# The Future of Proteins in Asia

Insights and implications for the next decade

FIA FOOD INDUSTRY ASIA

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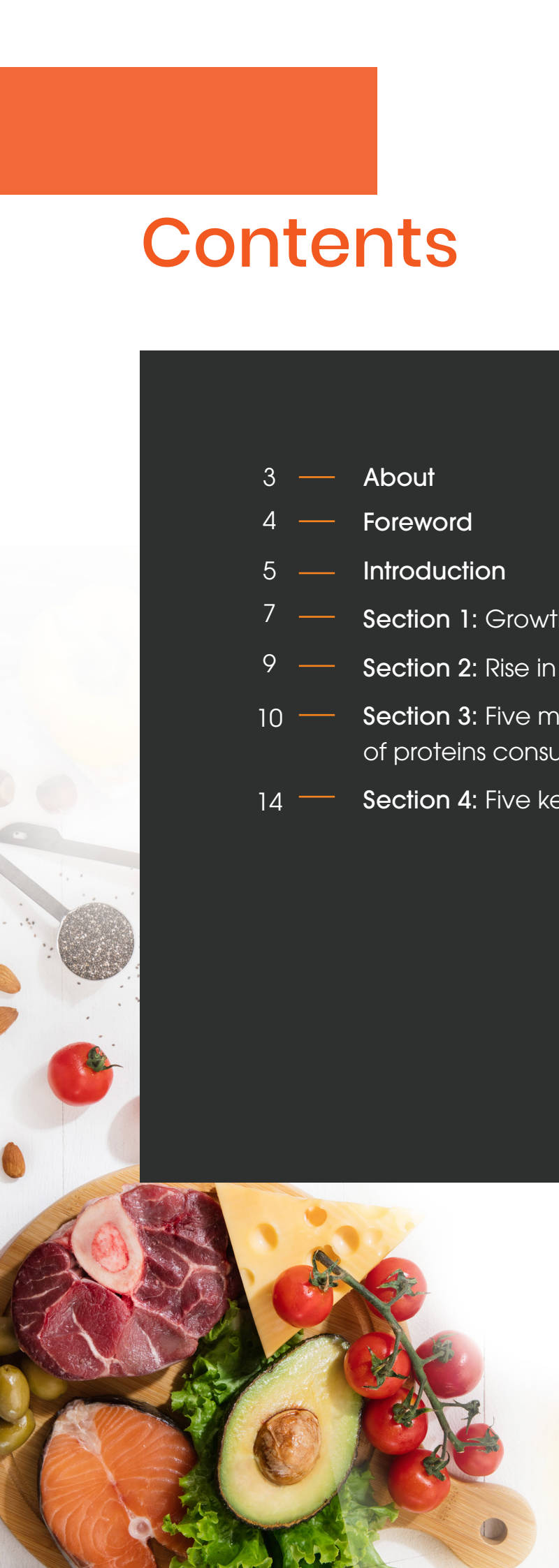
# Contents





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The financial figures in this report are estimated in US dollars.

FIA FOOD INDUSTRY ASIA

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# Foreword

**Jiang YiFan**
Head of Science and
Regulatory Affairs, FIA

By 2050, the global population is projected to grow to about 10 billion and global food demand is expected to double. The consumption of protein has shown significant growth in consumer markets in Asia in the past two decades, and it is expected that the demand for protein will continue to grow with the rise of urbanisation and growth of middle-class consumers.

As we look ahead to the next decade, there are different factors that may influence the demand of protein, and as a result, shift consumption patterns on protein. With that, a balanced assessment of the growth of protein in the next 10 years is crucial for producers and policymakers to prepare to meet expected demand and put in place the necessary measures to ensure sustainable sources of protein supply.

This report illustrates the implications on protein demand from potential scenarios that could take place in the next 10 years. Based on these projected outcomes, the report provides five major recommendations to effectively respond to potential changes in the protein landscape in Asia through 2030.

# Introduction

*An important macro-nutrient, protein is found in a wide spectrum of foods and is a critical source of nutrition. Its role in food markets across the world has rapidly increased in significance over the past two decades. This research summarises key developments in the protein demand landscape, focusing broadly on protein consumption in Asia, with specific insights for China, Indonesia, the Philippines, Thailand, and Viet Nam ("the Asia-5"). The research leverages a primary methodology that draws on protein consumption data from the UN Food and Agriculture Organization (FAO), inputs from a range of other literature, and insights from expert interviews to analyse protein consumption growth over the past two decades and project growth through 2030. Exhibit 1 details the 50 different sources of proteins under the six overall protein categories considered.*

**EXHIBIT 1**

## Protein demand for 6 categories and 50 sub-categories is analysed in this research

### 01 Plant-based[1]

1. Wheat
2. Rice
3. Maize
4. Barley
5. Rye
6. Oats
7. Millets
8. Sorghum
9. Cassava
10. Potatoes
11. Sweet potatoes
12. Yams
13. Beans
14. Peas
15. Nuts
16. Soybeans
17. Groundnuts
18. Coconut
19. Tomatoes
20. Onions
21. Fruits
22. Other vegetables
23. Other plant-based

### 02 Meat

24. Cattle
25. Mutton
26. Pig
27. Poultry
28. Other meats

### 03 Eggs & dairy

29. Butter, Ghee, Cream
30. Milk
31. Eggs

### 04 Wild catch fisheries

32. Freshwater fish
33. Pelagic fish
34. Demersal fish
35. Crustaceans
36. Marine fish
37. Cephalopods
38. Molluscs
39. Other wild catch

### 05 Aquaculture

40. Freshwater fish
41. Pelagic fish
42. Demersal fish
43. Crustaceans
44. Marine fish
45. Cephalopods
46. Molluscs
47. Other aquaculture

### 06 Non-traditional[2]

48. Alternative meats (i.e. plant-based and lab-grown)
49. Plant-based dairy
50. Edible insect protein

**1. Plant-based:** *Products included in this category include traditional vegetables, fruits, nuts, seeds, cereals, grains, etc. and does not include any products that use protein elements derived from these.*
**2. Non-traditional:** *Products included in this category are designed to be analogues or substitutes for traditional animal-based meat, eggs, and dairy products. These may contain plant-based proteins as ingredients, but these are protein isolates or concentrates that are placed into these products during a manufacturing process.*

SOURCE: Traditional protein types and categories (i.e. plant-based, meat, eggs & dairy, wild catch fisheries and aquaculture protein) are based on FAO classifications; non-traditional proteins based on latest market research

**Three scenarios were analysed to estimate overall increase in protein consumption demand[1] between 2019-30:**

01 **Historical growth scenario:** Protein consumption demand follows historical growth trend on a per capita basis. This scenario can be considered as "business-as-usual".

02 **Population growth scenario:** Protein consumption is only driven by population growth, with no growth in protein consumption demand on a per capita basis. This scenario shows the potential "lower bound" for protein consumption in the Asia-5.

03 **Consuming class scenario:** For new members of the "consuming class", protein demand is assumed to increase at a higher rate (above historical growth) than for those outside the consuming class, in line with estimates of how protein demand increases as people enter the consuming class.[2] Consuming class numbers adjusted downward to account for the impact of COVID-19 on incomes in 2020 and 2021. Protein consumption demand of those outside the consuming class grows at historical rates.

