

Alternative Protein



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This is the second part of a two-part series on the sustainable food sector. The first report covered sustainable solutions for the food sector, while this report focuses on the growing alternative protein subsector.

1. Key takeaways

This report serves as a primer for understanding the basics of the alternative protein market. The key takeaways are as follows:

- There is strong growth in the alternative protein sector, **attracting considerable financial investment and research interest**. This can be attributed to greater awareness of increasing pressures on population growth, climate change, health concerns and food safety uncertainties.
- The transition to alternative protein from conventional animal protein can lead to **significant resource savings (i.e. greenhouse gas emissions, water and land)**, contributing to the United Nations Sustainable Development Goals (SDGs).
- **Asia Pacific is the largest market for alternative protein** and will continue to grow at the fastest rate. It is anticipated to account for ~66% of global alternative protein consumption in 2035.
- There are **opportunities for investments across the alternative protein supply chain** in areas such as pea protein production, protein innovation, protein texturization and production plants.

2. Overview of alternative protein

2.1 Leading alternative protein sources

Alternative protein refers to ingredients high in protein content that are typically sourced from plants, insects, fungi or through tissue culture to replace conventional animal-based protein. There is increasing consumer interest in alternative protein, attributed to growing health and environmental concerns, as well as interest in animal welfare and ethical consumerism. Table 1 shows the leading alternative protein types with their respective characteristics.

Table 1: Some alternative protein types and characteristics

Product nature	Competitive position	Challenges	\$/kg, 100% protein
Plant-based (Soy protein)			
Sold as concentrate (~65% protein) or isolate (~85% protein)	-Well-developed with major investments across value chain -Low level of environmental impact	-Concerns over food safety as soy is generally a GMO -Reported to have allergenic and estrogenic effects	2.0
Plant-based (Pea protein)			
Sold as concentrate (~65% protein) or isolate (~85% protein)	-Low level of environmental impact -Non-GMO and non-allergenic -One of the cheapest alternative protein sources	-As processing peas for protein leads to high volume of by-product (i.e. starch), manufacturers have to find starch markets to make pea processing economics less vulnerable to pea price volatility	5.0
Microbial-based (Mycoprotein)			
A filamentous fungus, or mold, typically mixed with eggs, containing ~47% protein	-Higher fibre and lower fat content than meat -Experienced success in Europe and growing in the US	-Consumers are unfamiliar with the product and FDA requires labelling to include 'mold' that can affect consumer perception	13.0
Insects (Crickets)			
Sold as whole or milled as flour containing up to 25% protein	-Most efficient in conversion of feed into edible weight, and can be raised on low-value agricultural by-products	-Production is costlier than alternatives with higher-quality protein - Unfamiliar taste, texture and aroma requires further development	41.0
Cultured meat			
Aggregation of animal cells produced through tissue culture	-In the next decade, cultured meat should be cost competitive with conventional animal production systems	-Industry must overcome major technological challenges before it can become price competitive with conventional animal production systems	300.0

Source: McKinsey & Company (2019), OCBC

Soy and pea protein are the most competitively priced alternative protein types. Despite existing challenges, pea protein is expected to lead the alternative protein market in the short and medium term. The cultured meat industry has achieved much progress over the past half-decade and also has high potential for market growth, but has its own set of challenges e.g. recycling of culture media to produce cells.

2.2 Sustainable production of protein

Widespread adoption of alternative protein in global diets can bring environmental benefits. Emissions from the production of conventional animal protein (i.e. meat, poultry, dairy and growing crops to feed livestock) are substantial, accounting for more than half (57%) of food-related emissions. The transition to plant-based alternatives will save over 1 gigaton of CO₂e emissions by 2035. Compared to conventional animal-based protein, the production of plant-based alternatives emits 1/12 the CO₂e/kg of beef, 1/9 for pork, 1/8 for chicken and 1/3 for eggs.

By 2035, moving away from agricultural activities for the production of animal protein could save ~39 billion m³ of water, and free up 240,000 km² of land previously used for ranching. The land can be used for habitat restoration activities and contribute to increased carbon sequestration and biodiversity rehabilitation activities. The transition to alternative protein can contribute to several United Nations SDGs such as zero hunger, good health and well-being, responsible consumption and production, climate action and life on land.

