

Overview of alternative protein production

Varun Deshpande

Good Food Institute Asia



Regional Roundtable Meeting
**Advancing the Implementation
of Framework for Action
on Food Safety**

25-28 October 2021

The Good Food Institute

A global network of nonprofit organizations accelerating the shift to a sustainable, healthy, and just food system through three key areas of work:



Science & Technology

Analyzing, advancing, and funding the foundational science of alternative proteins



Corporate Engagement

Consulting with the world's biggest food companies to help them capitalize on opportunities in the alternative protein market



Policy

Advocating for fair regulation of plant-based and cultivated meat and lobbying for government investment in alternative protein R&D

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



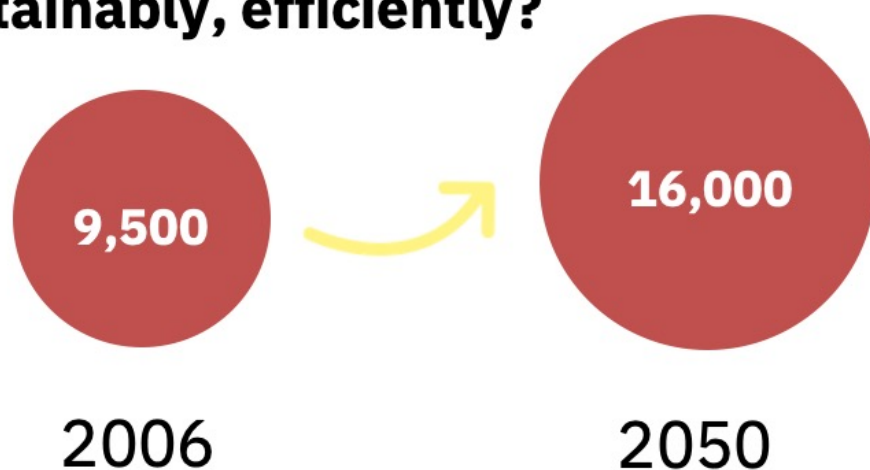
United States
Brazil
India

Europe
Asia Pacific
Israel

100+ staff in 6 regions

The key question

How will we feed 10 billion - safely, sustainably, efficiently?



trillion kcal/year

As the global population increases and people move into higher income brackets, more food is needed.

“To adequately feed more than 9 billion people by 2050, the world must close a nearly 70 percent gap between the amount of food produced in 2006 and that needed by mid-century.”

- World Resources Institute, 2014

How will we feed 10 billion people by 2050?

Sustainably



Industrialized animal agriculture is in the top **2-3 contributors** to the world's most pressing environmental issues.



IAA is responsible for **14.5% of greenhouse gas emissions**—a higher share than the entire transport sector.

Efficiently



It takes **nine calories** of food fed to a chicken to produce **one calorie** of meat.



75% of agricultural land is used for raising and feeding livestock yet only provides **1/3** of the global protein supply.

Safely



Animals in the United States **consume more than 2x** as many medically important antibiotics as humans do.



Medical experts expect **10 million annual deaths** from antimicrobial resistance in 2050, a 14-fold increase over current deaths.

In their latest test, *Consumer Reports* found bacterial contamination on 97% of chicken.

Drug resistant infections kill half a million people a year

THE GUARDIAN

Superbugs could cost the world \$100 trillion by 2050

THE TELEGRAPH



Growing food safety related incidences present a unique and urgent problem for regulators as demand continues to rise



...the global burden of foodborne disease is **borne by those living in low- and middle-income countries** (LMICs), who made up 75% of deaths from foodborne illness

GLOBAL ALLIANCE FOR IMPROVED NUTRITION

Protein diversification has important implications across different issues in regions such as South & South East Asia



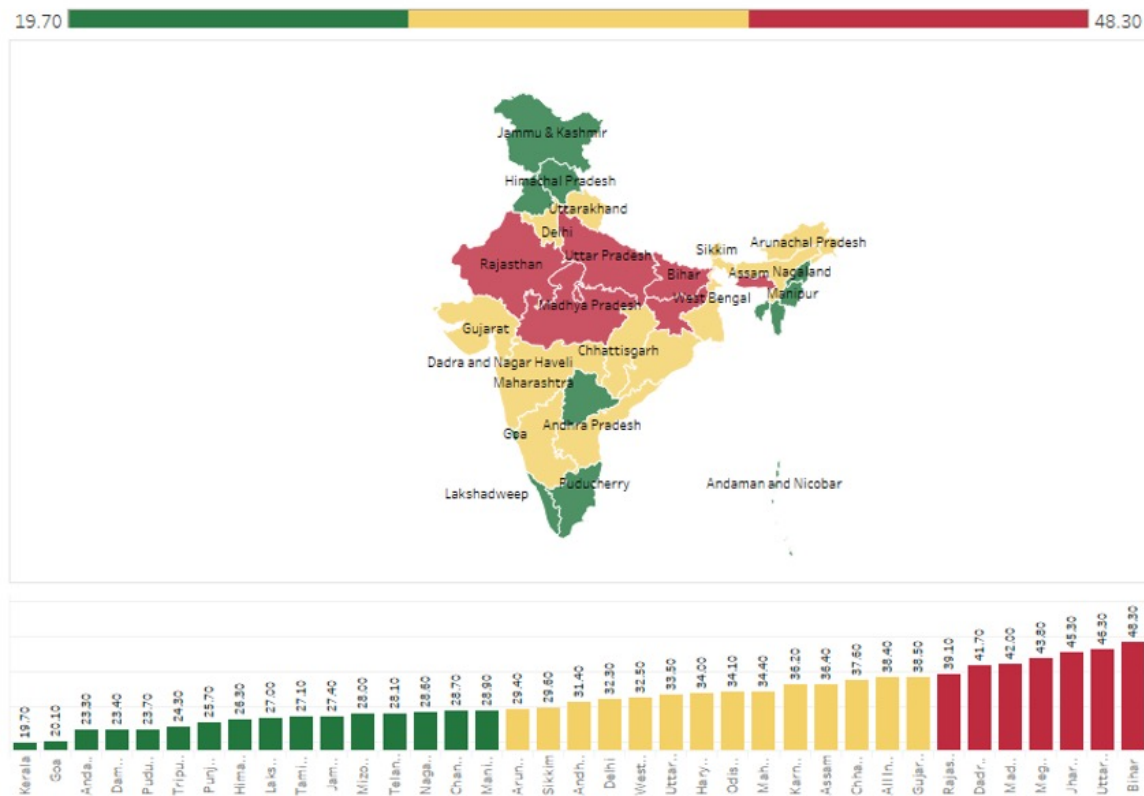
“Due to drastic fall in the demand of poultry, meat and eggs, chicken prices have sharply dropped at the farmgate to 60% below cost of production, milk demand has reduced by 20-25%...”