**Four scenarios were constructed to estimate the potential mix of proteins[3] consumed in 2030 (overall protein consumption was assumed to match the consuming class scenario detailed above):**

01 **Business-as-usual scenario:** Consumption is projected based on historical growth rates in per capita consumption by 50 different protein types under the six overall protein categories.


02 **Healthy diets:** Food consumption across different 11 food groups matches reference dietary intakes for East Asia and the Pacific as reported by the EAT-Lancet Commission[4], i.e., under- and over-consumption as at current levels matches nutritionally appropriate recommendations in the future.

03 **Resource constraints:** A ramp up in aquaculture and non-traditional proteins, enabled by technological breakthroughs, increases consumption in these categories, with accompanying declines in meat consumption. The remaining categories grow as per business-as-usual.

04 **Food security:** Protein consumption by categories in 2030 matches the equivalent mix of proteins in national production in 2019, illustrating the gap between current production and future national priorities for agri-food self-reliance.

The following sections detail the insights from this research.

[1] It is important to note that the metric of assessment in this study is protein consumption demand and not nutritional recommendations or requirements. For instance, research by the Sustainable Nutrition Initiative has shown that today's global average protein consumption already exceeds their nutritional recommendations. See Riddet Institute (2021), *Sustainable Nutrition Initiative*. Available at: sustainablenutritioninitiative.com

[2] Consuming class is defined as the people in the middle class, which is defined by Kharas (2017) from Brookings as households with per capita incomes between $10 and $100 per person per day (pppd) in 2005 PPP terms. This implies an annual income for a four-person middle-class household of $14,600 to $146,000. See Homi K (2017). *The unprecedented expansion of the global middle class: an update.* Brookings Institute. Available at: https://www.brookings.edu/wp-content/uploads/2017/02/global_20170228_global-middle-class.pdf

[3] It is important to note that this study assesses different sources of protein in relation to how they could satisfy overall protein consumption demand, and not as part of an overall view of nutritional value of these sources. Research has shown that there are important tradeoffs in other nutrient categories (e.g. fats, carbohydrates, etc.) to consider when evaluating different sources of protein holistically as part of our diets. See Riddet Institute (2021), *Sustainable Nutrition Initiative*. Available at: sustainablenutritioninitiative.com

[4] The EAT-Lancet Commission's research is just one example of a study on healthy and sustainable diets. The study is a useful illustration for this scenario for our research, but there are several other studies that approach healthy and sustainable diets from different perspectives balancing nutritional requirements and environmental impact considerations. Therefore, this scenario's results using EAT-Lancet's nutritional profiles should be seen as illustrative only and not as definitive nutritional recommendations. See: Walter Willett. et al. (2019), Food in the Anthropocene: The EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems. The Lancet Commissions, 393 (10170), P447–92 Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31788-4/fulltext

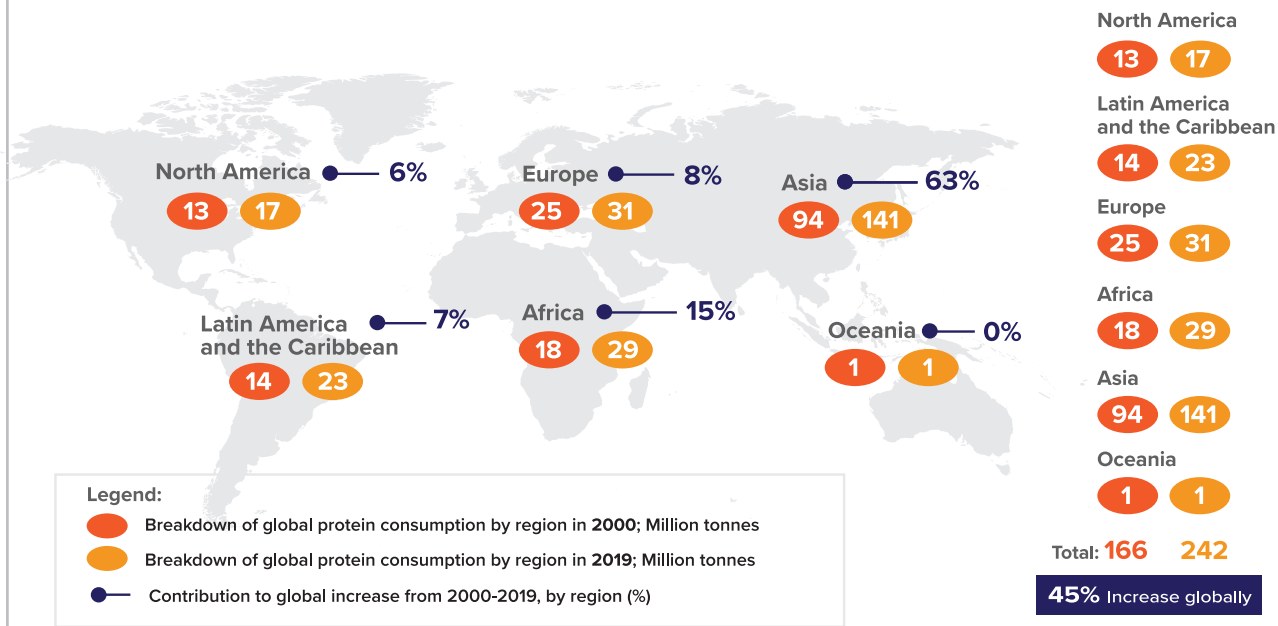
# SECTION 1 Growth in global protein consumption

Over the period 2000-19, global protein consumption grew by around 45%, rising from 166 million tonnes in 2000 to around 242 million tonnes in 2019 (Exhibit 2). This is equivalent to an increase from around 73 grams in 2000 to 85 grams per person per day in 2019.[5] Countries in Asia drove the vast majority of this growth – around 63% of the overall increase – with China (26%) and India (14%) displaying the largest growth among individual countries. Africa (15%) is another important source of the global increase in protein demand.

Rapid economic growth has created a booming consuming middle class, which in turn has increased per capita demand for proteins (Exhibit 3) – consistent with various studies that show a typical transition towards more energy-dense foods (e.g., meats) as income increases.[6] Despite the rapid recent growth in protein demand, there is still much room for growth given that most of these countries are still significantly below the global average of protein consumption. For instance, Indonesia's per capita protein consumption is 16% lower than the global average in 2019. This stability in consumption levels is observed once countries cross over the $20,000 GDP per capita (PPP) threshold.

## EXHIBIT 2

**Breakdown of global protein consumption by region in 2000 and 2019[1]; Million tonnes**




1. Latest FAO data on consumption is available as of 2017, 2019 data is estimated using latest available historical growth rates.
Note: Figures may not sum due to rounding

