Good Food Institute APAC℠

Paving the Way to Sustainability:

The Growth of Alternative Proteins in Asia

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29 August 2024

Good Food Institute APAC

1. Introduction to GFI
2. What are alternative proteins
3. Regulatory developments
4. Overview of the APAC alternative protein sector

1

Introduction to GFI

Good Food Institute

*We act as a **force multiplier**, bringing the expertise of our 150+ staff across our six regions to the rest of the world*

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

Our work spans three areas:

Science and Tech
Advance foundational, open-access research in alternative proteins

Corporate Engagement
Partner with companies and investors to unlock funds, innovation, and scale

Policy
Work with policy actors to ensure a clear path to market and secure public support for R&D

GFI is fully funded by philanthropy.

Protein diversification

Plant-based

Photo courtesy of TinDLE

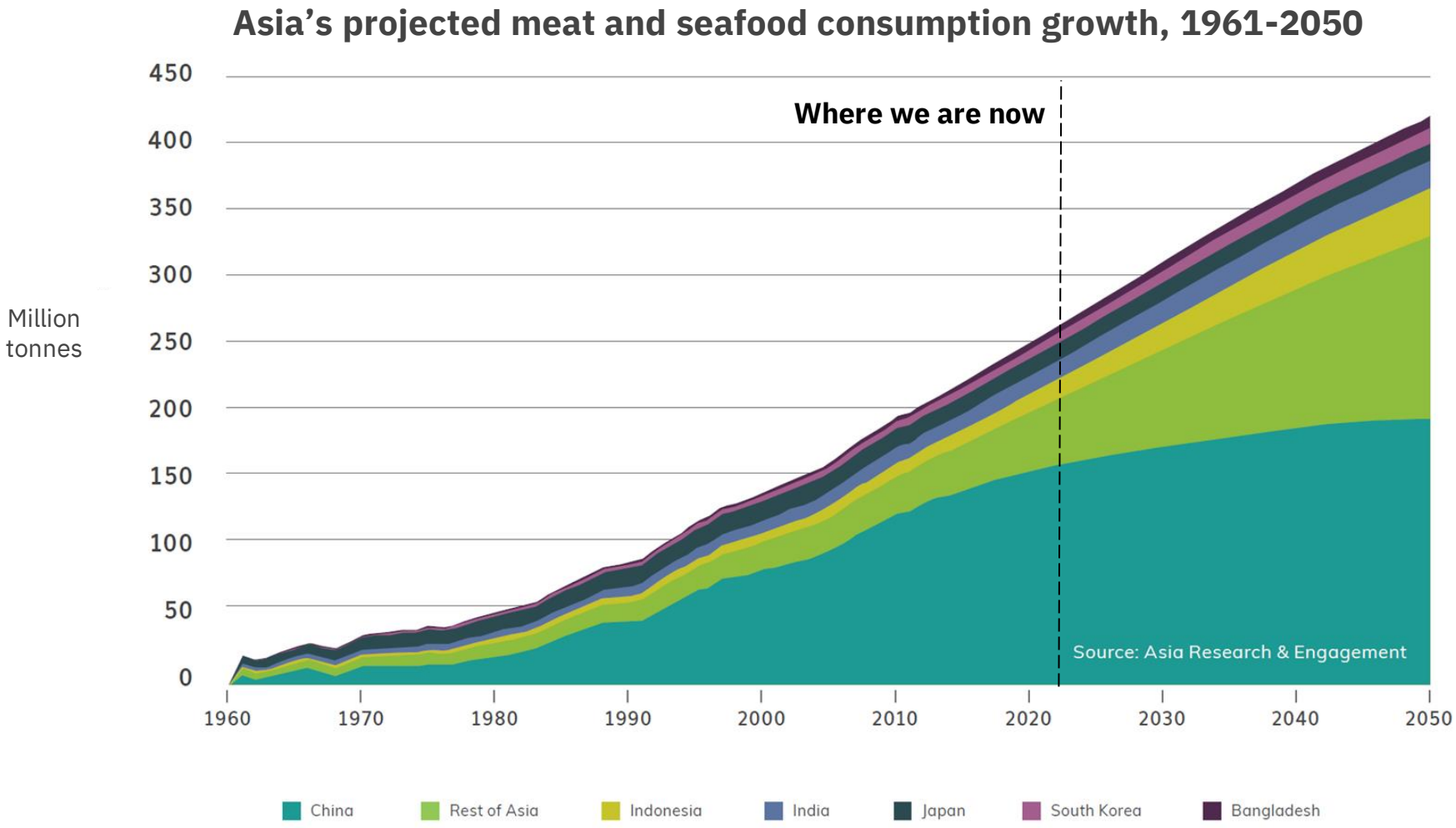
Cultivated

Photo courtesy of GOOD Meat

Fermentation

Photo courtesy of Meati

Demographic changes in APAC will push demand for animal protein to new heights



Source: Asia Research and Engagement (2018). Charting Asia's Protein Journey

Industrialised animal agriculture is no longer fit-for-purpose

20%

of greenhouse gas emissions are driven by industrial animal agriculture

87-97%

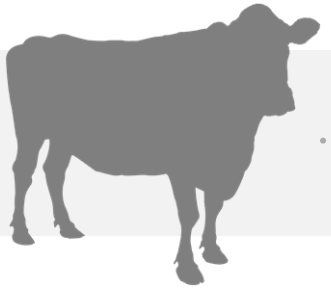
of food is wasted in conventional meat production

10 million

projected annual deaths from antimicrobial resistance by 2050

Source: FAO, retrieved from Our World in Data (2022); United Nations IAGC

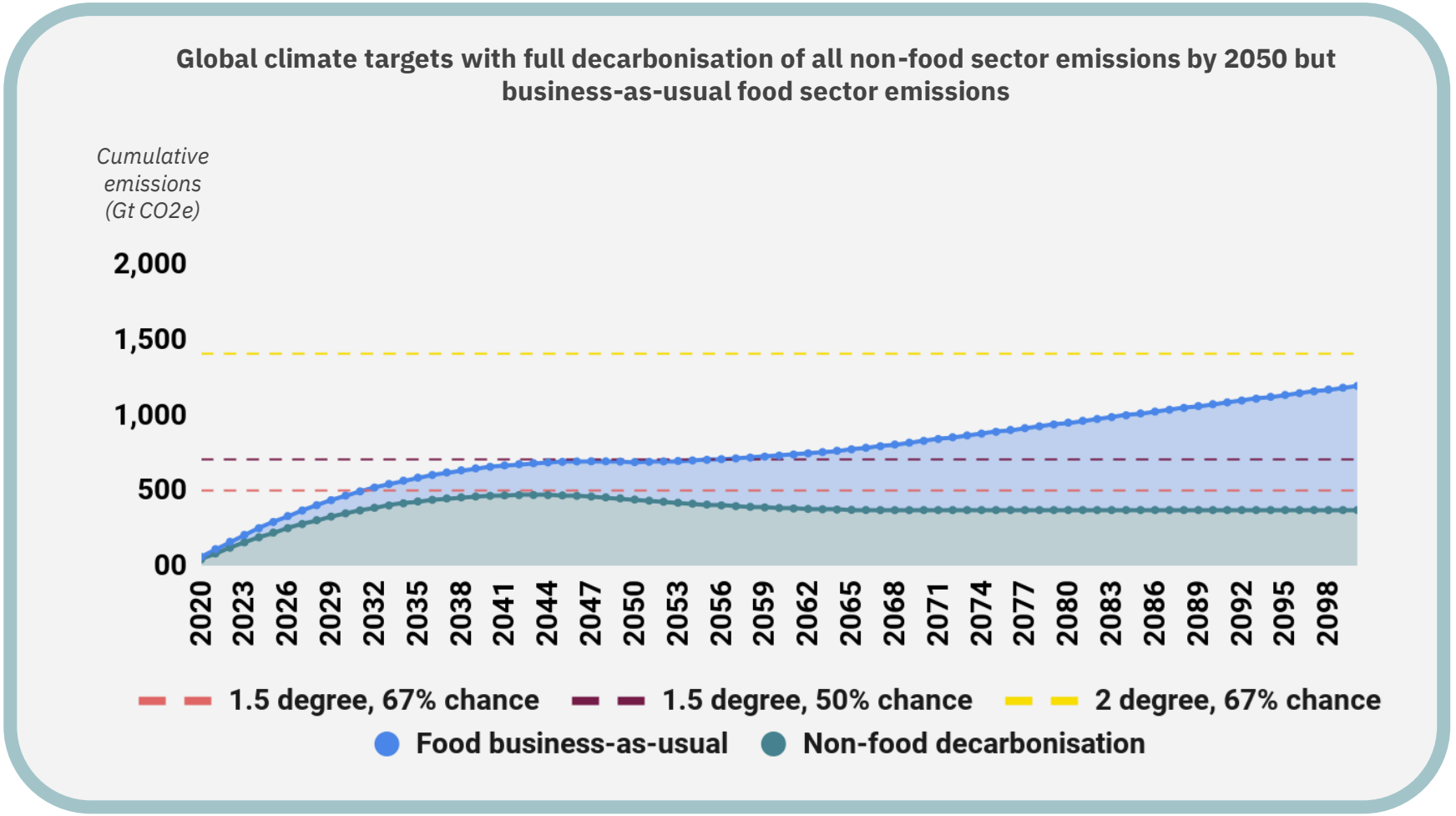
Livestock production is inherently inefficient

9 CALORIES IN		**1** CALORIE OUT	**13%** CONVERTED
11 CALORIES IN		**1** CALORIE OUT	**9%** CONVERTED
40 CALORIES IN		**1** CALORIE OUT	**3%** CONVERTED

This process of cycling calories through animals is equivalent to **87-97% food waste** in production

Source: Shepon, et al., Energy and protein feed-to-food conversion efficiencies in the US and potential food security gains from dietary changes.