Impact of COVID-19 and associated lockdown on livestock and poultry sectors in India

Jyotsnarani Biswal¹, Kennady Vijayalakshmy² and Habibar Rahman³

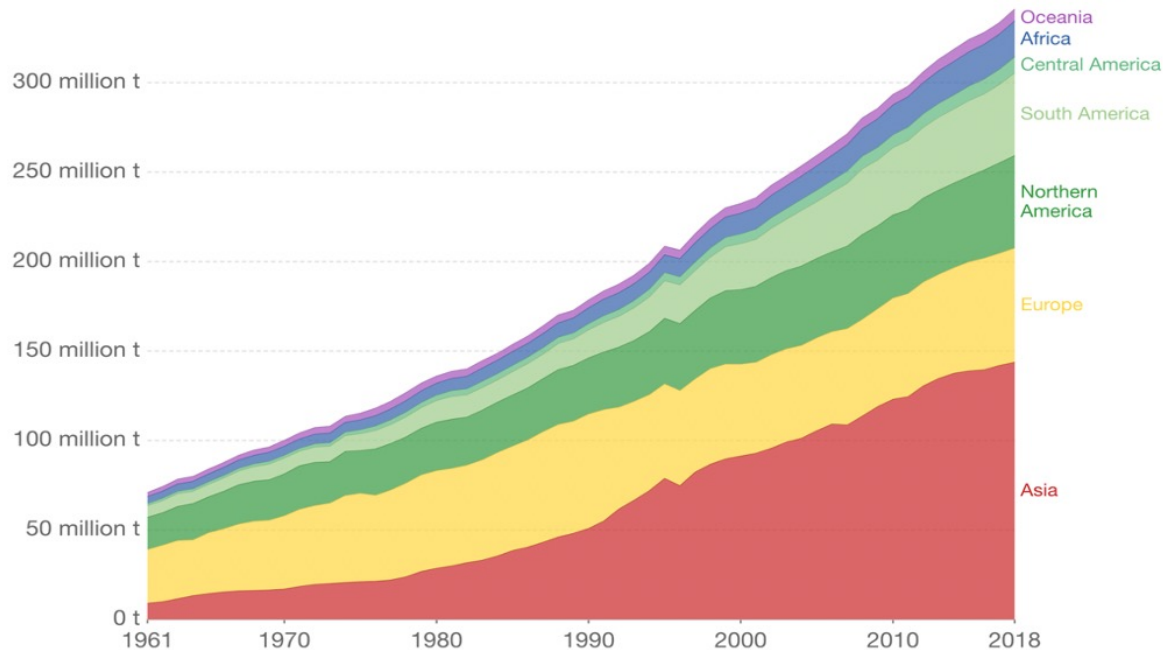
“As per the estimate, COVID 19 impacted 10 lakh broiler poultry farmers and 2 lakh layer farmers, losses were estimated at Rs. 27,000 crores. When the country was battling COVID-19 outbreak, the State of Assam was gripped under the threat of African Swine Fever. The deadly virus reported to have killed 14,000 pigs within 15 days of the outbreak.”

Children below 5 years Stunted - NFHS4



Meat demand ↑ 70% by 2050: Driven by emerging economies such as India, China & SE Asia