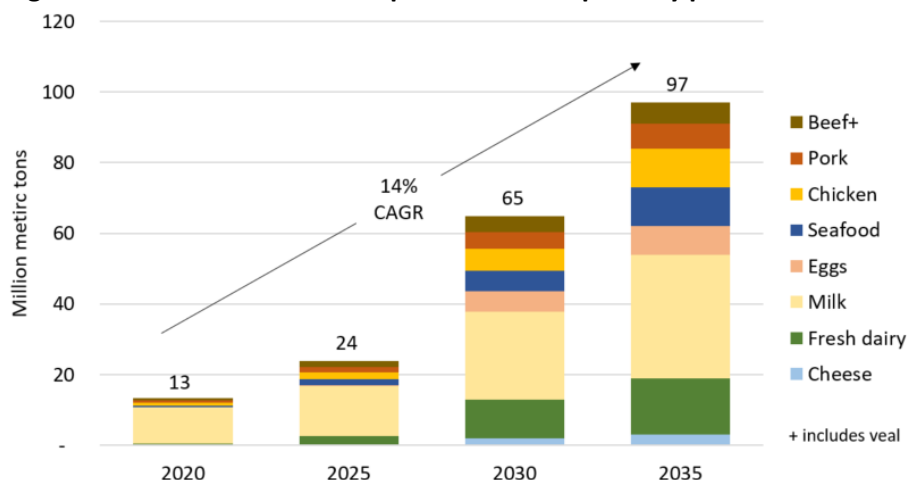
3. Industry growth and market trends

3.1 Market for alternative protein products and growth

The market for alternative protein is still nascent with 13 million metric tons consumed globally in 2020 (2% of animal protein market), currently valued at US\$29.4 billion from primary markets in North America, Europe and Asia. It is estimated that alternative protein consumption will expand by approximately seven times to 97 million metric tons by 2035, accounting for 11% of the overall protein market. The alternative protein revenues are anticipated to reach US\$290 billion in 2035, distributed throughout the value chain.

Figure 1 shows the proportion of alternative protein products and their growth rates through 2035. Milk alternatives (e.g. oat milk, almond milk) are alternative protein products that are most widely consumed at present, and are likely to account for the largest proportion of the market through 2035 (~36%). The market for meat alternatives such as chicken and seafood are also expected to increase quickly from 2030 to 2035.

Figure 1: Growth of alternative protein consumption by products.



	CAGR 2020 – 2025	CAGR 2025 – 2030	CAGR 2030 – 2035
Beef	19%	21%	6%
Pork	22%	27%	8%
Chicken	20%	26%	12%
Seafood	22%	28%	14%
Eggs	68%	79%	7%
Milk	7%	12%	7%
Fresh dairy	36%	36%	8%
Cheese	40%	50%	8%
Total	13%	22%	8%

Source: US Department of Agriculture, Euromonitor, UBS, ING, Good Food Institute, expert interviews, Blue Horizon, BCG, OCBC

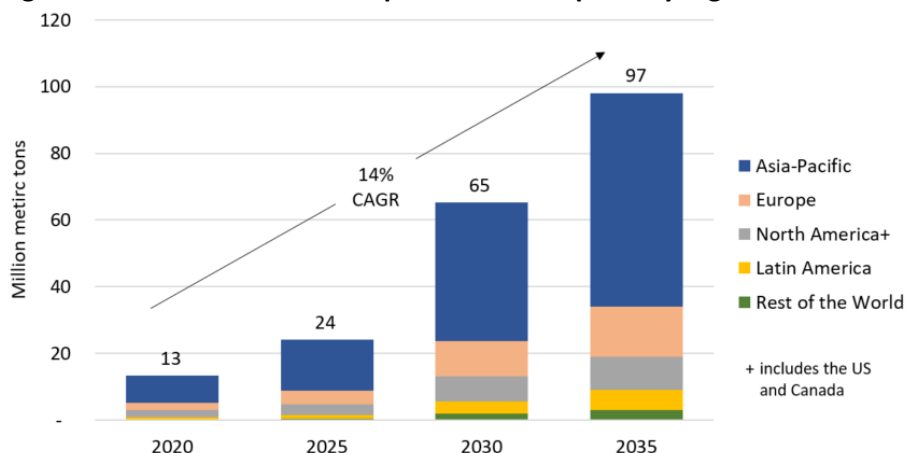
3.2 Regional market and growth

Asia Pacific is the largest market for alternative protein (~61% in 2020) and will continue to grow at the fastest rate. This is driven by a large, growing and increasingly wealthy population that is consuming greater volumes of protein. The region is anticipated to account for ~66% of global alternative protein consumption in 2035. As the sector continues to grow, proper regulation of the production, labelling and commercialisation of alternative protein products is improving. More new and existing companies in key Asian markets are entering the alternative protein space, as well as increased collaborations with other ecosystem players. Other alternative protein companies headquartered abroad have also anchored in key Asian markets to develop research capabilities, trial flavours for Asian markets and expand their business globally.

The most mature regional markets for alternative protein are North America (the US and Canada) and Europe, and both are expected to continue growing because of increasingly climate-conscious and health-conscious consumers.

Figure 2 shows the regional growth of alternative protein consumption through 2035.

Figure 2: Growth of alternative protein consumption by region.



	CAGR 2020 – 2025	CAGR 2025 – 2030	CAGR 2030 – 2035
Asia-Pacific	14%	22%	9%
Europe	12%	22%	7%
North America	9%	17%	6%
Latin America	12%	31%	10%
Rest of the World	12%	31%	10%
Total	13%	22%	8%

Source: US Department of Agriculture, Euromonitor, UBS, ING, Good Food Institute, expert interviews, Blue Horizon, BCG, OCBC

3.3 Protein substitutes for popular global dishes

Many popular dishes globally could have economical alternative protein substitutes by 2025, especially those with less structured meat e.g. ground chicken or beef. It is expected that viable alternatives will eventually be found for all egg and dairy products, as well as most structured meat and fish e.g. fillets. This could happen when alternative protein reaches parity with animal proteins in three key areas:

- Taste: Substitutes must imitate the familiar flavours and smells of conventional products e.g. meat, seafood.
- Consistency: Substitutes must have the same appearance and consistency as animal protein. For example, alternative eggs and dairy will be better perceived if they behave like real eggs and dairy when cooked.

