



FIAL
FOOD INNOVATION AUSTRALIA LIMITED
CATALYST FOR GROWTH

Protein market: Size of the prize analysis for Australia

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Who is FIAL?



Australian Government
Department of Industry,
Innovation and Science

Industry
Growth
Centres



Why we conducted this research?

We knew:

1. Protein is the **building block of life**, essential to proper functioning of life.
2. Consumers are increasingly basing their food purchasing decisions on the macro nutrient profiles of food.
 - **58 percent** of consumers purchase food products based on protein content.
3. To engage consumers, food businesses must remain aware of the trends in health and nutrition, particularly consumers' protein demand to drive potential value within their supply chain.

So, we aimed to answers 3 broad questions:

1. How is the demand of protein evolving?
2. How is the supply of different proteins changing?
3. How can Australian producers best capture the protein opportunity?

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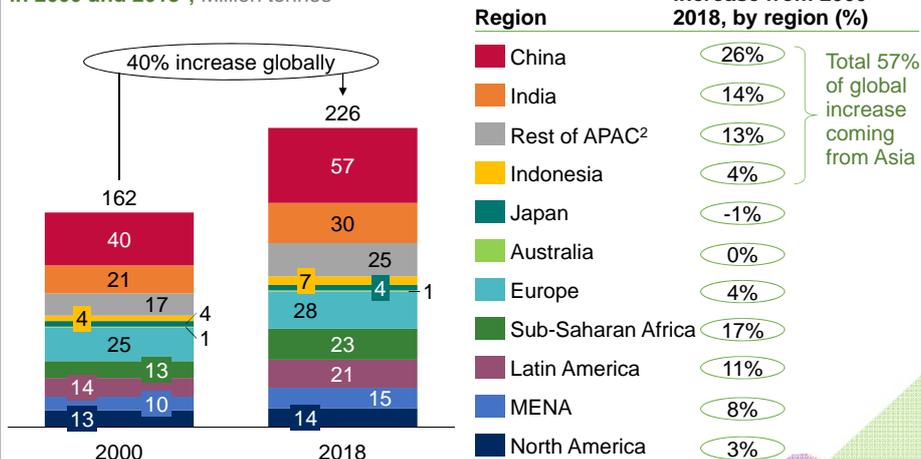
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EVOLVING DEMAND FOR PROTEIN

Global protein consumption has risen 40% since 2000, with more than half of the increase being driven by Asia

Breakdown of global protein consumption by region in 2000 and 2018¹; Million tonnes



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1. Latest FAO data point is 2013. 2018 estimated using historical growth rates (i.e. 5-year CAGR)
2. Rest of Asia Pacific excludes Australia, China, India, Indonesia, and Japan; MENA consists of Middle East and North Africa.
Note: Figures may not sum due to rounding
Source: FAO stats; AlphaBeta analysis

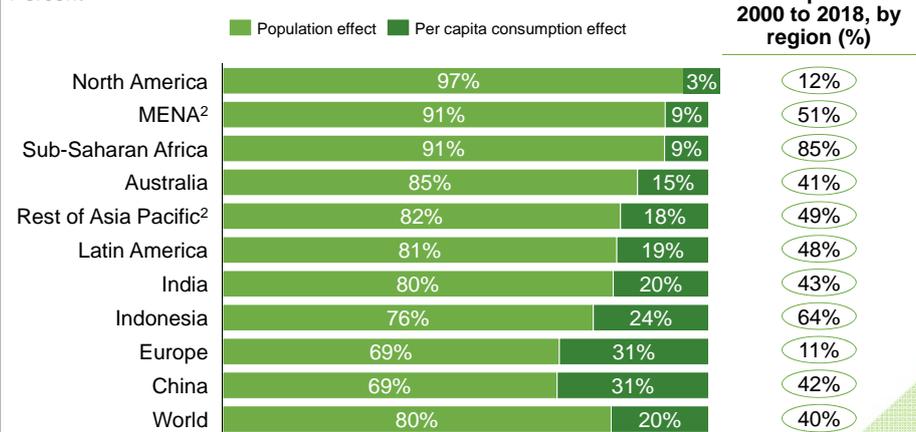
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EVOLVING DEMAND FOR PROTEIN

