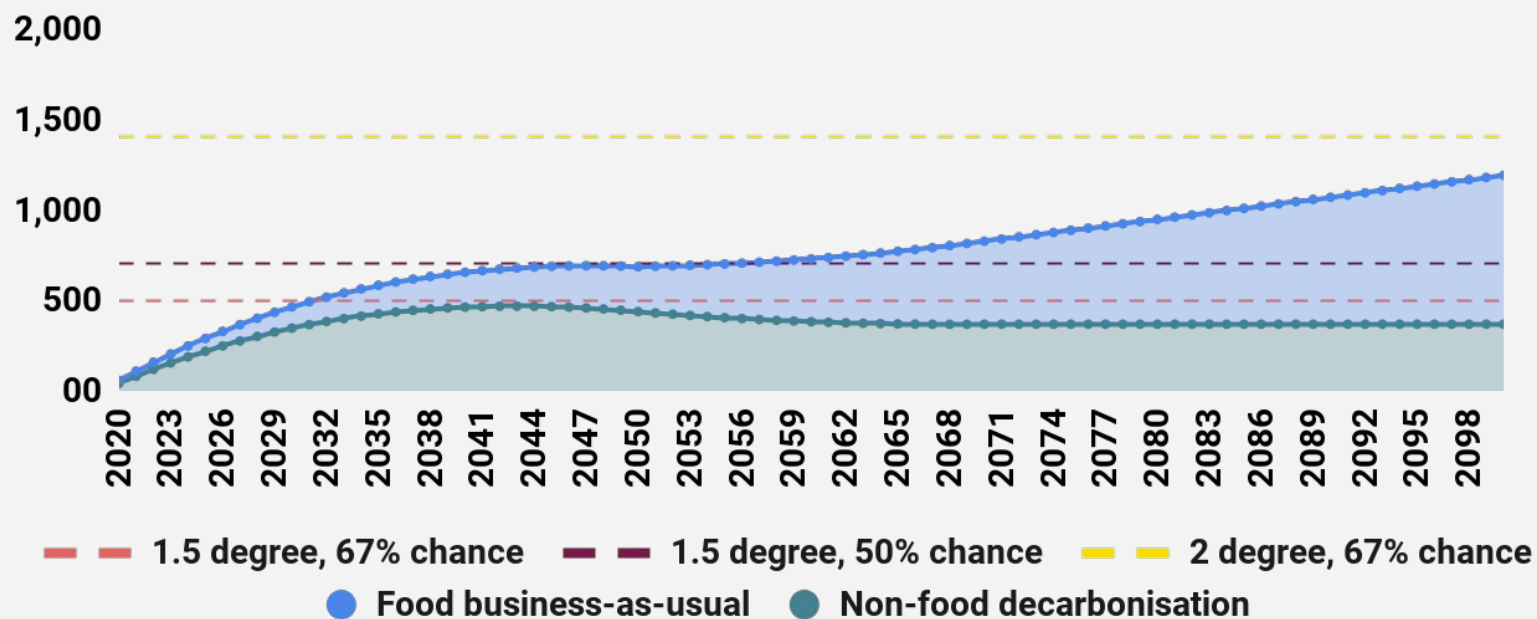
**Singapore leads the world on novel food regulations, and other APAC countries are following suit.**

Singapore was the first country in the world to approve a cultivated meat product for commercial sale back in 2020. In 2022, it gave the first commercial approval of protein made from gaseous feedstocks, and in 2023, it made history again by granting the first regulatory approval for serum-free media for cultivated meat. A cultivated meat application is currently being assessed under Australia and New Zealand's existing novel food regulatory framework with an outcome expected in 2024, while development of relevant regulatory approval pathways are under development in Japan and South Korea, and as of 2023, Thailand and Malaysia as well.

# The world cannot decarbonise without alternative proteins

Global climate targets with full decarbonisation of all non-food sector emissions by 2050 but business-as-usual food sector emissions

Cumulative emissions (Gt CO<sub>2</sub>e)



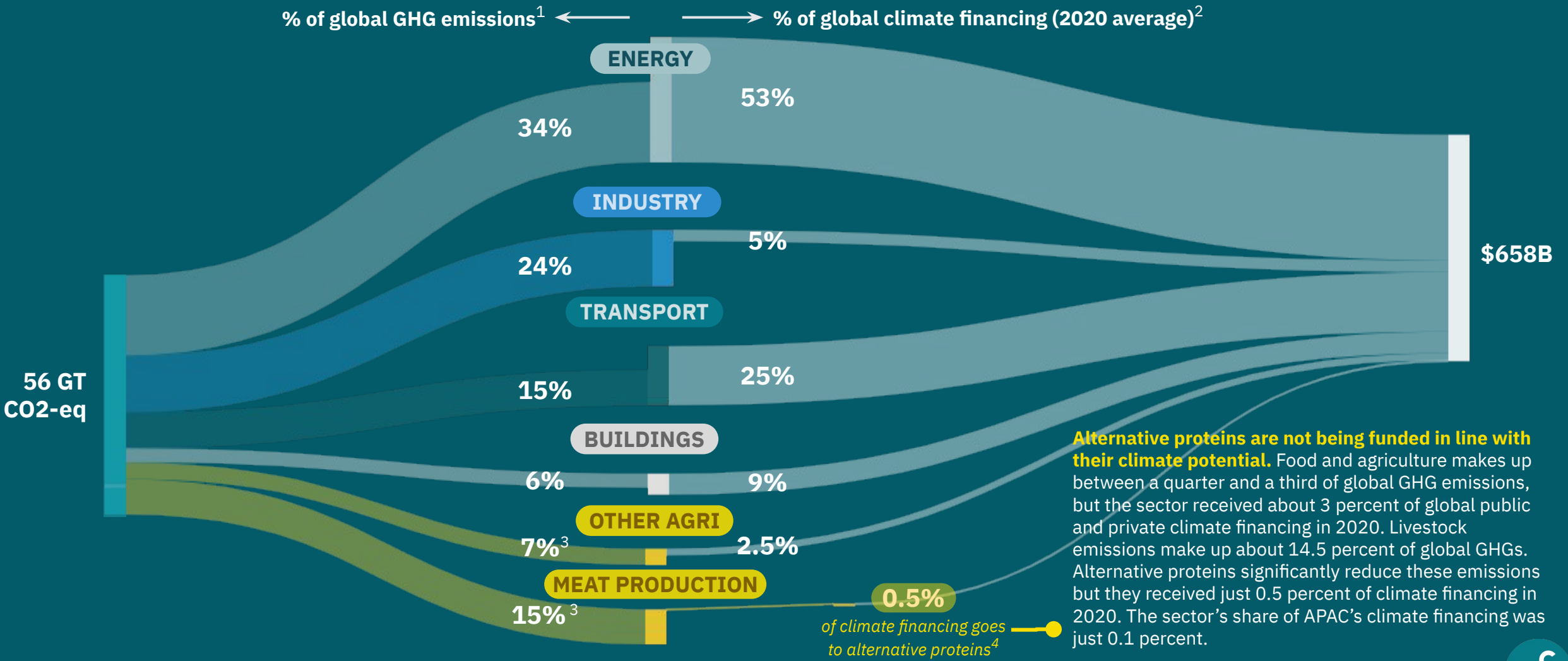
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*Even if fossil fuel emissions were immediately halted, current trends in global food systems would prevent the achievement of the 1.5°C target and, by the end of the century, threaten the achievement of the 2°C target. Meeting the 1.5°C target requires rapid and ambitious changes to food systems as well as to all non-food sectors.*

*Clark, M. A. et al. (2020)*



# Meat production contributes ~15 percent of global GHGs but alternative proteins account for less than 0.5 percent of global climate financing



Source: <sup>1</sup>Based on IPCC for all sectors; meat production share from Poore and Nemecek (2021). <sup>2</sup>Based on most recent sector-specific datasets from Climate Policy Initiative. Financing for "other" and "unknown" categories are excluded. Waste-related/ICT categories are grouped under "Industry". <sup>3</sup>Figures are lower-bound estimates–high-end estimates for AFOLU is 37 percent, and meat production 17 percent. <sup>4</sup>Figures for alternative proteins from GFI analysis of policy and Pitchbook data.



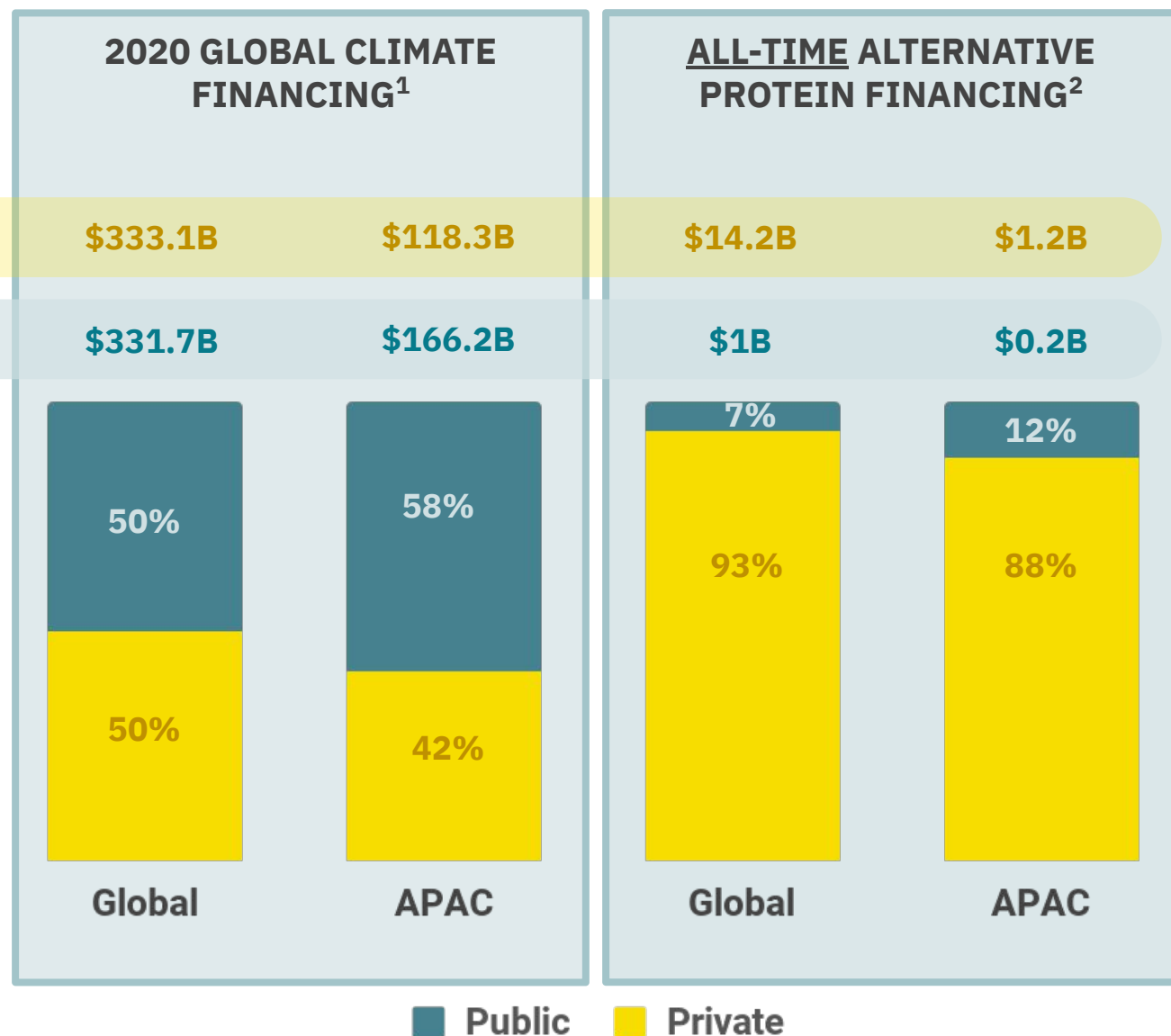
# More public financing is urgently needed

**Alternative protein funding pales in comparison to the level of public support seen for climate financing for other climate solutions.**

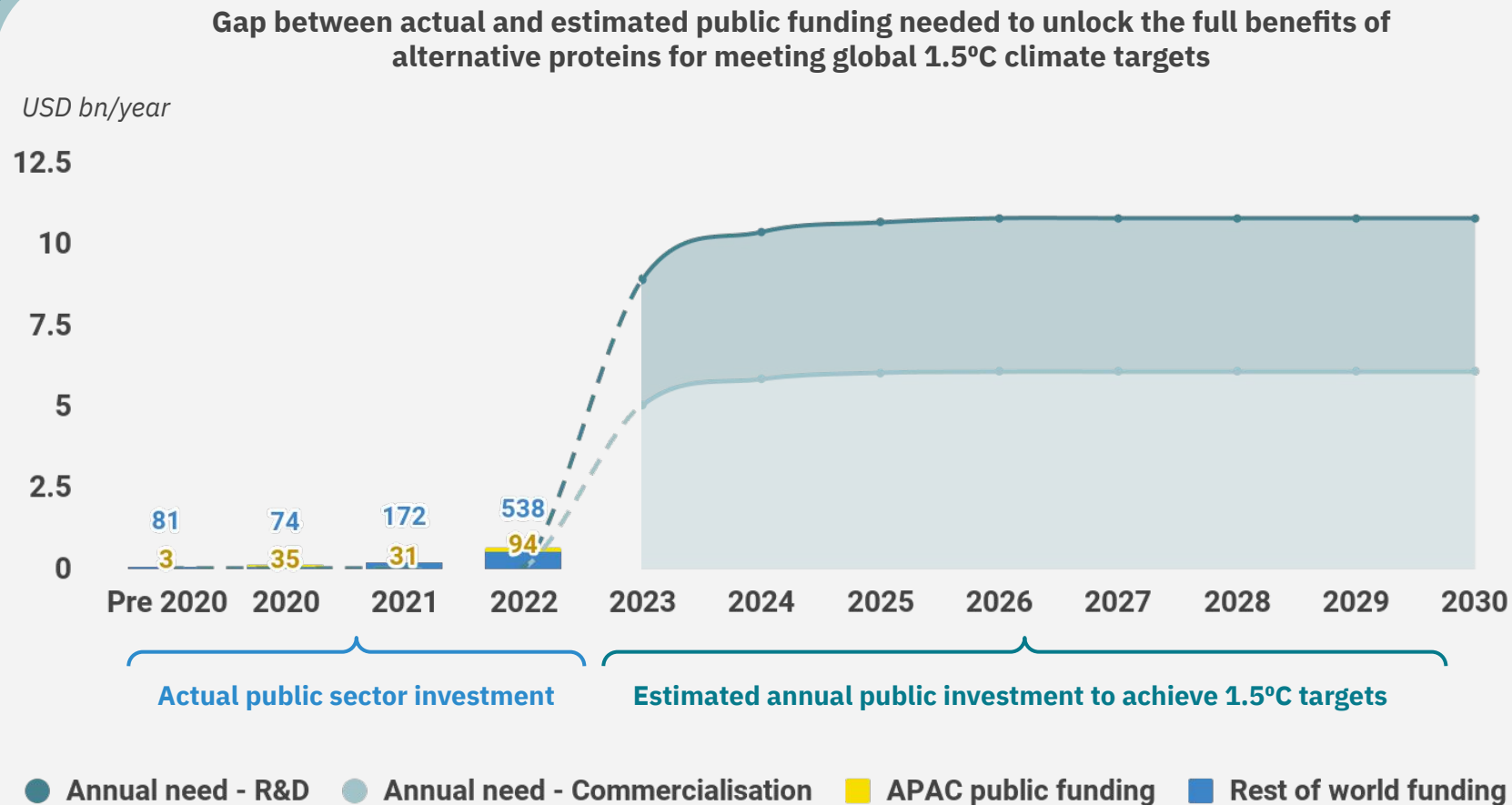
Governments funded over half of the total global public and private climate financing that went to all sectors in 2020. This share of about half has been consistent over the past decade. Early public support for other climate solutions has been critical to crowd-in the private sector, shape market conditions, and unlock sector-wide breakthroughs. Such government support in other sectors has paved the way for the establishment of competitive industries like renewables, which today has a seven times higher return on investment than fossil fuels.

**Alternative proteins need significantly more public support as a share of sector investment in the early years of sector scale-up.**

As of 2022, *all-time* private funding for alternative proteins was \$14.2 billion USD globally, and government funding was about \$1 billion USD. The 7 percent share of public funding (12 percent in APAC) as a percentage of total financing is much less than the over 50 percent seen for other climate solutions globally and regionally.



# To achieve 1.5 degrees, \$10.1B is needed in annual public funds



Public support should be focused on creating an environment in which the private sector can invest with greater confidence and at a lower cost. Cost, affordability, regulatory, and consumer acceptance barriers add extra risks to investor decisions, which can prevent the investment landscape from reaching its full potential.

*Global Innovation Needs Assessments (GINA) on protein diversity (2021)*

## The sector has gained high-level policy endorsement



”

*"Foodtech, including cellular foods, is an important technology from the perspective of realising a sustainable food supply. We have to support efforts that contribute to solving the world's food problems."*

**Prime Minister Fumio Kishida, Japan**  
**February 2023**



”

*"It is necessary to expand from traditional crops and livestock and poultry resources to more abundant biological resources, develop biotechnology and bio-industry, and seek energy and protein from plants, animals, and microorganisms."*

**President Xi Jinping, China**  
**March 2022**



”

*"The significant step-up in investment is an expression of our commitment to food security...Alternative protein is a promising area to meet Singapore's food and nutrition needs in an urban environment."*

**Deputy Prime Minister Heng Swee Keat, Singapore**  
**October 2022**



# Global governments stepped up their support in 2022

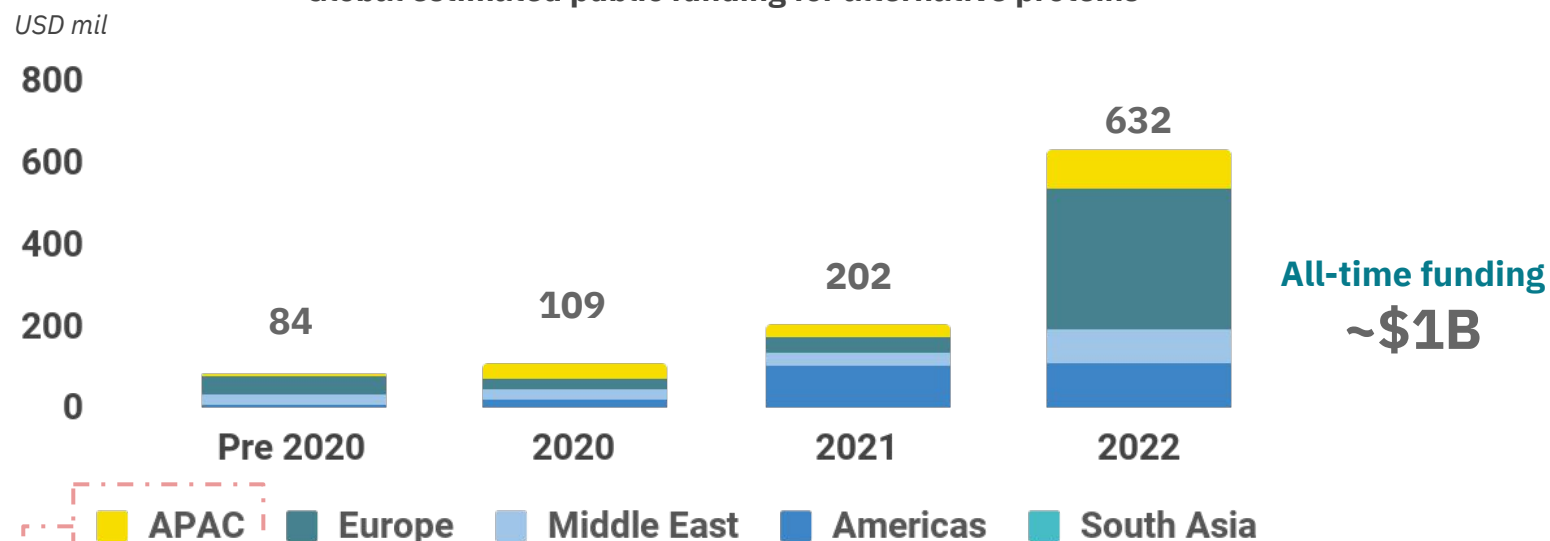
**All-time government funding likely surpassed \$1 billion USD as of 2022.<sup>1</sup>**

Governments have funded about 180 projects globally in the sector to date. More than a third of these were in 2022.