- Price: Most alternative protein is currently priced at a premium compared to animal proteins. The price of alternative protein must match or be lower than conventional products to be more widely accepted by consumers.

Structured meat such as brisket and steak with marbling are the least likely to be replaced at parity by 2035. Table 2 shows some popular protein-based dishes from different regions and the timeline at which the alternative protein dishes can reach taste, consistency and price parity with the conventional dishes.

Table 2: Some conventional protein-based dishes by region and corresponding alternatives’ timeline to reach parity with conventional products.

Asia-Pacific	Europe	North America	Latin America
Sushi	Pizza	Lasagne	Ceviche
Ramen	Sandwiches	Burritos	Feijoada
Dim sum	Pasta	Honey-baked ham	Asado
Dumplings	Steak with fries	Beef brisket	Churrasco
Kimchi	Roast	Quesadilla	Alfajor

■ Parity by 2025 (e.g. ground meat)
 ■ Parity by 2035 (e.g. structured meat)
 ■ Not or only partially replaceable by 2035 (e.g. highly structured meat)

Source: YouGov, Statistica, TasteAtlas, Blue Horizon, BCG, OCBC

4. Challenges to growth

In this new and growing market, investors may have to navigate through challenges in the following areas by having adequate technological understanding and ability to build a balanced portfolio:

- Consumer acceptance: Consumers’ interest to adopt alternative protein in their diets may be impaired by concerns on food health and safety, if regulation is not sufficiently strong as a result of excessive regulatory hurdles. Investors can support initiatives that connect alternative protein companies with researchers and regulators to provide consumers with safe and properly labelled products.
- Competing and new technologies: At present, several different technologies are being developed and piloted for alternative protein production e.g. stem cells vis-à-vis other cell types for cultured meat production. There may also be technological disruption when the industry is transformed by new technologies that may reduce the unit costs for protein. Investors may face challenges in identifying the success of various technologies, and may need to gain deep knowledge and develop a broad portfolio of technologies.

5. Opportunities for investments across the supply chain

To contribute to a sustainable food system and meet the increasing demand of alternative protein, investors can participate in the sustainable evolution of protein through investments in the supply chain. Some areas where investments are required are as follows:

- Pea protein production: While pea protein is expected to lead the alternative protein market in the short to medium term, it faces some challenges that may require more investments to overcome. The industry saw a limited supply of pea protein in recent years caused by insufficient processing capacity and doubling of pea protein prices. Another challenge faced by pea protein producers is producing a quality product with a minimal taste and colour profile. Investments in improved processing facilities and technologies may encourage consistency in pea protein supply and capture market share.
- Protein innovation: Investing in protein innovation is necessary to overcome criticisms of plant-based meat not meeting protein demand as much as animal-based meat e.g. developing pea varieties with higher pea content (pea starch comprises 60% of current pea volumes). Technologies include AI and computational breeding that produce seeds of premium characteristics such as higher protein content and nutritional value.
- Protein texturization capacity: Texture is an important factor for alternative protein to reach parity with conventional animal-based protein. Proper texturization of some plant-based meat continues to be a bottleneck in industry growth, as consumers are unlikely to transition to plant-based substitutes if their appearance and consistency are not the same as the animal-based products. As the experimentation of texturizing techniques can be capital intensive, investments in perfecting the texture of plant-based meat can accelerate the growth in the alternative protein sector because of higher consumer acceptance.
- Production capabilities: While there is significant headroom for consumer-packaged goods (CPG) companies and food manufacturers in the alternative protein sector, many do not have the required production capabilities to capture market opportunities. For these companies to increase market share in the long run, they may need to invest in capabilities to manufacture promising alternative protein products. A barrier to entry that requires large investment is the development of a supply chain. Collaborations with other key stakeholders like food manufacturers and research institutions may create economies of scale.

6. Summary

The strong growth in the alternative protein subsector is driven by increased consumer interest in health, climate change, animal welfare and food security. The transition to alternative protein is likely to bring benefits such as healthier diets, lower greenhouse gas emissions and more land available for carbon sequestration activities. By 2035, alternative proteins will likely capture 11% of the global protein market, and alternative protein consumption is estimated to be seven times of current levels. Asia Pacific is anticipated to be the largest and fastest-growing market, and is expected to account for approximately two-thirds of global alternative protein consumption in 2035.

The industry's growth is dependent on the ability of alternative protein types (e.g. plant-based, microbial-based, cultured meat) to reach taste, consistency and price parity with conventional animal protein. This would require continued technological advancements and innovation in the industry, through greater investments in areas such as pea protein production, protein innovation, protein texturization capacity and production plant capabilities.

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