SOURCE: FAO database; AlphaBeta analysis

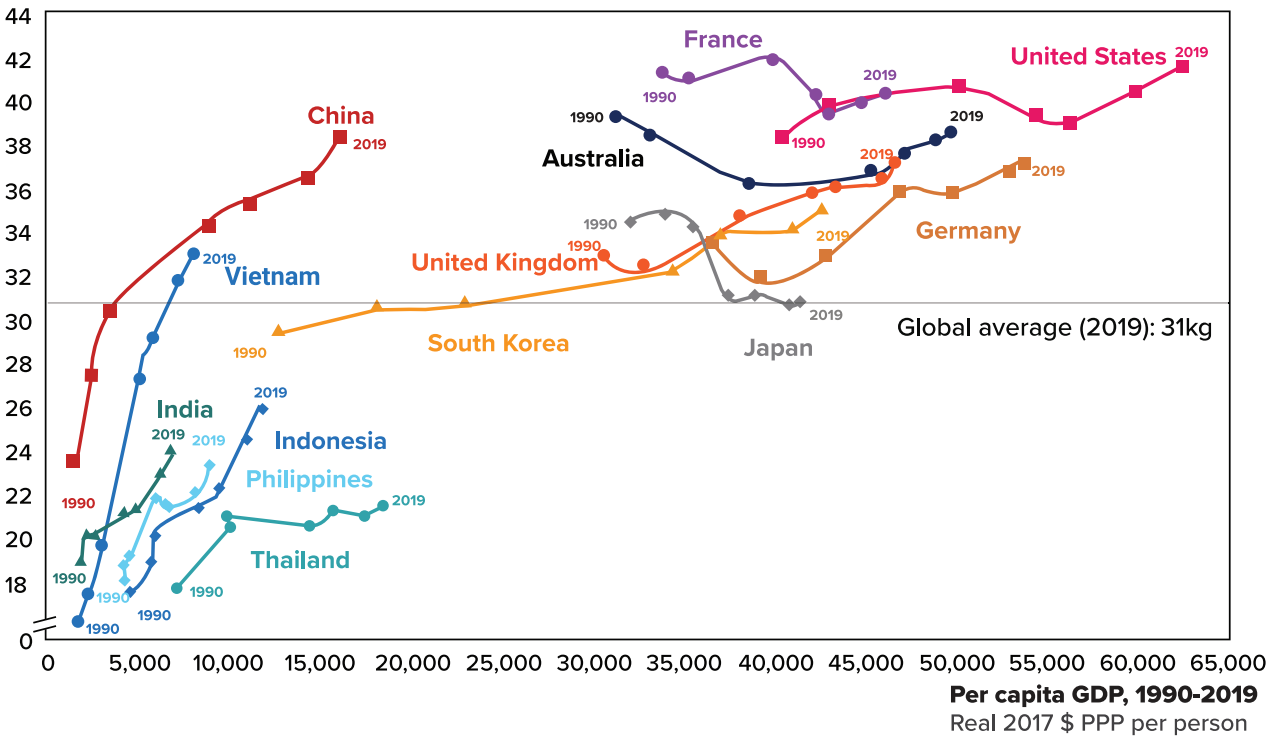
[5] It is important to note that the metric of assessment in this study is protein consumption demand and not nutritional recommendations or requirements. For instance, research by the Sustainable Nutrition Initiative has shown that today's global average protein consumption already exceeds their nutritional recommendations of 40-50g per capita. There are also important tradeoffs to consider for other nutrients (e.g. fats, carbohydrates, etc.) from different sources of protein when evaluating their role in the diet. See Riddet Institute (2021), *Sustainable Nutrition Initiative.* Available at: sustainablenutritioninitiative.com

[6] Kearney J (2010). *Food consumption trends and drivers.* Phil. Trans. R. Soc. B. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2935122/pdf/rstb20100149.pdf

EXHIBIT 3

## Rising incomes have played a significant role in increased demand for protein in developing Asian countries relative to the developed world

**Per capita protein consumption, 1990-2019**
Protein consumption per capita (kg/capita, annual)



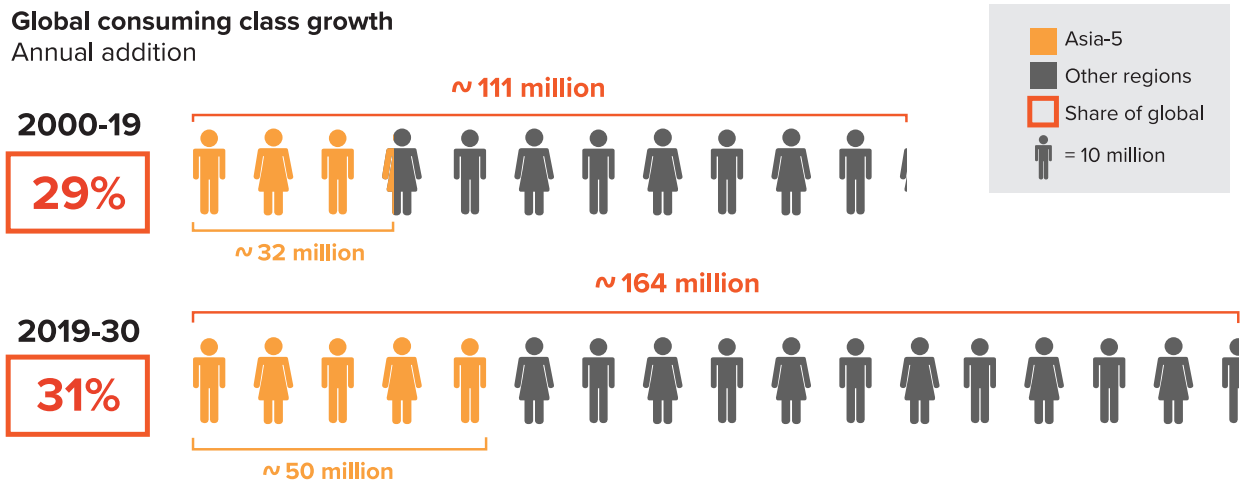

**Per capita GDP, 1990-2019**
Real 2017 $ PPP per person

SOURCE: FAO; World Bank; AlphaBeta analysis

# SECTION 2 Rise in protein consumption through 2030

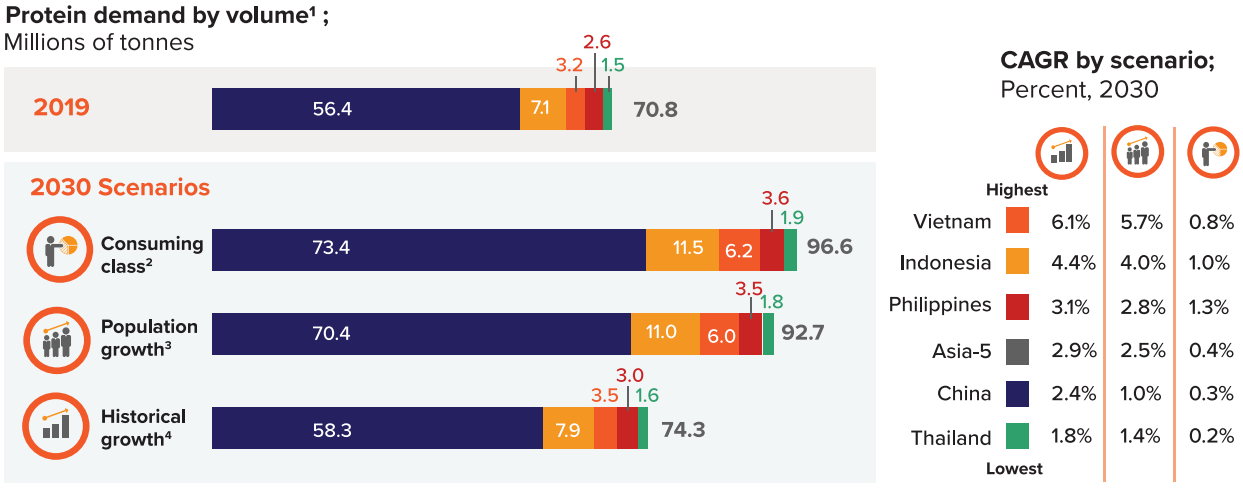
Emerging markets, especially those in the Asia-5, have contributed significantly to the historical increase of the consuming class.[7] Exhibit 4 shows that this contribution will increase over the next decade, with 50 million people from the Asia-5 expected to be added to the global middle class annually. This middle-class effect could result in growth in proteins consumption above the historical average in the Asia-5 through 2030 – 2.9% per annum as opposed to 2.5% per annum over 2000-19 (Exhibit 5).