Population growth accounted for about 80% of global protein demand growth between 2000 and 2018

Split of protein consumption increase from 2000 to 2018; Percent



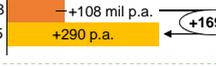
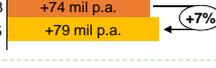
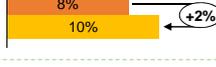
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1. Japan is not shown in this graph as Japan has experienced a decline in protein consumption of 9%, from 2018 to 2025, while this graph illustrates the breakdown of the increase in protein consumption into population and per-capita consumption effects for each region. Japan's experienced decline in protein consumption is due to the decrease in its population during this period.
2. MENA consists of Middle East and North Africa. Rest of Asia Pacific excludes Australia, China, India, Indonesia and Japan.
Source: FAO stats; AlphaBeta analysis
Note: Figures may not sum due to rounding

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EVOLVING DEMAND FOR PROTEIN

PREDICTION: Major drivers which may impact global protein consumption demand between 2018 and 2025

Description	Projected annual trend from 2018 to 2025 ²	Future growth rate relative to historical
 Population growth Population growth accounted for 80% of protein demand growth between 2000 and 2018	2000-18: +90 mil p.a. 2019-25: +79 mil p.a. 	
Consuming class¹ growth. Higher propensity to spend on food proteins as people enter the consuming class	2000-18: +108 mil p.a. 2019-25: +290 p.a. 	
 Change in per capita consumption Urban population growth. Increased incomes lead to higher protein consumption	2000-18: +74 mil p.a. 2019-25: +79 mil p.a. 	
Share of global population over age 65. An older population is likely to consume less protein per person	2018: 8% 2025: 10% 	
Change in dietary preferences due to health and ethical reasons	Not available	Not available

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1. Consuming class defined as 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.
 2. The bar charts in this column reflect the historical (2000-18) and projected (2019-25) annual average increase in absolute terms for all drivers except "share of global population over age 65". "p.a." in each of the bar charts for these drivers refer to "per annum". For the driver "share of global population over age 65", the bar chart displays the absolute percentage shares of individuals aged over 65 of global population in 2018 and 2025.
 Source: UN Population; Brookings Institute; AlphaBeta analysis



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CHANGING PROTEIN SUPPLY

Supply was analysed for 50 protein types across 6 categories

1. Plant-based

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



2. Meat

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



3. Eggs & dairy

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



4. Wild catch fisheries

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



5. Aquaculture

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



6. Non-traditional

47. Insects
49. Microalgae
50. Lab-grown meat



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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



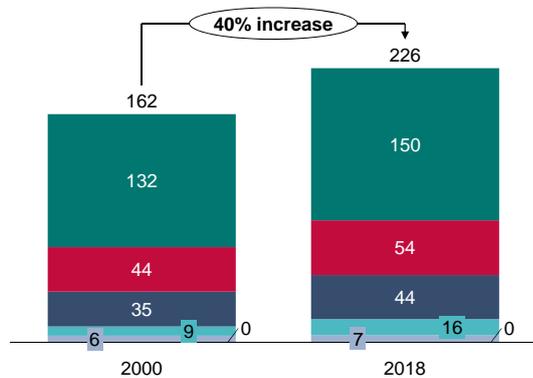
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CHANGING PROTEIN SUPPLY

Since 2000, plant-based protein has been the biggest category by volume, but growth has been faster in other categories

Breakdown of global volume by protein category in 2000 and 2018¹;
Million tonnes



Protein category	Percent increase from 2018-2025 (%)
Plant-based	14%
Meat	23%
Eggs & dairy	26%
Aquaculture	74%
Wild catch fisheries	9%
Non-traditional	872%

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¹ - Latest FAO data point is 2013. 2018 estimated using historical growth rates (i.e. 5-year CAGR)
Note: Figures may not sum due to rounding
Source: FAO stats; AlphaBeta analysis