Global meat production, 1961 to 2018

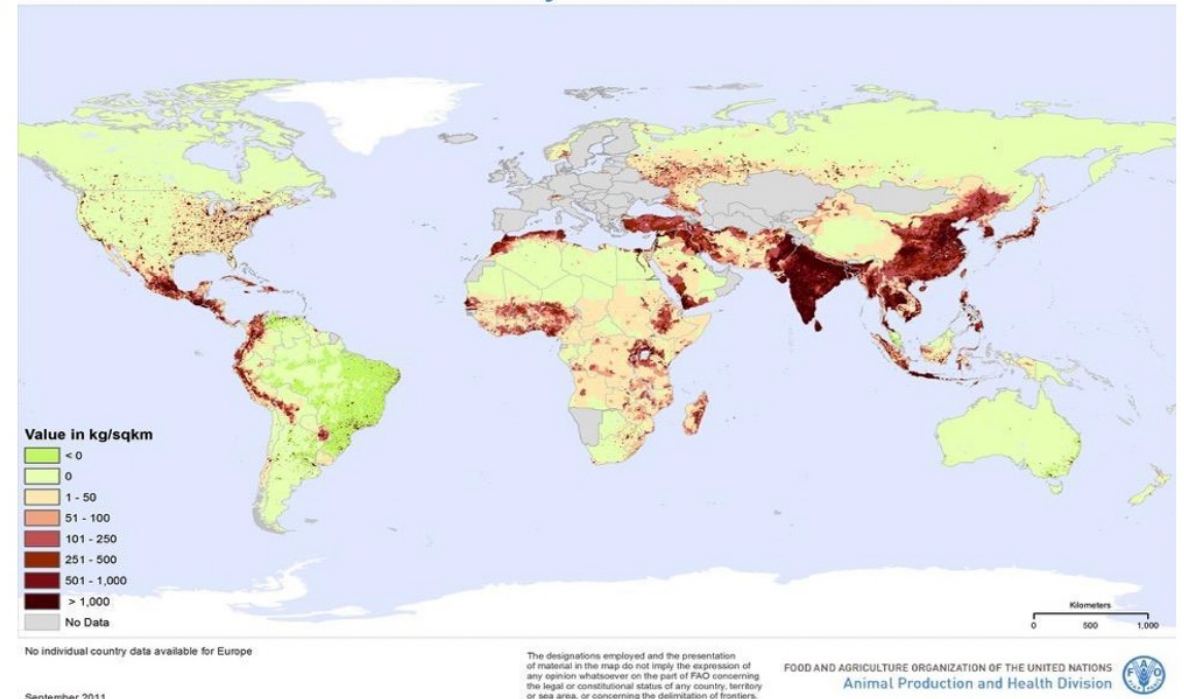


Source: UN Food and Agriculture Organization (FAO)

OurWorldInData.org/meat-production • CC BY

Our World
in Data

Growth in Demand for Poultry Meat 2000 - 2030



GFI's global theory of change:

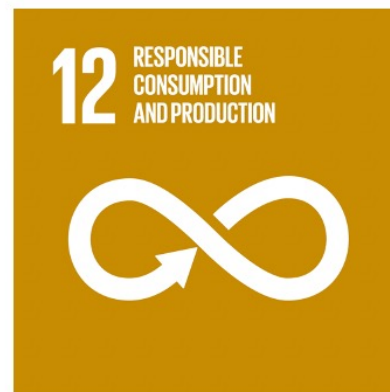
Accelerating 'Alternative Proteins'



Products which can reliably and predictably substitute the consumption of animal-derived meat, eggs, and dairy, because they perfectly replicate the sensory and cultural experience for consumers

Instead of asking consumers to give up the foods they love, GFI is accelerating the transition to smart proteins by helping companies make products that are **delicious**, **affordable** and **accessible**.

Alternative proteins present a multifaceted solution



The alternative protein landscape

Plant-based



Photo courtesy of Beyond Meat

Fermentation



Photo courtesy of Ecovative Design: Atlast Food Co.

Cultivated



Photo courtesy of Memphis Meats

What is plant-based meat?

Plant-based meat closely resembles an animal-based meat product in its organoleptic properties, using one or a combination of plant or crop ingredients.



The Impossible Burger 2.0.
Robyn Beck/AFP/Getty Images

Impossible Foods' burger patty which is a plant-based beef patty



Beyond Meat's Beyond Sausage which is a plant-based sausage



Ojah's plant-based meat

Plant based JUST Egg:

Made from mung

- 98% less water
- 83% less land
- 93% less CO2

>100 million 'eggs'
sold



Plant based Beyond Burger:

Made from yellow pea protein

- 89% less greenhouse gases
- 99% less water

\$BYND



The plant-based competitive landscape expands



The global plant-based meat market is projected to reach at least \$100b if not \$370b by 2035

Global plant-based meat market projections			
Source	Projected market size	By year	Projected share of global meat market
Markets and Markets	\$28b	2025	2%
J.P. Morgan	\$100b	2035	7%
Barclays	\$140b	2029	10%
A.T. Kearney	\$370b	2035	23%



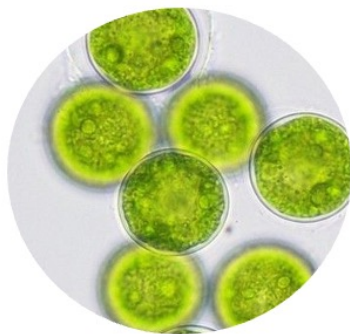
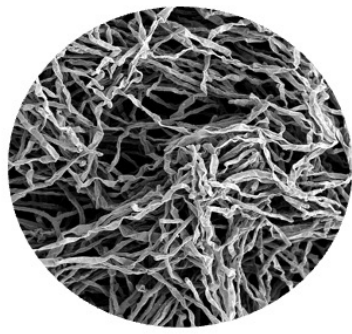
Source: [Nasdaq](#) (May 2019); [Business Times](#) (May 2019); [J.P. Morgan](#) (May 2019); [CNBC](#) (May 2019); [A.T. Kearney](#) (May 2019); [Grizzle](#) (May 2019)

gfi.org | Page

What is fermentation?

Fermentation includes **production of any microbial species** for either whole-cell biomass or a valuable fraction thereof.

This platform is well established, but this sector is a relatively new application area.