## EXHIBIT 4




## EXHIBIT 5

### Within the Asia-5, China will likely be the largest market under all scenarios, while Vietnam will experience the highest growth




1. Latest FAO data on consumption is available as of 2017, 2019 data is estimated using latest available historical growth rates; 2. This refers to the scenario in which protein consumption demand grows at a higher rate for the consuming class, while protein consumption demand of those outside the consuming class grows at historical rates; 3. This refers to the scenario in which there is no growth in protein consumption demand on a per capita basis, with demand only being driven by population growth; 4. This refers to the scenario in which protein consumption demand follows per capita historical growth trend on a per capita basis. Note: Figures may not sum due to rounding
SOURCE: FAO database; AlphaBeta analysis

[7] Homi K (2017). *The unprecedented expansion of the global middle class: an update.* Brookings Institute. Available at: https://www.brookings.edu/wp-content/uploads/2017/02/global_20170228_global-middle-class.pdf

# SECTION 3 Five major trends that will influence the mix of proteins consumed in 2030[8]

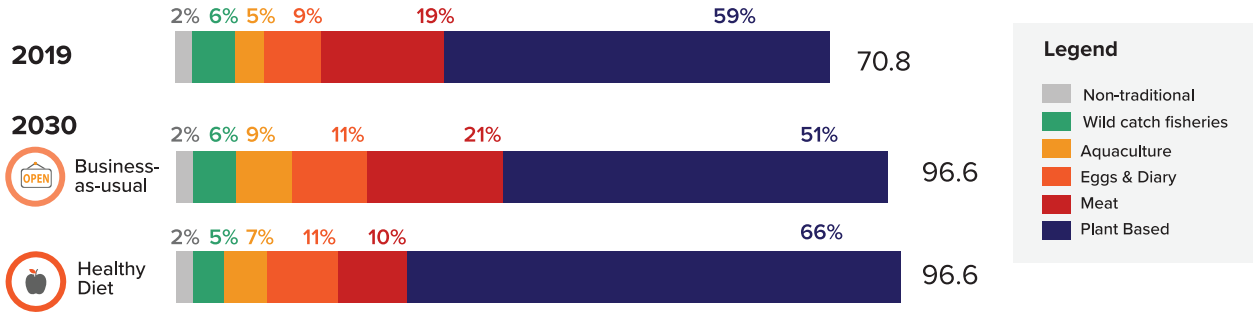
## 1. Dietary shifts to plant-based proteins

Recently, there has been increased scrutiny on the detrimental health impacts of diets with a higher proportion of select animal-based proteins. For instance, a consumer survey in China found that 34% of consumers reported eating less pork than in the year before the study was conducted because of the meat's perceived negative health attributes such as saturated fats, calories, and high cholesterol.[9] 36% of consumers indicated that they would reduce consumption of meat in the following 12 months. Consumers are embracing plant-based diets in increasing numbers. For instance, in the study mentioned above, 66% of consumers indicated they would consume more fruits and vegetables in the following 12 months. Additionally, a survey of urban consumers in Thailand found that 45% are looking to follow an exclusively plant-based, vegetarian, or vegan diet.[10]

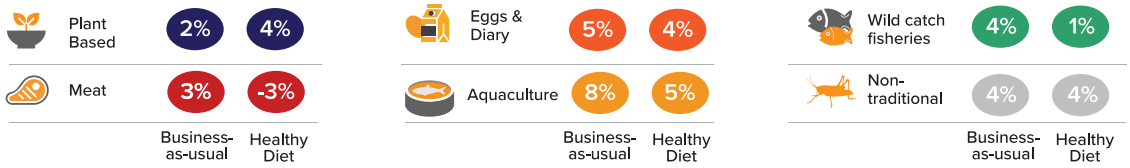
Our projections show that under a "healthy diets" scenario, in which consumption of plant-based food groups increase in line with reference dietary recommendations for East Asia, the share of plant-based proteins increases significantly to two-thirds of overall protein consumption – 7% higher than in 2019 and 15% higher than in a "business-as-usual" (BAU) scenario (Exhibit 6).[11] On the other hand, the share of meats is halved relative to both 2019 and 2030 BAU levels.

## EXHIBIT 6

**Volume by protein category in 2030 in the Asia-5[1];**
Millions of tonnes, Percentage share




**2019-2030 Compound Annual Growth Rate (CAGR)**




1. Please refer to the introduction for more information on methodology
SOURCE: FAO database; Literature review; AlphaBeta analysis

[8] It is important to note that this study assesses different sources of protein in relation to how they could satisfy overall protein consumption demand, and not as part of an overall view of nutritional value of these sources. Research has shown that there are important tradeoffs in other nutrient categories (e.g. fats, carbohydrates, etc.) to consider when evaluating different sources of protein holistically as part of our diets. See Riddet Institute (2021), *Sustainable Nutrition Initiative*. Available at: sustainablenutritioninitiative.com

[9] The New Zealand Institute for Plant and Food Research Limited (2017), Protein: *A Chinese Perspective.* Available at: https://www.plantandfood.co.nz/file/protein-china-perspective.pdf

[10] Food Navigator Asia (2018), "Thai food trends: Plant-based diets and personalisation on the rise as health awareness increases" Available at: https://www.foodnavigator-asia.com/Article/2018/08/15/Thai-food-trends-Plant-based-diets-and-personalisation-on-the-rise-as-health-awareness-increases

[11] The projections here have been modelled by matching reference dietary intakes for East Asia and the Pacific across 11 food groups as reported by the EAT-Lancet Commissions, i.e. under- and over-consumption as at current levels is adjusted to match recommendations contained in the EAT-Lancet research. The EAT-Lancet Commission's research is just one example of a study on healthy and sustainable diets. The study is a useful illustration for this scenario for our research, but there are several other studies that approach healthy and sustainable diets from different perspectives balancing nutritional requirements and environmental impact considerations. Therefore, this scenario's results using EAT-Lancet's nutritional profiles should be seen as illustrative only and not as definitive nutritional recommendations. See: Walter Willett. et al. (2019), Food in the Anthropocene: The EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems. The Lancet Commissions, 393 (10170), P447–92 Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31788-4/fulltext