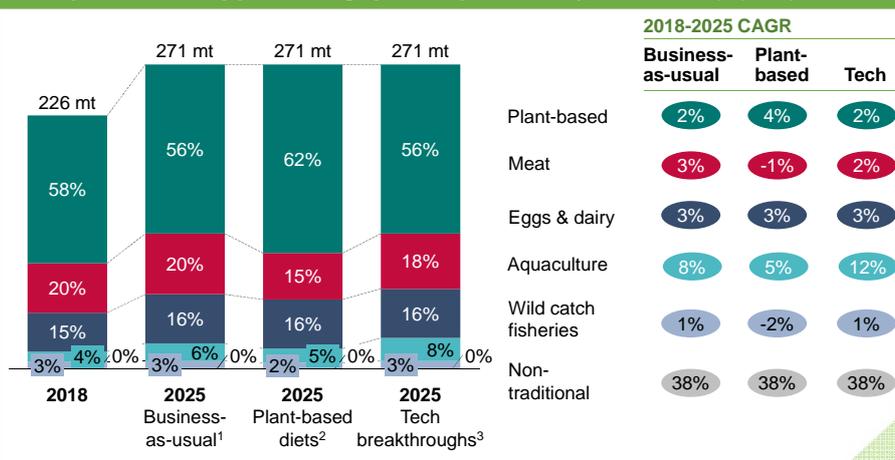
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CHANGING PROTEIN SUPPLY

PREDICTION: Across all scenarios, plant-based protein will remain the dominant source of consumption in volume terms

Global protein volume by protein category in 2025 (all scenarios); Million tonnes (mt) and percent



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¹ In this scenario, protein consumption was projected based on growth of population, historical per-capita consumption and consuming class
² In this scenario, a ramp-up in plant-based protein consumption with equivalent declines in meat, aquaculture and wild catch fisheries consumption was assumed based on regional data on expected vegetarianism rates.
³ In this scenario, aquaculture consumption was increased based on projections of productivity improvements due to technological innovations in the literature, with accompanying declines in meat consumption
Source: FAO stats; AlphaBeta analysis



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CHANGING PROTEIN SUPPLY

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Going forward, 4 major trends will potentially lead to shifts in the sources of protein consumption

Trends	Description	Key Facts
Dietary shifts due to health and ethical reasons	Increased focus on detrimental health impacts and rising consciousness of ethical issues linked to most animal-based diets, have accelerated the shift towards plant-based foods	Study reveals that 27% of Europeans intend to eat less meat over the next 5 years 
		A third of Americans intend to reduce meat consumption in the coming years 
		Survey shows 14% of Australians are making a concerted effort to avoid red meat 
Governance and regulations	Regulations on production of certain proteins would impact supply. Government advocacy could influence changes in production of proteins	Lab-grown meat start-ups in the US face potential regulation by the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA) 
		Chinese government has committed to halving the meat consumption of its citizens 
Environmental constraints	Production of certain produce could reach their natural limits due to environmental constraints such as overfishing or decline in arable land	Global fish production reaching sustainable limit, with around 90% of the world's stocks now fully fished or overfished 
Technological advances	Breakthroughs in research and development lead to more productive and cheaper methods to increase supply of high demand produce	Start-ups in the US and the Netherlands are developing lab-grown meat 
		Pathogen-free and pathogen-resistant approaches applied to shrimp farming in the US and Venezuela have led to higher yields 

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Source: Literature review, AlphaBeta analysis



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CHANGING PROTEIN SUPPLY

2

These trends will likely trigger a shift towards plant-based diets and increased aquaculture production

- Increase protein consumption at faster rate than historical¹
- Increase protein consumption at slower rate than historical¹
- Cause an absolute decline in protein consumption
- Unknown effect on protein consumption