Fermentation commercial landscape

Biomass

Whole-cut
product



AIR PROTEIN



Ingredient

Dairy



New Culture



Eggs



Gelatin



Agnostic/Multiple



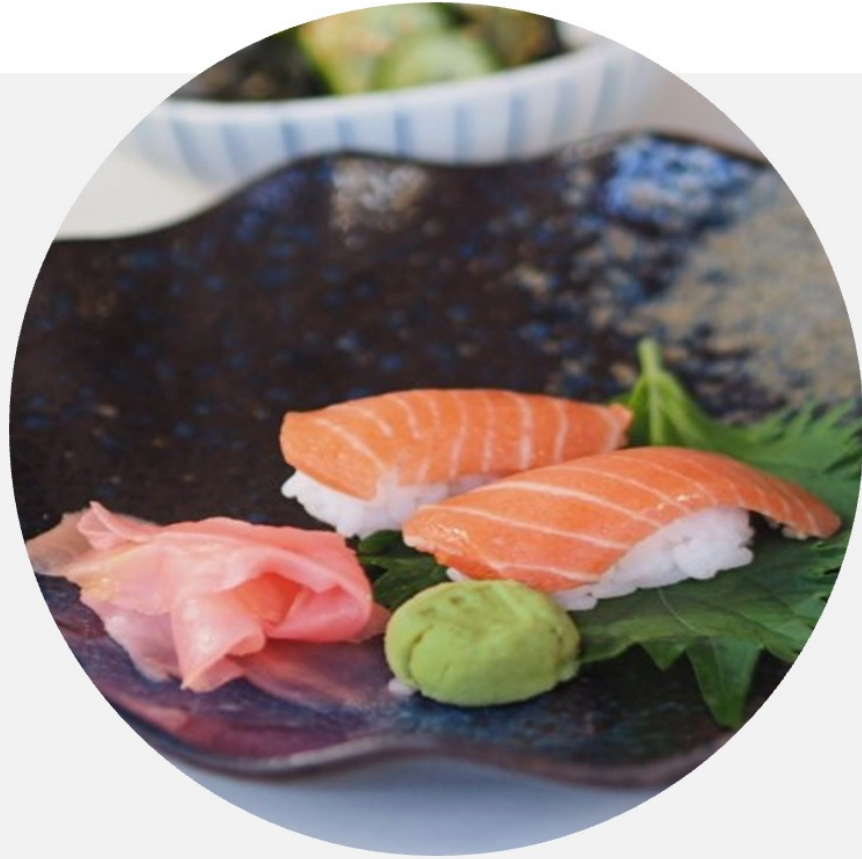
Pet Food



Fermentation derived protein



Cultivated



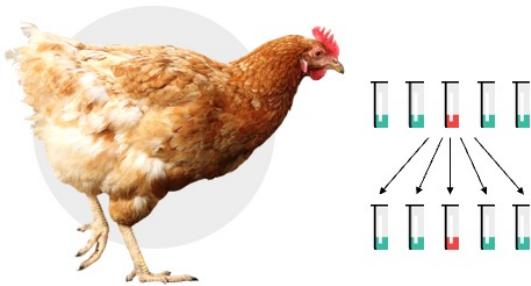
Cultivated meat is produced directly from animal cells.

Cultivated meat is genuine animal meat or seafood that can replicate the sensory and nutritional profile of conventional meat because it's comprised of the same cell types arranged in the same three-dimensional structure as animal muscle tissue.

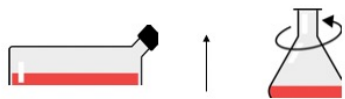
Cultivated meat production

SAMPLE

A small sample of cells is obtained from an animal.