## 2. National Food Policies

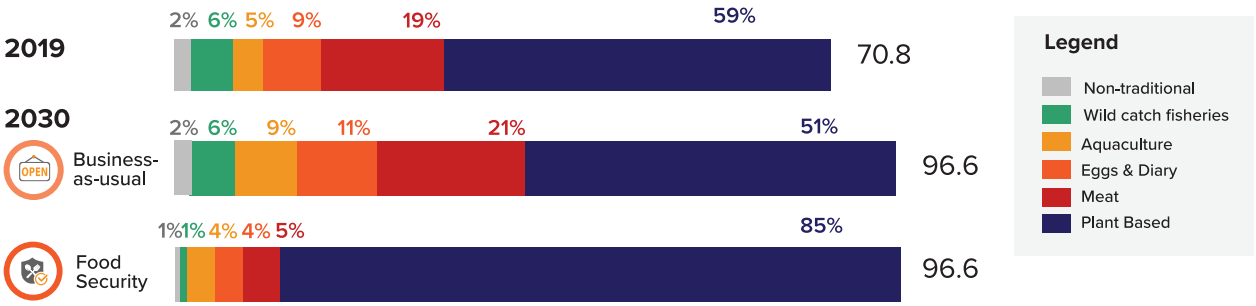
Government policy will likely play an increasing role in shaping protein consumption due to concerns with issues ranging from food security to health. For instance, China's Ministry of Health began a campaign in 2016 to cut meat consumption by half due to health concerns.[12] On the supply side, government regulation and advocacy, particularly in pursuit of food security goals, could increase production for certain prioritised commodities at the expense of others. For instance, Indonesia's 2012 Food Law (No. 18/2012) aims for self-sufficiency in five strategic commodities: rice, maize, soy, beef, and sugar.[13] China's Ministry of Agriculture and Rural Affairs has recently developed a "Five-Year-Action Plan for Promoting the Development of Meat, Beef and Sheep" to enhance and ensure local supply of beef and mutton.[14] An important consideration for regulators should also be to ensure affordable costs for providing sufficient, high-quality local supply of proteins. Countries will be better-placed to cost-effectively pursue certain food groups based on their relative comparative advantages in production and sourcing of raw materials.

Regulators also have safety concerns surrounding potential feedstock for non-traditional proteins products. For instance, there are safety concerns around the possible toxicity of proteins derived from microalgae, including mycotoxins, pathogens, heavy metals and pesticides, particularly from open marine systems.[15] There are also concerns around the potential of certain feedstocks triggering food allergies, such as anaphylaxis from nuts.

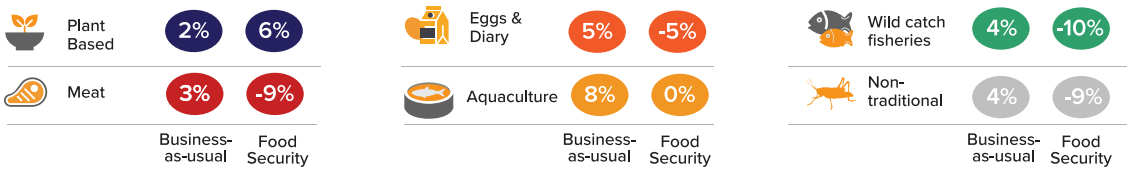
A hypothetical "food security" scenario reveals that, if governments were to mandate that all protein be sourced locally and consumption of proteins in 2030 were to match the current mix of protein production in the Asia-5, there would be a significant shift towards plant-based sources of protein (Exhibit 7).

### EXHIBIT 7

**Volume by protein category in 2030 in the Asia-5[1]; Millions of tonnes, Percentage share (%)**




**2019-2030 Compound Annual Growth Rate (CAGR)**




1. Please refer to the introduction for more information on methodology
SOURCE: FAO database; Literature review; AlphaBeta analysis

[12] Climate Action (2016), "China to reduce its meat consumption by 50%" Available at: https://www.climateaction.org/news/china_to_reduce_its_meat_consumption_by_50

[13] The President, Republic of Indonesia (2012), *Bill of the Republic of Indonesia Number 18 Year 2012 Concerning Food by the Mercy of God Almighty.* State Gazette Addendum of the Republic of Indonesia Number 5360. Available at: http://extwprlegs1.fao.org/docs/pdf/ins139381E.pdf;
Michelle Engel Limenta and Sianti Chandra (2017), Indonesian Food Security Policy. Indonesia Law Review (2017) 2:245-265. Available at: https://media.neliti.com/media/publications/178181-EN-none.pdf; and
OECD (2020), *Agricultural Policy Monitoring and Evaluation 2020: 14. Indonesia.* Available at: https://www.oecd-ilibrary.org/sites/9e2cf2f4-en/index.html?itemId=/content/component/9e2cf2f4-en

[14] China News Service, as reported under Teller Report (2021), "Ministry of Agriculture and Rural Affairs: To build a group of strong towns with meat, beef and sheep as the leading industry" Available at: https://www.tellerreport.com/business/2021-04-21-ministry-of-agriculture-and-rural-affairs--to-build-a-group-of-strong-towns-with-beef--beef-and-sheep-as-the-leading-industry.BksapUT8d.html

[15] Muhammed Imran Khan (2018), *The promising future of microalgae: Current status, challenges, and optimization of sustainable and renewable industry for biofuels, feed, and other products.* Microbial Cell Facroties 17, Article number: 26 (2018). Available at: https://microbialcellfactories.biomedcentral.com/articles/10.1186/s12934-018-0879-x; M. van der Spiegel et. al. (2013), *Safety of Novel Protein Sources (Insects, Microalgae, Seaweed, Duckweed, and Rapeseed) and Legislative Aspects for Their Application in Food and Feed Production.* Comprehensive Reviews in Food Science and Food Safety, Vol. 12, Issue 6, pp 662-678. Available at: https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12032

## 3. Resource constraints

At an estimated US$12 trillion, the hidden costs of the food, land and ocean use system now exceed its contribution to global GDP.[16] According to the EAT-Lancet Commission, without radically transforming food production processes, halving food loss and waste and making significant dietary shifts, we will not be able to feed the world's growing population while operating within safe planetary boundaries by 2050.[17] In line with these trends, the natural limits of production for certain proteins are being approached due to environmental damage caused by today's production methods. For instance, 90% of global wild-caught fish stocks have surpassed biological limits for sustainable production.[18] This is a particularly acute problem in Southeast Asia, where there is a heavy dependency on seafood for both production and consumption. For instance, in the Philippines, 70% of fish stocks were overfished in 2017; 90% of fish caught in the Philippines are consumed locally.[19] There is also a reduction in the availability of arable and pastureland due to poor land management and climate change. Climate change is also a key issue. The World Risk Index ranks the Philippines as the ninth most at-risk country in terms of potential impacts of climate change, including torrential rains, violent winds, storm surges, and flooding, further increasing risk to agricultural crops.[20] Such resource constraints will place immense strain on production costs for proteins producers and may incentivise shifts towards proteins that are relatively easier to produce.

**90% of global wild fish stocks have surpassed biological limits for safe production due to overfishing.**

***World Economic Forum (2018)***

## 4. Technological advancements

Breakthroughs in research and development for key protein categories has enabled more productive systems with higher yields and in turn cheaper produce. This has particularly been the case for aquaculture and non-traditional/alternative proteins. From constituting less than 10% of global seafood in 1980, aquaculture now constitutes over 70% of the seafood we consume.[21] China is the world's largest producer of aquaculture-based seafood, constituting 58% of global production, with Indonesia (7%) and Vietnam (5%) also in the top five global producers. There is immense capacity for further growth, but there is a range of environmental challenges which the sector faces, particularly in managing outbreaks of disease, optimising feed systems and reducing antibiotics, pesticides and organic pollutants, and reducing impact on mangrove forests and other wetlands used for aquaculture.[22] For non-traditional proteins, investment has exploded in recent years, with a record US$3.1 billion invested in 2020 across plant-based meat, eggs and dairy; cultivated meats;

[16] Food and Land Use Coalition [FOLU] (2019), *Growing Better: Ten Critical Transitions to Transform Food and Land Use.* Available at: https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf; and M. van Nieuwkoop, M (2019), "Do the costs of the global food system outweigh its benefits?" World Bank Blogs. Available at: https://blogs.worldbank.org/voices/do-costs-global-food-system-outweigh-its-monetary-value

[17] Walter Willett. et al. (2019), *Food in the Anthropocene: The EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems*. The Lancet Commissions, 393 (10170), P447–92 Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31788-4/fulltext

[18] World Economic Forum (2018), "90% of fish stocks are used up – fisheries subsidies must stop emptying the ocean" Available at: https://www.weforum.org/agenda/2018/07/fish-stocks-are-used-up-fisheries-subsidies-must-stop/

[19] Eco-Business (2017), "The Philippines commits to science-anchored fishery policies" Available at: https://www.eco-business.com/news/the-philippines-commits-to-science-anchored-fishery-policies/

[20] Congressional Policy and Budget Research Development, House of Representatives of the Philippines (2021), *World Risk Index 2020.* Available at: https://cpbrd.congress.gov.ph/images/PDF%20Attachments/Facts%20in%20Figures/FF2021-20_World_Risk_Index_2020.pdf

[21] UN FAO (2020), *The State of World Fisheries and Aquaculture, 2020.* Available at: http://www.fao.org/3/ca9229en/CA9229EN.pdf
World Bank (2013), Fish to 2030: Prospects for Fisheries and Aquaculture. Agricultura and Environmental Services Discussion Paper 03. Available at: http://www.fao.org/3/i3640e/i3640e.pdf

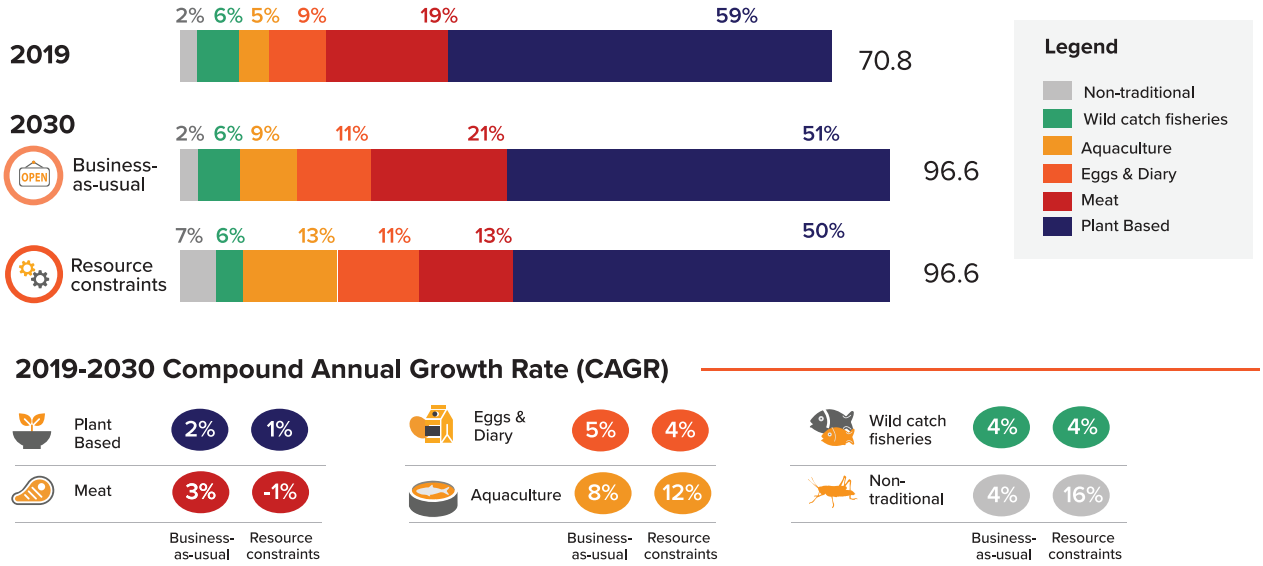
[22] SciDev.net (2019), "New diseases threaten aquaculture" Available at: https://www.scidev.net/global/news/new-diseases-threaten-aquaculture/; UK Centre for Environment, Fisheries and Aquaculture Science (2017), "Solving the $6 billion per year global aquaculture disease problem" Available at: https://marinescience.blog.gov.uk/2017/02/02/solving-the-6-billion-per-year-global-aquaculture-disease-problem/;
David W. Cole et. al. (2009), *Aquaculture: Environmental, toxicological, and health issues. International Journal of Hygiene and Environmental Health*, vol. 212, Issue 4, pp369-377. Available at: https://www.sciencedirect.com/science/article/abs/pii/S1438463908000631#

and fermentation alternatives.[23] Investor confidence is driven by a mix of increased consumer acceptance, significant increase in product launches and variety, and falling prices with higher production. China, and in particular Hong Kong, is emerging as a hub for alternative proteins companies, including Avant Meats and Omnipork.

Under the "resource constraints" scenario (Exhibit 8), which accounts for both environmental limits to production and technological breakthroughs, a significant increase is observed for aquaculture and non-traditional proteins – with the former nearly trebling relative to 2019 levels to 13% of overall protein consumption, and the latter more than trebling to account for 7% of overall consumption.

## EXHIBIT 8

**Volume by protein category in 2030 in the Asia-5[1]; Millions of tonnes, Percentage share**




**2019-2030 Compound Annual Growth Rate (CAGR)**




1. Please refer to the introduction for more information on methodology
SOURCE: FAO database; Literature review; AlphaBeta analysis

## 5. Consumer acceptance of non-traditional proteins

There is increasing acceptance for non-traditional proteins options, with consumer research showing that consumers around the world and in the Asia-5 are open to trying a range of new protein options. For instance, one in every two Chinese consumers surveyed were likely to consume cultivated meat (i.e., lab-grown or cell-based) proteins.[24] The Asian diet has also traditionally included a number of protein "alternatives", including vegetarian protein options such as jackfruit, tofu, and tempeh, and insect-based foods. For instance, insects are commonly consumed across Southeast Asia and particularly in Vietnam, where a range of insect protein companies including Cricket One are developing insect protein powders for use in snacks and animal feed.[25] However, there are also some barriers to widespread acceptance. For instance, Asian consumers value clean-label products (i.e., with "fresh" and "known" ingredients) and are wary of overly "processed" products.[26] This has important implications for alternative proteins companies to direct investments for research, production, and product sales in the region.

**1 in 2 Chinese consumers are likely to consume cultivated meats.**

***The New Zealand Institute for Plant and Food Research Limited (2017)***

[23] Good Food Institute (2021), "Record $3.1 billion invested in alt proteins in 2020 signals growing market momentum for sustainable proteins" Available at: https://gfi.org/blog/2020-state-of-the-industry-highlights/
[24] The New Zealand Institute for Plant and Food Research Limited (2017), *Protein: A Chinese Perspective*. Available at: https://www.plantandfood.co.nz/file/protein-china-perspective.pdf
[25] Saigoneer (2020), "Vietnamese Insect Protein Startup Cricket One Gets 7-Figure Funding" Available at: https://saigoneer.com/saigon-environment/19587-vietnamese-insect-protein-startup-cricket-one-gets-7-figure-funding
[26] Research by Ingredion, as reported by CNS Media (2015), "Stronger demand for clean label in Asia Pacific reveals Ingredion Consumer Research" Available at: https://www.foodingredientsfirst.com/news/stronger-demand-for-clean-label-in-asia-pacific-reveals-ingredion-consumer-research.html

# SECTION 4 Five key areas for multistakeholder action

## 1. Health and nutrition

There is presently a lack of rigorous insights into the health and nutritional benefits of various protein categories, particularly for the Asian phenotype.[27] Differences between Western and Asian phenotypes could influence the latter's tolerance towards certain food groups and ingredients, and recommended consumption levels.[28] The EAT-Lancet Commission report referenced earlier provides only a regional overview of reference dietary intakes and current deficiencies, with a lack of insights at the country level, as well as reference dietary intakes across age groups, ethnicities, and so on. It is also unclear how recommended intakes of protein may be maintained with a larger shift towards plant-based diets. This is particularly important given that other nutrients also accompany current major sources of protein, that would also require replacement in the diet overall. For instance, in addition to proteins, meats are also a rich source of iron, zinc, and vitamin B12.

There is also currently a lack of insights on the nutritional benefits of non-traditional proteins, and the role these can play in a balanced diet including to satisfy protein requirements as well as other key nutrients. Proteins from this category could potentially form a key part of national nutritional strategies. For instance, insect-protein-based flour could be a high-protein, low-cost substitute for wheat- or rice-based flour.[29] Recently, the nutritional "inadequacy" of plant-based dairy products has received attention, with some studies claiming that plant-based milk has less calcium, proteins, and vitamins relative to animal dairy products.[30] Accordingly, there are calls to establish clear and consistent naming and labelling conventions to communicate product properties, especially from producers of animal-based proteins.

It is imperative for industry stakeholders to conduct rigorous scientific research to plug gaps in our still nascent understanding of the nutritional benefits of proteins and other food groups. Industry associations and research groups could collaborate on this research at a pre-competitive level. Strong financial and technical support from local governments will also be critical to support this research. Such research could form the basis of future product offerings and partnerships between industry and government, to help develop science-based national nutritional roadmaps. A potential avenue for such a partnership is with Vietnam's National Institute of Nutrition, which is conducting technical consultation workshops for the development of a national nutrition strategy for 2021-30, with hundreds of participants from government, private sector, and the development community.[31]

[27] The "Asian phenotype" reflects physiological and biochemical differences between Asians and non-Asians.
[28] Melvin Khee-Shing Leow (2017), *Characterization of the Asian Phenotype – An emerging paradigm with clinicopathological and human research implications.* International Journal of Medical Sciences 2017; 14(7), pp639-647. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5562114/
[29] Forbes (2020), "Innovation in food technology could help bring insect flours to your pantry" Available at: https://www.forbes.com/sites/allisongasparini/2020/06/30/innovation-in-food-technology-could-help-bring-insect-flours-to-your-pantry/?sh=2e8e9a987ea9
[30] Yianna Y. Zhang (2020), *Got Mylk? The emerging role of Australian plant-based milk alternatives as a cow's milk substitute.* Nutrients, Vol. 12, Issue 5. Available at: https://www.mdpi.com/2072-6643/12/5/1254
[31] National Institute of Nutrition (2021), "Viet Nam national nutrition strategy for 2021-2030. More equitable, resilient, and sustainable food and health system" Available at: http://viendinhduong.vn/en/news--events-257/viet-nam-national-nutrition-strategy-for-2021-2030-more-equitable-resilient-and-sustainable-food-and-health-system.html

## 2. Food safety

There is a clear need to establish a best practice food safety regulatory framework for non-traditional proteins in Asia given the varying concerns around potential toxicity and allergenicity of feedstock. There is also a need to harmonise regulatory frameworks across countries to facilitate market access and trade, particularly in Southeast Asia, where there are already varying food standards, and even fewer frameworks regulating non-traditional proteins.

Existing best practice regulatory frameworks that could be referenced include the US Food and Drug Administration's (FDA) Generally Recognised as Safe (GRAS) database, which lists all known ingredients that are safe for usage across food products, and the Chinese food industry's voluntary group standard for plant-based meat products published by the Chinese Institute of Food Science and Technology (CIFST).[32] In addition, the Singapore Food Agency (SFA) is the first regulator worldwide to allow for the sale of cultivated meat products, beginning with Eat Just's cultured chicken bites in December 2020.[33]

A number of efforts are already ongoing in the development of food safety regulatory frameworks in the region. For instance, Food Industry Asia (FIA) engages with regulators around the region, to ensure that regulatory framework remains fit-for-purpose in view of the changing food system.[34] Advocacy to establish and harmonise best practice regulation for alternative proteins products could be embedded within these efforts.

[32] US Food and Drug Administration [FDA] (2019), "Generally Recognized as Safe (GRAS)" Available at: https://www.fda.gov/food/food-ingredients-packaging/generally-recognized-safe-gras; The National Law Review (2020), "Chinese food industry proposes the first group standard for plant-based meat" Available at: https://www.natlawreview.com/article/chinese-food-industry-proposes-first-group-standard-plant-based-meat?amp
[33] The Straits Times (2020), "Singapore first in world to approve lab-grown meat for sale" Available at: https://www.straitstimes.com/singapore/environment/singapore-first-in-world-to-approve-lab-grown-meat-for-sale
[34] FIA (2021), "Regulatory updates" Available at: https://regulatoryhub.foodindustry.asia/regulatory-updates

## 3. Sustainability

With there being both direct production-related impact, and indirect supply-chain related impact of the food system on climate change and biodiversity loss, urgent action is required to align the food system towards a nature-positive pathway by 2030. There are particular pressures on some elements of the proteins system due to their outsize environmental impact. For instance, production and supply of ruminant meats (e.g., beef, lamb, and mutton) typically requires more energy, land, and water resources while releasing more greenhouse gas emissions, and relative to other food groups such as poultry, seafood, vegetables, and nuts.

For instance, production of ruminant meats emits up to 24 times more greenhouse gases than an equivalent serving of vegetables.[35] It is important to note that this comparison has been made for equivalent servings of ruminant meats (28g) versus vegetables (1 cup measure). Other metrics of comparison may yield different results where the gap in emissions may be much smaller. For instance, comparing equivalent protein contributions of meats and vegetables may be more appropriate, assuming that vegetables provide lower protein in equivalent servings. While more research is required to determine the relative sustainability of different food groups when considering their nutrient contributions to our diet, it is clear that current methods of meat production require significant improvement towards net-zero, nature-positive production.

[35] Walter Willett. et al. (2019), Food in the Anthropocene: The EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems. The Lancet Commissions, 393 (10170), P447–92 Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31788-4/fulltext

There are two main ways in which the protein industry can increase its environmental sustainability:

## 3.1 More sustainable production of traditional proteins.

A range of productive and regenerative agricultural techniques could reduce the impact of livestock farming and ranching, including cattle intensification, optimal grazing, land rehabilitation, carbon sequestration through techniques like agro-forestry, using alternative animal feed (e.g., insects instead of soybean meal), and market incentives such as carbon credits. A recent example of the latter includes Microsoft's purchase of A$500,000 worth of carbon credits from Wilmot Cattle Co. in New South Wales, Australia, which is evidence of one of the world's largest beef industry's commitment to sustainable production.[36]

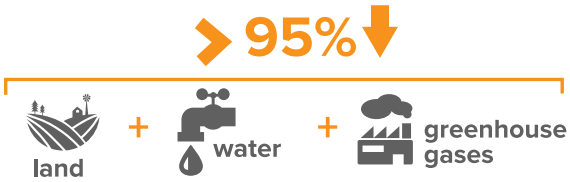
The company has spent a decade conducting time-controlled rotational grazing, increasing stocking density, and reducing paddock size, thereby increasing productivity and profitability while also increasing soil organic carbon concentration by 40,000 tonnes or from 2.5% to 4.5%, with the goal of reaching 6% by 2023. Addressing the impact of aquaculture through improved disease management and reduced environmental impact is also of critical importance. Past research has identified significant global opportunities in sustainable aquaculture, estimated to be worth up to US$115 billion in additional annual business value in 2030.[37] It will be critical for the proteins industry to conduct further research on these production techniques to understand feasibility and potential impact, and then scale these production methods in relevant countries.

## 3.2 Pursuing lower-impact non-traditional proteins.

Plant-based meats reduce land usage, water usage, and greenhouse gas emissions by over 95 %versus animal-based meats.[38] Significant additional research is required to determine feedstock options with the lowest environmental impact to support alternative proteins.

For instance, almonds have been suggested as a large potential feedstock for plant-based meats given their high protein content of 14% per kilogram but require over 16,000 litres of water to produce and emit 2.3kg of greenhouse gas emissions per kg.[39] In comparison, lentils require just under 6,000 litres per kg and emit 0.9kg of emissions, while having a higher protein content of 25%. There is similarly a large market opportunity presented by alternative meats, estimated to be worth up to US$85 billion in annual additional market opportunities by 2030.[40] Areas of action to further innovation in non-traditional proteins is explored in further detail below.

**Production impact of plant-based meats vs. animal-based meats can be**




[36] Farm Online (2021), "Microsoft buys carbon credits from NSW cattle operation" Available at: https://www.farmonline.com.au/story/7105542/microsoft-buys-carbon-credits-from-nsw-cattle-operation/
[37] AlphaBeta (2020), Identifying biodiversity threats and sizing business opportunities – *Methodological Note to the New Nature Economy Report II: The Future of Nature and Business.* Available at: https://alphabeta.com/wp-content/uploads/2020/07/200715-nner-ii-methodology-note_final.pdf
[38] Food Frontier (2018), *Meat Reimagined: The Global Emergence of Alternative Proteins – What does it mean for Australia?*
[39] M.M. Mekonnen and A.Y. Hoekstra (2010), *The green, blue and grey water footprint of crops and derived crop products.* Value of Water Research Report Series No. 47. Available at: https://waterfootprint.org/media/downloads/Report47-WaterFootprintCrops-Vol1.pdf; Global Pulse Confederation (2016), "Productivity and Environmental Sustainability" Available at: https://iyp2016.org/themes/productivity-environmental-sustainability
[40] AlphaBeta (2020), *Identifying biodiversity threats and sizing business opportunities – Methodological Note to the New Nature Economy Report II: The Future of Nature and Business.* Available at: https://alphabeta.com/wp-content/uploads/2020/07/200715-nner-ii-methodology-note_final.pdf

## 4. Food innovation

There are a range of exciting food innovations that could be pursued, with the most exciting being non-traditional proteins, but further research is required in a range of areas to enable potential growth. For instance, new feedstocks are required for plant-based meats – only three plant species (pea, soy, and pulses) of the 150 key species used in the global food and agriculture system are widely used in plant-based meat products today.[41] Additionally, there are over 250,000 known plant species not used in agriculture today at all that could hold commercial potential as well. Further research is also required to better functionalise extracted proteins into relevant products. Although a range of techniques are currently available, there is a trade-off between functionality and taste, e.g., as the binding of undesirable non-protein compounds with protein molecules from peas can result in "beany" flavour.[42]

There are also issues related to protein stability – particularly as this relates to how feedstock and non-traditional products can adapt to Asian climates (with high temperatures and humidity) and supply chain gaps (e.g., lack of cold storage). Additionally, cultivated meats require further research and development to reach price parity with traditional alternatives, including cheaper and more efficient cell culture media and a large-scale transition to clean energy sources to sustain an energy-intensive production process.[43] Significant capital investment in mass production facilities is also required.

**Over 250,000 known plant species are not used in agriculture and could be potential feedstock for plant-based meat products.**

***Good Food Institute (2017)***

To innovate for these challenges, food innovation hubs that bring together industry players, startups, and government agencies can be transformative in discussing regulatory solutions and support scaling of promising innovations. A number of efforts are already ongoing to spur innovation in non-traditional proteins in the Asia-5 and more broadly across Asia. For instance, China has rapidly developed as an "alternative proteins" hub, being the largest production hub outside the U.S. for plant-based meats.[44] Among other developments, there have been significant investments in cultivated meats, yeast engineering, fermentation, and machine learning to discover new edible plants, as well as development of alternative meat products more familiar to the Asian diet, including minced pork and seafood. Singapore's science research agency, Agency for Science, Technology and Research (A*STAR), and sovereign wealth fund Temasek, and sovereign wealth fund Temasek have jointly established a Food Tech Innovation Centre in the country to accelerate the commercialisation of new food technologies, including alternative meats, in pursuit of the country's food security goals of achieving 30% of food sourced locally by 2030 (up from less than 10% today).[45]

[41] Good Food Institute (2017), *Plant-based meat mind maps: An exploration of options, ideas and industry.*
[42] Dr. Akshay Arora/Ingredion (2019), *Technologies to remove/reduce flabour compounds in pea/pulse proteins (Presentation).*
[43] Green Queen (2021), "Cultivated Meat Has 92% Lower Climate Impact & Will Reach Price Parity By 2030, Says New Research" Available at: https://www.greenqueen.com.hk/cultivated-meat-has-92-lower-climate-impact-will-reach-price-parity-by-2030-says-new-research/
[44] Good Food Institute (2018), *China Plant-Based Meat Industry Report 2018.*
[45] Straits Times (2020)," Temasek in food tech innovation venture with A*Star" Available at: https://www.straitstimes.com/business/economy/temasek-in-food-tech-innovation-venture-with-astar

## 5. Consumer engagement

While studies have shown that consumer acceptance of non-traditional proteins are rising, there remains a lack of rigorous insights by country and broader questions on the preferences and concerns of Asian consumers in relation to alternative proteins. Consumer research in three areas will be critical. The first area is unpacking key differences in tastes, preferences, and nutritional needs between Asian consumers across sub-regions, rural and urban areas, age groups, and income levels. The second area is building further evidence on emerging dietary shifts and perceptions towards different food groups, where there is a lack of consumer insights across the Asia-5. For instance, consumers in China, Indonesia, and Viet Nam are indicating preferences for plant-based diets due to health and environmental concerns, while others in the same markets are demanding more "premium" animal-based proteins that are associated with "luxury", festivities, and tradition. The final area is better understanding shopping behaviours, which are rapidly changing, particularly given the effects of the COVID-19 pandemic. For instance, preference for traditional food retail outlets such as wet markets may be shifting to modern grocery and e-commerce, particularly in urban areas in China, the Philippines, and Viet Nam. Consumption may also be displaced from food service to food retail, as the "eating out" trend has been on the decline in some markets.

Industry research in these areas will significantly improve the quality of consumer engagement for the protein industry. Based on this research, the industry will not only be able to better understand consumer preferences and concerns but also develop advocacy campaigns to better inform consumers and governments on matters related to product safety, transparent labelling, nutritional information, role in diets, and so on.

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**Multistakeholder collaboration in these five key action areas will enable the protein industry to work with regulators, startups, investors, and consumers to navigate the challenges and capture the emerging opportunities in the Asian protein landscape over the next decade.**

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