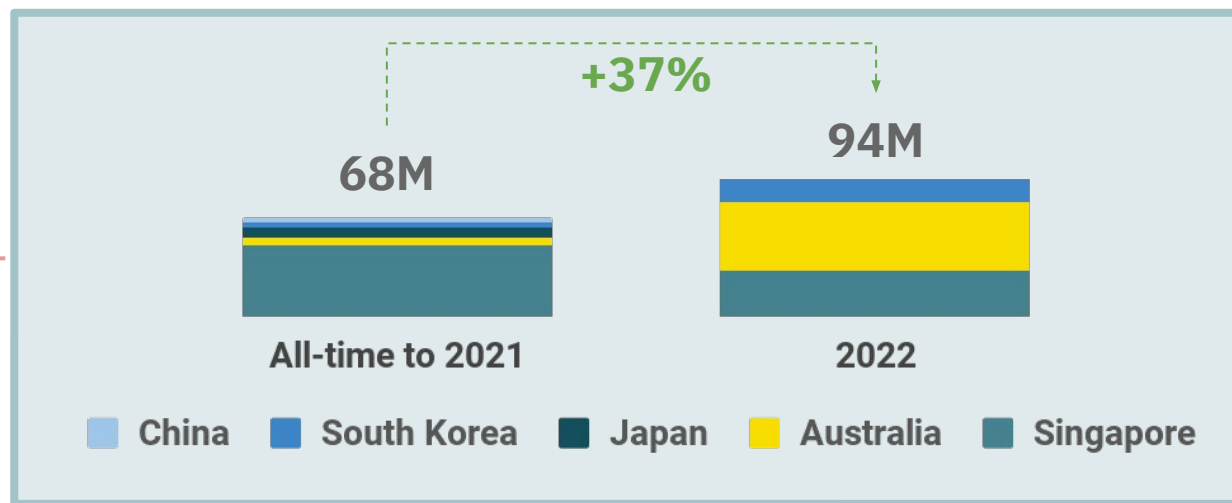
**APAC public investment in the single year of 2022 was 37 percent higher than all-time invested capital up to 2021.**

All-time public investment in APAC is estimated at \$162 million as of 2022, about 16 percent of all-time global public funding.

Global estimated public funding for alternative proteins<sup>1</sup>



APAC estimated public funding for alternative proteins (USD million)



Source: <sup>1</sup> Based on GFI analysis of publicly announced government funding; numbers here are estimates within a range; rounded to nearest million. Starting date based on year of announcement. Totals have been estimated where grant funding/programmes have been multi-sector.



# Governments in APAC are going beyond R&D

R&D  
47.8%

\$78M

All-time APAC  
public funding  
\$162M

\$85M

Commercialisation  
52.2%

## R&D funding

**SINGAPORE** In 2022, Singapore injected a further \$123 million USD to Phase 2 of the Singapore Food Story (SFS) R&D programme which has alternative proteins as one of its four pillars, bringing total SFS funding since the programme was launched to \$230 million USD. Another grant was given in 2022 by the Singapore Israel Industrial R&D Foundation—a bilateral development agency collaboration—to support Israel's Steakholder Foods and Singapore's Umami Bioworks to co-develop 3D-printed fish.



**SOUTH KOREA** In 2021, South Korea announced the \$13.5 million USD Green Bio Fund which mentioned plant-based and cultivated meat as key programme components. In 2022, South Korea awarded a \$15 million USD grant to SpaceF, a cultivated meat startup, as part of the Ministry of Trade, Industry and Energy's Alchemist Project to scale equipment for cultivated meat commercialisation.



**AUSTRALIA** In 2021, the Australian Commonwealth Government awarded a \$1 million AUD grant to Change Foods, a precision fermentation startup, in partnership with the Queensland University of Technology (QUT) to create a platform for upcycling sugarcane waste (bagasse) as a feedstock for precision fermentation to drive down the costs of animal-free dairy production.



## Commercialisation funding

**SINGAPORE** In 2021, the Temasek-backed company Nurasa and national R&D agency A\*STAR committed to invest \$22 million USD over three years into infrastructure and services for alternative protein startups. In 2022, Nurasa opened the Food Tech Innovation Centre (FTIC) to support startups and provided investment to set up both a precision fermentation and a plant-based co-manufacturing facility.

**SOUTH KOREA** In 2022, South Korea gave an undisclosed technology commercialisation support grant to Intake, a startup focused on raw meat texturisation for plant-based pork. It also gave an undisclosed grant to Thyssen Biopharmaceuticals, a company making alternative meat using 3D printing.

**AUSTRALIA** In 2021, the University of Queensland-led Food and Beverage Accelerator (FaBA) was awarded a \$33 million USD grant to boost alternative protein innovation. The programme is expected to attract \$1 billion in regional investment into F&B manufacturing and create 15,000 jobs by 2030. A FaBA consortium partner, Change Foods, was awarded a multimillion-dollar grant for commercialisation support for their precision fermentation products.

# 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.

# R&D ECOSYSTEM






**APAC is home to world-class research institutes which have continued their efforts to accelerate foundational plant-based, fermentation, and cultivated research for alternative proteins.** Over 400 publications have been published since 2020, almost a third of which were in Q1-2 2023. Singapore is home to three of the region's five most active research centres. Nationally funded multi-institutional research programmes that bring together local institutes of higher learning (IHLs), universities, and research institutes are essential in driving R&D and innovation to overcome industry bottlenecks. As example of this is the CentRe of Innovation for Sustainable banking and Production of cultivated Meats (CRISP Meats) hosted at the Agency for Science, Technology and Research (A\*STAR). Funded by the Singapore Food Story (SFS), this programme is seeking to help address the cell line accessibility gap for cultivated meat production by facilitating research collaborations between academic and industry stakeholders.

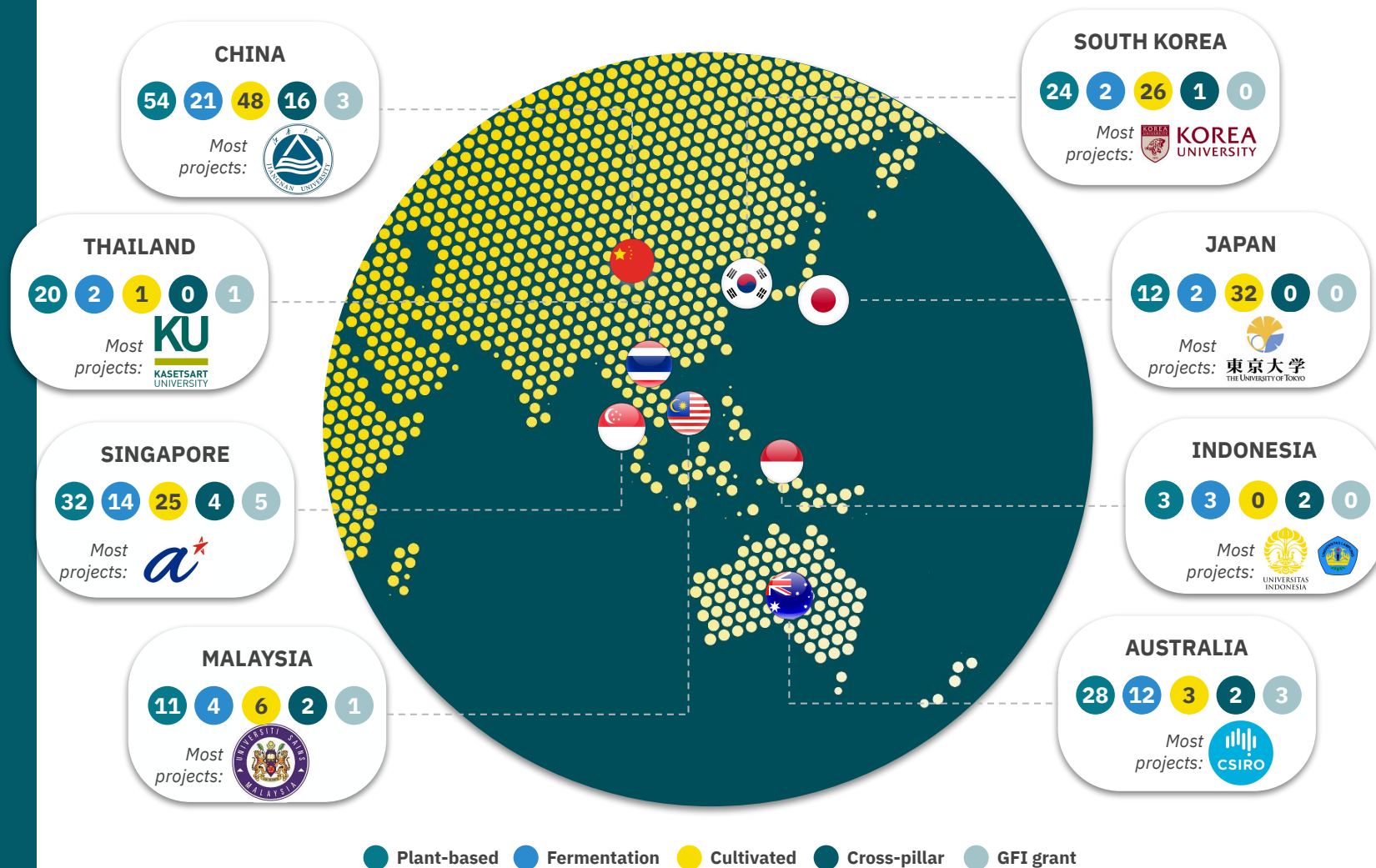
**Region-specific research is needed to close R&D gaps.** From regional climates and landscapes, to existing dietary patterns and consumer demands in flavours and food formats, to the socio-economic conditions that shape the costs and functioning of supply chains, there are many specific issues that influence how alternative proteins are produced, manufactured, sold, and consumed in the APAC region. Significant headway needs to be made to conduct targeted research that takes into consideration such regional conditions and needs. Research gaps include alternative seafood, which is Asia's most consumed protein but is comparatively neglected in the research literature, to locally-grown crops which are under-researched for their potential as ingredients and inputs for the alternative protein industry.



# Sector research publications

There have been 400+ alternative protein-related research publications in APAC since 2020.<sup>1</sup> About a third of these were in Q1-2 2023. **China** has carried out the most research for each pillar. **Singapore** has three of the region's five most active research centres, followed by **Australia**.

Most active research centres	# projects
 Agency for Science, Technology and Research SINGAPORE	45
 Australia's National Science Agency CSIRO	16
 KOREA UNIVERSITY	15
 NUS National University of Singapore	15
 NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE	12



Source: <sup>1</sup>Based on targeted word search across multiple publication search engines. May omit capture publications outside of this targeted word search and industry R&D publications. For China, only 2022-23 publications are included.

## CULTIVATED

**Japan | 2022** [Developed](#) dedifferentiated fat cells from mature bovine adipocytes and studied the effects of volatile fatty acids on adipogenic differentiation.

**Japan | 2022** [Established](#) an immortalised fish fibroblast-like cell line from a waste product (filefish fins) and characterised the morphological features and differentiation potential of the cells

**China | 2022** [Described](#) the use of an economical combination of pronase and dispase II enzymes to isolate porcine muscle stem cells at high purity and promote their myogenic properties through pre-plating.

### Cell line development

**Singapore | 2022** [Reported](#) the exposure of myoblasts to pulsed electromagnetic field-exposure as a technique to stimulate secretome production and enhance myogenesis.

**Japan | 2022** [Found](#) a nutrient extract from *Chlorella vulgaris* supported the growth of primary bovine myoblast cultures and can be used as an alternative to conventional media.

**Japan | 2022** [Established](#) a circular cell culture system in which microalgae are used as a nutrient supply for mammalian myoblasts and also act as a waste-medium recycler.

**China | 2022** [Demonstrated](#) that a natural compound, naringenin, promoted cell differentiation in vitro and increased the content and maturity of generated myotubes.

### Media and culture optimisation

**Japan | 2022** [Developed](#) a scaffold-free “cell sheet” technique to produce a cultivated meat prototype using bovine myoblasts.

**South Korea | 2022** [Found](#) that coating textured vegetable protein with fish gelatin and agar improved the textural and cell adhesive properties of the edible scaffold.

**Singapore | 2022** [Demonstrated](#) the potential of edible 3D-printed prolamin scaffolds in supporting proliferation and differentiation of muscle-derived cell types.

**China | 2023** [Demonstrated](#) the potential of gellan gum-gelatin scaffolds with Ca<sup>2+</sup> crosslinking for constructing a structured cultivated meat model.

### Scaffolding and bioprocess design

# Selected regional publications in 2022-23

## FERMENTATION

**China | 2022** [Screened](#) a set of small peptides to determine the best secretory pathway activators in *P. pastoris* to improve protein secretion.

**China | 2022** [Reported](#) the development of a *P. pastoris* strain with the highest leghemoglobin titer in a 10L bioreactor (up to 3.5 g/L) reported in the literature.

**Japan | 2022** [Developed](#) a filamentous fungi strain that is well suited to grow in liquid shake cultures and enables easier quantitative growth monitoring to improve upstream productivity.

### Strain development

**China | 2022** [Assessed](#) the production of single-cell protein by fermenting potato starch processing wastewater (PSPW) with different yeast strains and reported an optimised resource-recycling workflow for PSPW

### Feedstocks

**China | 2022** [Found](#) that a novel rectangular dynamic membrane airlift bioreactor was superior to a conventional cylindrical airlift bioreactor under both batch and continuous fermentation modes.

### Bioprocess design

**China | 2022** [Demonstrated](#) that co-culture fermentation of *M. plumbeus* and *B. subtilis* led to a marked increase in production of fungal lipids, fats, and total fungal biomass.

### Bioprocess developments

**Singapore | 2022** [Developed](#) a method to improve the production of edible oils from the microalgae *Chromochloris zofingiensis*, which can potentially be used as alternatives to palm oil.

## PLANT-BASED

**New Zealand | 2022** [Explored](#) the impact of 3D printing on animal- and plant-based blends, and found adding 20 percent chicken mince achieved better printability and structure.

**Thailand | 2023** [Conducted](#) metabolite profiling of the leaves of a fast-growing medicinal plant to identify novel compounds as a source for umami flavours.

**China | 2023** [Showed](#) the creation of compounds with umami flavour and low bitterness from a wheat gluten Maillard reaction.

**Japan | 2023** [Demonstrated](#) an enzymatic method to reduce the off-flavours in plant-based patties via a cyclodextrin mechanism as a potential clean-label solution.

**China | 2023** [Identified](#) specific soy protein isolate (SPI) characteristics and extrusion parameters that can improve the final extrudate texture.

### Taste and texture

**China | 2022** [Studied](#) the impact of the inclusion of microalgae on plant-based meat and found an improved nutritional profile and positive sensory evaluation results.

**Malaysia | 2023** [Reviewed](#) a range of methods to reduce anti-nutrients and address bioavailability challenges of plant-based foods without affecting their physicochemical and nutritional aspects.

**Australia | 2023** [Studied](#) solid-state fermentation as an effective method to reduce allergenicity of legume-based proteins.

### Nutrition

# Alternative protein education

Singapore is the regional centre for further education in alternative proteins, and has offered seven courses across academic institutions. These courses span undergraduate, graduate, continuing education, and professional training. Australia has one elective course on cultivated meat. In 2023, corporates have begun to partner with academic institutions to offer joint educational and internship programmes.



Nanyang Polytechnic

1-day course | [Introduction to alternative protein and cultivated foods](#)



NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Undergraduate module | [Introduction to advanced meat alternatives](#)



NUS National University of Singapore

Undergraduate and graduate module | [Intro to advanced meat alternatives](#)  
Undergraduate and graduate module | [Tissue engineering for designing food](#)



SIT SINGAPORE INSTITUTE OF TECHNOLOGY

Continuing education and training | [High-moisture extrusion course at FoodPlant](#)



SP Singapore Polytechnic

Professional training courses | [Customisable courses at Food Innovation and Resource Centre \(FIRC\)](#)



SUTD SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Online webinar | [Webinar on 3D food printing](#)



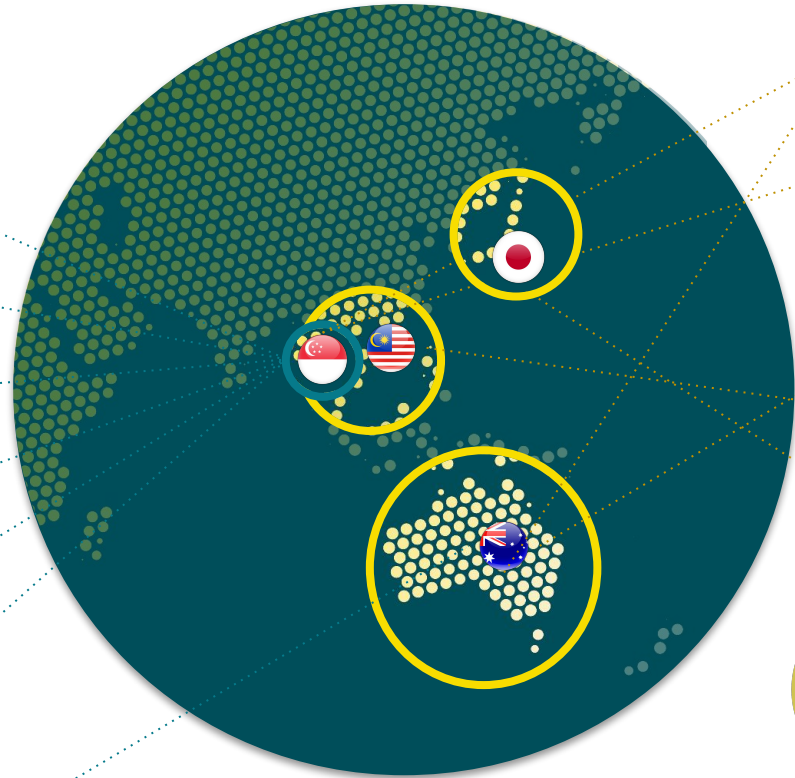
Temasek POLYTECHNIC

Undergraduate projects | [Final-year projects to develop local future foods](#)



UNSW SYDNEY

Elective course | [Vertically Integrated Projects: Cellular Agriculture](#)



The number of APAC-based student communities in GFI's Alt Protein Project doubled to six in 2023. These student-led groups at leading regional universities are driving the development of academic ecosystems for alternative proteins by raising awareness, holding events, building communities, and accelerating research and education.

Founding year:

2022



2022



2022



2023



2023



2023



## Alternative protein student groups





# More R&D is needed to target regional whitespaces

For GFI's full suite of global solution spaces, see [Advancing Solutions for Alternative Proteins \(ASAP\)](#)

## REGIONAL OPPORTUNITY

### Develop seafood-specific research toolkits for cultivated seafood, including addressing stemness and proliferation in cell cultures

Asia consumes 72 percent of global fish production and per capita consumption is double the global average. While species-specific research toolkits exist for many terrestrial animals, they are sparse for marine counterparts. Little is known about the biology of many aquatic species and cell types relevant to cultivated seafood, which hinders cell line development and characterisation efforts. Closing these gaps will lower barriers to entry for researchers in this area of research.



## REGIONAL OPPORTUNITY

### Identify crops and sidestreams that are well-positioned as inputs for alternative proteins

APAC is the world's largest producer of agricultural commodities. Local crops are underexplored and could offer significant value as plant protein ingredients, such as mung beans. The sidestreams of crops produced in APAC could also provide valuable inputs for alternative protein production as protein ingredients, and for culture media inputs or feedstocks for fermentation and cultivated production.



### Mapping animal cell metabolism to optimise media formulation

The cost and environmental impact of cultivated meat are driven by the cell culture media formulation and its conversion efficiency into meat. Metabolic modeling and engineering techniques can aid media.



### Fiber spinning innovations for improved plant protein texturization

Fibers from non-traditional texturization techniques like electrospinning, jet spinning, or blow spinning could impart texture throughout a product even if they don't comprise the bulk of the end product, which may render these approaches economically viable for enhancing texture within a bulk product even at a relatively small scale.



### Plant-based category market

### Guaranteed offtake contracts for products and ingredients

## REGIONAL OPPORTUNITY

### Microbial screening in APAC ecosystems to identify new protein production strains

The microbial strains used in fermentation heavily affect the process, from taste to bioprocess scalability. A minimal number of strains are available for alternative proteins. Most research and screening being done to close this gap is focused on temperate regions, but comparatively little is known about the diversity of important groups of microorganisms in tropical ecosystems such as those in many parts of Asia.



## REGIONAL OPPORTUNITY

### Regional lifecycle assessments and techno-economic analyses

Asia has the potential to be an alternative proteins manufacturing hub to further optimise cost-efficient production at scale. While TEAs have been done in other regions to identify key cost drivers and opportunity improvements, no TEAs have been done in any Asian country. In addition, no LCAs in any region have been conducted for alternative seafood, which is one of Asia's most consumed proteins.