The world cannot decarbonise without alternative proteins



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)

Source: GFI analysis based on supplementary data files from Clark, M. A. et al. (2020)

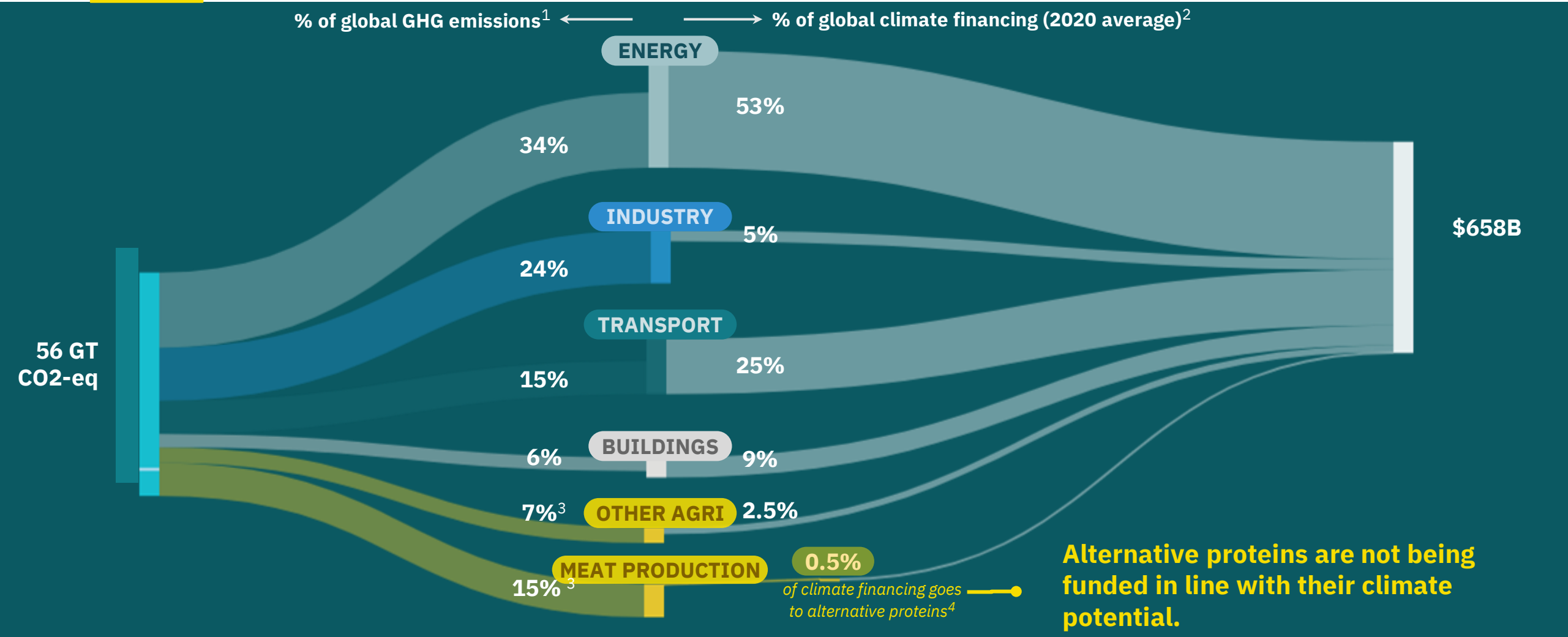
Comparing alternative proteins and conventional meat on environmental impacts

Comparative Life Cycle Assessments*

Producing this alternative protein	instead of this conventional meat	reduces this environmental impact category by this much		
		GHG EMISSIONS	LAND USE	AIR POLLUTION (PM)
Impossible Burger[I]	Beef burger patty	89%	96%	–
Beyond Burger[II]	Beef burger patty	90%	97%	–
Quorn Fillet[III]	Chicken breast	75%	78%	–
Morningstar Original Chik Patties[IV]	Chicken sausage patty	46%	84%	69%
Plant-based burger (soy protein)[V]	Beef burger patty	98%	87%	99%
	Chicken burger patty	90%	82%	90%
	Pork burger patty	90%	85%	90%
Plant-based burger (soy)[VI]	Beef burger patties	82%	84%	95%
Plant-based burger (pea)[VI]		84%	64%	91%
Fermentation-based burger (mycoprotein)[VI]		82%	69%	91%
Cultivated beef[VII]	Conventional beef	92%	90%	94%
Cultivated chicken[VII]	Conventional chicken	+3%	64%	20%
Cultivated pork[VII]	Conventional pork	44%	67%	42%

Sources: I. Khan, et al. (2019); II. Heller, et al. (2023); III. Kazer, et al. (2021); IV. Dettling, et al. (2016); V. Saerens, et al. (2021); VI. Smetana, et al. (2021); VII. Sinke, et al. (2023).**

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



Source: [1] Based on IPCC for all sectors; meat production share from Poore and Nemecek (2021). [2] 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". [3] Figures are lower-bound estimates–high-end estimates for AFOLU is 37 percent, and meat production 17 percent. [4] Figures for alternative proteins from GFI analysis of policy and Pitchbook data.

2

What are alternative proteins?

Protein diversification

Plant-based

Photo courtesy of TinDLE

Cultivated

Photo courtesy of GOOD Meat

Fermentation

Photo courtesy of Meati

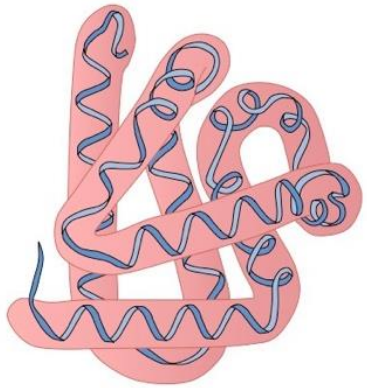
Plant-based

Plant-based meat, eggs, and dairy are produced directly from plants.

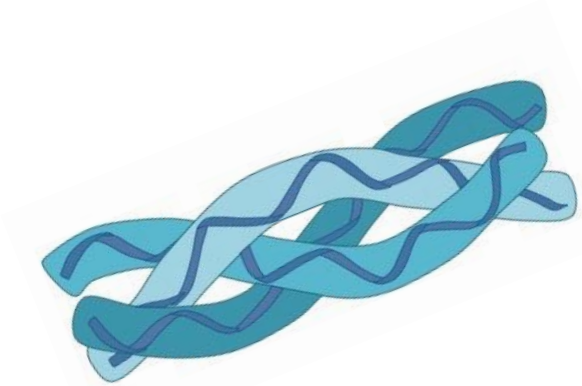
Like animal products, they are composed of protein, fat, vitamins, minerals, and water. Next-gen plant-based options look, taste, and cook like conventional meat, and offer complex carbs and fibre.

Making plant proteins mimic animal proteins

The core goal of plant-based meat is persuading plant proteins to act like animal proteins



Globular proteins



Fibrous proteins

Cultivated Meat

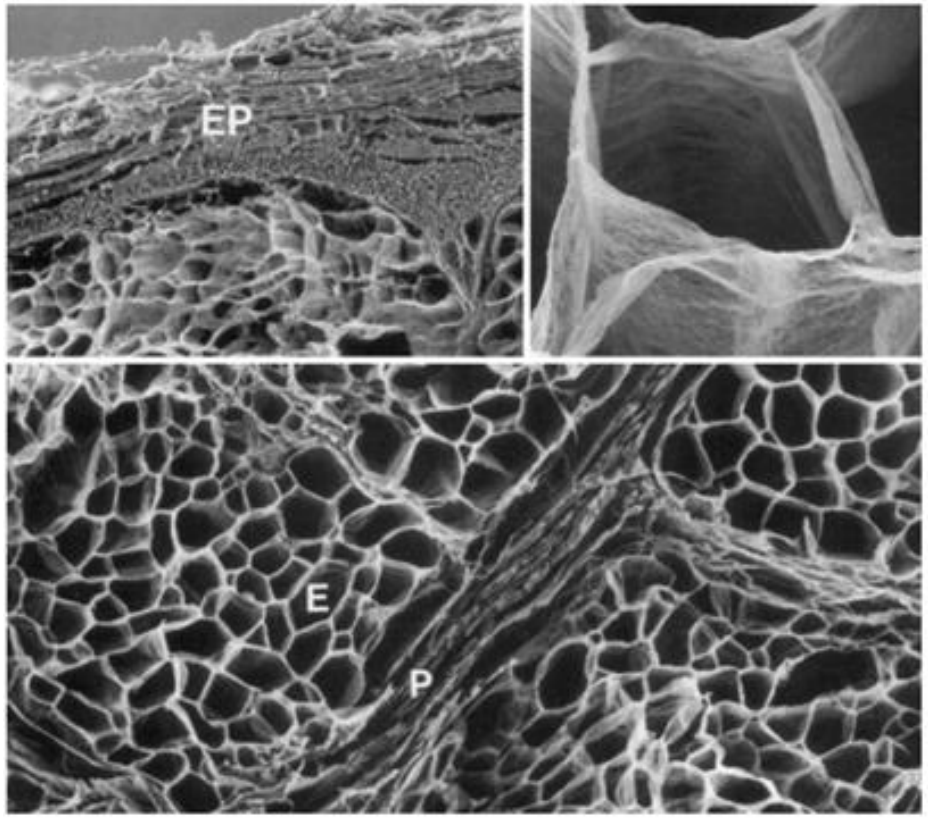
Cultivated meat is produced directly from animal cells.