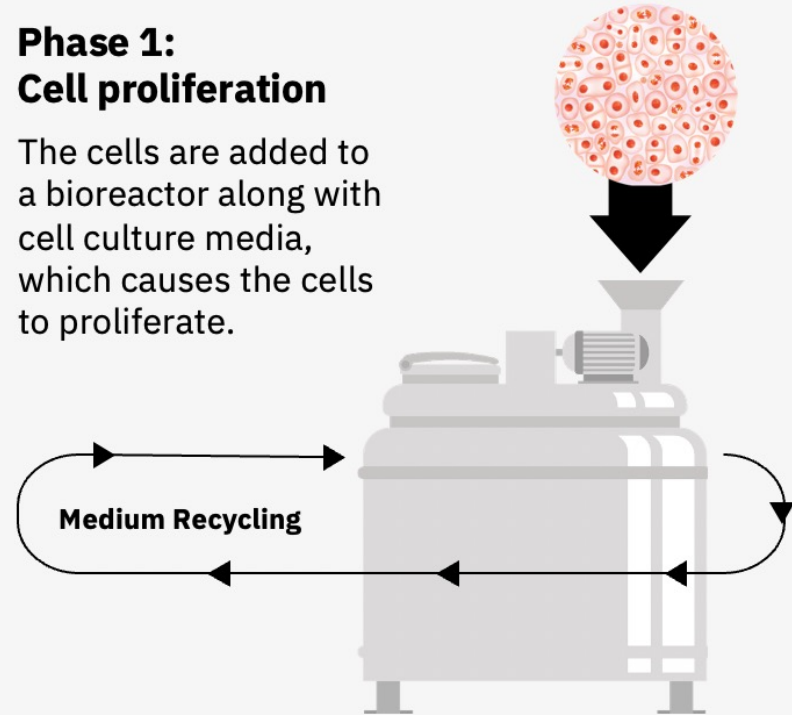


CELL STARTER CULTURE



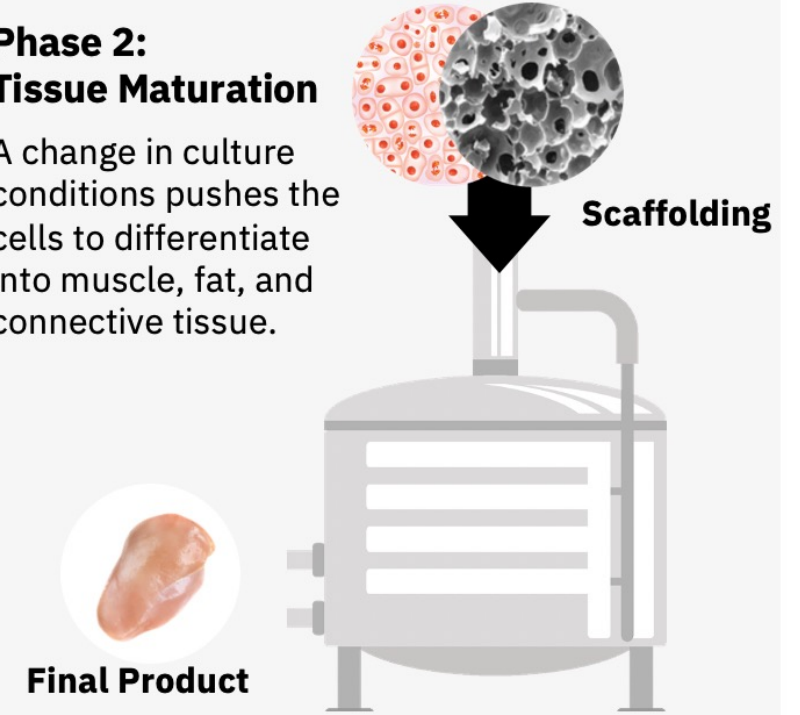
Phase 1: Cell proliferation

The cells are added to a bioreactor along with cell culture media, which causes the cells to proliferate.



Phase 2: Tissue Maturation

A change in culture conditions pushes the cells to differentiate into muscle, fat, and connective tissue.



CELLS AT MATURATION

Primarily muscle, fat, and connective tissue.