Trends	Plant-based	Meat	Aquaculture	Wild catch	Eggs & Dairy	Non-traditional
Dietary shifts due to health and ethical reasons	Increase protein consumption at faster rate than historical ¹	Cause an absolute decline in protein consumption	Increase protein consumption at slower rate than historical ¹	Increase protein consumption at slower rate than historical ¹	Increase protein consumption at slower rate than historical ¹	Unknown effect on protein consumption
Governance & regulations	Increase protein consumption at faster rate than historical ¹	Cause an absolute decline in protein consumption	Unknown effect on protein consumption	Unknown effect on protein consumption	Increase protein consumption at slower rate than historical ¹	Cause an absolute decline in protein consumption
Environmental constraints	Increase protein consumption at slower rate than historical ¹	Cause an absolute decline in protein consumption	Increase protein consumption at faster rate than historical ¹	Cause an absolute decline in protein consumption	Increase protein consumption at slower rate than historical ¹	Increase protein consumption at slower rate than historical ¹
Technological advances	Unknown effect on protein consumption	Increase protein consumption at slower rate than historical ¹	Increase protein consumption at faster rate than historical ¹	Unknown effect on protein consumption	Unknown effect on protein consumption	Increase protein consumption at faster rate than historical ¹

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¹ This refers to the comparison of growth rates between the two time periods: 2000-2018 and 2019-2025.
Source: Literature review, AlphaBeta analysis



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2 CHANGING PROTEIN SUPPLY

PREDICTION: Based on these trends, there are 3 possible scenarios for the future of protein supply

#	Scenario	Relevant trends	Description and brief methodology	Data sources
1	Business-as-usual 	All	Protein consumption is projected based on growth of population, historical per-capita consumption and consuming class	FAO database
2	Shift towards plant-based diets 	<ul style="list-style-type: none"> Dietary shifts due to health and ethical reasons Governance and regulations Environmental constraints 	Ramp up in plant-based protein, with corresponding decline in animal-based protein (which includes meat, aquaculture and wild catch fisheries) due to a combination of health, environmental and ethical concerns	Market estimates and surveys
3	Technological breakthroughs in aquaculture and non-traditional protein sources 	<ul style="list-style-type: none"> Dietary shifts due to health and ethical reasons Environmental constraints Technological advances 	Ramp up in aquaculture consumption enabled by technological breakthroughs, with accompanying declines in meat consumption. Non-traditional protein will also increase, but from current low base	FAO Fish to 2030 Report; market estimates

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Source: AlphaBeta analysis



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CAPTURE THE OPPORTUNITY

There are three strategic opportunities for Australian producers to unlock new opportunities in the global market

#	Opportunity	Description
1	Shift into higher-value protein categories	<ul style="list-style-type: none"> Restructuring Australia's protein production mix to match projected global consumption could lead to an additional production value of A\$55 billion as compared to business-as-usual approaches
2	Strengthen partnerships in high-potential markets	<ul style="list-style-type: none"> With 3 of the 5 largest contributors to the projected increase in global protein consumption between 2018 and 2025 projected to come from the Asia Pacific region, Australia is well-situated to capture the opportunities in these markets Capturing this geographical prize requires Australian producers to take advantage of existing free trade agreements and form commercial partnerships with local players in these markets
3	Deepen collaborations across players in the value chain	<ul style="list-style-type: none"> To fully harness future gains, Australian food producers should explore deeper collaborations with other players across the value chain such as food processing companies, researchers, nutritionists and technology providers

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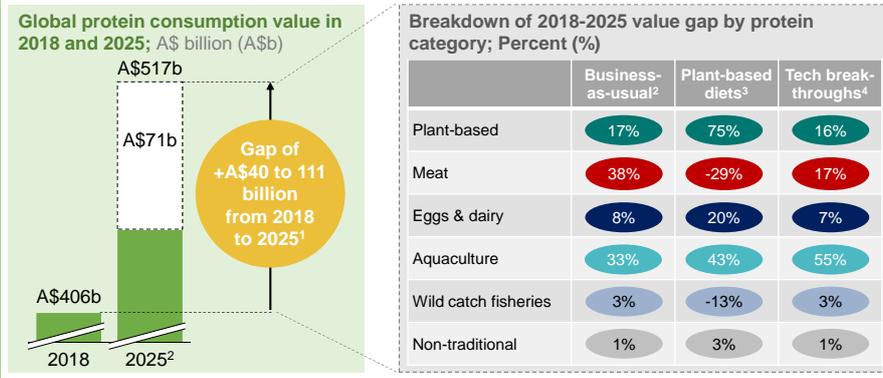
Source: AlphaBeta analysis



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Aquaculture could account for over 50% of the projected gap in global protein consumption value between 2018 and 2025

2018-2025 gap in global protein consumption value and breakdown by protein category (all scenarios); A\$ billion and percent

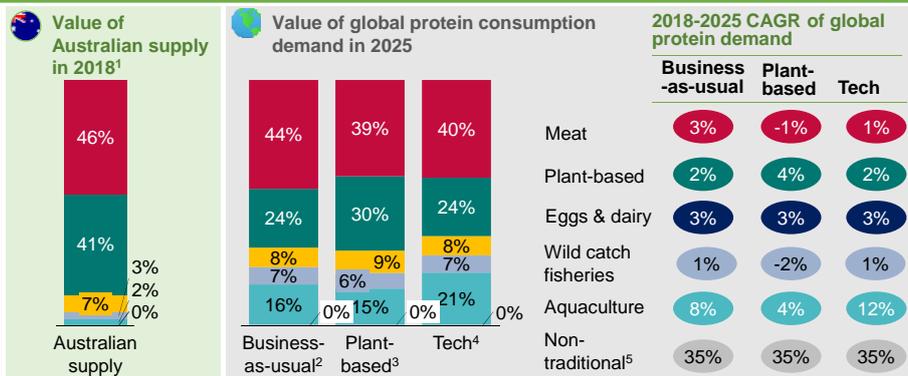


¹ Values for all three 2025 scenarios are reflected in this chart. This value ranges from A\$446 billion under the 'plant-based diets' scenario, to A\$517 billion under the 'technological breakthroughs' scenario. Between these upper and lower bounds, there is a difference of A\$71 billion. Hence, the gap between 2018 and 2025 ranges from A\$40 billion to A\$111 billion.
² In this scenario, protein consumption was projected based on growth of population, historical per-capita consumption and consuming class
³ In this scenario, a ramp-up in plant-based protein consumption with equivalent declines in meat, aquaculture and wild catch fisheries consumption was assumed based on regional data on expected vegetarianism rates.
⁴ In this scenario, aquaculture consumption was increased based on projections of productivity improvements due to technological innovations in the literature, with accompanying declines in meat consumption



Australia's current production structure appears to be underweight in aquaculture – a rapidly growing protein category which could make up 21% of the global market in 2025

Value of Australian food production vs. value of global protein consumption demand with breakdown by protein categories; Percent



¹ Refers to Australian production of food with protein content, and not solely to protein content. Data is based on latest available figures from FAO and Australian Government Department of Agriculture and Water Resources
² In this scenario, protein consumption was projected based on growth of population, historical per-capita consumption and consuming class
³ In this scenario, a ramp-up in plant-based protein consumption with equivalent declines in meat, aquaculture and wild catch fisheries consumption was assumed based on regional data on expected vegetarianism rates.
⁴ In this scenario, aquaculture consumption was increased based on projections of productivity improvements due to technological innovations in the literature, with accompanying declines in meat consumption
⁵ Growth in non-traditional proteins is largely fuelled by the insects market, which will experience a CAGR of 45% across all scenarios.
 Source: Data from FAO and Department of Agriculture and Water Resources; AlphaBeta analysis

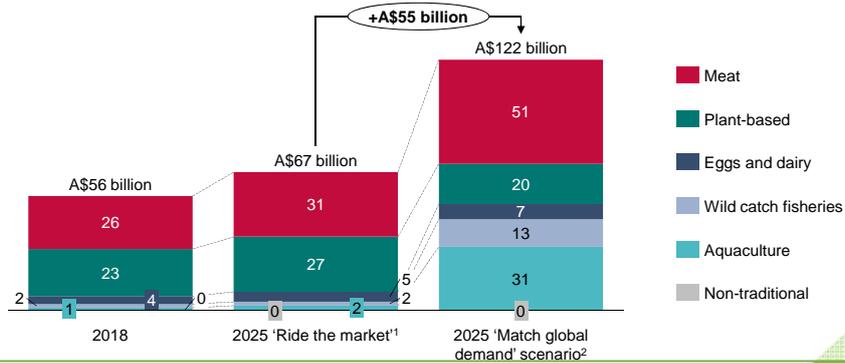


Opportunity 1: Shift into higher-value protein categories

By shifting towards higher-value protein categories, Australia could capture A\$55 billion more in producer value in 2025

Value of Australian production of protein-containing foods in 2018 and in 2025 under two scenarios ('Ride the market'¹ and 'Match global demand'² scenarios)

Breakdown of the value of Australia's production of protein-containing foods by protein category³; A\$ billion



1. 'Ride the market' scenario: In this scenario, the projected growth rates in global protein consumption demand for each protein category were applied to current (2018) Australian production of foods containing protein. These growth rates were based on the 'business-as-usual' scenario under the supply analysis.
 2. 'Match global demand' scenario: In this scenario, the total production volume of Australian protein-containing foods was pegged to the total volume under the 'ride the market' scenario. The breakdown of this total volume by protein category was then modelled to mirror the projected breakdown of global protein consumption demand in 2025 under the 'business as usual' scenario in the supply scenario.
 3. Note that the values presented in this exhibit reflect the value of protein-containing foods, and should not be compared against the earlier-presented values of protein consumption, which relate to the value of pure protein consumption (and not the foods they are present in).
 Source: Data from FAO and Department of Agriculture and Water Resources; AlphaBeta analysis



Opportunity 2: Strengthen partnerships in high-potential markets

With 3 of the 5 largest contributors to the potential increase in global protein demand from 2018 to 2025 expected to come from Asia Pacific, the region holds great potential for Australia

Projected breakdown of 2018-2025 gap in global protein consumption and top protein in terms of value in 2025, by region ('Business-as-usual' scenario¹); Percent

Region	Breakdown by volume (million tonnes)	Breakdown by value (A\$ billion)	Top protein category by value in 2025, and as % of total value in region
China	14	47	Meat (46%)
India	7	9	Plant-based (67%)
Sub-Saharan Africa	7	11	Plant-based & Meat (38% each)
Rest of Asia Pacific	6	12	Plant-based & Meat (33% each)
Latin America	4	8	Meat (67%)
MENA	3	8	Meat (53%)
Indonesia	2	5	Aquaculture (32%)
Europe	2	5	Meat (55%)
North America	1	3	Meat (61%)
Australia	0	0.5	Meat (62%)
Japan	0	-0.3	Meat (32%)
Total	45	107	



1. In this scenario, protein consumption was projected based on growth of population, historical per-capita consumption and consuming class
 Source: FAO stats; AlphaBeta analysis



Opportunity 3: Deepen collaborations across players in the value chain

The 16 opportunities identified in past FIAL research remain highly relevant to most protein categories

Largest opportunities	Value 2025 ¹ A\$ billion; 2015 values	Relevance for protein category					
		Plant	Meat	Eggs & Dairy	Aquaculture	Wild Catch	Non-trad
Global consuming class	2,730 – 3,640		✓	✓	✓	✓	✓
Health and wellness	3,400	✓				✓	✓
Energy smart food	250 - 785		✓	✓	✓	✓	✓
Food waste	465 - 775	✓	✓		✓	✓	
Targeted eating	695 - 770	✓			✓	✓	
Urban agriculture	185 - 395	✓					
Sustainable agriculture	240	✓					
Supply chain transformation	135 – 200	✓	✓	✓	✓	✓	
Direct to consumer model	160 - 195	✓		✓			
Precision agriculture and big data	110 -135	✓			✓		
Advanced breeding and fertilization	125	✓	✓		✓		
Sustainable input	105 - 110	✓	✓	✓	✓		
Animal feed and health	75 - 90	✓	✓	✓	✓		
Food safety	60-90	✓	✓	✓	✓	✓	✓
Soil and land management	65 - 85	✓					
Sustainable packaging	10 - 80	✓	✓	✓	✓	✓	✓



1. Based on estimated savings or projected market sizings in each area. Rounded to nearest A\$5 billion.
Source: Past FIAL work on "Food and agribusiness: size of the prize analysis for Australia"; AlphaBeta analysis



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THE TAKE HOME MESSAGE!

It is time to think Differently

*Its time to think about the
Functional Properties of foods we produce
rather than just by commodity type.*





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