### Plant-based analytical characterization service

Plant-based food manufacturers often struggle with batch-to-batch ingredient inconsistency and variability between suppliers. Better analytical tools for predicting plant-based ingredient performance could improve manufacturing efficiency and create more transparent ingredients.



### Hybrid products to optimise taste, nutrition, cost, and sustainability

Hybrid products are a promising means to improve the cost and sustainability of animal-derived meat while retaining the benefits of plant proteins. Promoting the development of hybrids may facilitate...



# PRIVATE INVESTMENT

**All-time private investment deals with disclosed amounts in APAC's alternative protein sector have surpassed a total of \$1 billion USD, but investment declined significantly in Q1-2 2023.** Private sector alternative protein investment climbed by 45 percent year-on-year to reach a height of \$556 million USD investment in 2022. However, a broader downturn in macroeconomic conditions which has brought global venture funding for all sectors to a 13-quarter low, combined with progress that still needs to be made for alternative protein products to reach taste, nutrition, and price parity, has created disillusionment in the market. Despite the drop, the majority of active investors in APAC see the long-term potential of alternative proteins and plan to continue making investments.

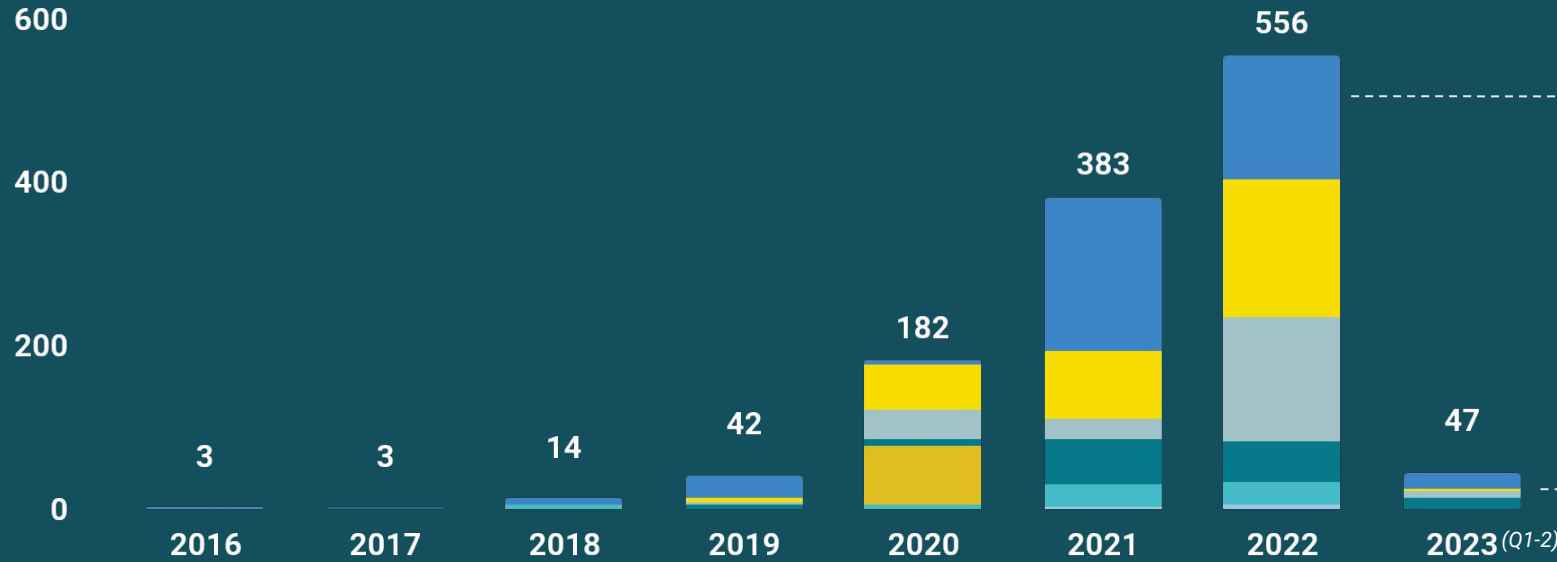
**Investments are diversifying across global regions, production pillars, and focus areas.** In 2023, the top deals in the alternative protein sector shifted from plant-based to the cultivated and fermentation production pillars. Australia/New Zealand lead in all-time alternative protein private investments for every pillar in the region, followed by Singapore.



# All-time private investment in APAC has surpassed \$1 billion

APAC private investments in the alternative protein sector<sup>1</sup>

■ Australia/New Zealand 
 ■ Singapore 
 ■ China 
 ■ South Korea 
 ■ Hong Kong 
 ■ Japan 
 ■ Other APAC



APAC's 2022 private investments increased by **45 percent** compared the previous year, to hit **\$556 million USD**. Investment for fermentation and cultivated in 2022 surpassed **regional all-time totals** for each.

Investment is significantly down in APAC in Q1-Q2 2023, mirroring the drop in global venture funding. The APAC region has captured a **9 percent share of global private investments** in the first half of 2023.

	2016	2017	2018	2019	2020	2021	2022	2023 (Q1-2)	All-time Total
Australia/New Zealand	3	0	7	28	3	187	151	20	399
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
Hong Kong SAR	0	0	0	1	72	1	0	2	76
Japan	0	2	5	0	7	28	28	0	71
Other APAC <sup>2</sup>	0	0	0	0	0.1	3	7	0	11

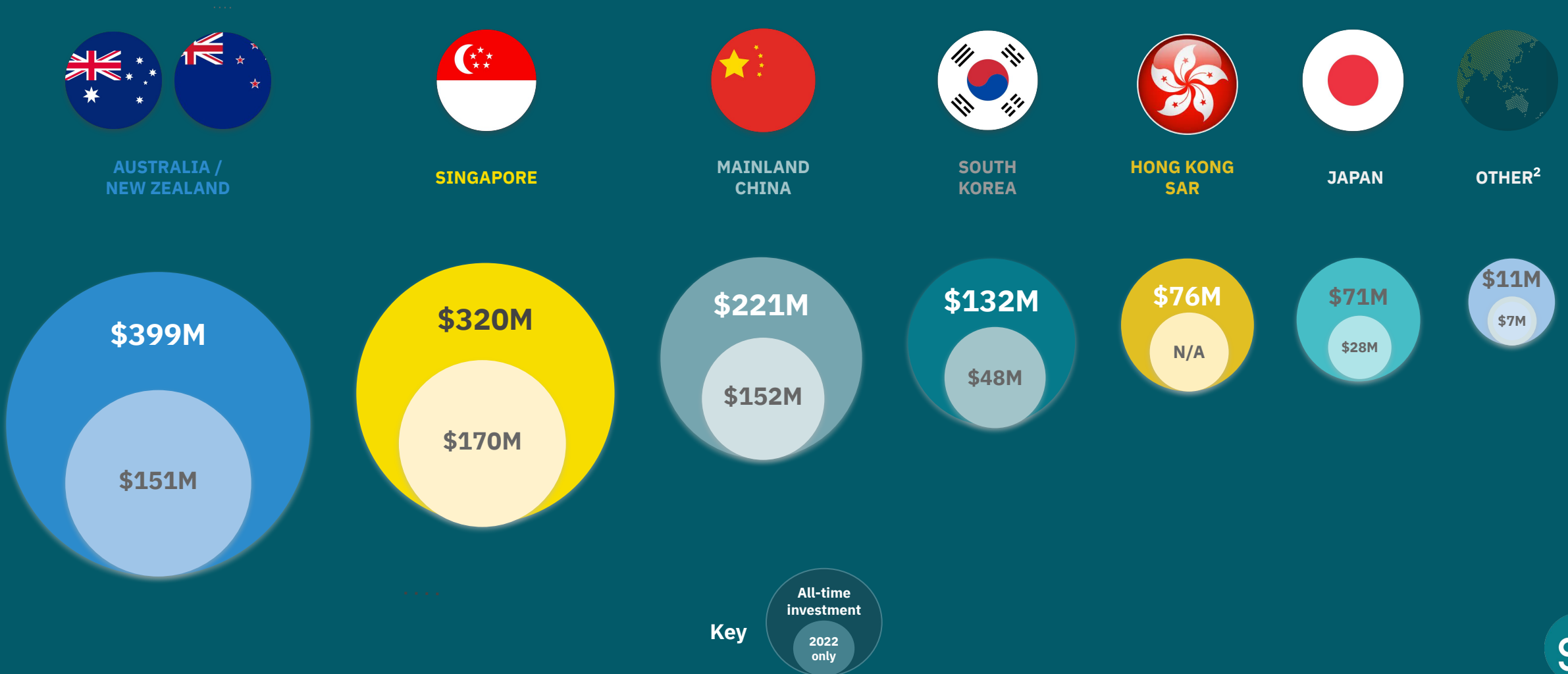
**All-time APAC private investment \$1.2B**



Source: <sup>1</sup>Analysis of Pitchbook data. Note data only includes deals with disclosed amounts and is only a partial view of 2023 (up to Q2); <sup>2</sup> Includes other countries for which investment data exists, in this case Indonesia and the Philippines.

# All-time and 2022 sector private investment (2010 to Q1-2 2023)

C O U N T R I E S / R E G I O N S

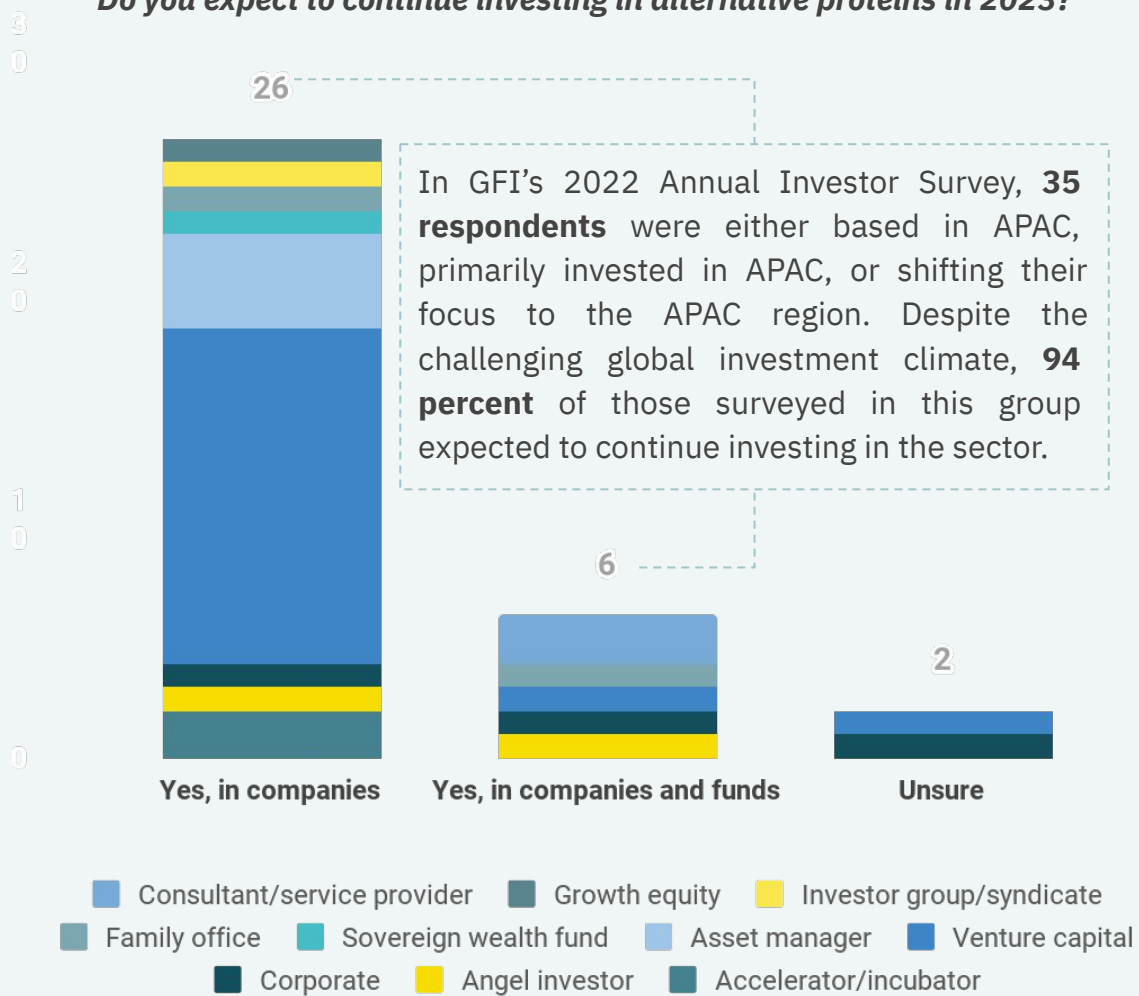


Source: <sup>1</sup> Analysis of Pitchbook data. Note data only includes deals with disclosed amounts and is only a partial view of 2023 (up to Q2); <sup>2</sup> Includes other countries for which investment data exists, in this case Indonesia and the Philippines.



# Sector investors in APAC are committed for the long-term

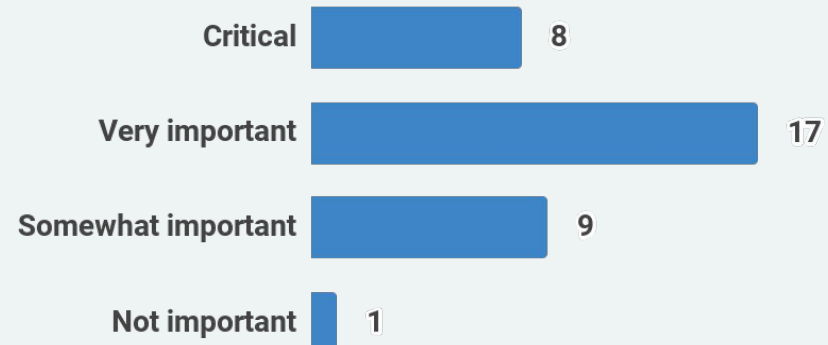
“Do you expect to continue investing in alternative proteins in 2023?”



## ESG mandates

“How important are ESG factors and potential impact for your investment decision-making?”

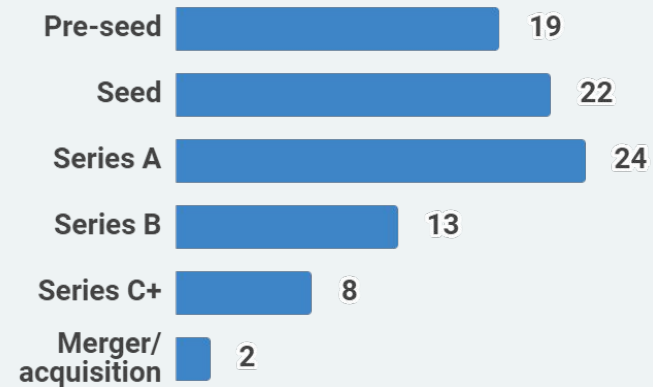
(APAC respondents n=35)



## Deal type

“What deal stage in 2023 are you planning to invest in?”

(APAC respondents n=35)





”

*“The alternative protein sector has demonstrated success in at least one segment, plant-based milk, where it commands a 16 percent market share in the U.S. As fermentation and cultivated technologies come online, products will improve further. Innovation continues to thrive with new technologies and product formats. The alternative protein sector is addressing key long-term issues such as climate change, a protein shortage due to the rising population, and a consumer desire for healthy eating. While sector headwinds will abate as they reflect short-term changes, these long-term trends will fuel industry growth for decades to come. We continue to deploy capital at a steady pace and remain excited about the long-term potential of the sector. Challenging times give rise to resilient founders to create disruptive companies with a strong foundation.”*

**Gautam Godhwani | Managing Partner, Good Startup**

*A Singapore-based venture capital firm focused on the alternative protein sector with over 25 investments across seven countries.*



”

*“Asia Pacific is the region with largest share of the global meat, seafood, and dairy production. And the protein market continues to grow, driven by increases in population and affluence. This arguably makes APAC the most important and the most attractive region for alternative protein investments, both from an impact and potential return perspective. That is why we focus on Asia Pacific, and despite the slowdown in overall VC funding, we have invested in around 10 innovative startups from across APAC in 2023 alone.”*

**Michal Klar | Founding Partner, Better Bite Ventures**

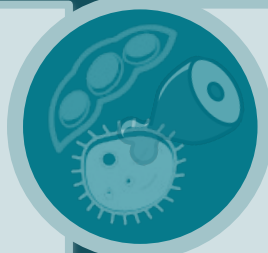
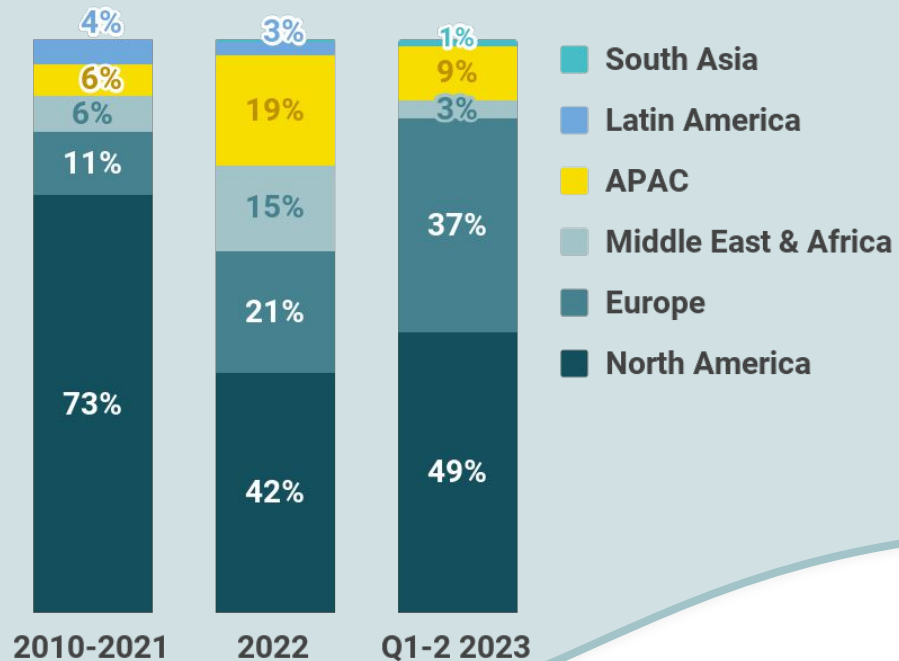
*The first alternative protein fund dedicated to APAC, which invests primarily at founding, pre-seed, and seed stages.*

# Investment has been diversifying across regions and pillars



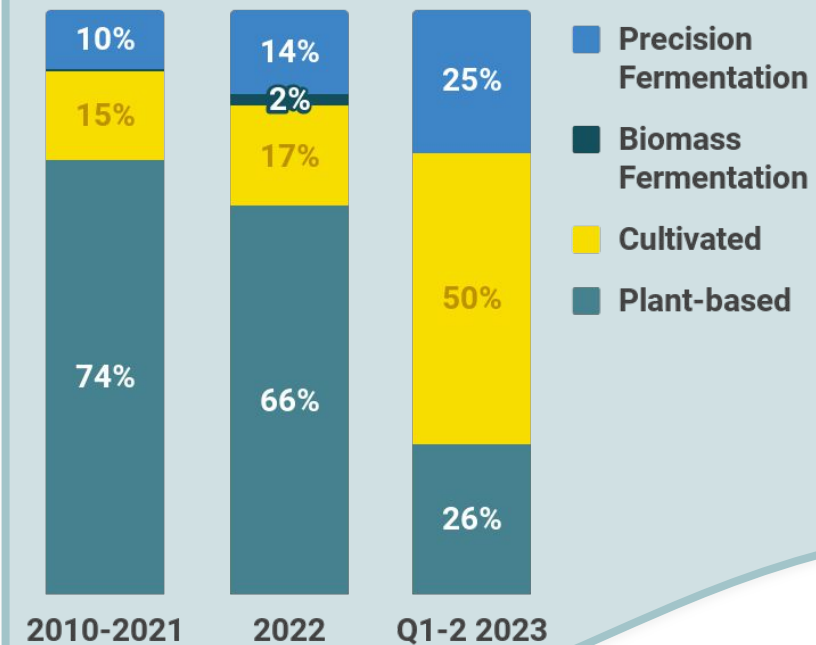
**BY REGION**, investment has been diversifying. Between 2010-21, 73 percent of sector investment was in North America, and **only six percent was in APAC**. In 2022, APAC's share **increased to 19 percent**. As of Q2 2023, APAC has attracted **9 percent** of 2023 investment.

Global sector investment by regional share of total



**BY PILLAR**, plant-based has a declining investment share in APAC. Regional investment in fermentation and cultivated in 2022 **surpassed previous all-time totals** for each. Plant-based investment has declined from an average of 74 percent in the years up to 2021 to **26 percent as of Q2 2023**.