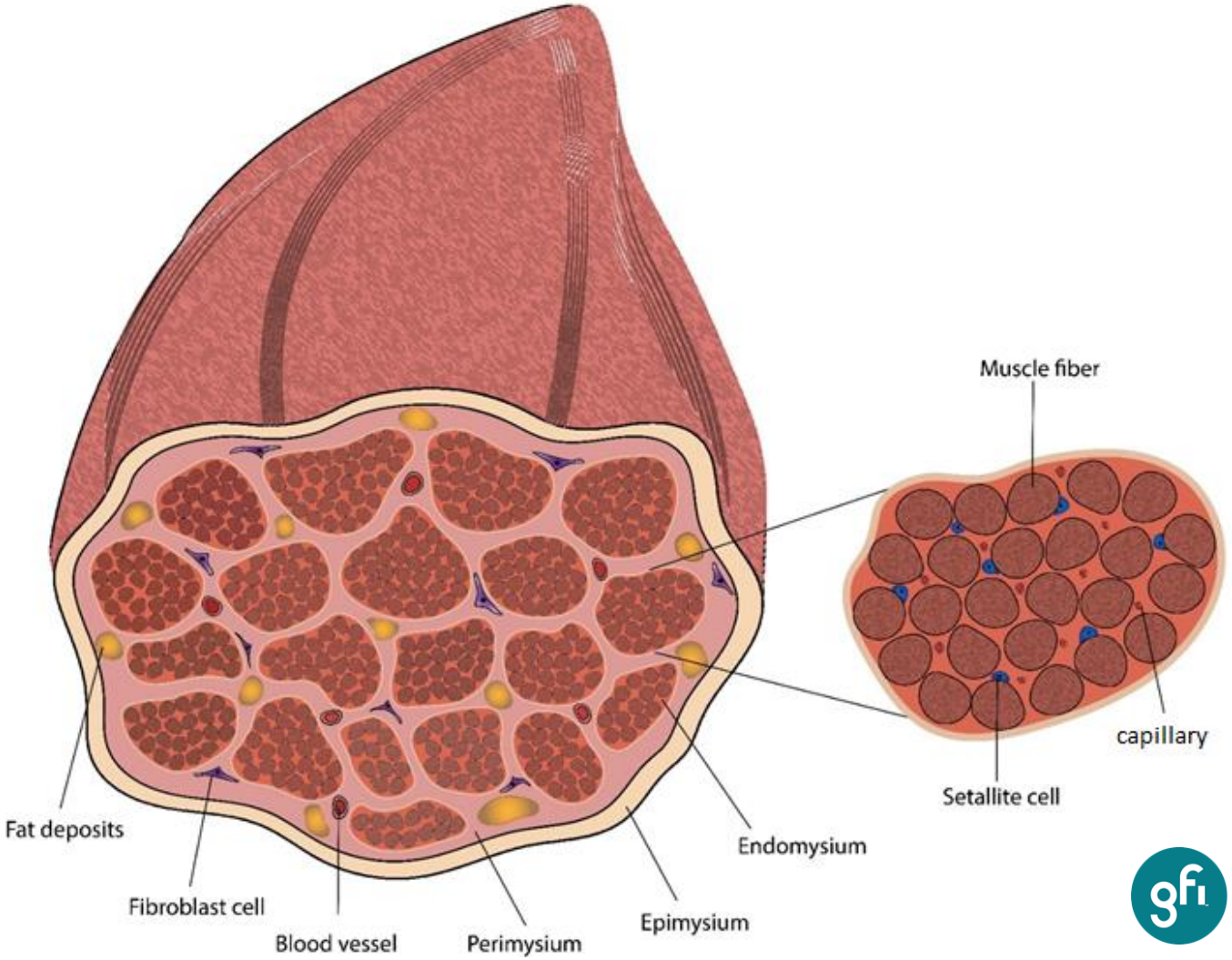
Meat cultivation facilitates the same biological process that happens inside an animal by providing cells with the warmth and basic nutrients required to build muscle and fat.

Tissues

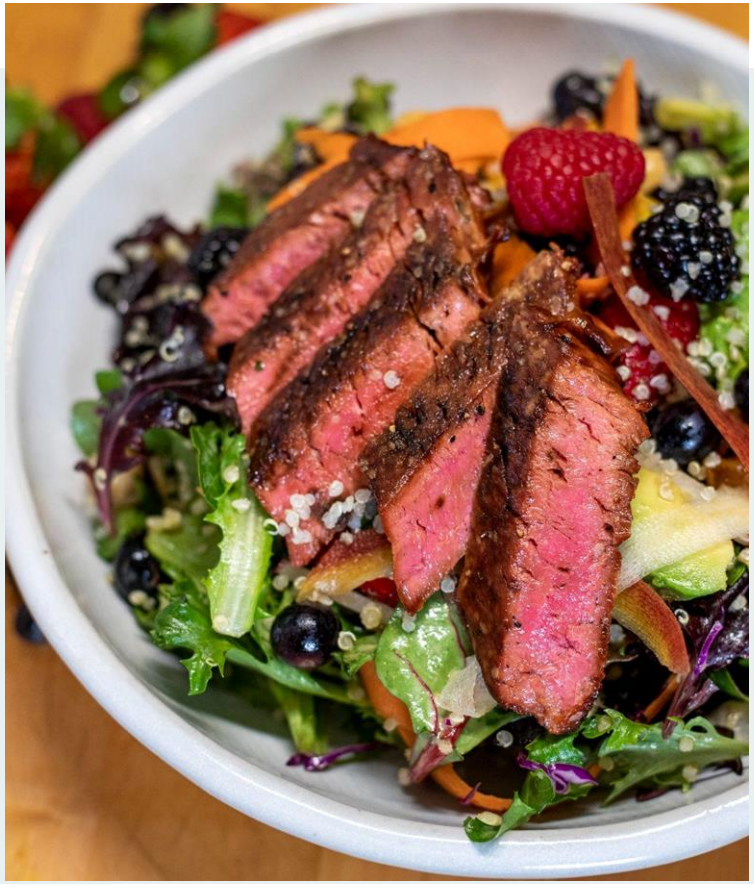
Animal muscle is made of muscle fibres, connective tissue, and fat tissue

- **Hierarchical designed structures**
- **Extracellular matrix (ECM)**





Fermentation-derived proteins



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

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

Fermentation is expanding our ability to innovate

3 types of fermentation in the alternative protein industry

Traditional Fermentation

- Uses **intact live microorganisms** to modulate and process plant-derived ingredients.
- Produces unique flavour and nutritional profiles, modified texture.

Biomass Fermentation

- Leverages microorganism **fast growth** and **high protein content** to produce large protein quantities.
- Biomass serves as predominant or primary ingredient of a food product.