Fat
Cell



Muscle
Cell

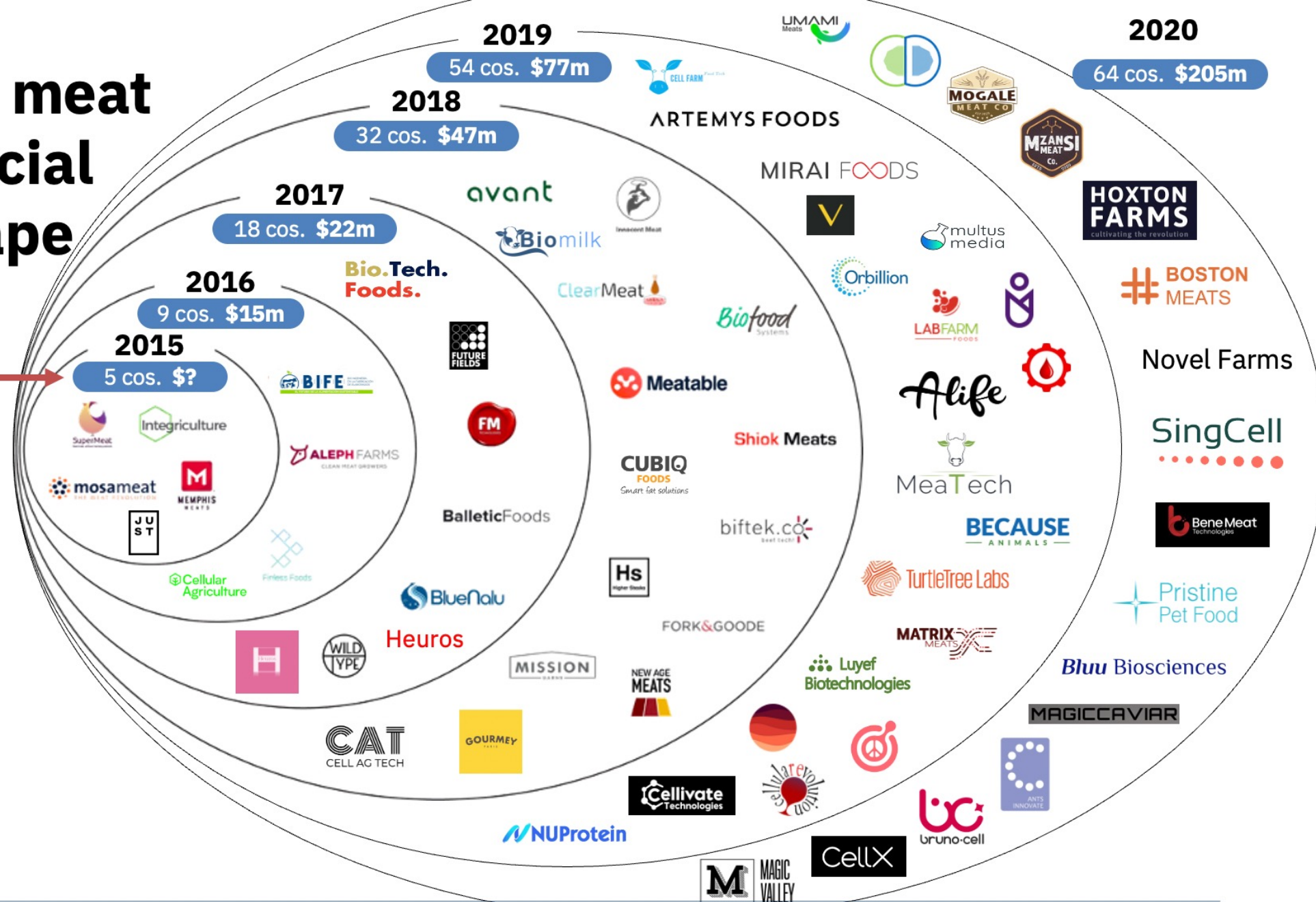


Fibroblast
Cell



Cultivated meat commercial landscape

Number of companies
and capital invested
annually



Cultivated Meat: Supply chain technology segmentation

Cultivated Meat Technology Segment

Cell Lines

Cell Culture Media

Scaffolding

Bioprocess Design

Upstream

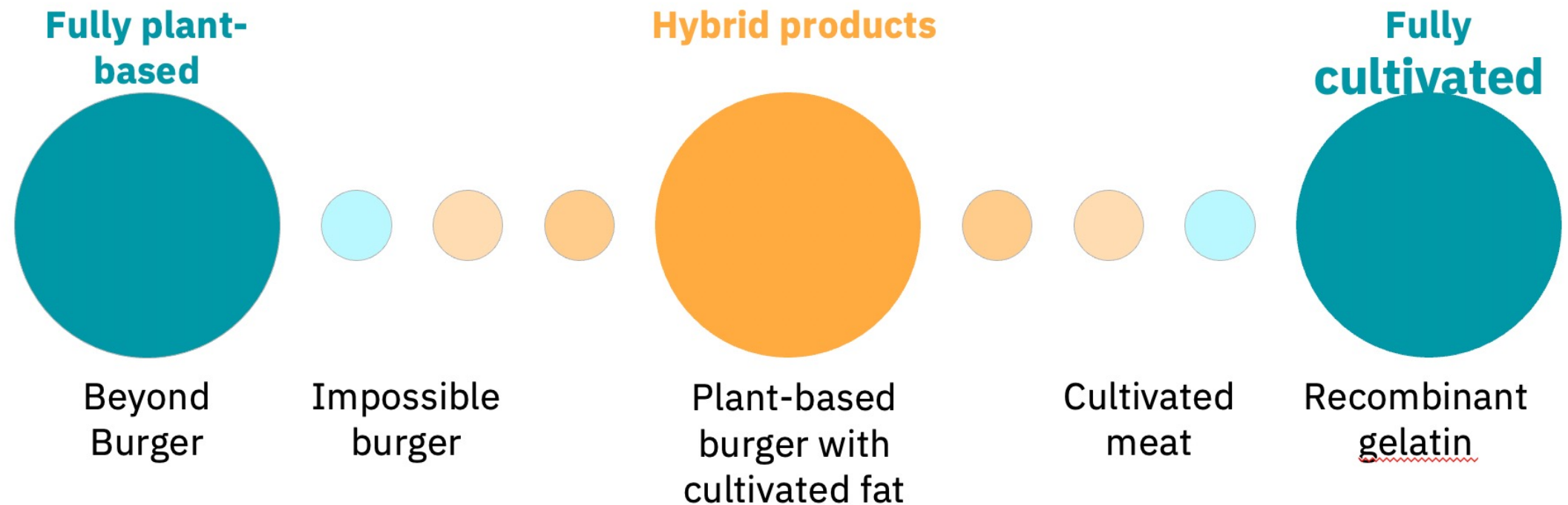
Manufacturing

Distribution






Increasing confidence in the industry has led to emergence of B2B-focused ventures.

The Spectrum of Alternative Protein Foods



Source: GFI analysis

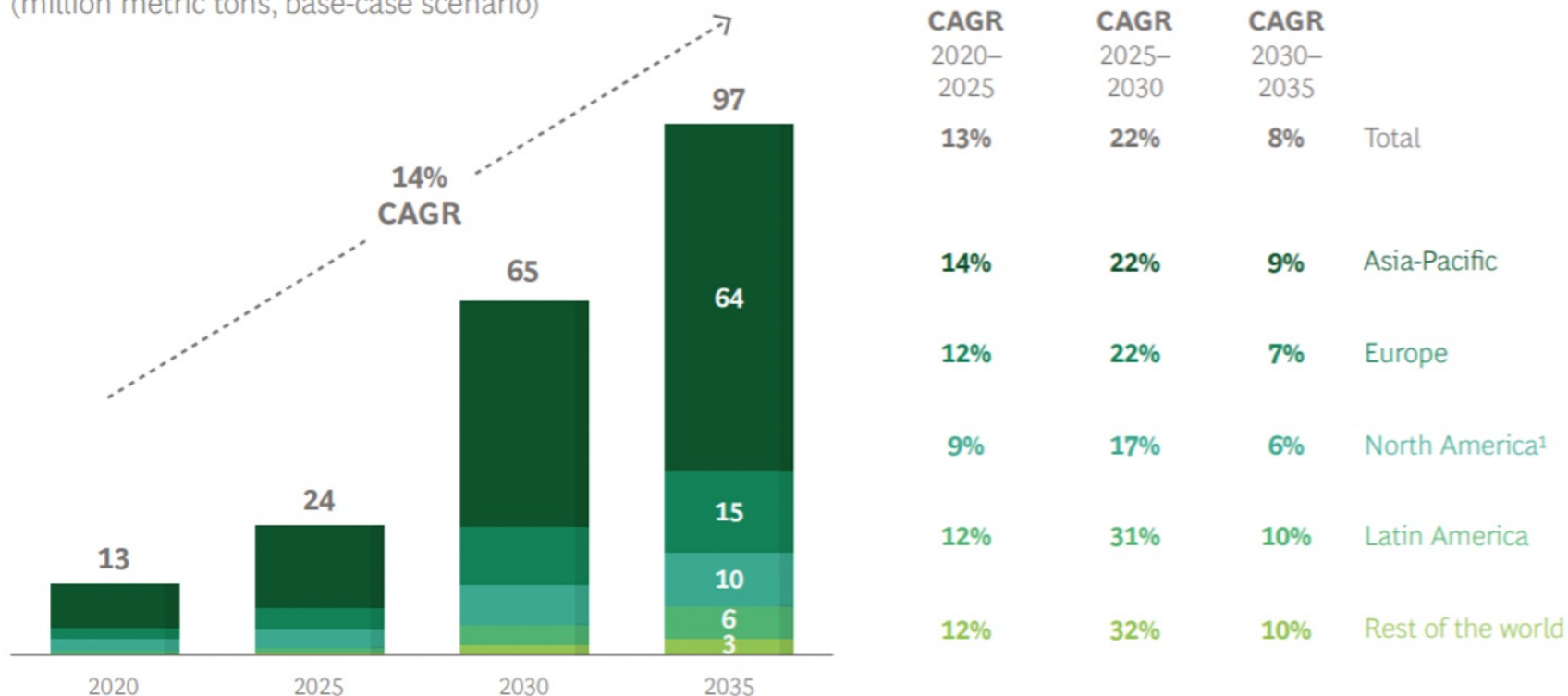
Investments overview (through 3Q 2021)