APAC sector investment by sub-sector share of total





# Countries are becoming investment hotspots for different pillars

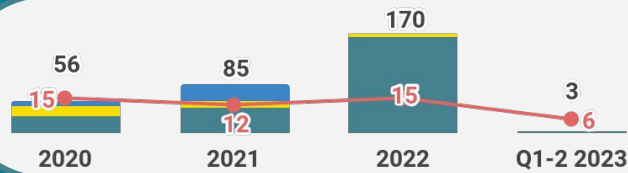
Singapore was a first mover in the region and attracted **\$56 million USD** to the sector in private capital in 2020. That included almost half of cultivated investment and all of the precision fermentation investment in the entire APAC region in that year. Private funding in other countries has since increased significantly, especially for fermentation and cultivated. Australia/New Zealand's all-time invested capital in fermentation was **\$90 million USD** as of Q2 2023, surpassing the \$83 million USD in the rest of the region combined. Australia/New Zealand also lead in all-time cultivated investment at \$59M USD, followed by South Korea with \$50 million USD.

## ANNUAL PRIVATE INVESTMENT

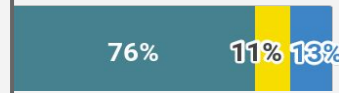
## ALL-TIME INVESTED CAPITAL

## SUMMARY OF PRIVATE SECTOR INVESTMENTS

### Singapore

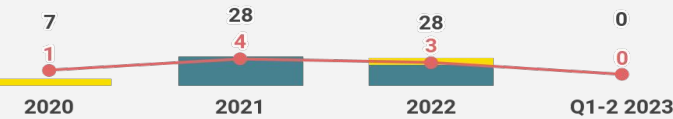


**\$244M**  
**\$35M**  
**\$41M**



Singapore led the region as an **early investor in all three pillars of alternative proteins**. Plant-based continues to dominate in terms of all-time investment, with the peak in 2022 driven by two deals (\$100M in TiNDLE Foods and \$63M in Outside).

### Japan

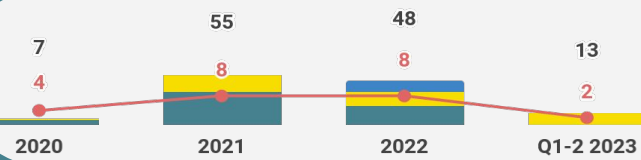


**\$54M**  
**\$17M**  
**\$0**



While plant-based dominates all-time investment, Japan was an **early investor in cultivated meat**. Almost a quarter of all-time private sector investments in Japan are in the cultivated sector.

### South Korea

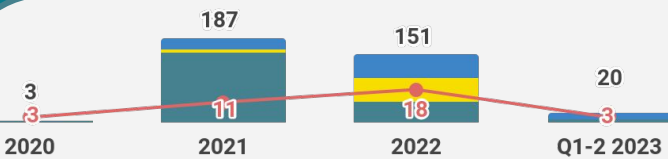


**\$70M**  
**\$50M**  
**\$12M**



South Korea has emerged as a **leader in cultivated investments** in the region with all-time investment at \$50 million USD as of Q2 2023. Investment in cultivated has **continued into 2023**.

### Australia / New Zealand

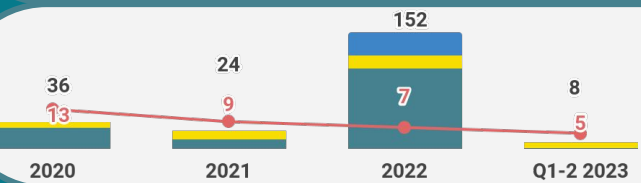


**\$249M**  
**\$59M**  
**\$90M**



Australia/New Zealand have attracted diversified investment, especially for fermentation. **97 percent of fermentation investment has gone into precision fermentation and the rest in plant molecular farming**, an emerging production platform.

### Mainland China



**\$147M**  
**\$44M**  
**\$30M**



Plant-based dominates all-time investments in Mainland China. The **biggest deal to date was in 2022 with an \$100M investment** in the plant-based company Starfield.

Source: <sup>1</sup> Analysis of Pitchbook data. Note data only includes deals with disclosed amounts and is only a partial view of 2023 (up to Q2).



# Top 2023 deals were in the cultivated and fermentation pillars

In Q1-2 2023, there were 11 deals with disclosed amounts across APAC with a combined investment total of **\$47 million USD**. This is a significant drop compared to the 29 deals and \$376 million USD invested in Q1-2 2022. While in 2022 the top three deals in APAC's alternative protein sector were all in plant-based, the top three deals as of 2023 Q1-Q2 are one each in plant-based, fermentation, and cultivated. South Korea saw the biggest deal in the region with **\$13.1 million USD** in cultivated meat.

## Top 5 deals



	COUNTRY	ROUND	DEAL SIZE	CATEGORY	DESCRIPTION
	South Korea	Series A	13.1	Cultivated	Producing cultivated seafood with a focus on shrimp and caviar.
	Australia	Seed	10.5	Precision Fermentation	Building a process to scale up precision fermented prototypes to commercial quantities with a faster and lower cost of goods than other methods.
	Australia	Series A	8.6	Plant-based	Produces plant-based meat made from mushrooms that are minimally processed and free from GMO, preservatives, and artificial ingredients.
	China	Series A	6.5	Cultivated	Producing cultivated meat products for consumers in China and around the world.
	Singapore	Seed	3.0	Plant-based	Creating whole-plant based meat using whole, biodiverse ingredients sourced from Asia, starting with jackfruit-based pork.



# FROM LAB TO PRODUCT

**Ten major regional food companies have launched 15 in-house plant-based brands.** Thailand's biggest meat company, Japan's biggest meat manufacturer, and South Korea's biggest food company are among the regional corporates active in the sector. Major meat companies along with regional conglomerates and other food and biotechnology companies have participated in over 20 investments and partnerships with startups. Corporate-startup partnerships are underway for end product development as well as B2B solutions, particularly culture media development.

**The region has over 200 startups, with recently launched startups focusing on B2B solutions.** In 2022, the number of B2B startups launched in APAC surpassed the number of B2C startups for the first time. The first plant molecular farming company has also been launched in the region to produce dairy proteins and fats in the seeds of oilseed crops. B2C companies have also emerged with new value propositions, including whole food plant proteins focused on nutrition benefits.

**Singapore is a critical player in the region that is helping global companies incubate, innovate, partner, and export their alternative protein solutions to the world.** Singapore is home to 24 percent of the region's alternative protein startups. Over 25 non-local startups and corporates have set up in Singapore to conduct alternative protein R&D and develop their business. Four of the world's top five food and nutrition companies, all of the top five flavour and fragrance companies, and all of the top five ingredient companies have a corporate base in Singapore. Shared R&D facilities and a supportive regulatory framework are enabling companies to bring their products from lab through to testing in the local market.

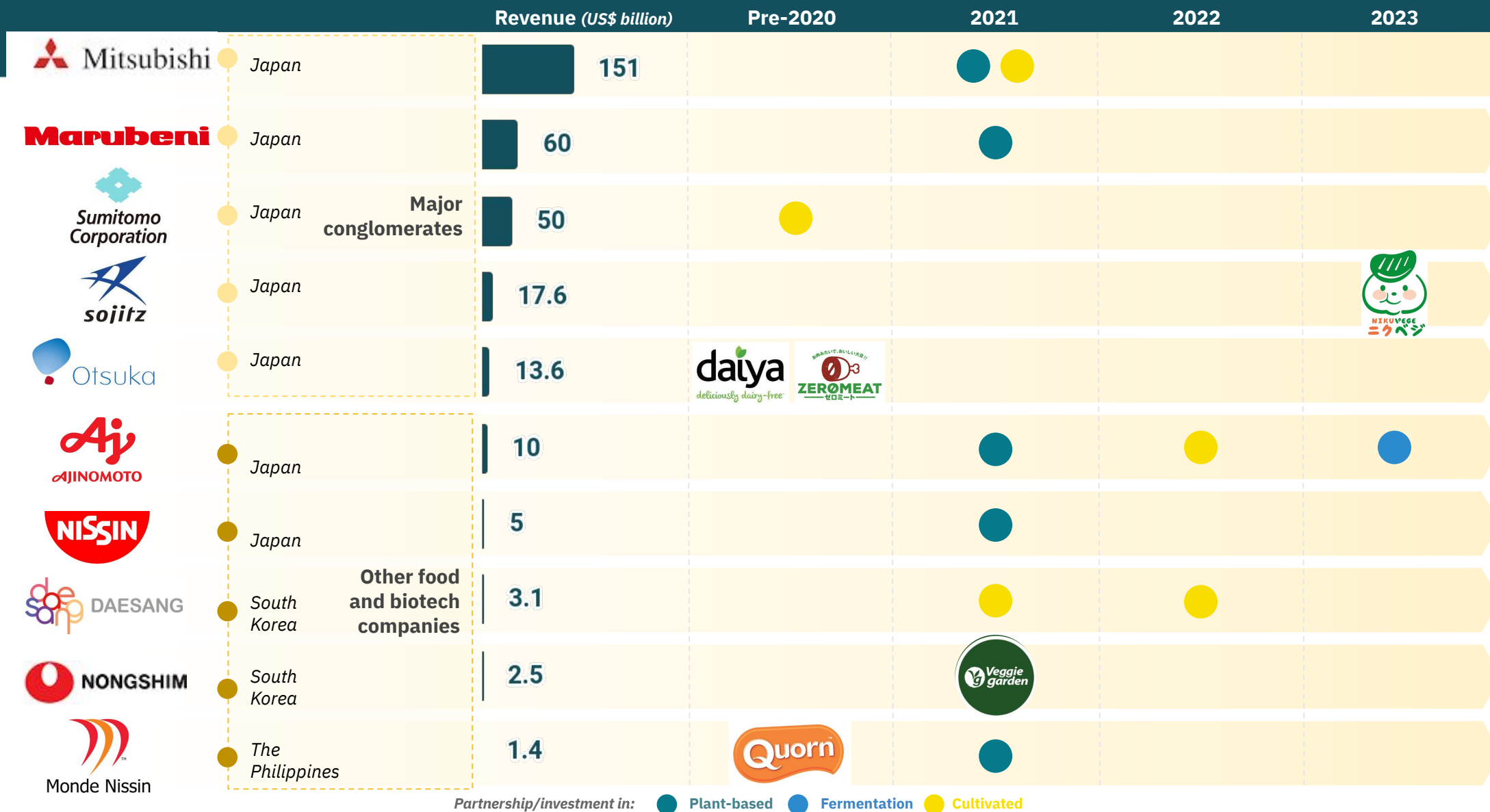
# Regional meat companies are embracing protein diversification (non-exhaustive)



Partnership/investment in:  Plant-based  Fermentation  Cultivated



# Conglomerates as well as food and biotech companies are stepping in (non-exhaustive)





# Corporate capabilities are being unlocked in B2B partnerships (non-exhaustive)

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.



AJINOMOTO




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 media.





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

# Startup-corporate partnerships are driving product innovation *(non-exhaustive)*

## Plant-based



Thailand's CP Foods partnered with the plant-based startup Lypid to create plant-based meat using Lypid's encapsulated plant-based fat ingredient.

Australia's Wide Open Agriculture (WOA) entered a supply partnership with Monde Nissin Australia which will offtake up to 60 percent of WOA's lupin-based protein ingredient.



**KAGOME**  
**2foods**

Japanese food brand 2foods by TWO Inc. partnered with Japanese manufacturing company Kagome Co. to develop a plant-based egg substitute, a first for Japan.

## Hybrid plant-based & cultivated

Dutch cultivated meat company Meatable partnered with Singapore's plant-based butcher Love Handle to launch a "Future of Meat" innovation centre to create hybrid meat products.



Japanese plant-based company Next Meats, their spinoff cultivated meat startup Dr. Foods, and Singapore's cultivated fat startup ImpacFat signed an MOU to collaborate on product development in Japan and Singapore.

Thailand's CP Foods partnered with Israeli cultivated meat startup Believer Meats to create a line of hybrid products for the Asian market.



World's biggest tofu manufacturer Pulmuone and cultivated meat startup Simple Planet, both from South Korea, partnered to develop hybrid products, aiming for a 2025 launch.

## Cultivated

Aleph Farms signed an MOU with South Korea's CJ CheilJedang to accelerate cultivated meat scale-up for the South Korean market.



Pulmuone and BlueNalu strengthened their partnership to commercialise cell-based seafood in South Korea, including carrying out joint research projects on cultivated market trends.

Japan's Mitsubishi, which owns major salmon farming business Cermaq, partnered with BlueNalu to accelerate product and market development for cultivated seafood in Asia.



BlueNalu also strengthened a partnership on cultivated meat with Thai Union, Thailand's biggest canned tuna producer.

Maruha Nichiro Corporation entered into a collaboration agreement with Umami Bioworks to accelerate cell-cultivated technology for seafood.



ShioK Meats signed an MOU with Vietnamese shrimp producer Minh Phu Seafood to open a joint cultivated seafood R&D facility in Vietnam.



Spotlight on  
Japan and  
South Korea

Industry players  
are driving R&D  
innovation  
(non-exhaustive)

## CULTIVATED STARTUPS

Japanese cellular agriculture platform company IntegriCulture commercially released its cell-culture medium I-MEM which replaces animal-derived growth factors with food-grade replacements, which it claims reduces media costs by up to 98 percent.



IntegriCulture



South Korean cultivated meat company CellMeat announced the development of its serum-free media CSF-A1 for cultivated meat, which it claims can grow cells up to 250 percent faster than FBS-based media or alternative animal-free options.

## MEAT MANUFACTURERS



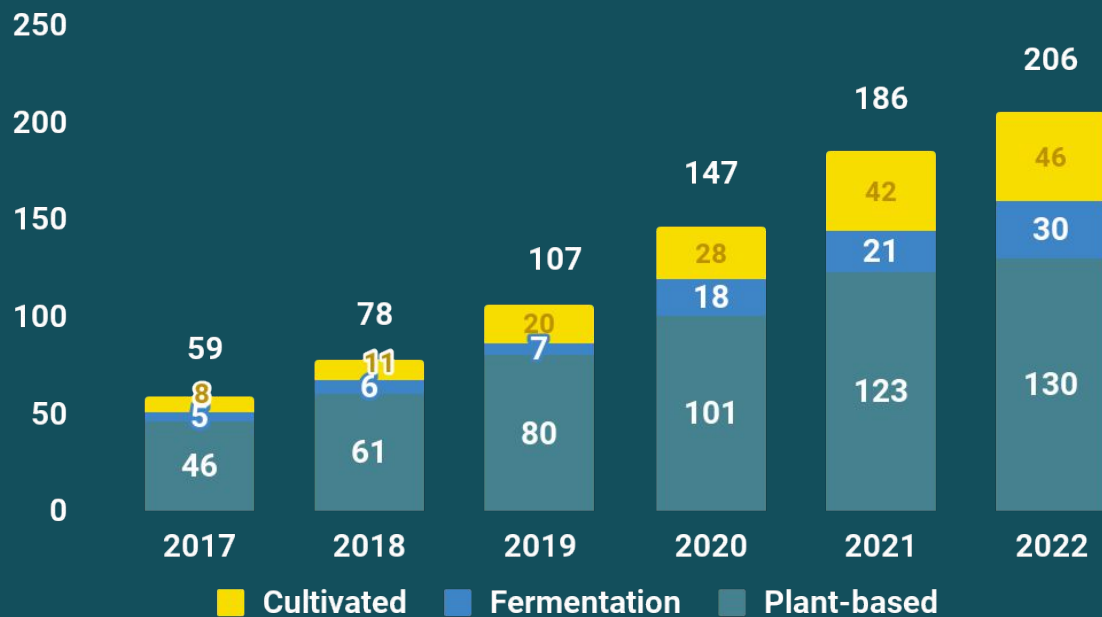
The R&D team of Japan's largest meat manufacturer Nipponham announced the development of a serum-free media in 2022 that they estimate will reduce the costs compared to a conventional product by 95 percent.

Japan's largest instant noodle manufacturer Nissin Foods has partnered with the University of Tokyo on cultivated meat R&D since 2017. The partnership has since produced Japan's first edible cultivated meat, and has a target to develop the technology for cultivated steak by 2025.

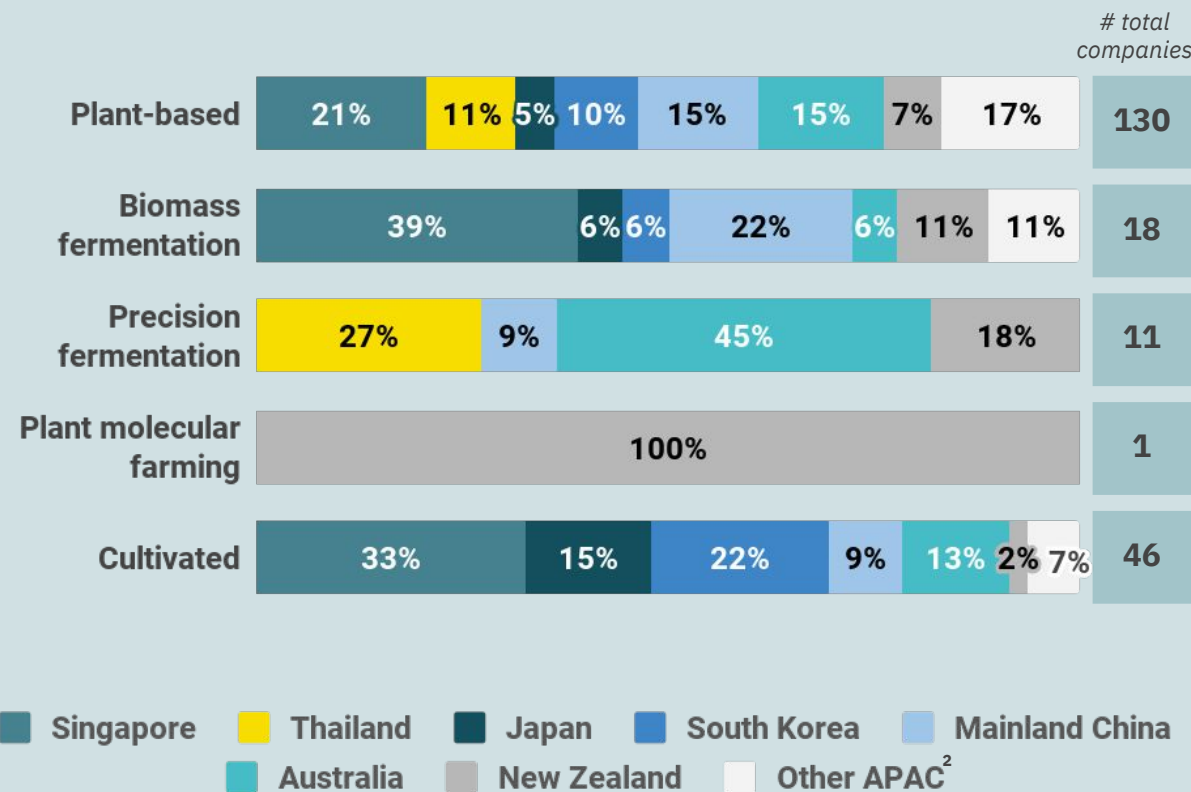


# APAC is home to 200+ startups

Cumulative number of APAC startups by alternative protein pillar



Share of APAC startups by country/region and alternative protein pillar

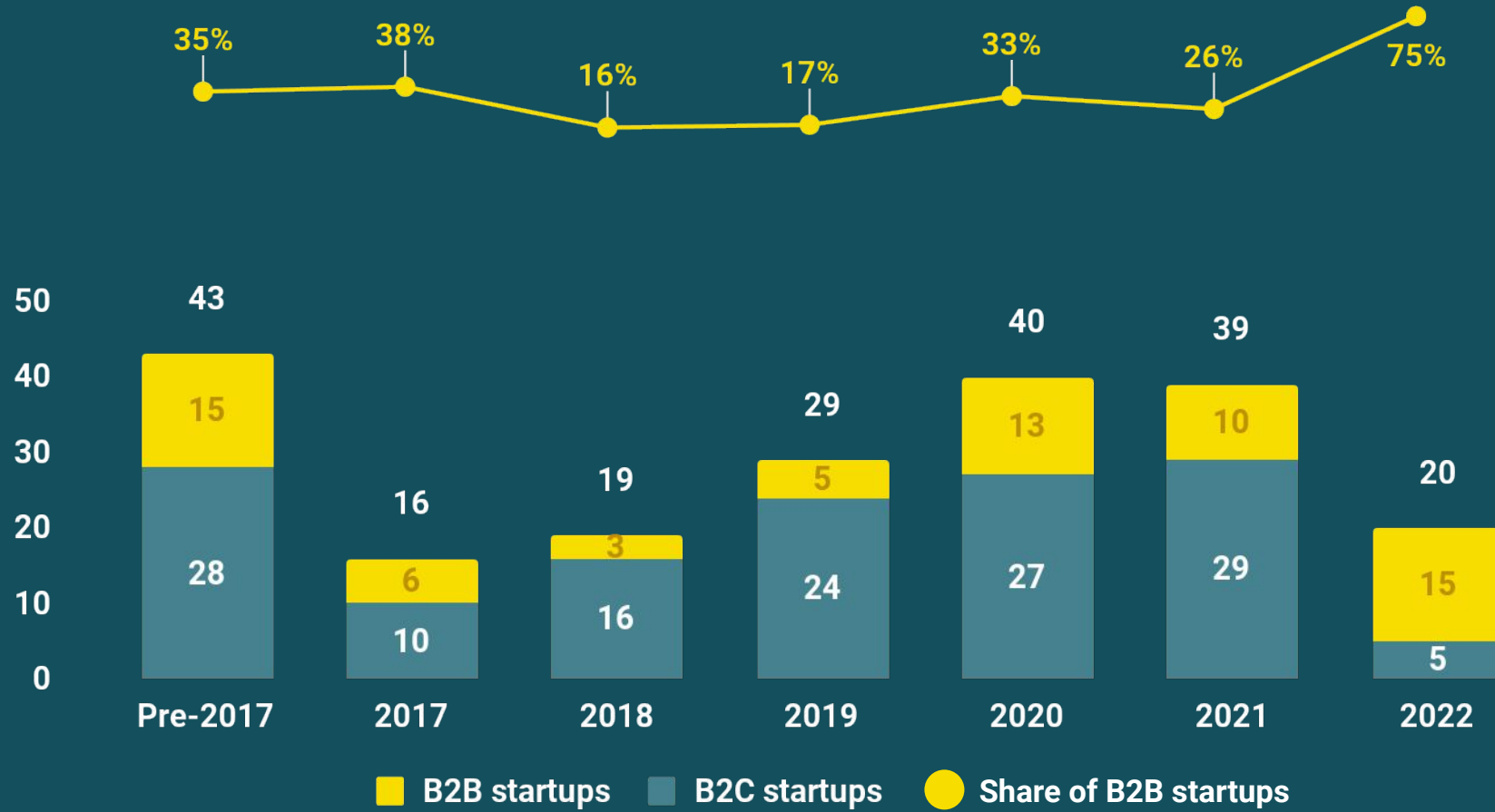


Source: <sup>1</sup> GFI company database as of Q2 2023. Excludes alternative protein brands launched by corporates.

Source: <sup>2</sup> Groups together other APAC countries/regions with less than ten alternative protein startups as listed in GFI APAC's database (Hong Kong SAR, Taiwan, Indonesia, Vietnam, Malaysia, Philippines)



# A shifting focus to B2B among new startups is a clear trend break



**In 2022, the number of B2B startups launched in APAC surpassed the number of B2C startups for the first time.** While the number of startups launched is down in 2022, the share of B2B startups rose from 26 percent of the startups launched in 2021 to three-quarters in 2022.

**The emergence of a B2B marketplace is essential so B2C companies can specialise and scale.** A lack of B2B inputs, equipment, and services means B2C companies either lack access to solutions that could level up their products, or they have to go beyond their core to create their own solutions in-house. B2B-focused startups are the sign of a maturing industry and will support B2C companies to specialise and optimise for scale.



# 20 regional startups launched in 2022, mostly with B2B solutions

## NOVEL INGREDIENTS

Plant-based cheese using soy byproducts (okara) **SOILABS**

Flavour catalyst technology for "vegan heme" from byproducts **THE MEAT**

Protein ingredients from *Wolffia*, an aquatic plant **ADGRREEN**

Fermentation-derived protein from rice byproducts **PLANT ORIGIN**

Fermentation-derived protein from soy byproducts (okara) **MYCOSORTIA**

Fermentation-derived protein from fruit byproducts **PULLULO**  
Changing alternative to essential

**B2C startups:** *Hybrid products* **FOODURAMA** Plant-based and cultivated meat

*Microalgae-based protein* **(70/30 Food Tech)** Ready meals from mycelium

*Plant-based whole foods* Plant-based product focused on jackfruit **JUNGLE KITCHEN**

Plant-based product focused on jackfruit **IFT**  
Innovation Grown, Goodness Sown

## CULTIVATED MEAT INPUTS

Cell line supplier from New Zealand livestock **BIO AOTEAROA**

Cell type-specific microcarriers and complementary solutions **SMART MCs**

## FERMENTATION-DERIVED INGREDIENTS

Protein ingredients from microalgae and mycelium co-cultures **allium bio**

Mycoprotein ingredients through microbial technology platform **MoreMeat**  
—— 蘑米生物 ——

Precision fermentation and mycelium ingredients supplier **BLUE CANOPY**  
New foods & better food with less environmental impact

Fermentation-derived protein from microalgae **ALGROW BIOSCIENCES**

Plant-based fat using encapsulated fat technology **Fattastic Technologies**

Cultivated fat from fish stem cells **Vimpacfat**

## ALTERNATIVE FAT

## MANUFACTURING PLATFORMS

Cultivated meat co-manufacturing platform services **Cell AGRITECH**

Precision fermentation co-manufacturing platform services **Cauldron**



# B2B plant-based ecosystem in APAC

## Ingredients

The Leaf Protein Co.



Leaf protein ingredients from crop byproducts and regenerative plants

ADGREEN



Supplier of a plant-based source of protein, *Wolffia*

THE MEAT



Plant-based version of heme acting as a flavour catalyst technology

ANPOLY  
Advanced Natural Polymer



Producer of nanocellulose to improve the texture of plant-based meat

URBAN TILLER



Proprietary platform that can process leaves of any type to extract Rubisco protein from leaves

leafit  
FOODS



Extracts Rubisco protein from leaves in a form that is highly digestible

EnerGaia



Provides premium grades of spirulina as an ingredient for plant-based products

イ-グレタ

いきる、たのしむ、サステナブル。



(*Euglena*)

Provides microalgae ingredients (*Euglena* and *Chlorella*)

## Processing technologies

Whole.



Zero waste, enhanced nutrient extraction technology for ingredient and food manufacturers

## Alternative fat



Fattastic Technologies



Plant-based fat for alternative protein products

## Formulation and development

Kindness.



Formulation and food processing techniques and plant-based product development

Harvest B



Plant protein formulations and processing technologies, as well as co-manufacturing and technical development

# Fermentation ecosystem in APAC

## Biomass Fermentation (B2B)

## Biomass Fermentation (B2C)

## Contract Manufacturing / CDMO

## Precision Fermentation (B2B)

## Precision Fermentation (B2C)

## Traditional Fermentation

## Plant Molecular Farming

# Cultivated ecosystem in APAC

## Cultivated Meat

## Cell Line Providers

## Contract Manufacturing / CDMO

## Scaffolds and Cell Culture Solutions

## Cultivated Seafood

## Media Ingredients & Growth Factors

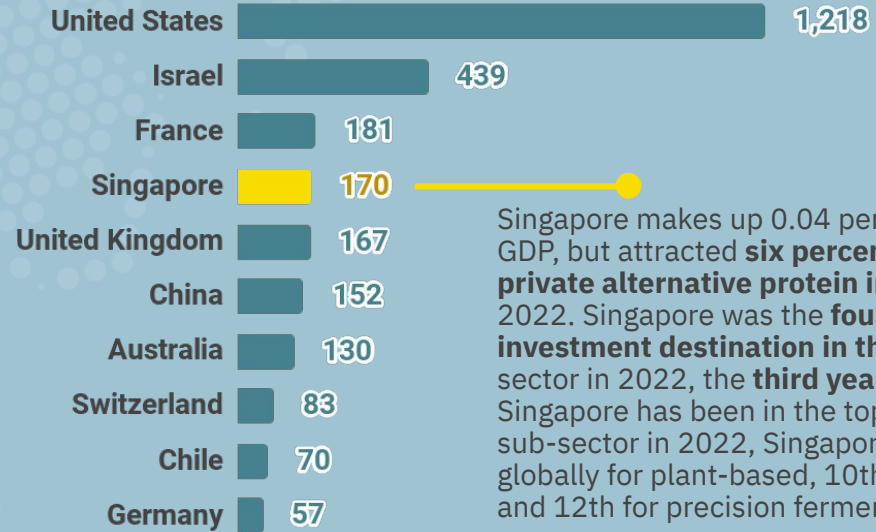
## Bioreactors





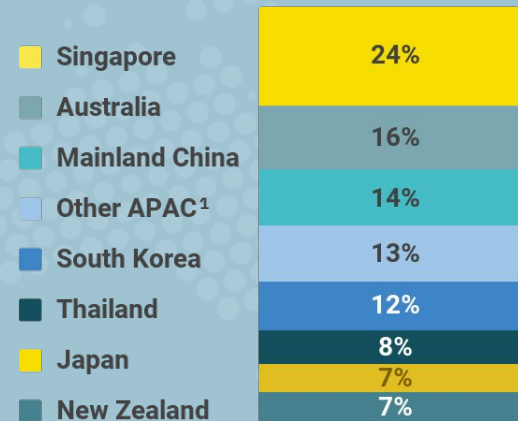
# Spotlight on Singapore

## Global private sector investment in 2022 by country total



Singapore makes up 0.04 percent of global GDP, but attracted **six percent of global private alternative protein investment** in 2022. Singapore was the **fourth biggest investment destination in the world** for the sector in 2022, the **third year** in which Singapore has been in the top ten. By sub-sector in 2022, Singapore was third globally for plant-based, 10th for cultivated, and 12th for precision fermentation.

## Regional alternative protein companies by country / region



Singaporean companies make up a **24 percent share of alternative protein startups in the region**. Of the 200+ startups known to GFI APAC, Singapore is home to 50 of them. Over half of Singapore's sector startups are in plant-based, almost a third in cultivated, and the rest are in fermentation.

Source: <sup>1</sup> Groups together other APAC countries/regions with less than ten alternative protein startups as listed in GFI APAC's database (Hong Kong SAR, Taiwan, Indonesia, Vietnam, Malaysia, and the Philippines)

# Singapore is a global testbed exporting R&D to the world (non-exhaustive)

## A HUB FOR GLOBAL STARTUPS

**15+** non-local alternative protein startups have an active presence in Singapore



## A BASE FOR GLOBAL CORPORATES

**12+** major corporates are conducting alternative protein innovation locally



## A PARTNER FOR GLOBAL INNOVATION

**5+** non-local sector companies are partners to Singapore's top research institute
















## AN INNOVATION TESTBED

**14+** shared lab, pilot, and scale-up facilities serving local and global startups





# Singapore has a host of shared R&D facilities (non-exhaustive)

	DESCRIPTION	KEY EQUIPMENT	CAPACITY
	The <b>Food Innovation &amp; Resource Centre (FIRC)</b> is a joint initiative between Singapore Polytechnic and Enterprise Singapore, which provides pilot facilities, laboratories, and a test kitchen.	High-moisture extrusion	10/L
	The <b>Protein Innovation Centre</b> is a collaborative project between equipment company Bühler and flavour house Givaudan that provides pilot facilities to develop plant-based products.	High-moisture extrusion	350 kg/day
	The <b>Food Tech Innovation Centre (FTIC)</b> is a partnership between Nurasa and A*STAR that offers R&D and advisory, lab- to pilot-scale facilities, and potential investment support.		
	Part of the FTIC, the <b>Food Processing Joint Lab</b> provides high-moisture extrusion & high pressure processing technology on a fee-for-service basis.	High-moisture extrusion	60 kg/hour
 	Part of the FTIC, the <b>Fermentation Joint Lab</b> is a partnership between Nurasa, A*STAR, and the company ScaleUp Bio which provides lab- and demo-scale bioreactors for fermentation-based products.	Bioreactor	10-100L
 	<b>Singapore Institute of Technology's (SIT) FoodPlant</b> provides small-batch production facilities for food companies.	High-moisture extrusion	150 kg/day
 	The <b>KH Roberts and Leistritz collaboration</b> offers pilot-scale extruders for product development of plant-based products.	High-moisture extrusion	
	The <b>Life Science Incubator</b> is a co-working laboratory for biotech and food companies.	Bioreactor	250ML-50L
	The <b>Monde Nissin Green Protein Hub</b> provides small-batch production facilities for mycoprotein and plant-based product development.	Testing centre	
	<b>Innovate360</b> supports agri-food tech startups with a range of services and R&D facilities. Pilot-scale facilities for cultivated meat are also available from the startup ShioK Meats' facility at Innovate360.	Bioreactor	10L-200L

Colour key

- Plant-based
- Fermentation
- Cultivated

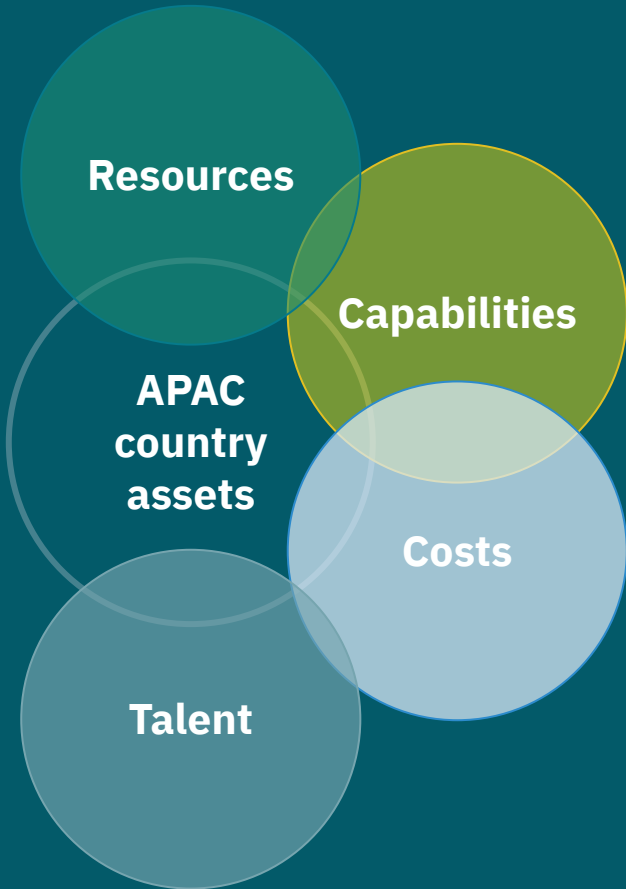
# FROM PRODUCT TO SCALE

**For alternative proteins to scale, they have to be cheaper.** While innovations in ingredients and equipment will reduce the cost of alternative proteins, there is no way to reach price parity without scaling up production globally. APAC has supply chain capabilities to support affordable sector scale-up.

**Plant-based technologies have been proven to work at a large scale, but more technology innovation is needed to create products that compete with conventional meat.** Ingredient innovation, new processing technologies, and hybrid products that pair plant-based technologies with products made from fermentation and cell-cultivation are promising paths to better products. But scaling these newer technologies will be risky and capital-intensive. The private sector cannot solve this scaling problem alone. New types of capital and collaborations between private, public, and philanthropic actors will be needed to accelerate the rapid scaling of alternative proteins.

**Smart scaling strategies are needed for the industry to bridge the affordability gap as quickly as possible.** Building factories cheaply and proving demand in early markets will help to make scale-up cheaper, easier to finance, and lower risk. Co-manufacturing organisations (CMOs) at various scales can support efficient sector scaling. Singapore has laid the foundations of a CMO network to de-risk early scale-up. First movers are exploring the scaling advantages of other countries in the region for later-stage co-manufacturing. Regional innovators are finding other ways to de-risk alternative protein scale-up, including modular scale-out, platform technologies, higher-value markets, and targeted value propositions, to strengthen market adoption.

# APAC's supply chain solutions can help the sector scale affordably

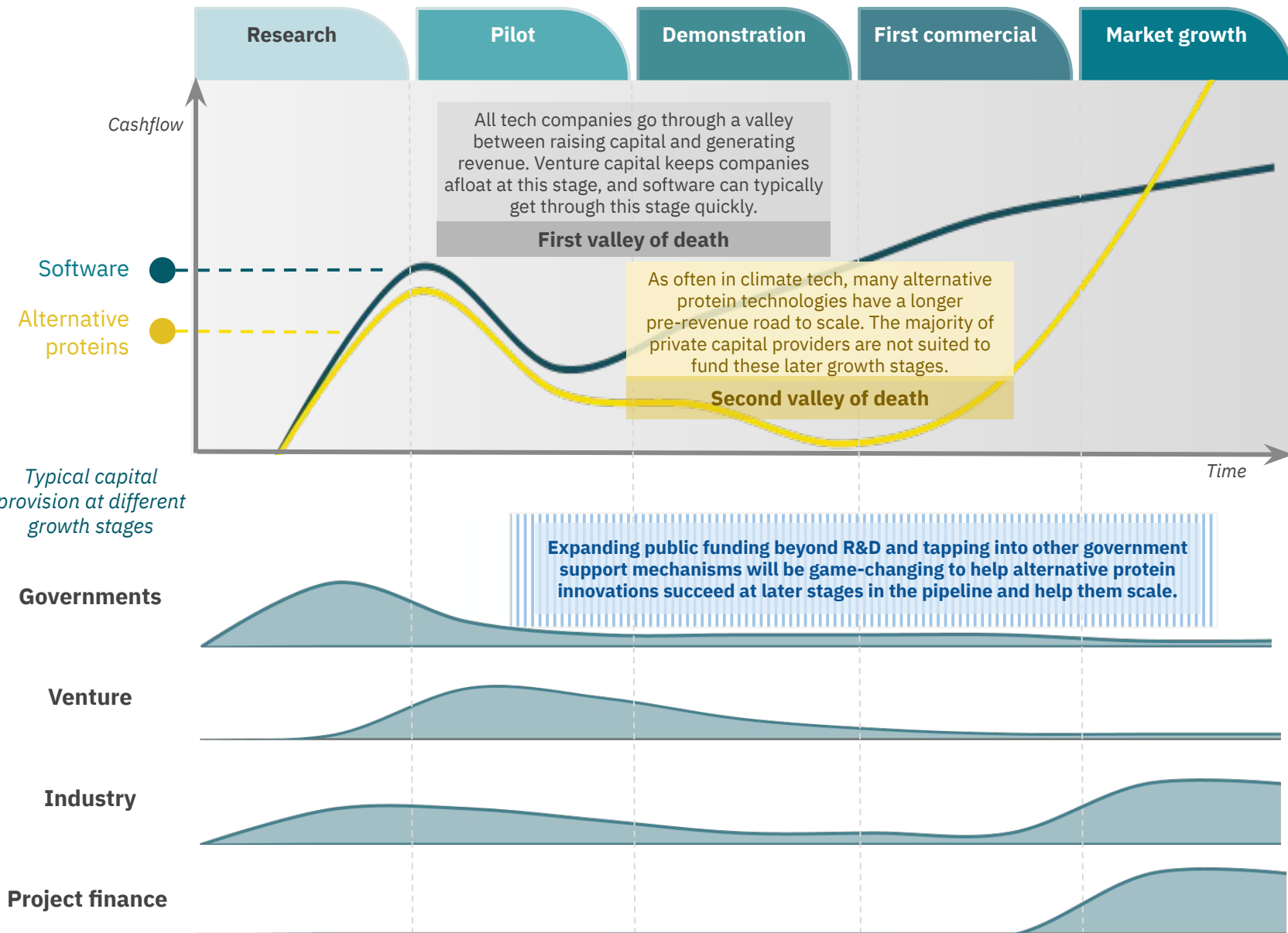


**APAC has significant agricultural resources.** The region can tap into its potential to become a plant protein ingredient supplier for the industry—a role Australia is already leaning into with the development of science and local processing facilities to turn domestic crops into value-added plant protein ingredients. APAC is also rich in biomass feedstocks. China, Thailand, and Indonesia are top ten global sugarcane producers and are home to several biorefineries, which could provide feedstocks and infrastructure capabilities for fermentation-derived and cultivated protein production. In 2022, Thailand became the home for Asia's first second-generation biofuel production plant which uses sugar and cassava waste as feedstocks, a critical avenue of future development for the alternative protein industry.

**APAC is advancing its bio-based economy.** 37 percent of the membership base of the Global Biofoundry Alliance come from APAC—five in China, three each in Australia and South Korea, and one each in Japan and Singapore. The Chinese government unveiled its 14th Five-Year Plan for Bioeconomy Development in 2022, the South Korean government rolled out its Bio Economy 2.0 roadmap in 2023, and the Japanese government launched its Japan Bioeconomy Strategy in 2019. Thailand has also made the development of a Bio, Circular, and Green (BCG) Economy a central government priority.

**China and Southeast Asia are manufacturing giants.** China has the world's largest workforce and is a manufacturing powerhouse, ranking first by share of global output in 16 out of 22 manufacturing categories, and second in the other six. After China and India, Southeast Asia is the world's third largest workforce. It will add 23 million new workers by 2030 to its young and cost-competitive labour pool. Agri-food provides over half all jobs in Vietnam and more than 40 percent in Thailand, Indonesia, and the Philippines—of which 27 percent are in manufacturing or distribution. The blend of competitive costs, specialty skills, and relatively free access to Western and Asian markets in Southeast Asia makes it a prime candidate for manufacturing scale-up.

Conceptual overview of unique scale-up (top) and funding (bottom) needs for alternative protein startups



Note: For illustrative purposes only.

# Early scale-up hurdles must be overcome

**Alternative proteins can compete in the market once quality products hit price parity and scale, but there is a “valley of death” to get there.** For startups in areas like software, products can quickly be prototyped and start to generate revenue and scale. But many alternative protein innovations have to prove technological and economic viability at incrementally larger scales, as what works in a 100L lab fermenter may not work the same or at all in the industrial setting. This requires a lot more capital and risk—a combination not suited to most private investors. Even for alternative protein technologies at higher stages of market readiness, such as plant-based extrusion, early products still have a “green premium” but compete in commodity protein markets where consumers are often not willing to pay more. This presents offtake risks which can prevent the crowding in of traditional growth capital.

**Alternative proteins need money and support beyond the private sector to scale.** Governments and the private sector need to work together to speed up the path to market for alternative proteins. Catalytic funding from the public sector, along with other concessionary capital sources like philanthropy, can reduce the risks of marginally bankable projects and crowd-in private capital. Blended finance has been critical to building a bridge to bankability for impactful technologies in other sectors—such as the supply-side mechanisms used to support renewables, as well as demand-pull mechanisms such as advance market commitments used to scale low-cost pharmaceuticals and now carbon removal.





# De-risking scale

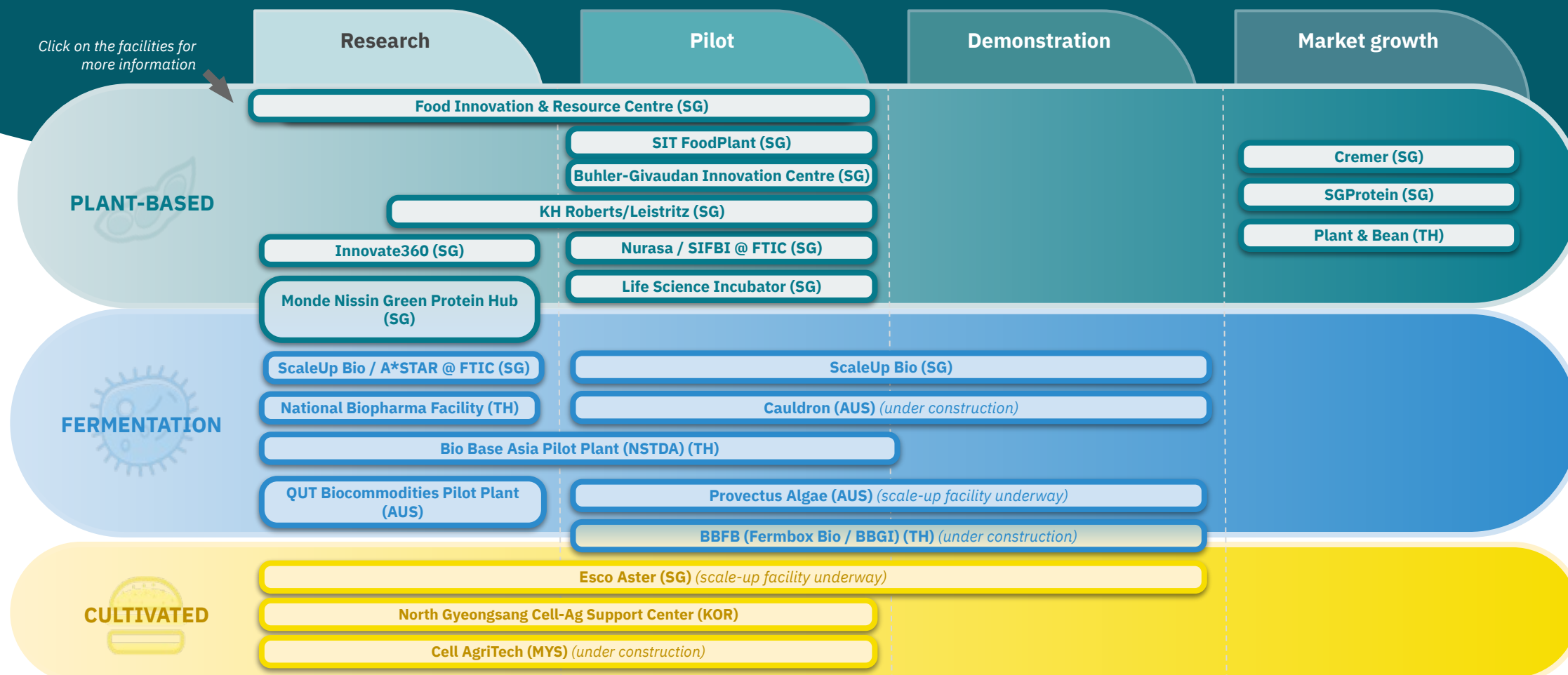
Co-manufacturing

High-value markets & platform technologies

Modularity

Product-market fit

**Shared facilities and co-manufacturing organisations (CMOs) can reduce the technology risks and capital needs associated with scaling.** Significant know-how is required to navigate the process of moving from lab to pilot, demo, and eventually commercial scales. CMOs diversify risk and income streams by working with multiple paying customers, while they enable companies to focus on testing and iterating their technologies in an asset-light way. The first CMOs are emerging in the region beyond the pilot scale, led by Singapore where government involvement has shared risks and costs with strategic corporates in many of these projects.



Note: Non-exhaustive and refers to dedicated sector facilities only. Scale categories are indicative. Excludes in-house facilities that are also used for co-manufacturing, which is significant especially in the plant-based (downstream) industry.



# De-risking scale

Co-manufacturing

High-value markets & platform technologies

Modularity

Product-market fit

## Singapore: CMO solutions for pilot, demo, and early commercial



“ScaleUp Bio is a joint venture company of Nurasa, wholly owned by Singapore’s global investment company Temasek, and ADM, a nutrition leader. ScaleUp Bio is among the first in Asia, and of only a few in the world, that provides food-grade microbial and precision fermentation CDMO solutions to food tech startups. We offer two dedicated food-grade microbial and precision fermentation facilities in Singapore, from the R&D phase to capacities of up to 10,000 litres, as well as scientific and technical expertise, business advisory, and market entry support.”

Startup partnerships



“Nourish Ingredients is an Australian foodtech company creating potent, animalic fats that make plant proteins delicious. It’s vital that companies are provided with the right commercialisation pillars to accelerate scalability. Singapore has for several years pioneered innovation in alternative proteins. We have entered a strategic expansion to Singapore to scale up our potent fat production. Our partnership with ScaleUp Bio will support 10,000L batches of fermentation capacity as well as 100L of thermal processing to scale production of our speciality fats.”



“CurieCo is partnering with ScaleUp Bio to manufacture an enzyme product for food and beverage applications, which can replace methylcellulose and reduce salt in alternative meats, as well as enable gelation for alternative dairy products. Singapore has a vibrant food-tech landscape and presents an interesting opportunity to collaborate in development of new products and access the food market in Asia. ScaleUp Bio has focused on bringing world-class fermentation assets and expertise to the operation, with the ability to seamlessly transition from R&D scale to larger commercial scale in close proximity.”



# De-risking scale

Co-manufacturing

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Modularity

Product-market fit

## Thailand: CMO solutions for large-scale manufacturing

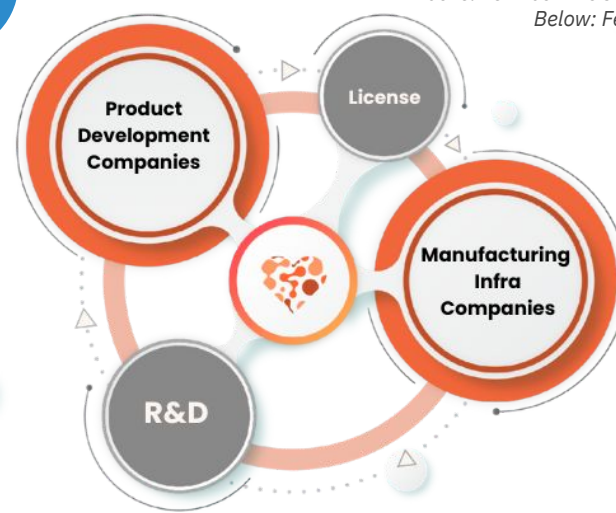


Above: Fermbox Bio's "lab-to-launch" operating system  
Below: Fermbox Bio's collaboration model

“Fermbox Bio is a synthetic biology research and manufacturing company developing and delivering sustainable product solutions by leveraging microbial fermentation and synthetic biology. Cultivated meat and alternative protein companies often require strategic partners to navigate the complexities of scaling up. Fermbox Bio's crucial role in the process involves offering tailored support from the early stages of growth, recognising that scaling up is a phased progression rather than a one-size-fits-all approach, and adjusting our support accordingly.”

We provide clone-to-commercial-scale technology and manufacturing solutions that cover the entire spectrum of product development, scale-up engineering, team building, and manufacturing operations. We bridge the expertise gap between product development and manufacturing infrastructure, ensuring that these companies can thrive and contribute to the evolution of sustainable food production.

We see Thailand as a promising destination for the Synbio industry, backed by its abundant access to raw materials, strategic geographical advantage, and young and educated population including experienced professionals from related bio-based sectors. We hope to see policy initiatives that incentivise and safeguard tech transfers, investments, and intellectual property rights, alongside efforts in organised skill development, and innovation hubs to nurture local entrepreneurship.”



# De-risking scale

Co-manufacturing

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Modularity

Product-market fit

**In some markets customers may be willing to pay a “green premium,” but many consumers are not willing to pay more for mass market food commodities.** Just like offshore oil platforms did for the solar industry and forklift trucks are doing for hydrogen fuel cells, niche markets are an important part of sustaining early scale-up phases in emerging industries. In alternative proteins, regional companies have developed platform technologies that can lower offtake risks for nascent industries by diversifying across multiple markets, while others are targeting higher-value niches to bridge the affordability gap while technologies are yet to move down the cost curve.

*“Initially we were really gung-ho about full spectrum milk, but bovine milk is traded on the market at \$2 a gallon and we couldn’t see a way to get to that point anytime soon using lactating mammalian cells. We were also working on producing growth factors for cultivated meat and milk to support our cell cultured milk programme, but over time we also pulled away from that to focus on high-value dairy ingredients. Whey protein trades on the market at about \$1 - 3 per kilo and casein is around \$13, but lactoferrin, a bioactive protein in human and bovine milk, is around \$1,000 per kilo, so that’s where we shifted our focus. But we’re also looking at human lactoferrin, human milk oligosaccharides (beneficial carbohydrates found in mammalian milk), and half a dozen high-value dairy proteins.”*



**Fengru Lin |  
Founder and CEO**  
TurtleTree

*“Algae-based ingredients offer supply chain solutions for the entire biomanufacturing industry. We have built a platform technology that is automated, cloud-enabled, and modular. We can scan thousands of species of algae to determine their composition, then conduct fast selection and scaling without ever adapting our hardware or software. The early use cases we are exploring are high-value markets including bioactive cosmetics, methane reduction in agriculture, and specialty food ingredients including natural colours and binding agents. One of the products we are really excited about is a livestock methane reduction product with the potential to reduce gigatons of greenhouse gas emissions globally.”*



**Nusqe Spanton |  
Founder and CEO**  
Provectus Algae

# De-risking scale

Co-manufacturing

High-value markets & platform technologies

**Modularity**

Product-market fit

**Some regional innovators are developing modular technologies for a lower-risk and lower-cost approach to scale-up.** Modularity can enable experimentation, and small can scale up and become big fast. Regional examples of companies taking this approach include modular CMO solutions that enable fast deployment and fast iteration cycles that foster continual improvement, reduce costs, and mitigate risks.

*“We looked at the electric vehicle industry and saw how suppliers have disrupted the traditional idea of gigafactories with a micro-factory model. We realised this could work for plant-based. With the micro-factory, we deploy modular factories in proximity to our customers and this has drastically reduced our costs—importing frozen products from Malaysia to other countries is expensive and import duties are high. You also miss out on things like tax incentives and local content regulations that can be critical to reach price parity. Modularity has also opened up a new revenue stream for us. We typically start working with overseas distributors with our final product so they can test the momentum of final products in their market. With our micro-factory, we can now support them to set up a local production base in their country that is operational in a really short time. Then we give them our “blubag” which is our ingredient bundle that contains everything you need to manufacture our plant-based products.”*



**Tom Hew | Chief Development Officer**  
Alternative Proteins at BaseFood Sdn Bhd (MADEBETTER™ | RightSide™ brands)

*“I believe that in this market there aren’t going to be too many A\$200 million or A\$300 million raises for precision fermentation startups to build their own plants. To me, that’s a capital-intensive distraction; these companies should be asset-light. It makes much more sense for us to build smaller, smarter, cheaper facilities. There is a huge leap to go from the laboratory to approaching someone like ADM. So we’re seeing a lot of interest in that 10,000L capacity range where startups can create tons of products, not hundreds of tons, to get through the regulatory process, and see if there is a path forward. We have developed a continuous process to fermentation which enables a five-times increase in the amount of product we’re able to get out of a fermenter. Ultimately, what that means is we can build a 100,000L biomass reactor that will put out more product than a 500,000L batch fermentation line. Cauldron will serve as a regional powerhouse for production to ensure Australia plays a part in the future of agriculture and other industries.”*



**Michele Stansfield | Founder and CEO**  
Cauldron Farm



# De-risking scale

Co-manufacturing

High-value markets & platform technologies

Modularity

Product-market fit

**Early markets can be found when the value proposition of alternative proteins is aligned with the needs of end users.** On the demand side, companies are tapping into varying motivations for alternative proteins that bring value to consumers—from health-focused products for the health-conscious, to taste-focused products with a bonus health benefit for consumers who don't want to compromise but need to eat healthier out of necessity. On the supply side, companies can align with the multiple reasons that food manufacturers have for seeking out alternative proteins, from cost to convenience.

*“In plant-based, there are two customers—end consumers and manufacturers.*

*For end consumers, we entered plant-based because we realised getting people to eat without feeling guilty is a business. To distribute our products, we launched a franchise restaurant model called RightSide which is “feel good fast food” that promises healthier fast food without compromise. This taps directly into the problem we are facing in Malaysia. Malaysia is the most obese country in Asia. One in two adults are overweight or obese. Consumers want the real thing, but they face this barrier. Our promise to consumers is a no-compromise solution that gives them what they want but with the benefit related to why they can't have the real thing in the first place. That is our formula to win in plant-based. You've got to be obsessed with customers. Part of the reason we entered a franchise is that it gave us a direct line to consumers. We continuously get feedback to improve our products. Our products this month won't be the same as our products next month.*

*For manufacturers, we realised some meat companies in the region are experiencing huge supply issues. We formulated a plant-based offering for manufacturers so they can create blended products by mixing their meat with our plant-based meat at an inclusion level that creates an almost identical product at a lower cost. It is really hard to convince a food manufacturer to start a fully plant-based product line tomorrow. Blended products gives them a stepping stone into the industry.*

*For both of these markets, we are selling at price parity with conventional products. But when we started, we bought everything from the market. We quickly realised that was unviable. We needed price parity to be relevant for our end users. So we went back to first principles and identified critical building blocks of taste, texture, and cost. We built what we could in-house, including binders and we also worked out how to modify the cooling die of an extruder to create thicker chunks—what we call high moisture fibre. But, crucially, we didn't get into the commodity or extrusion business, but gave our modified cooling die to our pea protein supplier. They can optimise in that niche with a level of knowledge and scale that we just can't compete on. We get the ingredient that goes into our end products and we also put it into our “blubag” ingredient bundle for food manufacturer customers. You have to know what to do in-house and what is not your core. It doesn't make business sense to go everywhere.”*



**Tom Hew | Chief Development Officer**  
Alternative Proteins at  
BaseFood Sdn Bhd  
(MADEBETTER™ |  
RightSide™ brands)



# MARKET GROWTH

**This section focuses on the critical long-term consumer market of Southeast Asia—a region that represents 8.5 percent of the global population, but where plant-based meat is at a nascent stage.** The SE Asia population is approximately 1.8 times that of the U.S. market, but indicative data suggests sales in SE Asia are a fraction of sales in the U.S. There is a need for improved and reliable sales data in the SE Asia region to aid a definitive and clearer overview of segment performance.

**Companies are launching new plant-based meat products that are increasingly localised to regional tastes.** Plant-based meat product launches made up about six percent of all meat product launches during the period 2022 to Q2 2023. New plant-based meat products launched in the region are a mix of both Western-style foods and those localised to SE Asian cuisines. On average, 38 percent of new products launched since 2022 have been localised.

**Plant-based meat products are on average 35 percent more expensive than conventional meat.** Plant-based meat products are more expensive in virtually every category. Plant-based minces, flakes, and meatballs are all nearly or over double the price that consumers pay for conventional meat. This is a critical barrier given that a consumer survey of about 6,000 respondents in SE Asia showed a drop-off in willingness to pay at only a 20 percent premium.

**Affordability, nutritional value, and taste are the leading drivers associated with increasing plant-based meat consumption.** Of the ~6,000 respondents in a recent SE Asian consumer insights study, half of respondents had never tried plant-based meat, and three-quarters indicated their interest to try or eat more plant-based meat. Respondents who are regular consumers of plant-based meat also regularly consume animal meat and are not actively reducing their meat consumption. Interest in increasing PBM consumption was linked to higher affordability, higher nutritional value, better taste, and increased availability.

## Spotlight on SE Asia

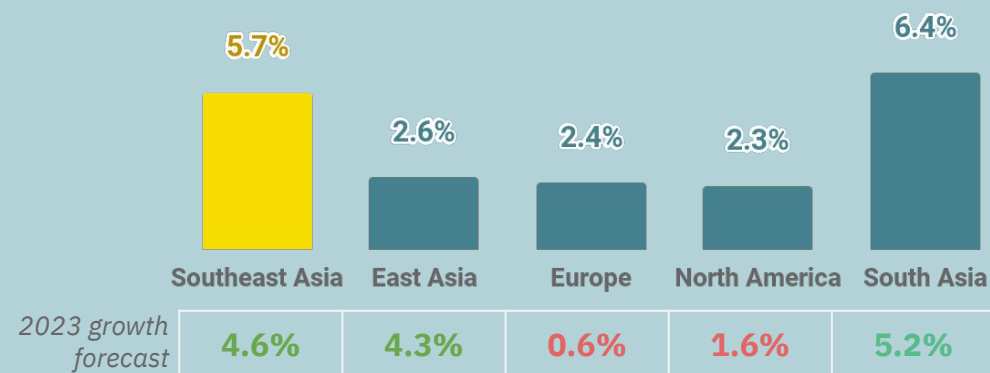
**An economic powerhouse.** SE Asia is the world's fifth largest economy with a combined GDP of over US\$3 trillion. In 2022, SE Asia's GDP grew by 5.7 percent, outpacing most markets, and is expected to stay resilient in 2023 despite global headwinds.

**Powered by the people.** SE Asia represents 8.5 percent of the global population and is among the world's fastest growing regions. SE Asia has the world's third-largest workforce behind China and India, and will add 23 million new workers by 2030.

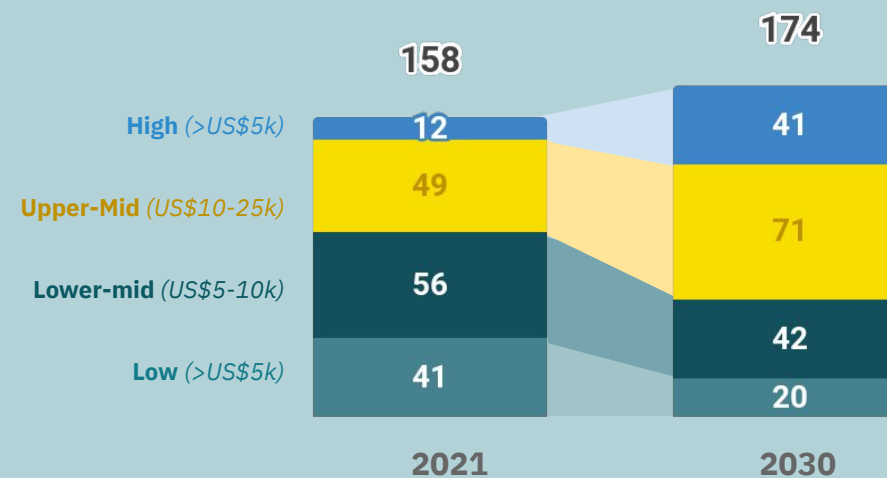
**A growing demand hub.** Until now, growth in SE Asia's middle class has largely been at the lower-middle income end of the consuming class. By 2030, low and lower-middle income households will drop by 35 million, while 51 million households will join SE Asia's upper-middle and high income classes.

Source: <sup>1</sup>Based on data from [Meta and Bain and Company \(2022\)](#)

### Real % GDP growth in 2022<sup>1</sup>



### Southeast Asia's rising consumer class<sup>1</sup>



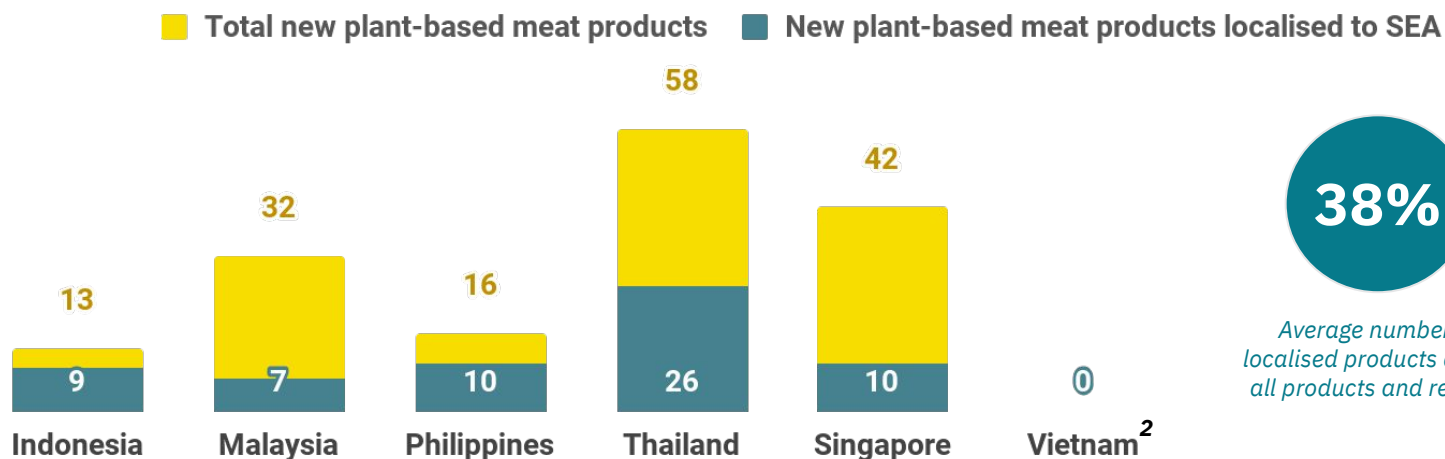
# Over a third of plant-based meat products launched are localised

Between 2022 and Q2 2023, more than 150 new plant-based meat products were launched in Southeast Asia.<sup>1</sup> Thailand led the region with 58 products, followed by Singapore at 42. Overall, there is a significant gap between plant-based meat launches and conventional meat launches, as ~2,500+ new conventional meat products were launched in the same period. Around 25 percent of the new plant-based meat products were in breaded form—typically nuggets, cutlets, strips, popcorn, and katsu. These were followed by cuts or pieces, which made up ~24 percent of the launches.

**Around 38 percent of these new PBM launches were in forms localised to the SEA market.**

Indonesia saw the highest number of localised products as a share of total product launches (~69 percent), followed by the Philippines at 62 percent. Thailand, the country with the highest number of plant-based product launches, had around 45 percent of products in localised formats. The most common localised formats were dumplings, dried meats, cuts and pieces, and breaded meats.

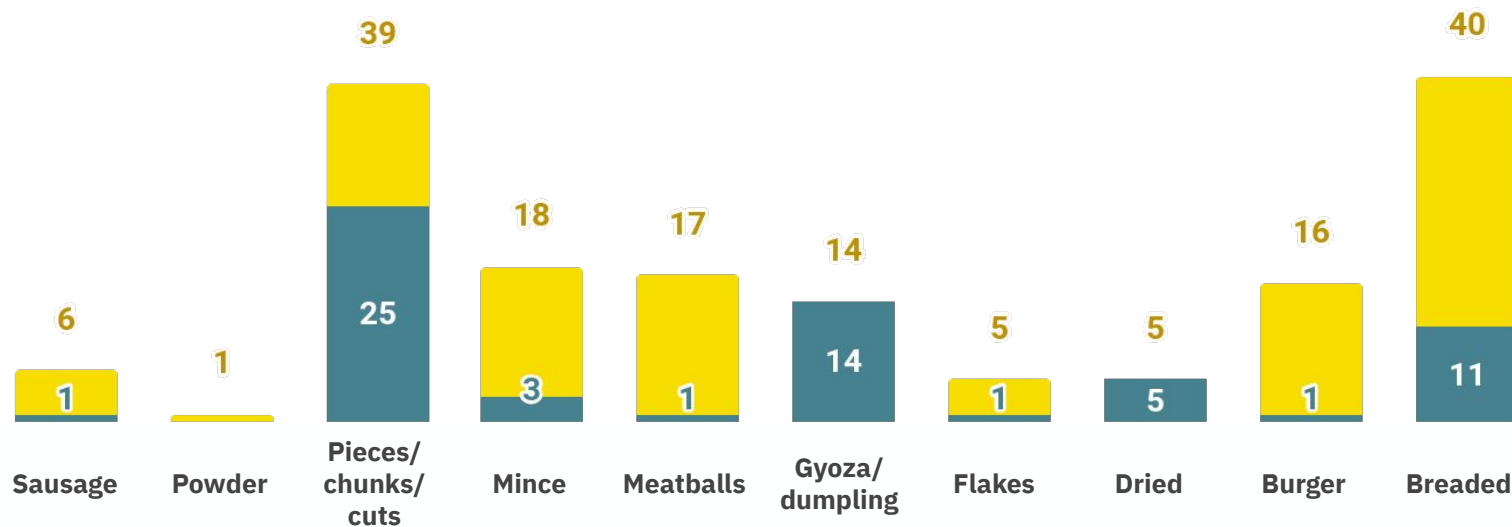
New plant-based meat product launches in SE Asia by country, 2022 - Q2 2023 (By country and localisation)



**38%**

Average number of localised products across all products and regions

New plant-based meat product launches in SE Asia, 2022 - Q2 2023 (By product type and localisation)

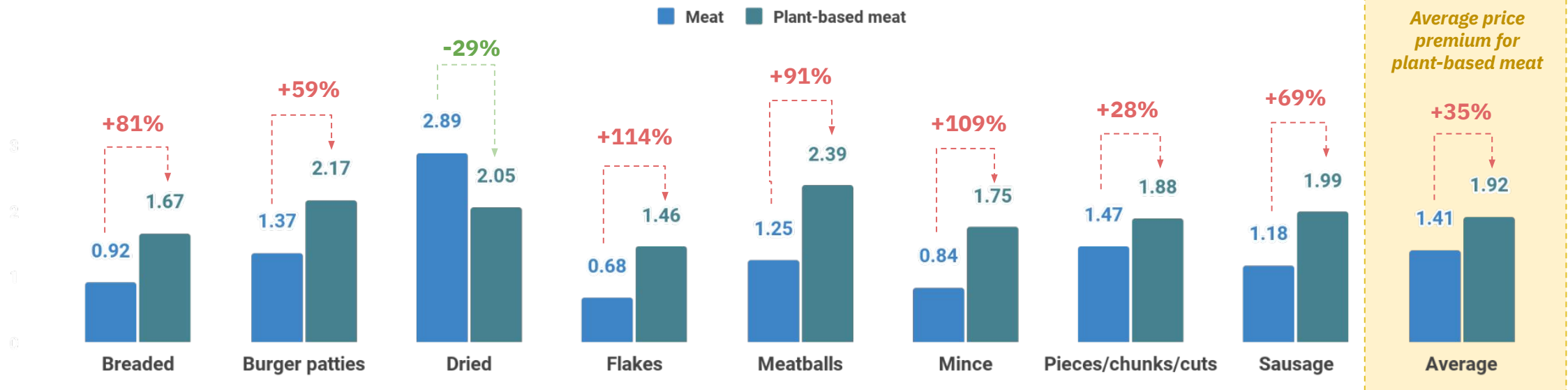


Source: <sup>1</sup>Based on internal GFI analysis of the Mintel Global New Product Database (GNPD); products include seafood. <sup>2</sup>Note the GNPD has logged no launches in Vietnam.

# Plant-based meat has an average 35 percent premium over meat

**Plant-based meat products launched between 2022 and Q3 2023 were priced at significant premiums compared to conventional meat products launched in the same period, with prices over double for some categories.** Price premiums exist across all product types, except for dried formats where plant-based meat products were cheaper on average. Mince, flakes, and meatballs are the product types with the highest premiums, with price premiums more than or nearly double the average price of conventionally launched counterparts. Breaded forms of plant-based meat are ~80 percent more expensive, sausages ~70 percent, and patties ~60 percent. The price premium of plant-based meat products was the highest in the Philippines, followed by Malaysia.












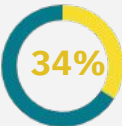


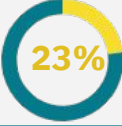

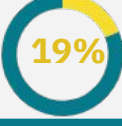
Average price comparison for meat and plant-based meat products launched between 2022 and Q2-2023 (USD/100g)





# 42 percent of survey respondents want to try or eat more plant-based meat

This and the following slides are based on a consumer insights study conducted in 2023 with ~6,000 respondents in six Southeast Asian countries: Indonesia, Malaysia, Singapore, Thailand, the Philippines, and Vietnam. Consumers have been profiled into six segments based on their experience and intended consumption of plant-based meat.

	Segment	Heard of	Tried	Planned consumption	Income	Age	Most common location	Meat habits	Segment size
1	<b>Skeptics</b>	✓	✗	✗ Unlikely to try	Tends to be lower	More likely to be over 45	 Singapore  Malaysia	 Red meat consumption trending down	 10%
2	<b>Rejectors</b>	✓	✓	↓ Want to eat less or none			 Singapore		 5%
3	<b>Novices</b>	✗	✗	Mixed responses	Mixed	Most likely to be under 35	 Indonesia	 Intending to reduce red meat consumption	 9%
4	<b>Curious</b>	✓	✗	✓ Likely to try			 Vietnam  Indonesia		 34%
5	<b>Expanders</b>	✓	✓	 Want to eat same or more	Tends to be higher	Evenly distributed	Evenly distributed	 Meat consumption trending up	 23%
6	<b>Enthusiasts</b>	✓	✓ Current consumers				 Thailand		 19%

Source: <sup>1</sup> Based on a survey of 5,971 respondents in six Southeast Asian countries. "Meat habits" are determined on a combined score of self-reported claims of increasing/maintaining same/decreasing meat consumption compared to the past year, and the same question for meat consumption intention in the coming year.

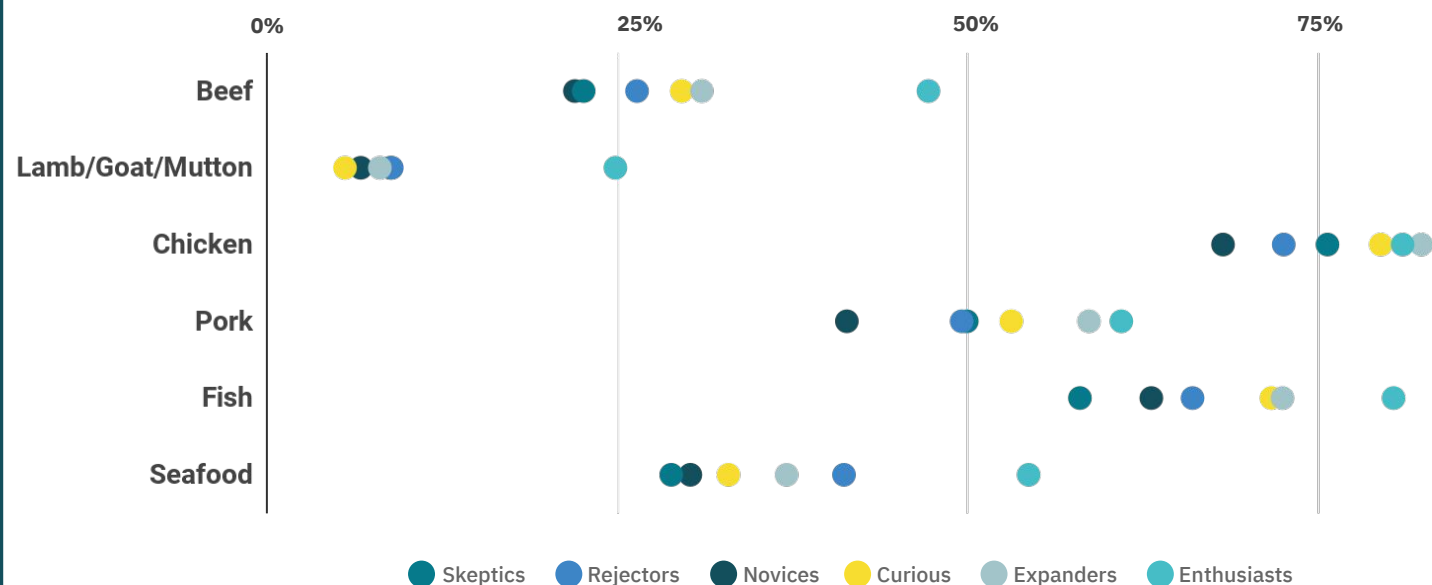


# Current consumers of plant-based meat also consume meat the most

**Surprisingly, Enthusiasts consume meat the most often, while Skeptics and Novices consume the least.** Chicken and fish are the most consumed meat types across all segments, while lamb/mutton is consumed the least often. Around half of the sample consumes pork weekly, but this varies widely across countries due to religious restrictions.

**Enthusiasts are more likely to want to eat more of all kinds of meat.** This may indicate that they have greater and more diverse dietary habits and protein requirements. For the other segments, reducing red meat is the clearest trend, with 30 percent and 27 percent of respondents overall reducing beef and pork, respectively. Very few consumers are interested in reducing fish (8 percent) or chicken (14 percent), while a moderate percentage (21 percent) intend to reduce their consumption of seafood like shrimp and crab.

How often do you consume the following foods? (% respondents eating weekly)<sup>1</sup>



Which products do you intend to eat less of in the upcoming year? (% respondents)<sup>2</sup>

	PBM Skeptics	PBM Rejectors	PBM Novices	PBM Curious	PBM Expanders	PBM Enthusiasts	Average
Beef	28%	34%	29%	31%	32%	25%	30%
Pork	24%	23%	28%	28%	28%	24%	27%
Seafood	25%	25%	21%	21%	18%	19%	21%
Chicken	12%	15%	17%	15%	13%	13%	14%
Fish	9%	11%	10%	7%	7%	8%	8%

Source: <sup>1</sup> All respondents (n=5,971); <sup>2</sup> Beef - n = 5,208; Pork - n = 4,169; Seafood - n = 5,672; Chicken - n = 5,917; Fish - n = 5,855. This question excludes those who say they "never" consume a certain type of product.

# If barriers are resolved, consumption can significantly increase

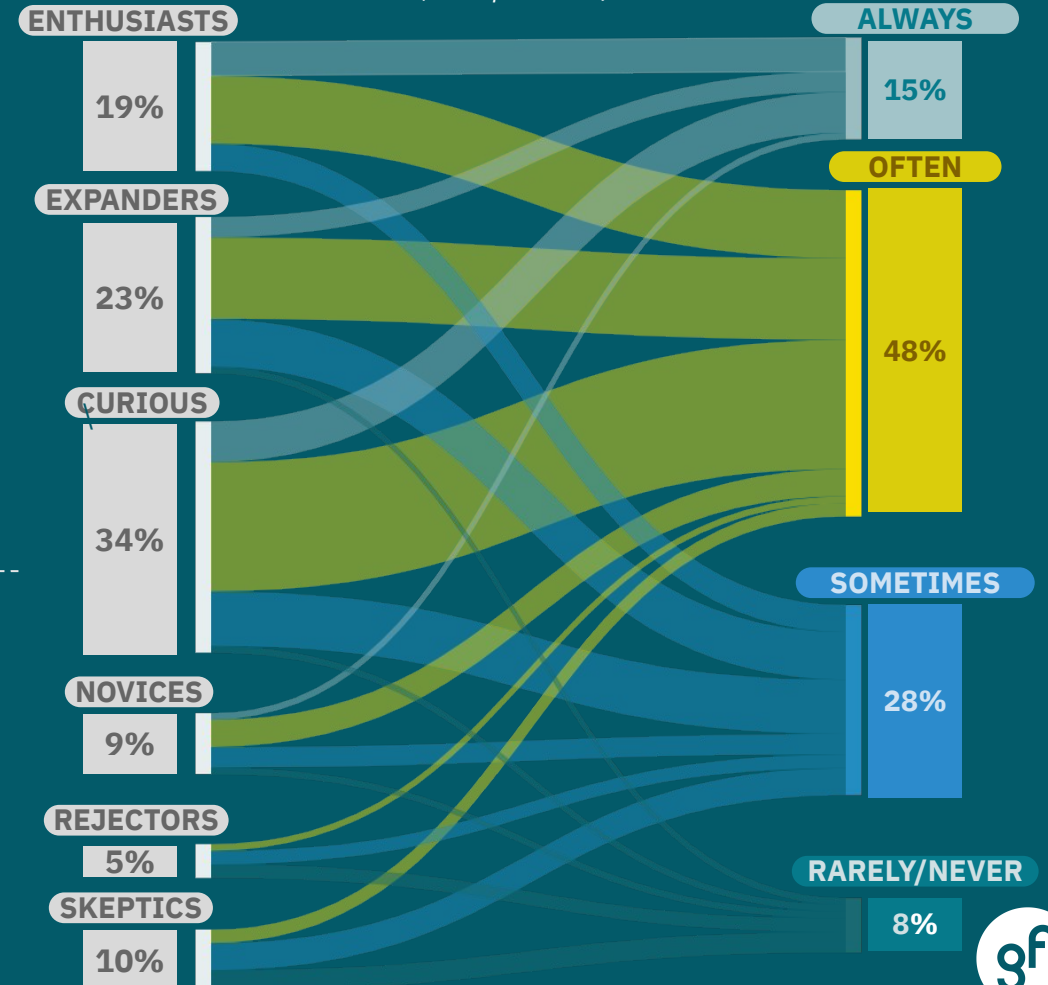
Almost half of all respondents ranked affordability as one of their top three barriers to consuming more plant-based meat. Expanders and Enthusiasts cared more about greater availability/variety, while Novices and the Curious segments saw affordability as the greater barrier. Concerns around processing are more common among those who have tried plant-based meat, but did not emerge as topmost concerns.

In a scenario where these concerns were resolved, the percentage of respondents who eat plant-based meat would increase from 5 percent who eat it regularly now to 63 percent who claim they would eat it always or often. 15 percent of respondents indicate that they would fully replace meat with plant-based meat if their concerns were resolved. ~26 percent of both the Skeptics and Rejectors say they would convert to consuming always or often.

What would make you eat more plant-based meat products? (Rank up to 3)<sup>1</sup>

	Skeptics	Rejectors	Novices	Curious	Expanders	Enthusiasts	Average
Was more affordable	54%	39%	45%	52%	43%	39%	47%
Was more nutritious	39%	35%	46%	44%	37%	39%	41%
Tasted better	40%	39%	38%	35%	31%	30%	34%
Tasted more like meat	30%	29%	26%	28%	27%	26%	28%
Is more available when shopping	18%	17%	22%	32%	26%	28%	27%
Had more variety	21%	19%	19%	19%	26%	31%	23%
Was less processed	20%	26%	15%	16%	22%	22%	19%

How often would you choose plant-based meat if all your concerns were resolved? (% respondents)<sup>2</sup>



Source: <sup>1</sup> All respondents (n=5,971) except those who said they would not eat any, or unlikely to try (n=279); <sup>2</sup> All respondents (n=5,971)



# There is a positive outlook towards plant-based meat, with strong associations to health

**Health is the top determining factor for choosing to eat plant-based meat instead of meat, followed by taste and affordability.** Compared with other segments, being better for the environment and animals are significantly more important for the segments that have tried plant-based meat. Taste and affordability are relatively more important for the segments that haven't tried plant-based meat. A significant share of **Skeptics** and **Rejectors** are not interested in plant-based meat, with 17 and 22 percent respectively selecting the option that "nothing will make me consume plant-based meat."

**There are more positive associations of plant-based meat than negatives across all segments, with lower-interest segments having more health-related negative associations.** Between two-thirds and three-quarters of **Enthusiasts**, **Expanders**, and the plant-based **Curious** consider plant-based meat as healthy, with key associations being easy to digest, high in protein, and low in cholesterol. While a considerable share of **Skeptics** and **Rejectors** also view plant-based meat as healthy, these groups have concerns around over-processing and chemicals/additives.

What makes / would make you choose plant-based meat over meat in a meal? (Rank up to 3)<sup>1</sup>

	Skeptics	Rejectors	Novices	Curious	Expanders	Enthusiasts
Health	42%	36%	55%	60%	62%	56%
Taste	47%	25%	47%	50%	34%	40%
Affordability	45%	24%	40%	50%	28%	28%
Environment	18%	34%	24%	31%	41%	43%
Animals	18%	32%	21%	24%	43%	40%
Hygiene	22%	25%	27%	26%	31%	36%
Availability	22%	20%	24%	31%	19%	21%
Convenience	22%	20%	22%	21%	25%	27%
Nothing	17%	22%	5%	0%	2%	0%

Which of the following characteristics do you associate with plant-based meat? (Multiple selection)<sup>2</sup>

	Skeptics	Rejectors	Novices	Curious	Expanders	Enthusiasts
Healthy	39%	46%	57%	72%	71%	65%
Easy to digest	21%	27%	35%	50%	48%	51%
High in protein	18%	23%	26%	35%	38%	37%
Low in cholesterol	18%	22%	25%	34%	37%	29%
Hygienic	16%	16%	24%	32%	31%	33%
Natural / no additives	13%	12%	19%	24%	25%	25%
Is overly processed	26%	31%	19%	18%	19%	17%
May have bad chemicals/additives	24%	23%	12%	16%	16%	12%
Low in protein	12%	8%	10%	11%	11%	10%
High in sodium	11%	16%	9%	9%	13%	11%
May have hormones	11%	8%	9%	9%	9%	8%
Unhealthy	8%	8%	6%	4%	4%	6%

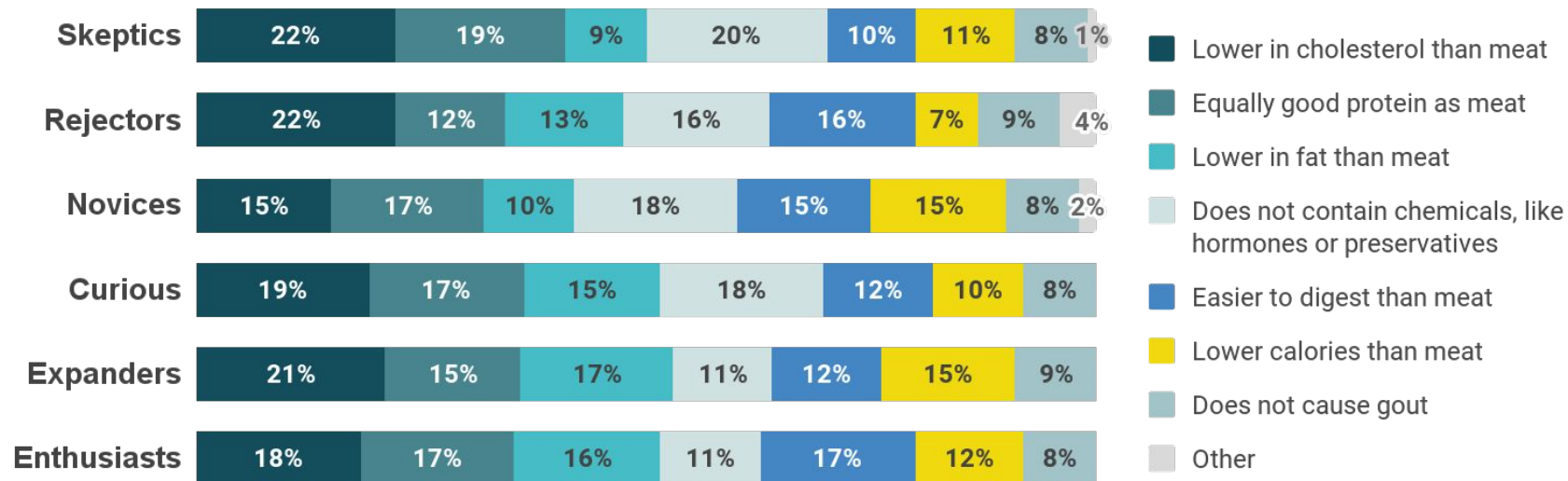
Source: <sup>1</sup> All respondents (n=5,971) "Nothing would make me choose plant-based meat" is an exclusive answer. <sup>2</sup> All respondents (n=5,971); Respondents had the option of choosing more than one options.

# What is considered “healthy” is nuanced

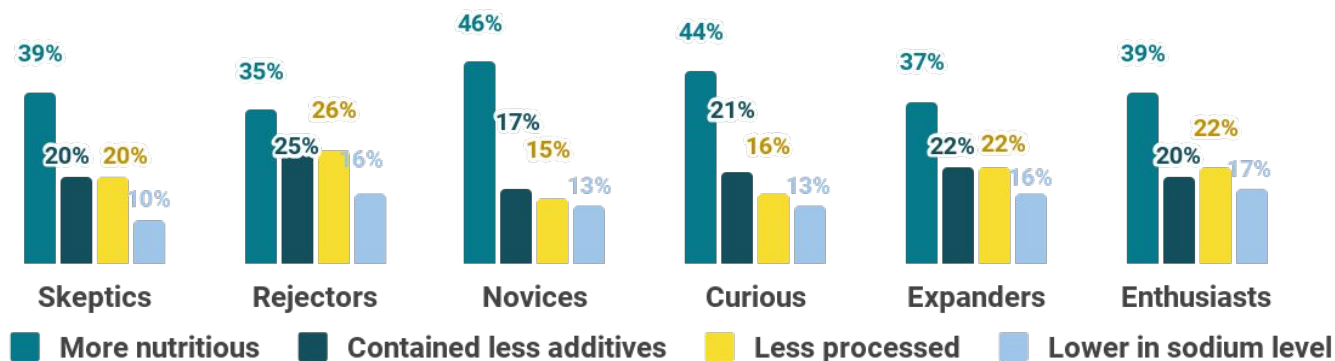
For respondents who indicated health as a consumption motivator, respondents ranked lower in cholesterol and fat, good protein, ease of digestion, and absence of chemicals as top drivers. The segments were broadly similar in their health motivations, but **Expanders** and **Enthusiasts** were more likely to choose plant-based meat because of it being lower in fat and easy to digest, and less likely to choose it because of lack of chemicals or hormones.

Improving the nutritional content and related marketing can encourage a significant percentage of consumers across all segments to eat more plant-based meat. When respondents were asked to rank three choices for what would lead them to eat more plant-based meat, of the health-related options, 41 percent across all segments chose “more nutritious” as one of their top three barriers. Some respondents had more specific concerns about processing, additives, and sodium content.

Which of the following health benefits would make you choose plant-based meat over meat? (% respondents, top factor)<sup>1</sup>



What would make you eat more plant-based meat products? (% respondents, health-related answers only)<sup>2</sup>



Source <sup>1</sup> Respondents who chose “health” as one of their top 3 motivators (n=3,327); <sup>2</sup> All respondents (n=5,693); except those who said they would not eat any, or unlikely to try (n=278)



# Price sensitivity is high, even among more enthusiastic segments

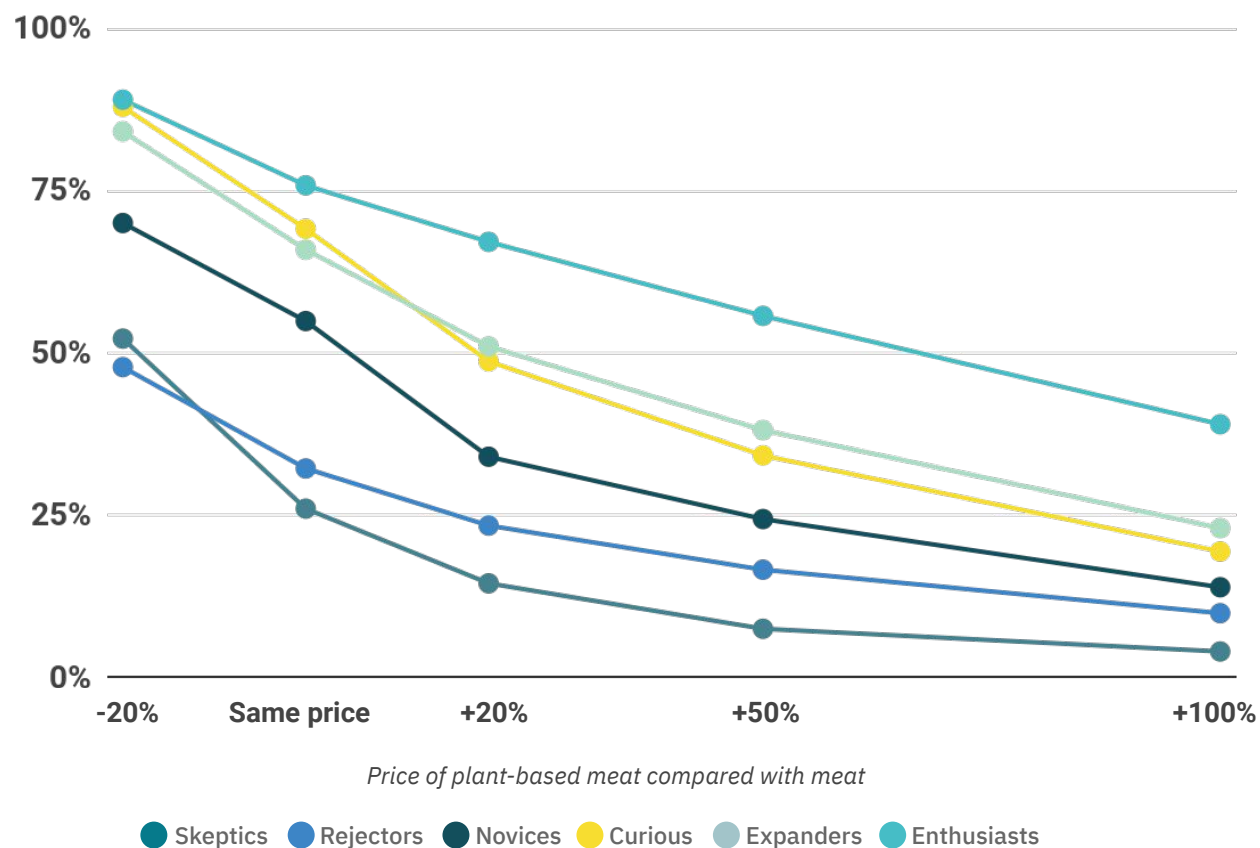
**Higher-interest segments are much more willing than lower-interest segments to choose plant-based meat when it is the same price as conventional meat.** Over half to three-quarters of **Enthusiasts, Expanders, the Curious, and Novices** were willing to pay for plant-based meat if it was the same price as meat. However, the drop-off rates were relatively high for the **Curious, Novices** and **Expanders** when a premium of 20 percent was applied to plant-based meat. Once reaching a 50 percent premium, well under half would opt for plant-based meat.

**Even at 20 percent cheaper than meat, the percentage of Rejectors and Skeptics willing to pick plant-based meat is lower than the percentage of the other segments choosing plant-based meat at the same price.** This indicates that (lower) price may not necessarily be a deciding factor for consumers who are not interested in plant-based meat.

*Imagine you were doing your grocery shopping and the following products were available that would suit the dish you were wanting to cook. Which would you purchase?*

*(Options: Plant-based meat, meat, neither)<sup>1</sup>*

% respondents who chose plant-based meat



Source: <sup>1</sup> Respondents were asked whether they would buy plant-based meat or meat if both items were the same price, without describing specific products. Prices were then increased or decreased depending on their answer and the question was asked again. Answers are better interpreted as an indication of level of interest in plant-based meat comparatively to other consumers when price is taken into account, rather than a definitive representation of willingness to pay.



# Taste perceptions are relatively positive for high-interest segments, but need to improve

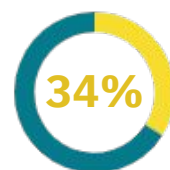
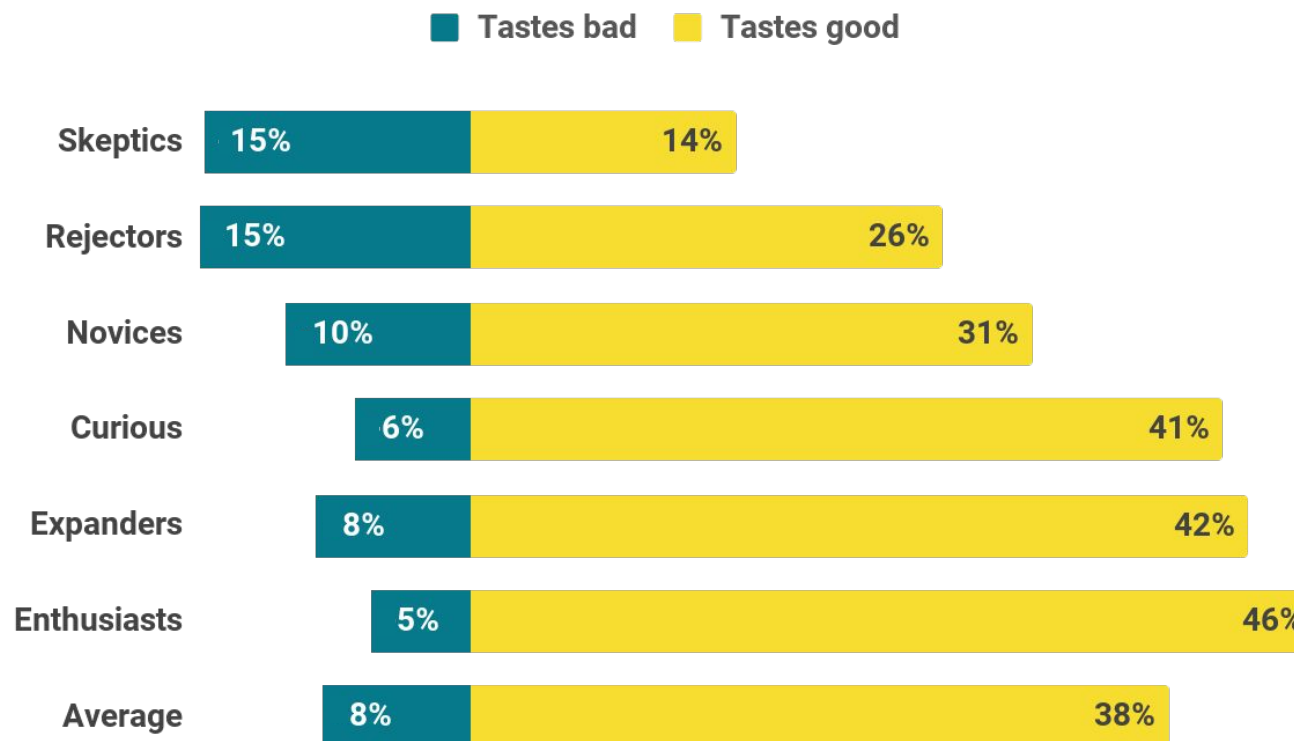
**38 percent of respondents associated plant-based meat with “tastes good,” while only 8 percent did the same for “tastes bad.”**

The remaining respondents did not select either option. **Skeptics** were the only group with an overall negative perception of taste, with more people choosing “tastes bad” than “tastes good.” The **Novices** and **Curious** segments were slightly more likely to view taste as a barrier, while **Enthusiasts** had the most positive view.

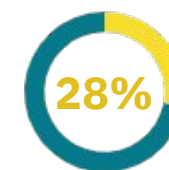
**However, taste remains one of the top three barriers to higher consumption of plant-based meat across all segments.**

To determine whether respondents were more concerned about general taste or in similarity to animal meat, respondents had the choice to select “If it tasted better” or “If it tasted more like meat” as a motivator for higher consumption. 34 percent of respondents said they would eat more plant-based if it tasted better, and 28 percent if it tasted more like meat.

Which of these characteristics do you associate with plant-based meat? (% respondents)<sup>1</sup>



**34%** of respondents would eat more PBM if it **tasted better**<sup>2</sup>

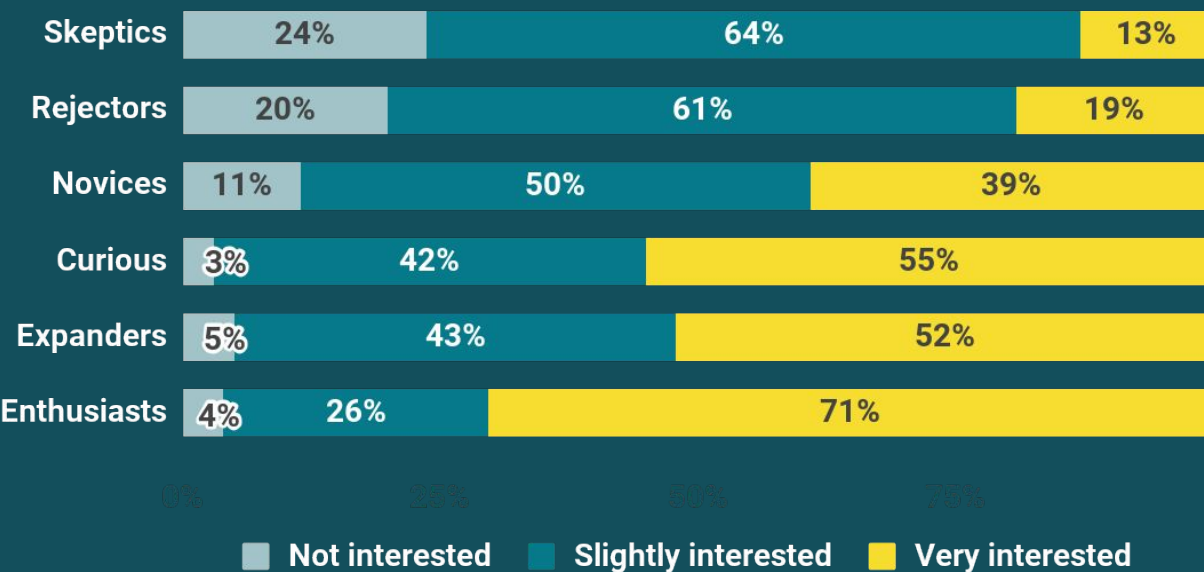


**28%** of respondents would eat more plant-based if it **tasted more like meat**<sup>2</sup>

# There are high levels of interest in “meat + plant-based meat” blends

**93 percent of respondents reported at least some interest in trying a blended product that mixed conventional and plant-based meat, with over half stating they were very interested.** Almost a fifth of **Rejectors** were very interested in blended meat options, and along with **Skeptics** almost two thirds of both had some interest. **Enthusiasts** were the most interested, which emphasises that **Enthusiasts** are generally looking for more protein diversity, rather than meat replacements.

How interested are you in trying a type of meat that has mixed both animal and plant-based meat in it? (% respondents)<sup>1</sup>



**No segment preferred a vegetable-forward option (tofu/tempeh or beans/legumes) over a plant-based/hybrid product. Enthusiasts, Expanders, and the plant-based Curious all ranked plant-based meat the highest out of the given selection of various plant-based protein sources. Novices, Rejectors, and Skeptics ranked plant-based meat the lowest but ranked hybrid products the highest, indicating their general preference for meat. Blends are a high potential pathway to tap into more resistant segments.**

If you could only pick one option to put in a dish with vegetables and rice, which would you choose in order of preference? (By aggregated score)<sup>1</sup>

	Skeptics	Rejectors	Novices	Curious	Expanders	Enthusiasts
1	Blends	Blends	Blends	Plant-based meat	Plant-based meat	Plant-based meat
2	Tofu/ Tempeh	Tofu/ Tempeh	Plant-based meat	Blends	Blends	Blends
3	Beans/ legumes	Beans/ legumes	Tofu/ Tempeh	Tofu/ Tempeh	Tofu/ Tempeh	Tofu/ Tempeh
4	Plant-based meat	Plant-based meat	Beans/ legumes	Beans/ legumes	Beans/ legumes	Beans/ legumes

Source: <sup>1</sup> All respondents (n=5,971)





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