Precision Fermentation

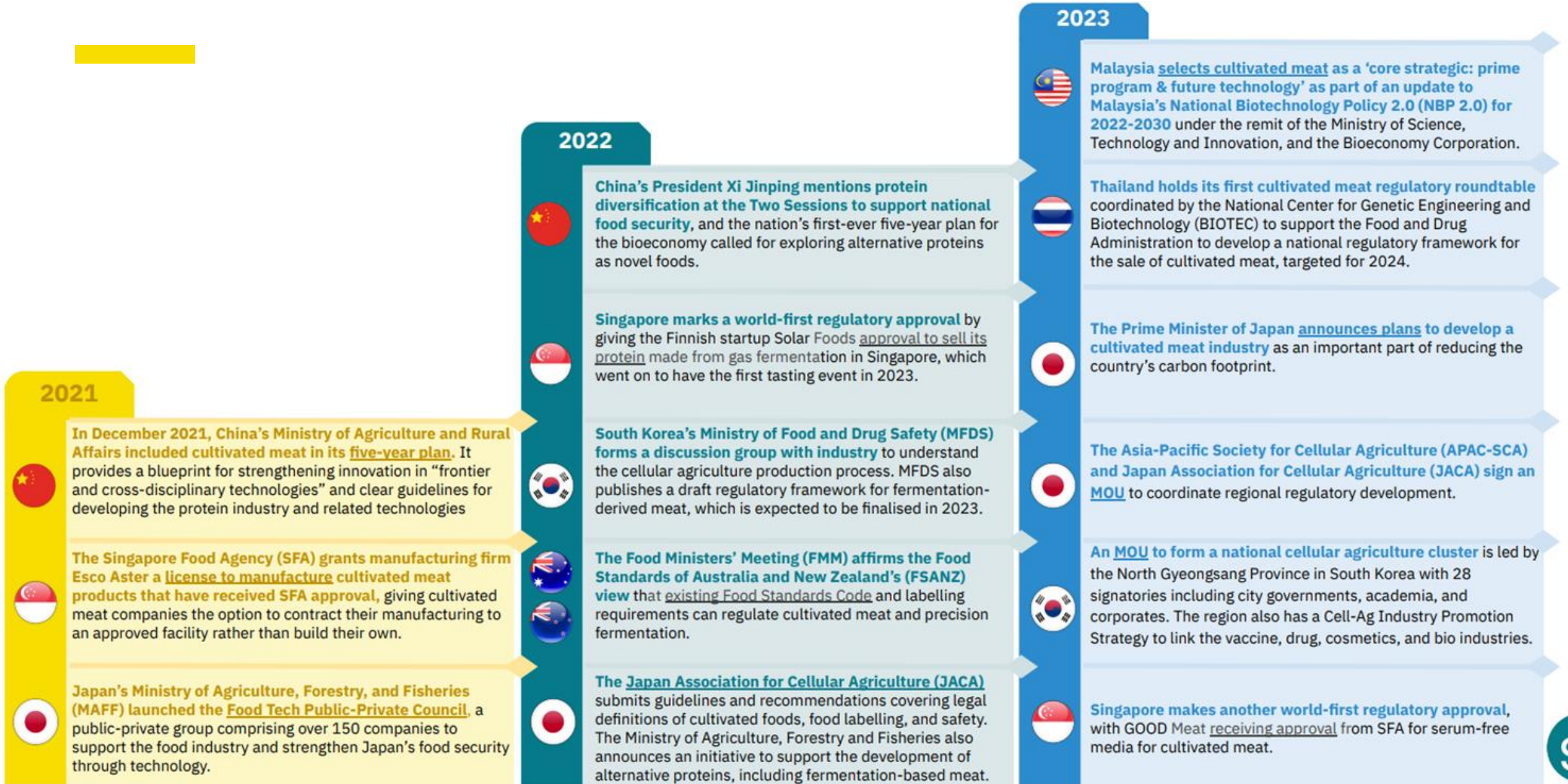
- Uses **microbial hosts** to produce **specific functional ingredients** that often require greater purity.
- Ingredients enable improved sensory characteristics, functional attributes.

better nature — PROTEIN, THE BETTER WAY
LIGHTLIFE™
Quorn — Dedicated to MEAT-FREE
MEATI FOODS
Nature's Fynd
Geltor
IMPOSSIBLE™
Clara Foods
Perfect Day
gfi

3

Regulatory developments

Governments are implementing supportive policy frameworks



The cultivated meat regulatory landscape is progressing globally and in APAC

Commercial Sales

- First country to approve cultivated meat by GOOD Meat in 2020. Followed by its first retail sale in 2024.
- First country to grant approval for microbe-based protein ingredient Solein.
- Approval for Vow to sell cultivated quail in 2024.

Commercial Sales

Second country in the world to approve cultivated meat in 2023. Approved the sale of cultivated chicken by UPSIDE Foods and GOOD Meat.

Commercial Sales

- The EU approved several novel plant-based and fermentation-derived ingredients, but not cultivated meat.

Application

- In July 2024, ESFA received its first application for cultivated meat approval from Gourmey, that is using cultivated duck to make foie gras.

Regulatory-free Zone

- North Gyeongsang Province designated a special regulatory-free zone in Uiseong.
- Companies can showcase proof-of-concept prototypes, accelerating the development and commercialisation of cultivated meat.

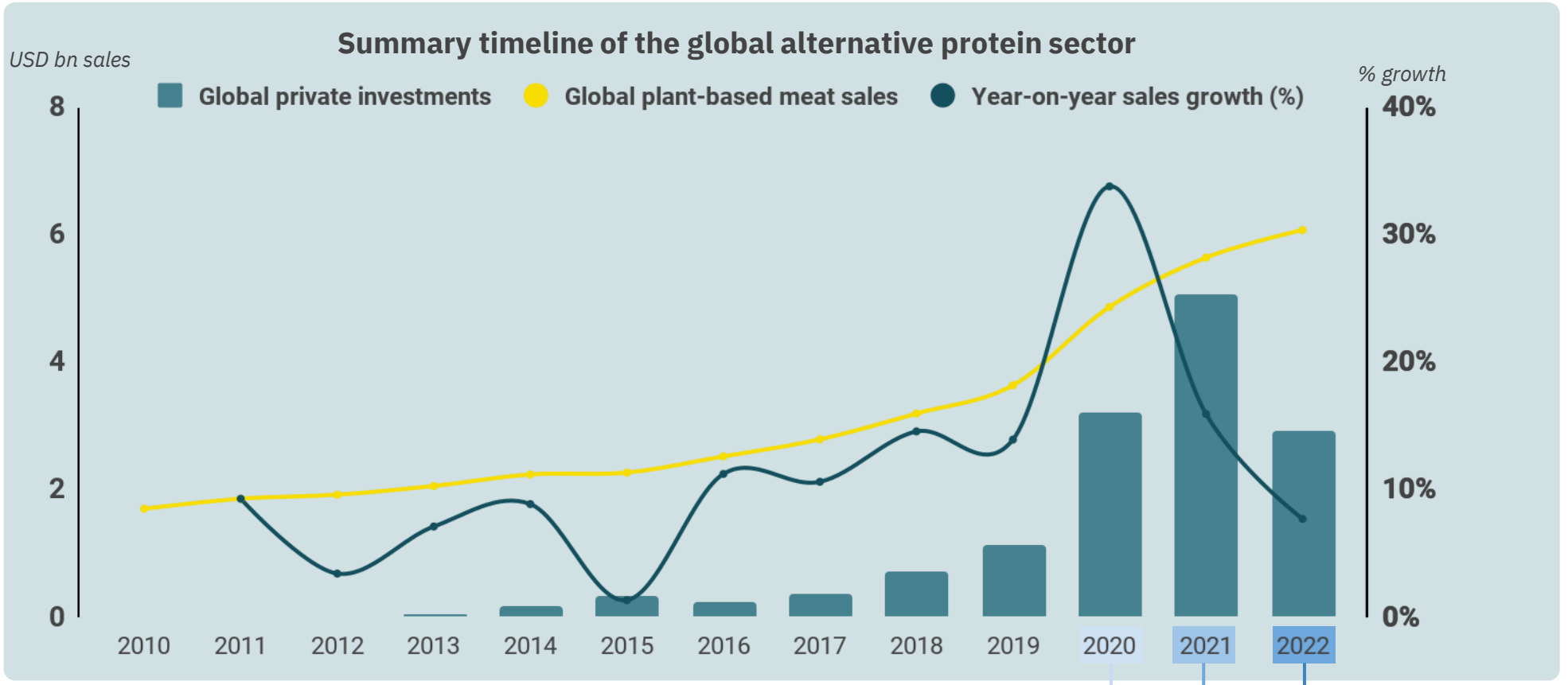
International organisations are actively developing guidelines and standards for novel food

- Codex has 189 member countries, 1 member organisation (the EU) and 240 observer organisations, **including GFI**
- Codex's food standards are **recognised by the World Trade Organization**
- Currently developing **guidelines on novel foods and new production systems**, including products derived from biomass and precision fermentation
- Singapore is championing work proposal of developing standards for cultivated meat

4

Overview of the APAC alternative protein sector

The global alternative protein sector has made progress



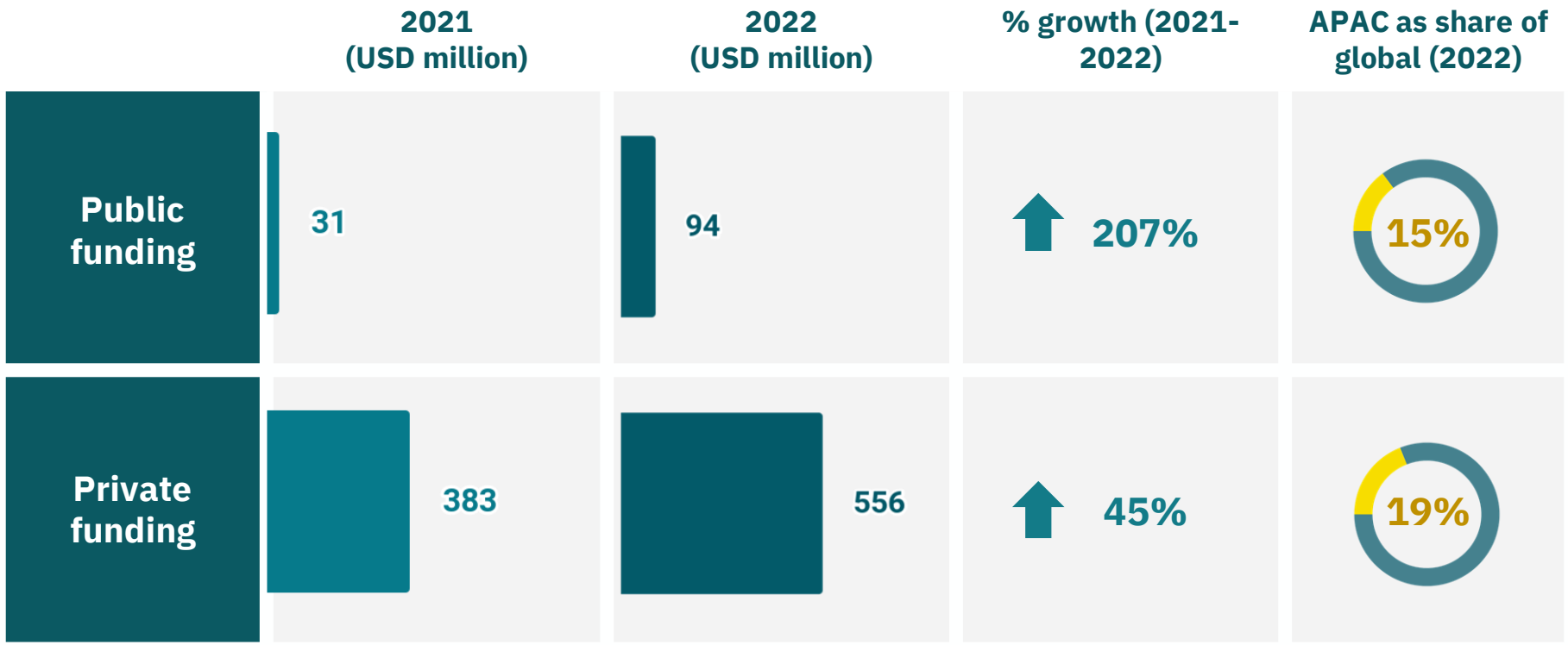
More private capital is invested in the year of 2020 than in the entire sector's history

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

Source: Private investments based on GFI analysis of Pitchbook data. Sales based on Euromonitor data.

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

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."

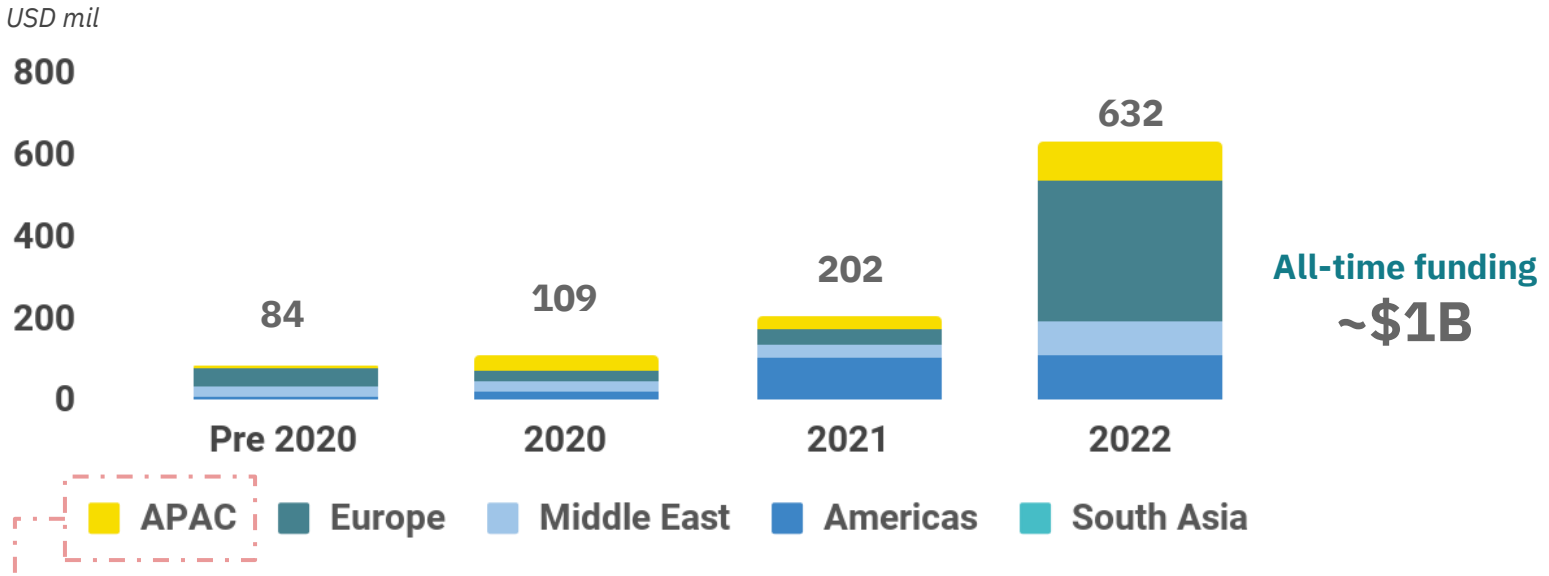
Deputy Prime Minister Heng Swee Keat, Singapore
October 2022

Global governments stepped up their support in 2022

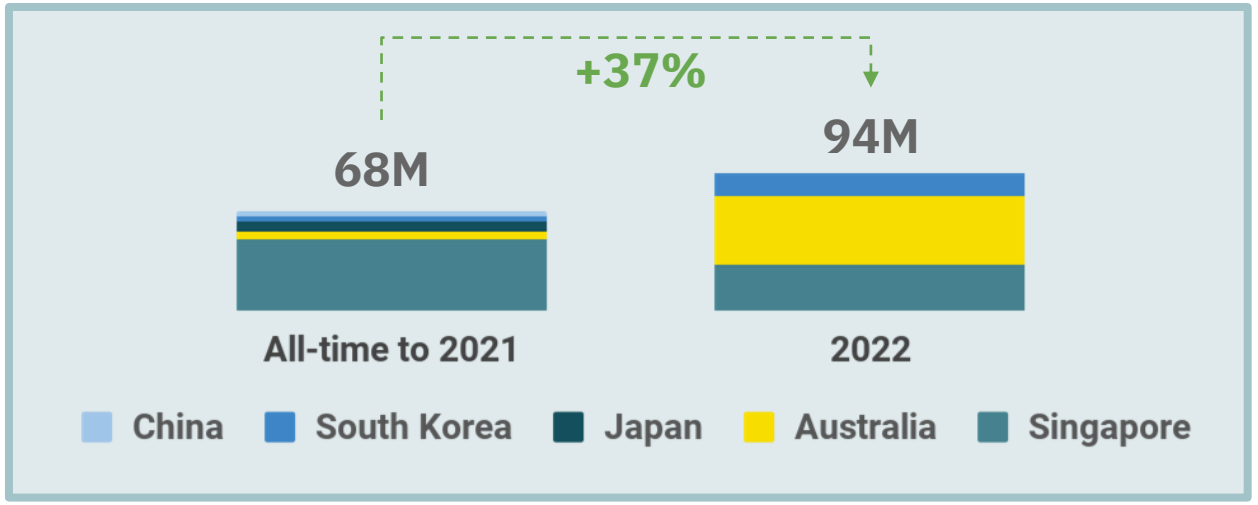
All-time government funding likely surpassed $1 billion USD as of 2022.[1] Governments have funded about 180 projects globally in the sector to date. More than a third of these were in 2022.

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[1]

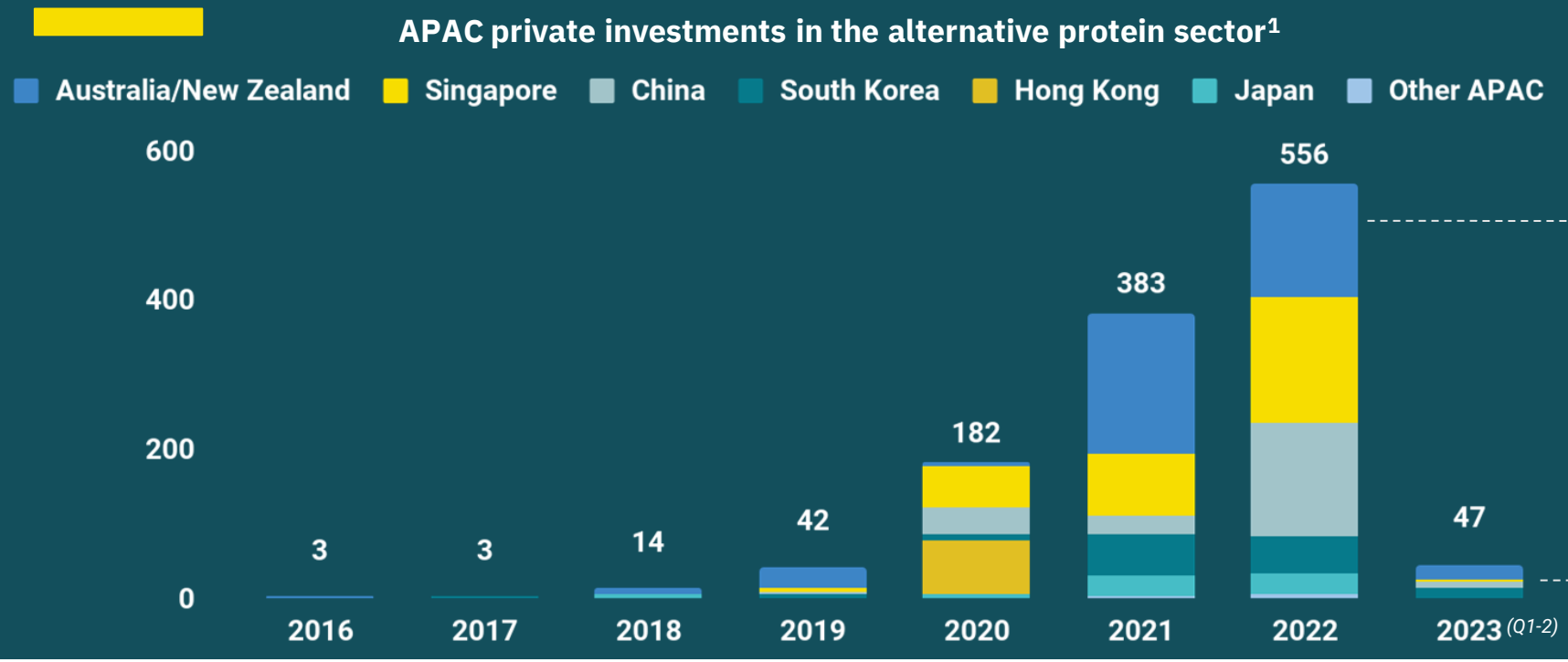


APAC estimated public funding for alternative proteins (USD million)



Source: [1] 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.

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



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.

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[2]	0	0	0	0	0.1	3	7	0	11

All-time APAC private investment
$1.2B

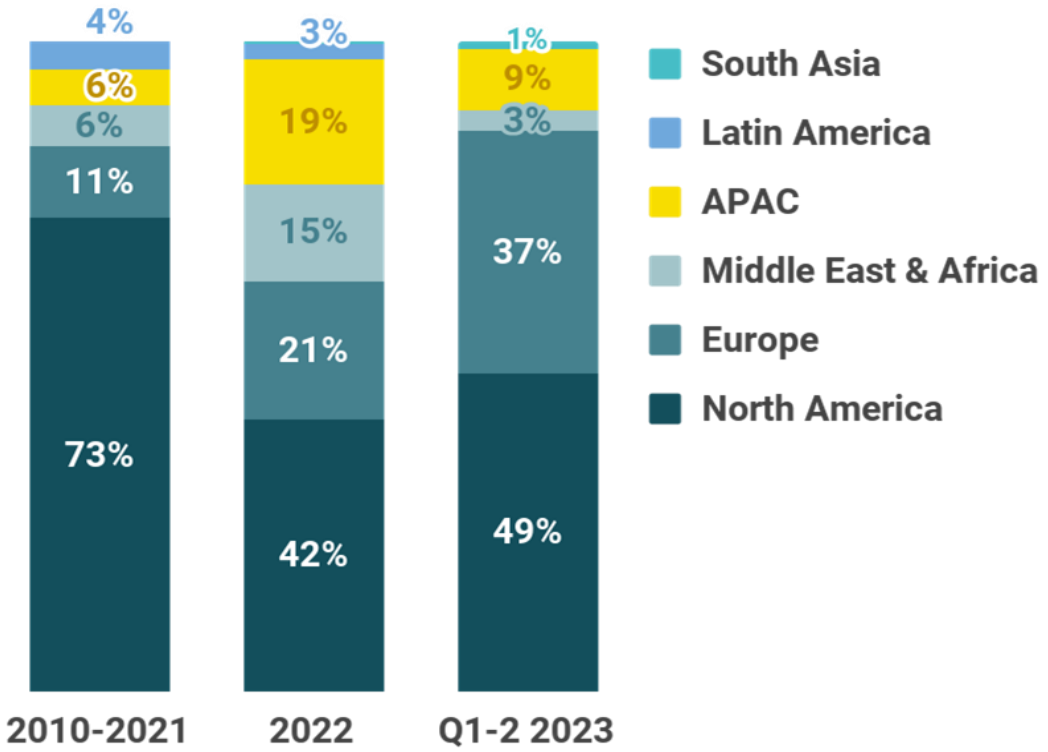
Source: [1]Analysis of Pitchbook data. Note data only includes deals with disclosed amounts and is only a partial view of 2023 (up to Q2); [2] Includes other countries for which investment data exists, in this case Indonesia and the Philippines.

Investment has been diversifying across regions

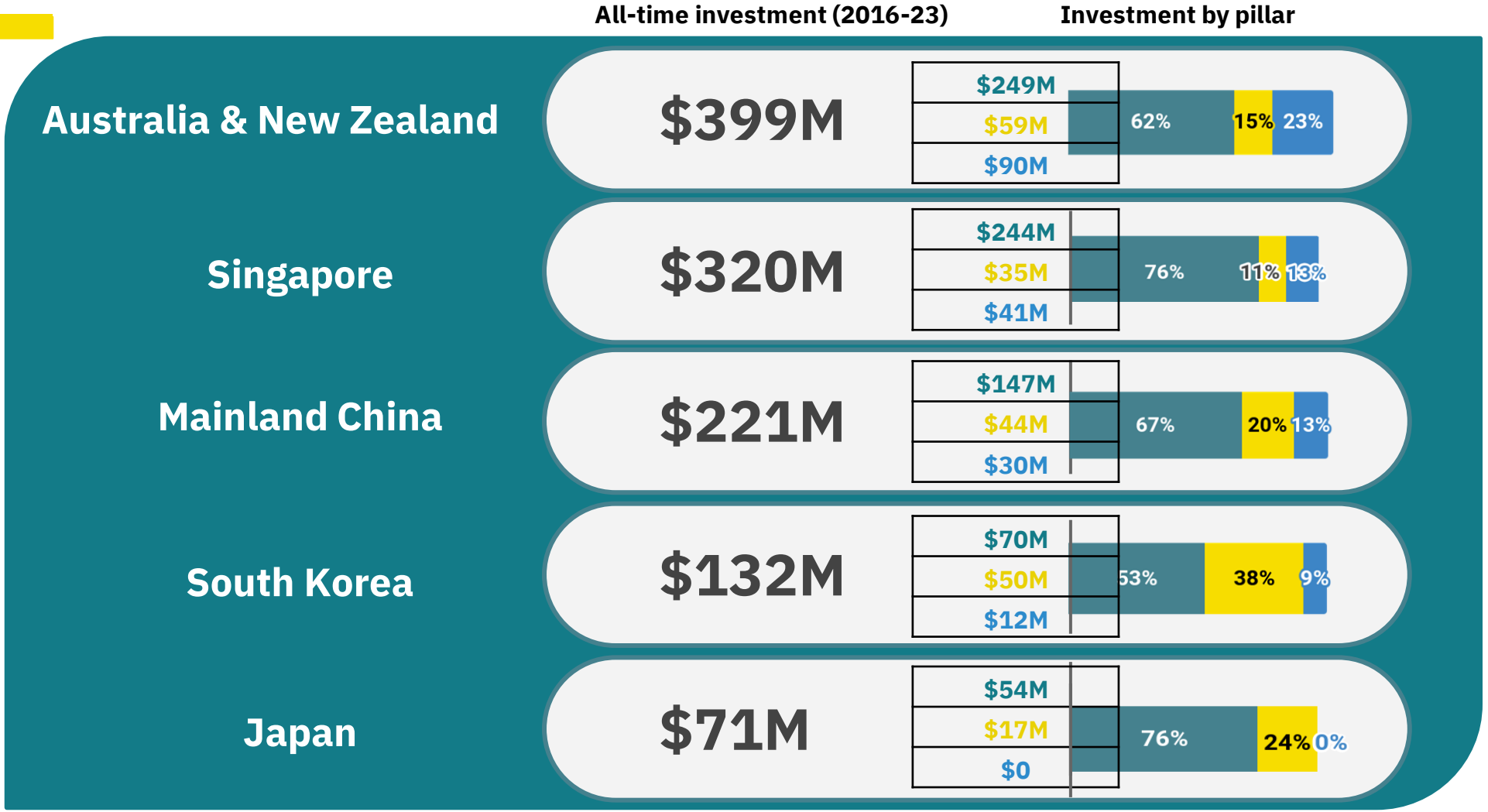
BY REGION, investment has been diversifying. Between 2010-21, 73 percent of sector investment was in North America, and **only six percent was in APAC**.

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

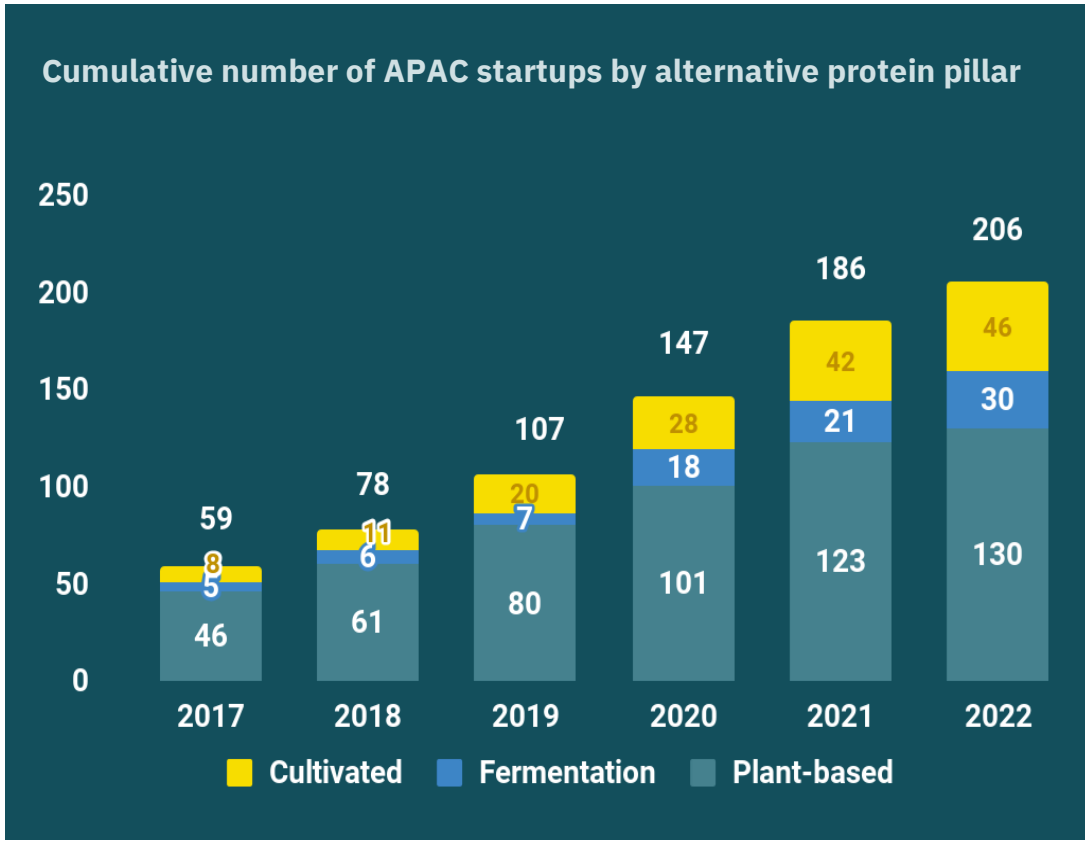


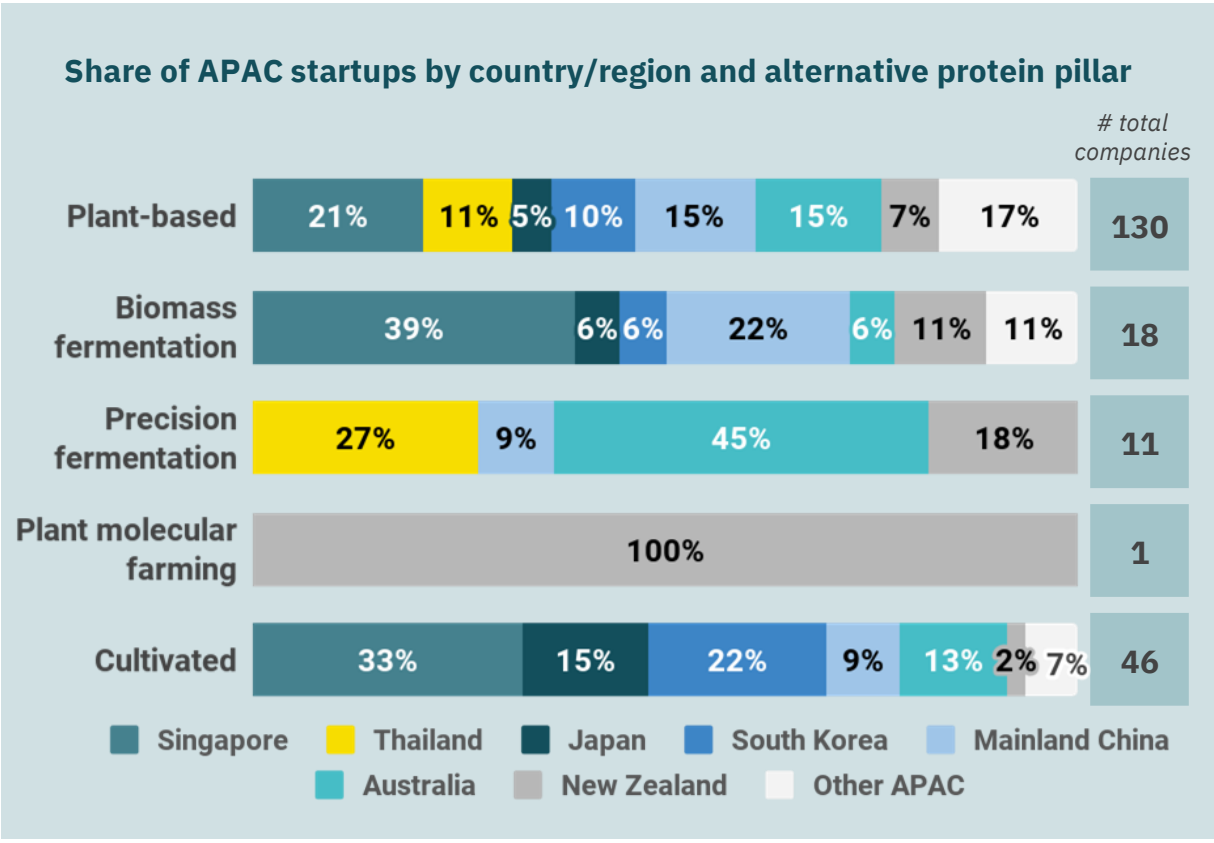
APAC countries are becoming investment hotspots



APAC is home 200+ startups

206 startups as of 2022





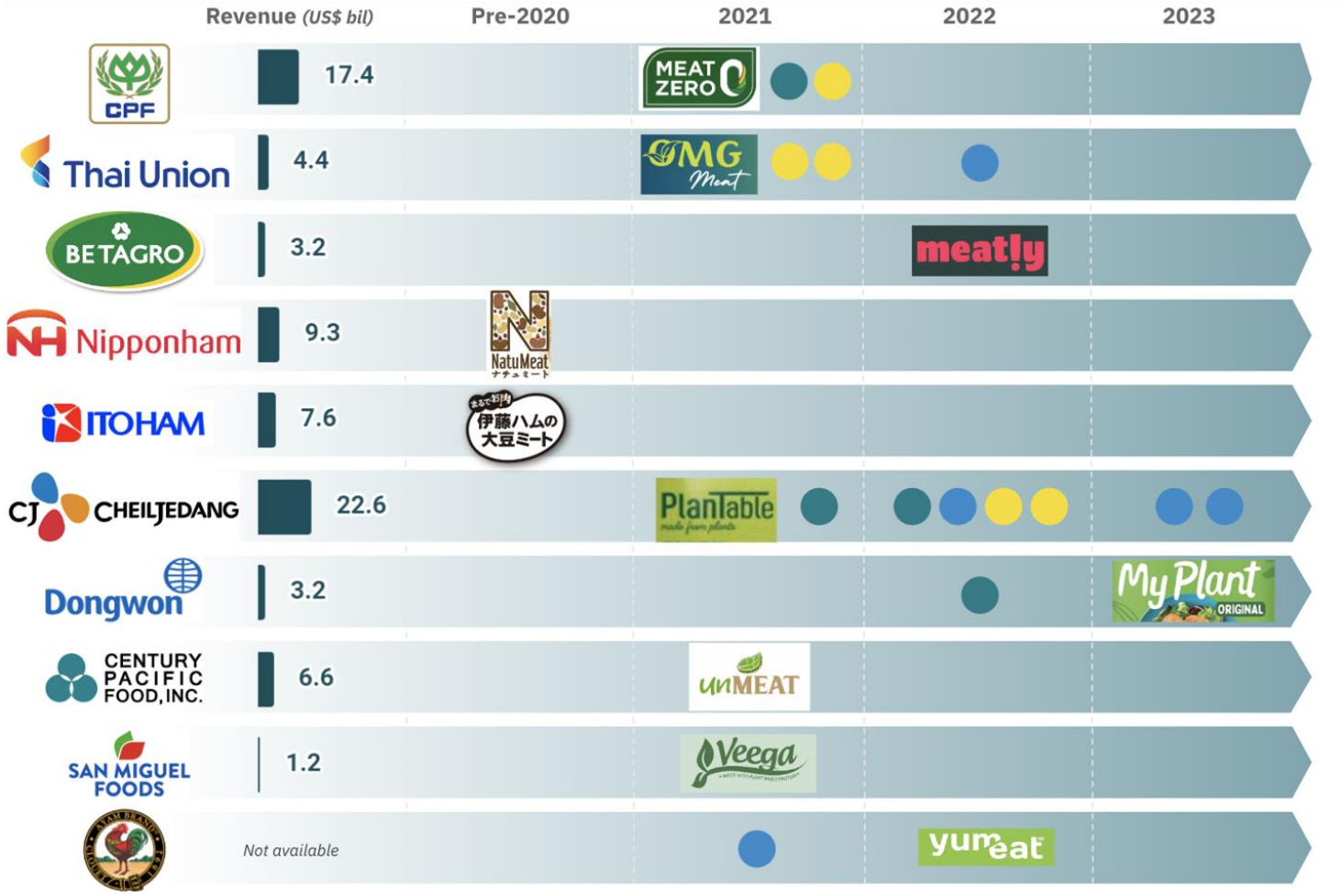
2

Source: [1] GFI company database as of Q2 2023. Excludes alternative protein brands launched by corporates.

Source: [2] 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)

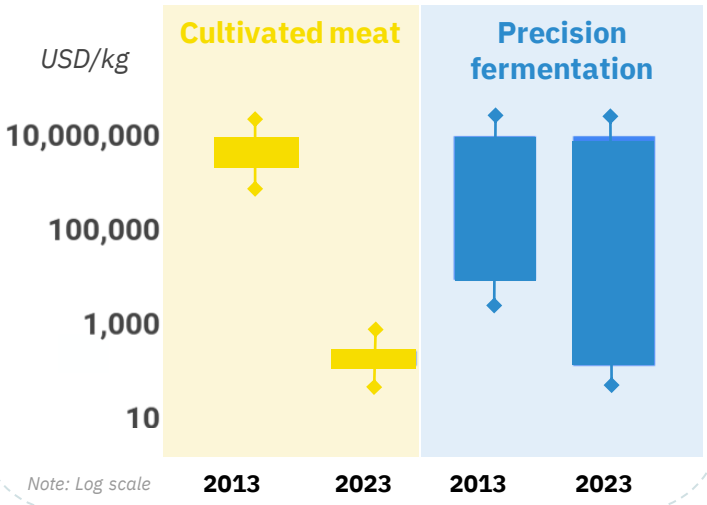
Regional meat companies are embracing protein diversification

15 plant-based meat brands launched by regional major food companies



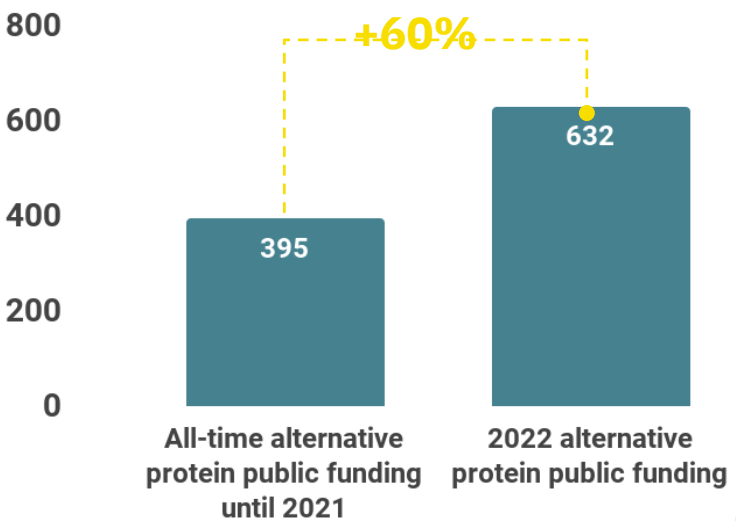
Powerful growth drivers are in place

Costs of novel technologies are falling



Note: Log scale

Governments are increasing support

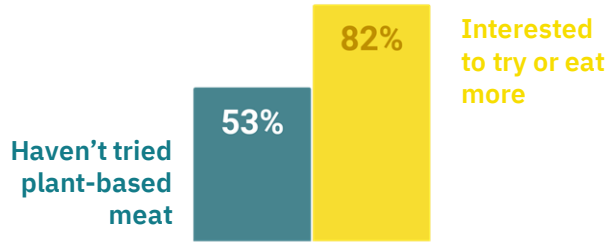


Source: Internal GFI analysis; based on year announced.

The market opportunity resonates

In a 2023 survey of six Southeast Asian markets

- **Half** had not yet tried plant-based meat
- **Over three-quarters** want to try or eat more
- **Health** is the main motivator for consumption

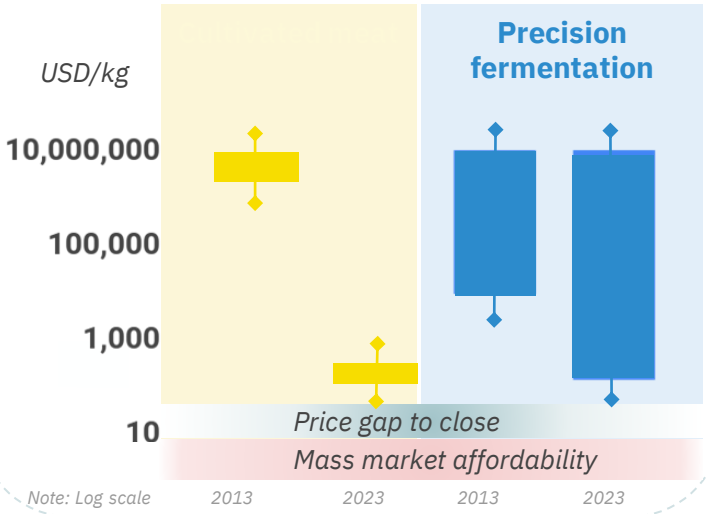


Source: Survey of 5,971 respondents across six SE Asian countries

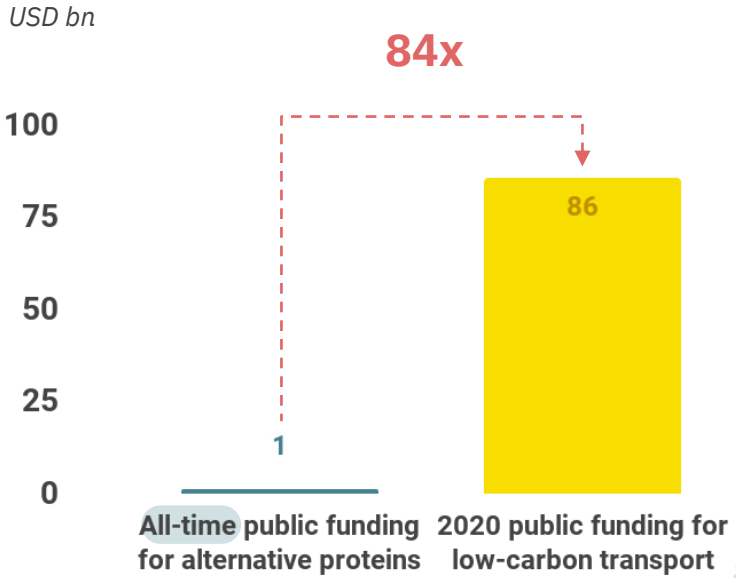
Source: [1] Analysis of Pitchbook data. Note data only includes deals with disclosed amounts and is only a partial view of 2023 (up to Q2).

But significant progress needs to be made

Costs still have to drop considerably



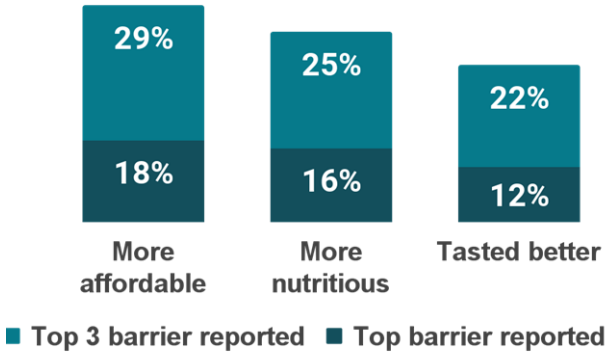
Much more public funding is needed



Source: Based on most recent datasets from Climate Policy Initiative

Product quality must improve

In a 2023 survey of six Southeast Asian markets...

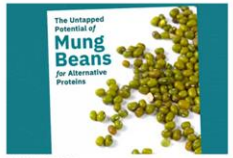


Source: Survey of 5,971 respondents across six SE Asian countries

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

GFI resources

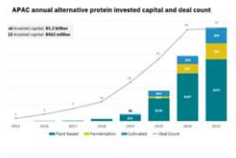
- State of the Industry Report takes a deep dive into each sector (cultivated, plant-based and fermentation-enabled foods)
- The Advancing Solutions For Alternative Proteins (ASAP) database explores commercial whitespaces, research gaps, technological needs, and investment priorities
- For further reading of scientific materials, please see the GFI Alternative Protein Literature Library
- Other useful resources:
  - Cell line development and utilisation trends
  - Cultivated meat cell lines and research tools
  - The Untapped Potential of Mung Beans for Alternative Proteins
  - Life cycle analysis and techno-economic assessment of cultivated meat production



03/12/2023

New Report Reveals the Untapped Potential of Mung Beans for Alternative Proteins

How to unlock the potential of what it describes as "one of Asia's most underutilised crops."



02/14/2023

Defying economic headwinds, APAC alt protein investments soared in 2022

New analysis released today by the Good Food Institute APAC shows that investments into alternative protein companies in Asia Pacific...

10/28/2022

Leading APAC Cellular Agriculture Stakeholders Announce Historic Agreement in Singapore

A wide range of terms has been used to describe food products grown directly from animal cells.

08/28/2022

New research reveals what Asian consumers crave in alternative seafood

Seafood can now be made from plants and cultivated directly from animal cells—but will consumers bite?

Good Food Institute

Thank you!


Loo's Hainanese Curry Rice / GOOD Meat


Avant Meats

gfi APAC