Category	Total invested capital, 2010 – 3Q 2021	Invested capital, 2020	Invested capital, YTD 2021	YTD 2021 % of 2020
Total alternative protein	\$9.4 billion	\$3.1 billion	\$3.4 billion	108%
 Plant-based	\$5.8 billion	\$2.1 billion	\$1.4 billion	65%
 Fermentation	\$2.3 billion	\$597 million	\$1.3 billion	209%
 Cultivated	\$1.3 billion	\$415 million	\$763 million	184%

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

Asia, already the largest market for alternative proteins, will continue to grow the fastest through 2030

Consumption of alternative proteins by region
(million metric tons, base-case scenario)



Sources: US Department of Agriculture; Euromonitor; UBS; ING; Good Food Institute; expert interviews; Blue Horizon and BCG analysis.

¹North America includes only the US and Canada.

High positive disposition seen towards the category in India with 54% early adopters familiar with plant-based meats and 77% willing to try them

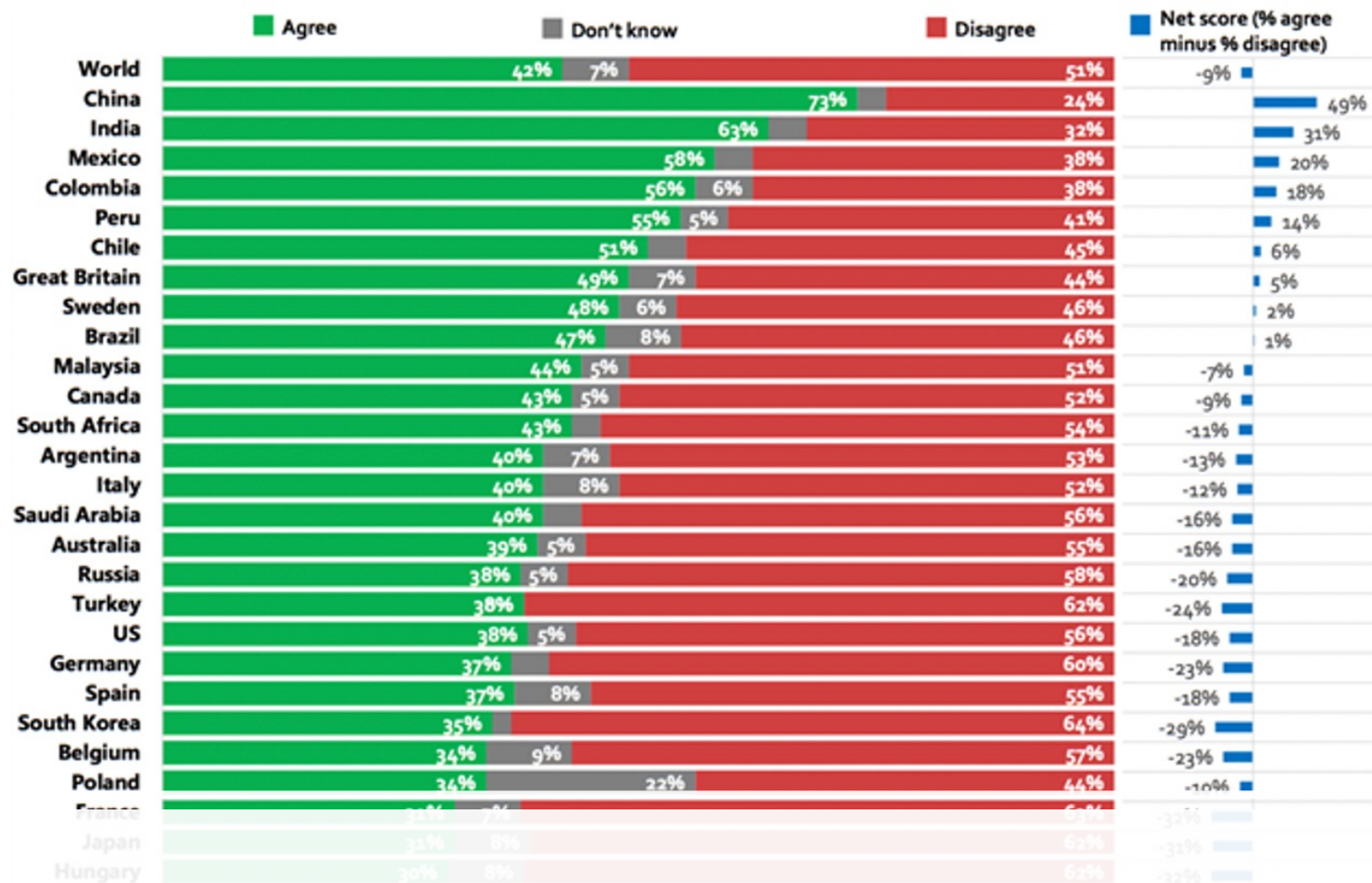


Source : GFI India consumer research, All scores are top 2 box (very/extremely)

Major growth expected across the continent, similarly driven by rising demand from consumers

SINGAPORE, Dec. 16, 2020 – DuPont Nutrition & Biosciences (NYSE: DuPont) and IPSOS, a global market research firm published a new research study that shows a significant increase in demand for plant-based meat alternatives in key Asia Pacific (APAC) markets.

In China and Thailand, demand for plant-based meat is forecasted to increase by 200 percent over the next five years, driven by consumer values around health, taste and sustainability. This trend is replicated more widely across the entire APAC region, with an expected 25 percent increase in the market size for plant-based meat alternatives – to \$1.7 billion USD – over the next five years.



Source : Ipsos, C

After Covid-19 reopening, plant-based meat takes off in China



X



经典餐食

- 炸鸡
- 米饭
- 卷
- 汉堡
- 小食
- 甜品
- 饮料
- 早餐系列



Plant-based eggs, as seen on the Dicos menu

”

This menu expansion is designed to offer our customers the same flavours and handcrafted service they know and love from Starbucks, in a new way. We're excited to continue our journey toward becoming resource positive together with our customers in Asia.

Sara Trilling, President of Starbucks Asia-Pacific

PLANT-BASED WHOPPER

0% MEAT
100% WHOPPER



v2 food™

100%
FLAME-GRILLED
0%
BEEF



Source:

tion o



Global Government Support



Israeli PM commits a national level coordinator for cultivated meat promotion

Funding by Israel Innovation Authority towards emerging alternative protein



World's first cultivated meat regulatory approval in Singapore

Inclusion of smart protein in Singapore's '30 by 30 vision'



Multiple academia-industry partnerships for smart protein projects

Specialised curriculum for alternative protein



Protein Superclusters - academia, industry, significant govt funding

e.g. \$100 mn federal investment in plant protein processing



Singapore all set to embark on its own mission impossible foods

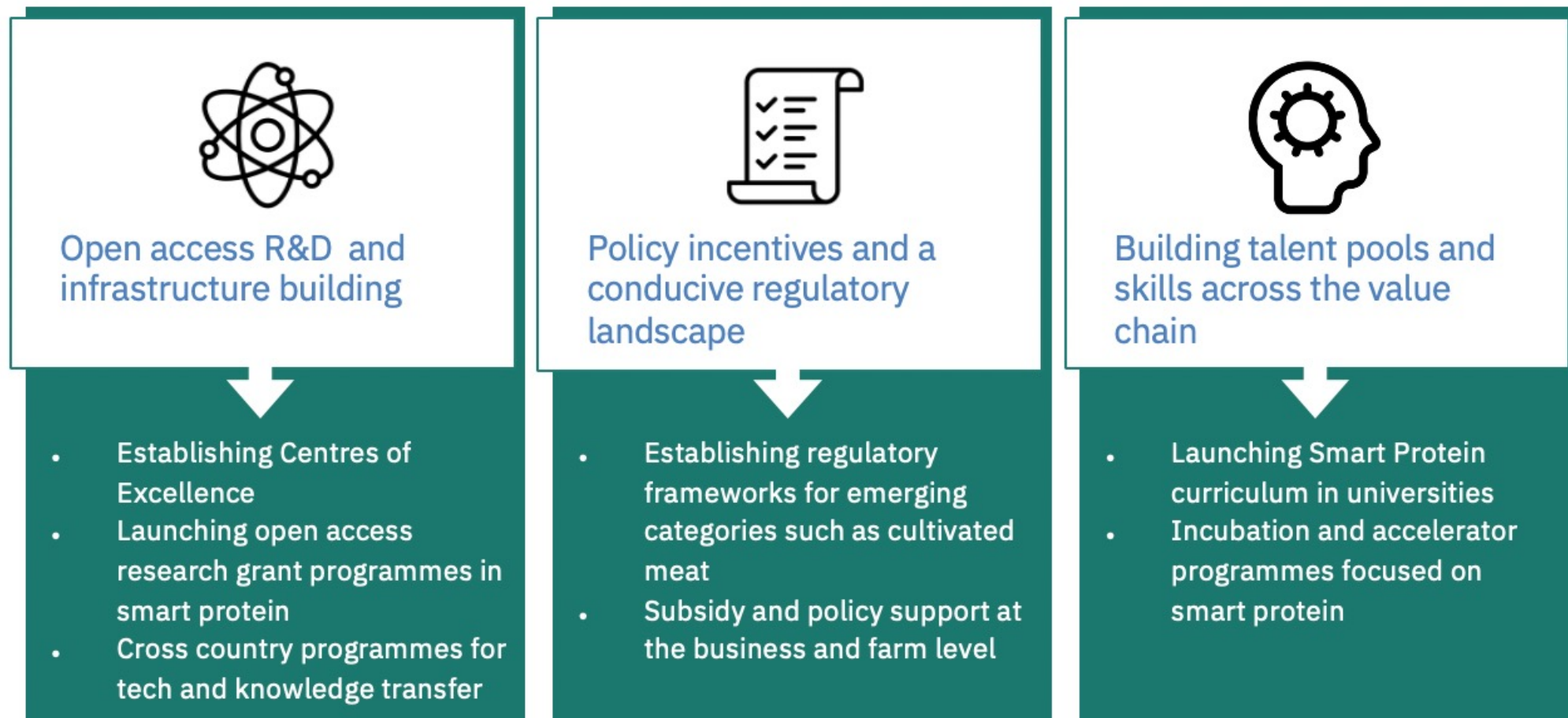
Alternative protein a boon for food security. What can Spore do to this end?

The Government also took a major step to commit a total of S\$144 million to catalyse and facilitate more investments in the agri-food space, which included priority areas such as urban agriculture and alternative proteins.

SINGAPORE FOOD STORY – 1ST ALTERNATIVE PROTEIN SEED CHALLENGE

And \$144 million will go towards food research, including urban farming and lab-grown meat.

High impact priorities across Asia



Q&A

For more resources, see our global website:

