

Agriculture Practice

# Alternative proteins: The race for market share is on

Consumer interest in non-meat-based protein options is increasing globally. Food industry players that want to capture the opportunity must understand the evolving market dynamics and where to place their bets.

*by Zafer Bashi, Ryan McCullough, Liane Ong, and Miguel Ramirez*



In countries with economic wealth, there is growing consumer awareness of, and interest in, alternative proteins. Meat has been the main source of protein in developed markets for years, and there has been an increased appetite for traditional protein in developing markets in recent years. However, changing consumer behavior and interest in alternative-protein sources—due in part to health and environmental concerns as well as animal welfare—have made way for growth in the alternative-proteins market.

Several entrants in the alternative-protein space are already rolling out new technologies and ingredients, and some are attempting to solidify their place in the market. Innovative food companies are able to mirror the customer experience of eating meat to a much higher degree. This is paralleled with strong social media marketing campaigns to gain traction for their products. Beyond Meat recently had a high-performing IPO, which signaled to investors that there is opportunity ahead in the alternative-proteins market.<sup>1</sup> And numerous fast-food chains announced deals with alternative-protein producers to offer vegetarian options of popular menu items.<sup>2</sup>

This emerging shift could explain why even though aggregate consumption of meat-based proteins worldwide is increasing, the overall growth rate is expected to decline by half.<sup>3</sup> Plant-based food (the largest source of alternative protein) sales rose 17 percent in 2018<sup>4</sup> and the use of alternative protein as a food ingredient in consumer products is predicted to continue growing. Currently, the market base for alternative protein is approximately \$2.2 billion compared with a global meat market of approximately \$1.7 trillion,<sup>5</sup> making the growth rate of the alternative proteins marginal to the overall meat market. While there is significant headroom for consumer-packaged goods (CPG) companies and food manufacturers in the alternative proteins market, many don't have the necessary production

capabilities to capture this market opportunity, nor do they know where to focus their efforts.

In response to these market forces and consumer concerns, industry leaders are rolling out a range of products and ingredients using different plant-based proteins (soy, pea), new animal sources (insects), and biotechnological innovations (cultured meat or fungal protein). In fact, a 2015 McKinsey survey of dairy-industry professionals showed that 21 percent of respondents believe the nondairy alternatives market, including plant protein, is "sizable and will continue to grow."<sup>6</sup>

For CPG companies and food manufacturers to win market share in this fast-growing segment over the long term, they must invest in the capabilities required to develop and manufacture the most promising alternative-protein products.

## Evolving consumer and market trends

Interest in alternative protein grew gradually up to and including 2007, only accelerating over the past decade. Several factors contributed to this evolution: increased consumer interest in health, price, and ethical considerations (such as where meat is sourced from and animal welfare) around different types of protein. Global populations and ethnic communities vary significantly in the amount and types of meat consumed. In the Middle East and much of Asia-Pacific, for example, most protein comes from legumes and seafood,<sup>7</sup> while Chinese consumers mainly rely on beef, pork, and poultry. In China, approximately 50 percent of animal protein calories come from pork, compared with the Middle East, which reports minimal protein calories coming from pork but nearly 50 percent from dairy and eggs.<sup>8</sup>

An analysis of consumer search queries found that the most popular food-and-beverage product search was for vegan products, with a 16 percent

<sup>1</sup> Mike Murphy, "Beyond Meat soars 163% in biggest-popping U.S. IPO since 2000," *MarketWatch*, May 5, 2019, marketwatch.com.

<sup>2</sup> Nathaniel Popper, "Behold the beefless 'Impossible Whopper,'" *New York Times*, April 1, 2019, nytimes.com; and Sigal Samuel, "Del Taco's newest 'meat' taco is 100% meatless," *Vox*, April 15, 2019, vox.com.

<sup>3</sup> Justin Ahmed, Jeffrey Lorch, Liane Ong, and Jay Wolfgram, "How the global supply landscape for meat protein will evolve," October 2018, McKinsey.com.

<sup>4</sup> "Plant-based market overview," The Good Food Institute, 2018, gfi.org.

<sup>5</sup> Food and Agriculture Organization of the United Nations, June 3, 2019, fao.org.

<sup>6</sup> "A winning growth formula for dairy: Perspectives from McKinsey & Company," International Dairy Foods Association, January 23, 2019, idfa.org.

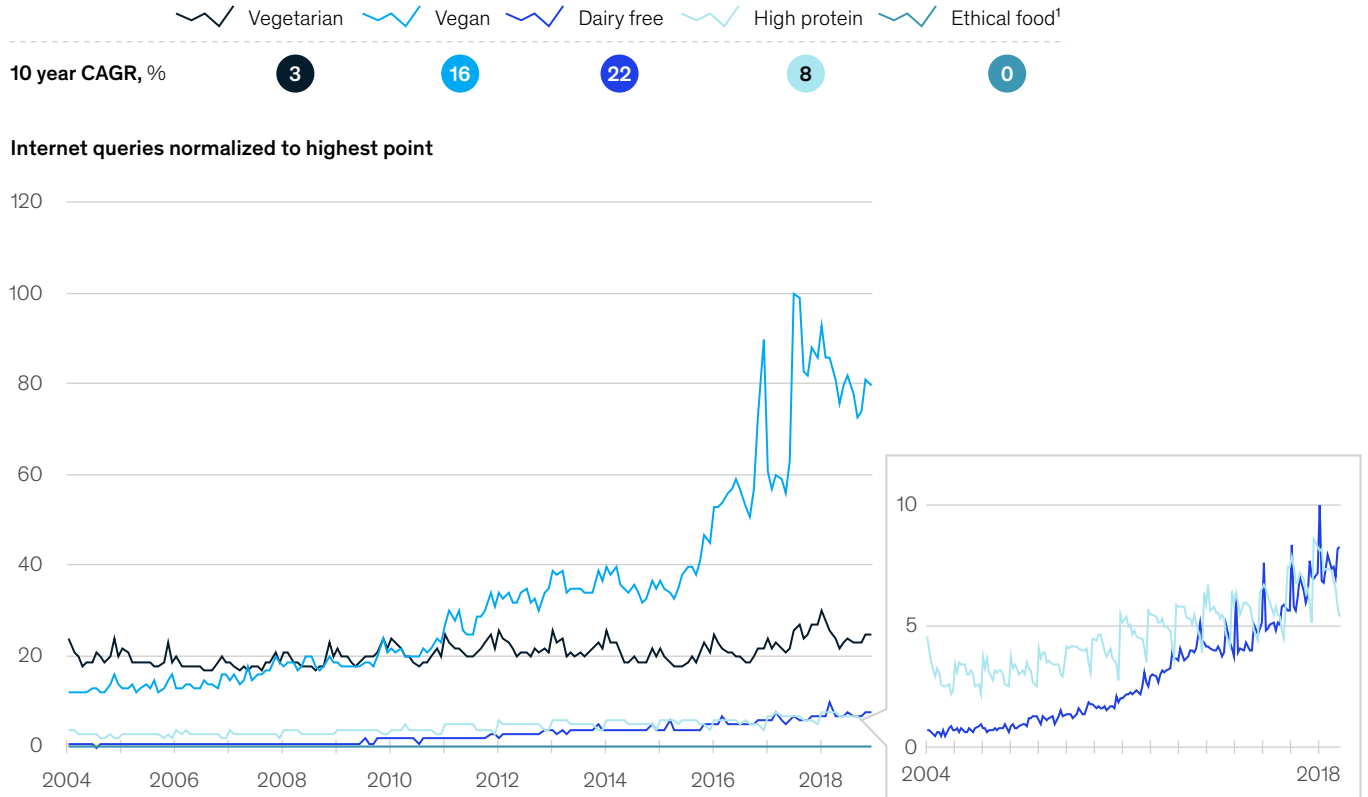
<sup>7</sup> Ahmed, Lorch, Ong, and Wolfgram, "How the global supply landscape for meat protein will evolve"; OECD and FAO, *OECD-FAO Agricultural Outlook 2012–2021*, eighteenth edition, Paris, France: OECD Publishing and FAO, 2012; and World Bank, *World development indicators 2012 (English)*, World Bank, April 2012, documents.worldbank.org.

<sup>8</sup> Ahmed, Lorch, Ong, and Wolfgram, "How the global supply landscape for meat protein will evolve."

Exhibit 1

**Customer interests in alternative protein diets have evolved over the past 15 years.**

**Interest in different protein diets, 2004–19**



<sup>1</sup> "Ethical" means producers do not contribute to animal cruelty.  
Source: Google Trends

compound annual growth rate (CAGR). Dairy-free products (products free of milk proteins) drew increasing consumer interest, growing at a 22 percent CAGR (Exhibit 1). These findings are consistent with McKinsey's 2018 Dairy Survey, which revealed that 73 percent of millennials and members of Generation Z reported purchasing a dairy-free alternative in the past 12 months.<sup>9</sup>

In general, protein consumption has grown slowly in developed markets, while demand in developing markets is increasing more rapidly.<sup>10</sup> As countries

experience rising income levels and urbanization, for example, the demand for protein increases, whereas in developed markets protein consumption is a matter of market maturity. US residents, for example, consume almost twice the amount of beef protein compared with the global average.<sup>11</sup> It is therefore likely that traditional protein consumption in the United States will continue to be robust and may include both conventional and alternative-protein products. However, consumer views on protein are shifting; the 2018 McKinsey dairy survey found

<sup>9</sup> McKinsey 2018 Dairy Survey, December 2018, McKinsey.com.  
<sup>10</sup> Mark Fenelon et al., "Future Protein Supply and Demand: Strategies and Factors Influencing a Sustainable Equilibrium," *Foods*, July 20, 2017, Volume 6, Number 7, p. 53, ncbi.nlm.nih.gov.  
<sup>11</sup> Patrice Dumas et al., *Shifting diets for a sustainable food future*, World Resources Institute working paper, 11, Creating a Sustainable Food Future, April 2016, wriorg.s3.amazonaws.com.

that 82 percent of respondents rated plant protein as healthy, and 74 percent viewed animal protein as such.<sup>12</sup>

Food manufacturers are taking note of shifting consumer interests. The share of new products released with a protein claim grew from 2 percent to more than 5 percent from 2007 to 2016 (Exhibit 2). In addition, there was a surge in released products touted as vegan,<sup>13</sup> dairy free, and ethical (meaning producers do not contribute to animal cruelty). As new trends grow, the landscape becomes more competitive with the presence of additional products.

### Leading alternative-protein sources

Alternatives are protein-rich ingredients sourced from plants, insects, fungi, or through tissue culture to replace conventional animal-based sources

(Exhibit 3). Four alternative-protein profiles offer promising opportunities for CPG companies:

**Plant protein:** This type of protein is the most well established and is derived from protein-rich seeds through dry or wet fractionation.<sup>14</sup> The most popular types for consumers are soy, followed by pea and several niche types, such as chickpea, rapeseed, and lupin, among others.

**Insect:** Crickets are the most common source of edible insects and a good source of protein. In fact, some producers are already milling crickets for flour. However, it is currently cost prohibitive to isolate protein from the flour as the cost of the crickets is high, making the process difficult to scale. Food producers are also exploring using grasshoppers as an edible insect source, but development is still in an

<sup>12</sup>McKinsey 2018 Dairy Survey.

<sup>13</sup>A vegetarian diet excludes meat and mainly consists of vegetables, fruits, grains, nuts, and sometimes eggs or dairy products. A vegan diet is solely plant based with no animal products—not even eggs or dairy products.

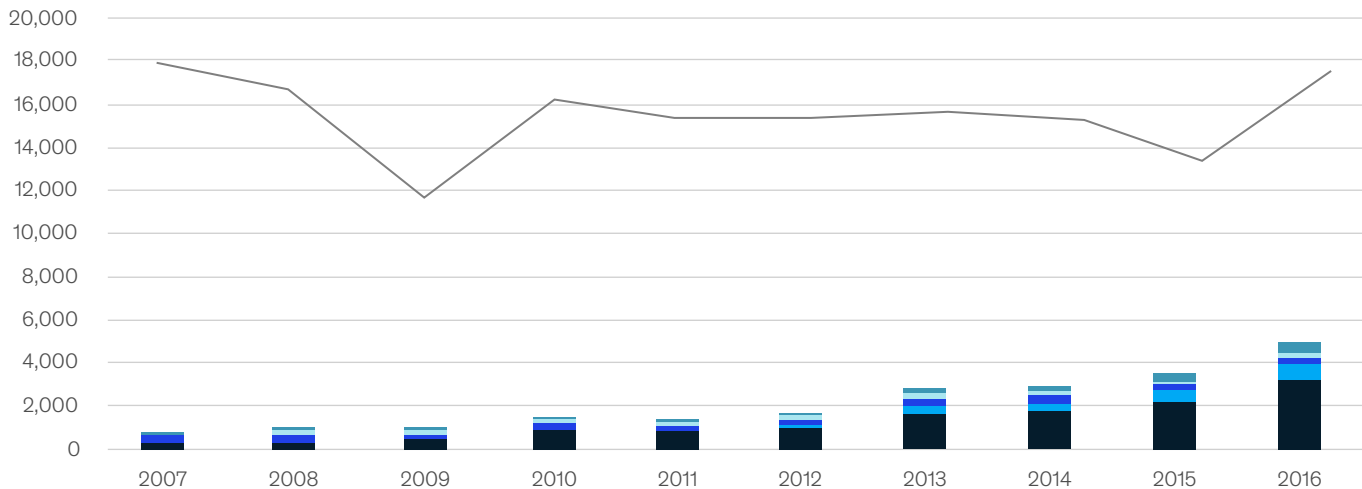
<sup>14</sup>This is the process whereby a specific amount or quantity of a mixture is broken down into different “fractions,” which helps food producers isolate the protein component of a food substance.

Exhibit 2

## New product releases in the alternative-protein categories have evolved to address customer interests.

— Total product release ■ Vegan and no animal ingredients ■ Dairy free ■ Vegetarian ■ High protein ■ Ethical

### New product release with relevant protein claim



Note: Vegan (contains no animal ingredients or byproducts); high protein (any product whether it's plants, insects, fungi, or meat that contains a high protein claim); dairy free (product free of dairy but may include other animal-based ingredients); vegetarian (product free of meat and fish but may use dairy-based ingredients); and ethical (concerned with animal welfare).

Source: Mintel

early stage.<sup>15</sup> Other insects are more commonly used for the feed industry. Ynsect uses mealworm, while Protix uses black soldier flies.

**Mycoprotein:** This protein source is typically composed of whole, unprocessed, filamentous fungal biomass, commonly known as mold. It has been around since the 1980s and is produced through fermentation of biological feedstock. Fungi contain approximately 40 percent protein, are high in fiber, have limited carbohydrates, and contain no cholesterol.

**Cultured meat:** Scientists have been working on this protein since 2013, when the first lab-grown burger made its public debut.<sup>16</sup> Cultured meat is made using tissue-culture technology (the process by which animal cells are regenerated using a single cell as the source) to propagate animal cells in vitro. This

process creates muscle tissue that mimics animal muscles and has the same protein profile.

Based on an analysis of search query data, consumer interest remains flat around mycoprotein and edible insects. Soy protein, which was an early leader in alternative protein, has declined by a CAGR of 6 percent. This trend is due in part to the development of other production options (such as pea protein) and concerns over allergenic and estrogenic effects from the soybean. However, recent studies have shown that these concerns are limited to only a small percentage of the public.<sup>17</sup> In contrast, interest in cultured meat had a 16 percent CAGR, and interest in pea protein grew at a CAGR of 30 percent from 2004 to 2019 (Exhibit 3). This growth signals that consumers are interested in protein sources that are consistent with a plant-based diet.

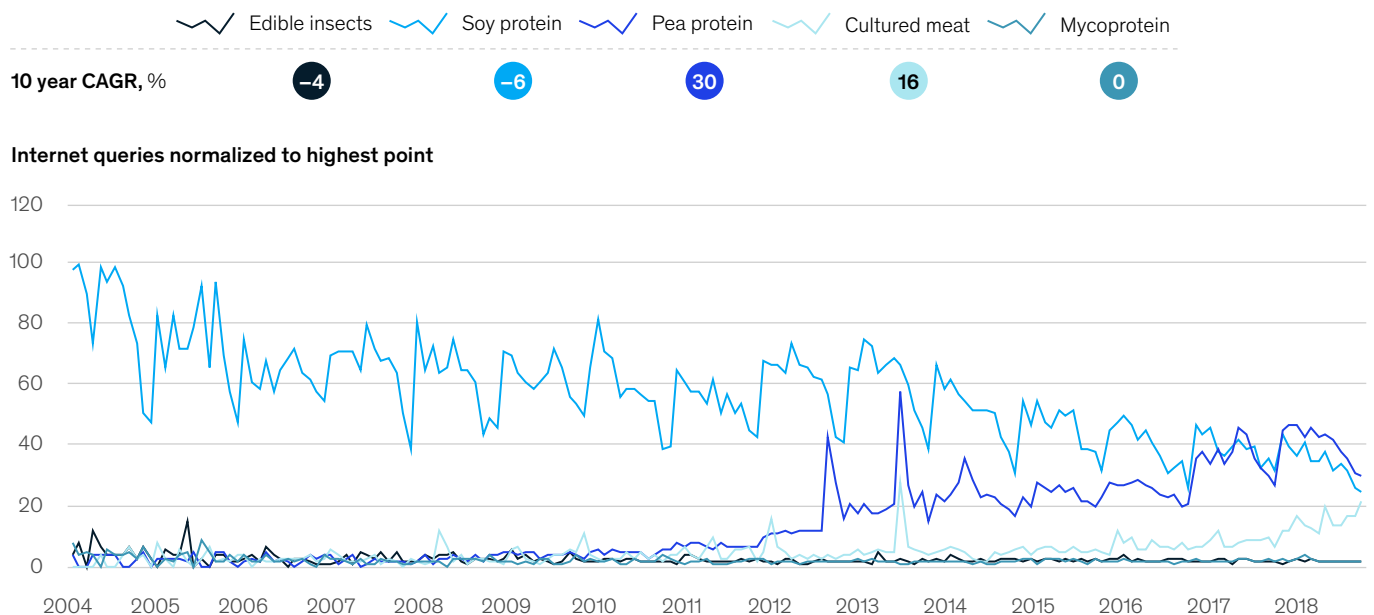
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<sup>15</sup>Elaine Watson, "Grasshoppers, not crickets, will drive the edible insect revolution, says Hargol Foodtech," *Food Navigator*, April 12, 2019, foodnavigator-usa.com.  
<sup>16</sup>G. Owen Schaefer, "Lab-grown meat," *Scientific American*, September 14, 2018, scientificamerican.com; and Pallab Ghosh, "World's first lab-grown burger is eaten in London," *BBC*, August 5, 2013, bbc.com.  
<sup>17</sup>The Nutrition Source, "Straight talk about Soy," Harvard T.H. Chan School of Public Health, May 30, 2019, hsph.harvard.edu.

Exhibit 3

## Consumer interest in soy protein declined over a 15-year period, while interest in pea protein is growing.


Interest in different alternative proteins, 2004–19




Source: Google Trends

# Comparing alternative protein sources based on key consumer criteria for food selection reveals opportunities and challenges.


## Soy protein




**Product nature**  
Sold as concentrate containing around 65 percent protein or isolate containing 85 percent protein.



**Functionality**  
It has one of the highest scores on digestibility and amino acid balance for all alternative proteins and a neutral taste profile, making it a versatile ingredient.




**Competitive position**  
Soy is extremely well developed, with major investments across its value chain from farm to fork. It has one of the lowest levels of environmental impact as a nitrogen-fixing crop and a low price point.<sup>1</sup> All of these factors make soy the highest-value alternative protein.




**Challenges**  
Soy is generally a GMO, so perceptions may be affected by the broader consumer debate about the safety of GMOs. In addition, soy is reported to have allergenic and estrogenic effects, though a recent review of the literature shows that any negative effects are very limited.<sup>2</sup>

Safety perception	\$/kg, 100% protein
Concern over estrogenic effect or GMO	<b>2.0</b>
Taste	
Clean taste; versatile ingredient	
Protein digestibility-corrected amino acid score	Perceived animal welfare
<b>0.96<sup>3</sup></b>	N/A
Environmental impact	Novelty
LOW	>10 years on the market


## Pea protein




**Product nature**  
Sold either as a concentrate 65 percent prepared through dry fractionation or an isolate at 85 percent protein through wet fractionation, which could be functional or denatured protein depending on the process.



**Functionality**  
Its minimal beany flavor makes it versatile, but it has a lower score than soy on amino acid balance and digestibility.



**Competitive position**  
Coming from a nitrogen-fixing legume, pea protein has one of the lowest levels of environmental impact.<sup>4</sup> In addition, it is one of the cheapest alternative protein sources and also gets points with consumers for safety, as it is non-GMO and nonallergenic. The industry has seen a spike in patent filing on pea protein by 15 percent CAGR since 2009, while soy declined by 2 percent over the same period, signaling growing interest.



**Challenges**  
Peas contain approximately 24 percent protein. Processing them for protein leads to a high volume of by-product, mainly starch, therefore manufacturers must find a specialty starch market to make pea processing economics less vulnerable to pea price volatility. Current markets include vermicelli noodles, thickening agents, and batter.

Safety perception	\$/kg, 100% protein
Non-GMO, nonallergenic, and very safe	<b>5.0</b>
Taste	
Slight beany taste must be masked	
Protein digestibility-corrected amino acid score	Perceived animal welfare
<b>0.72<sup>5</sup></b>	N/A
Environmental impact	Novelty
LOW	>10 years on the market

## Insect protein; 'crickets'



### Product nature

Sold as whole or milled as flour containing up to 25 percent protein;<sup>6</sup> no protein isolate is currently available in large scale.



### Functionality

The flour has a distinct texture, appearance, and aroma that creates challenges in product formulation.<sup>7</sup> The protein also has a low digestibility and amino acid balance score.



### Competitive position

Insect protein is the most efficient in conversion of feed into edible weight, requiring 2.3 kilograms of feed to 1.0 kilogram of live animal weight and can be raised on low-value agricultural by-products.<sup>8</sup> Chicken (2.3 kilograms), pork (5.0 kilograms), and beef (8.8 kilograms) all call for significantly more feed.<sup>9</sup>



### Challenges

Production is currently costlier (\$4 to \$5 a pound) than alternatives with higher-quality protein, such as poultry, dairy, and beef. To be competitive, insect protein would need to be ~\$2 a pound.<sup>10</sup> Furthermore, the taste is a barrier for adoption.

#### Safety perception

Potentially allergenic

#### \$/kg, 100% protein

**41.0**

#### Taste

Unfamiliar taste, texture, and aroma requires extensive development

#### Protein digestibility-corrected amino acid score

**0.73**<sup>11</sup>

#### Perceived animal welfare

Acceptable

#### Environmental impact

Low

#### Novelty

>5 years on the market

## Mycoprotein



### Product nature

A filamentous fungus, or mold, that is processed in its whole form typically without going through protein extraction. It contains approximately 47 percent protein and has a high digestibility and amino acid balance score.



### Functionality

Mycoprotein is typically mixed with eggs to achieve a meat-like texture. Its neutral aromatic and flavor profile allows it to be a versatile ingredient.



### Competitive position

Mycoprotein has higher fiber and a lower fat content than meat. It has experienced relative success in Europe and is growing in the US market. The food industry is selecting new strains and using gene-editing technology to improve performance. Traditionally, mycoprotein has been produced using glucose, a relatively costly feedstock. Start-ups are working on changing the feedstock to reduce production costs.



### Challenges

Consumers are unfamiliar with mycoprotein, and a recent legal settlement required labeling to explicitly include the term "mold," which negatively affects consumer perception and could impede its growth.

#### Safety perception

FDA requires mold labeling due to lawsuit

#### \$/kg, 100% protein

**13.0**

#### Taste

Currently mixed with egg and frozen to mimic meat texture

#### Protein digestibility-corrected amino acid score

**1.0**<sup>12</sup>

#### Perceived animal welfare

N/A

#### Environmental impact

Medium

#### Novelty

>5 years on the market



## Cultured meat



### Product nature

An aggregation of animal cells produced through tissue culture. Current production techniques seek to mimic animal muscle architecture and fat content and subsequently meat texture and flavor.



### Functionality

Cultured meat scores high on digestibility, amino acid balance, and taste. Ground beef is expected to be the initial product offered.



### Competitive position

Cultured meat is currently not available for purchase, but over the next five years it is predicted to reach the high-end market through specialty restaurants. In the next ten years, it should be cost competitive with conventional animal production systems.



### Challenges

The industry must overcome major technological challenges before it can hope to become price competitive with conventional animal production systems. The electric energy consumed when producing cultured meat is the main contributor to the environmental impact. The barrier to entry is high for food producers as this technology is still in the development stage and substantial investment in infrastructure and expertise is required.

#### Safety perception

Complex technology perceived cautiously

#### \$/kg, 100% protein

**300.0**

#### Taste

Requires texture development and fat cell inclusion to mimic animal meat

#### Protein digestibility-corrected amino acid score

**0.92**<sup>13</sup>

#### Perceived animal welfare

Acceptable

#### Environmental impact

High

#### Novelty

Not available

## Whey protein



### Product nature

A protein derived from dairy products, it has a high digestibility and amino acid balance score.



### Functionality

Whey's neutral flavor profile means that it can be included in a range of products without altering taste and functionality.



### Competitive position

Whey falls in the middle of other proteins by cost, and it is well established and accepted by consumers in the market.



### Challenges

Whey has faced competition from the dairy-free industry, which is typically supported by consumers who desire to be healthier and more environmentally conscious.

#### Safety perception

Very safe

#### \$/kg, 100% protein

**7.5**

#### Taste

Clean taste; excellent functionality in beverages

#### Protein digestibility-corrected amino acid score

**1.0**<sup>14</sup>

#### Perceived animal welfare

Consumer concerns

#### Environmental impact

Medium

#### Novelty

>10 years on the market



### *The value that each protein offers is a function of price and nutrition*

Exhibit 5 showcases the viability of certain protein sources as measured by price per kilogram and protein digestibility-corrected amino acid score (PDCAAS)—a tool used to measure a protein by its amino acid requirements and the ability of humans to digest it. Soy and pea protein are leaders by price, while cultured meat and cricket powder are not yet economically viable on a large scale.

### **Where is the opportunity for alternative protein?**

In general, pea protein and cultured meat show the most promise for market growth over the coming five to ten years, and plants are expected to be the largest source of alternative protein due to their limited environmental impact and healthy perception by customers. The economics of plant protein production are also advantageous because it avoids the feed-to-food conversion loss typical of other protein forms. For example, insect protein loss ratio is the lowest among animal protein at 1.7 to 1.0 and it is still higher than plant protein. Producers may need to balance plant-protein nutritional

profiles with additional amino acids to make them competitive with the amino acid profile in animal proteins.<sup>18</sup>

However, with the projected growth of meat consumption in major developed markets, such as China, animal protein will likely maintain a significant market share. This type of protein has advantages: poultry, pork, and dairy-based proteins are relatively efficient in feed conversion compared with traditional meat protein (though not as efficient as plant-based proteins) and offer products and tastes that are familiar to most consumers. Nonetheless, producers should not discount alternative proteins, as they do have the potential to capture a share of the growing protein market.

#### **Pea protein**

Pea protein is expected to lead the alternative-protein market in the short and medium term, though the product does face certain challenges.

The past few years witnessed a limited supply of pea protein caused by a shortage in processing capacity. Processors responded and announced

<sup>18</sup> Avik Basu, Leeann, L. Fu, and Peter J. Woolf, "vProtein: identifying optimal amino acid complements from plant-based foods," *PLoS ONE*, 2011, Volume 6, Number 4, ncbi.nlm.nih.gov.

#### **Scorecard endnotes**


Note: Prices are based on industry interviews at the time of writing this article.

- <sup>1</sup> A nitrogen-fixing crop is one whose roots are populated by bacteria through the process of extracting nitrogen from the air and converting it into a form it can use to help its growth. In short, the plant and the bacteria have a symbiotic relationship.
- <sup>2</sup> The Nutrition Source, "Straight talk about Soy."
- <sup>3</sup> Glenna Hughes, et al., "Protein digestibility-corrected amino acid scores (PDCAAS) for soy protein isolates and concentrate: criteria for evaluation," *The Journal of Agricultural and Food Chemistry*, 2011, Volume 59, Number 23, pp.12707–12, ncbi.nlm.nih.gov.
- <sup>4</sup> Volker Heinz et al., "Meat alternatives: life cycle assessment of most known meat substitutes," *The International Journal of Life Cycle Assessment*, 2015, Volume 20, Number 9, pp. 1254–67, link.springer.com.
- <sup>5</sup> The protein digestibility-corrected amino acid score for pea protein is an average score based on the following two studies referenced. The score is also influenced by the type of protein fractionation process used. Shane Rutherford, et al., "Protein Digestibility-Corrected Amino Acid Scores and Digestible Indispensable Amino Acid Scores Differentially Describe Protein Quality in Growing Male Rats [1–3]," *The Journal of Nutrition*, November 2014, Volume 145, pp. 372–9, academic.oup.com; "Protein quality of cooked pulses," *Pulse Canada*, 2016, pulsecanada.com.
- <sup>6</sup> Arnold van Huis et al., *Edible insects: future prospects for food and feed security*, Food and Agriculture Organization of the United Nations, 2013, fao.org.
- <sup>7</sup> Amy Zhong, *Product development considerations for a nutrient rich bar using cricket (Acheta domesticus) protein*, California State University Department of Family and Consumer Sciences, May 2017, search.proquest.com.
- <sup>8</sup> Dennis G. A. B. Oonincx et al., "Feed conversion, survival and development, and composition of four insect species on diets composed of food by-products," *PLoS ONE*, 2015, Volume 10, Number 12, pp. 1–20, journals.plos.org.
- <sup>9</sup> Huis et al., *Edible insects*; J. Mike Wilkinson, "Re-defining efficiency of feed use by livestock," *International Journal of Animal Biosciences*, Volume 5, Number 7, 2011, pp. 1014–22, cambridge.org.
- <sup>10</sup> Adele Peters, "Lab-grown meat is getting cheap enough for anyone to buy," *Fast Company*, May 5, 2018, fastcompany.com; Elaine Watson, "Grasshoppers,"; and Huis et al., *Edible insects*; Morales-Ramos, *Mass Production of Beneficial Organisms*, first edition, Oxford, UK: Elsevier, 2014.
- <sup>11</sup> Florence Oibiokpa, et al., "Protein quality of four indigenous edible insect species in Nigeria," *Food Science and Human Wellness*, June 2018, Volume 7, Number 2, pp. 175–83, sciencedirect.com.
- <sup>12</sup> D. G. Edwards and J. H. Cummings, "The protein quality myth of mycoprotein," *Proceedings of the Nutrition Society*, 2010, Volume 69, cambridge.org.
- <sup>13</sup> Gertjan Schaafsma, "The protein digestibility-corrected amino acid score," *The Journal of Nutrition*, 2000, Volume 130, Number 7, pp. 1865S–7S, academic.oup.com.
- <sup>14</sup> Schaafsma, "The protein digestibility-corrected amino acid score," 1865S–7S.

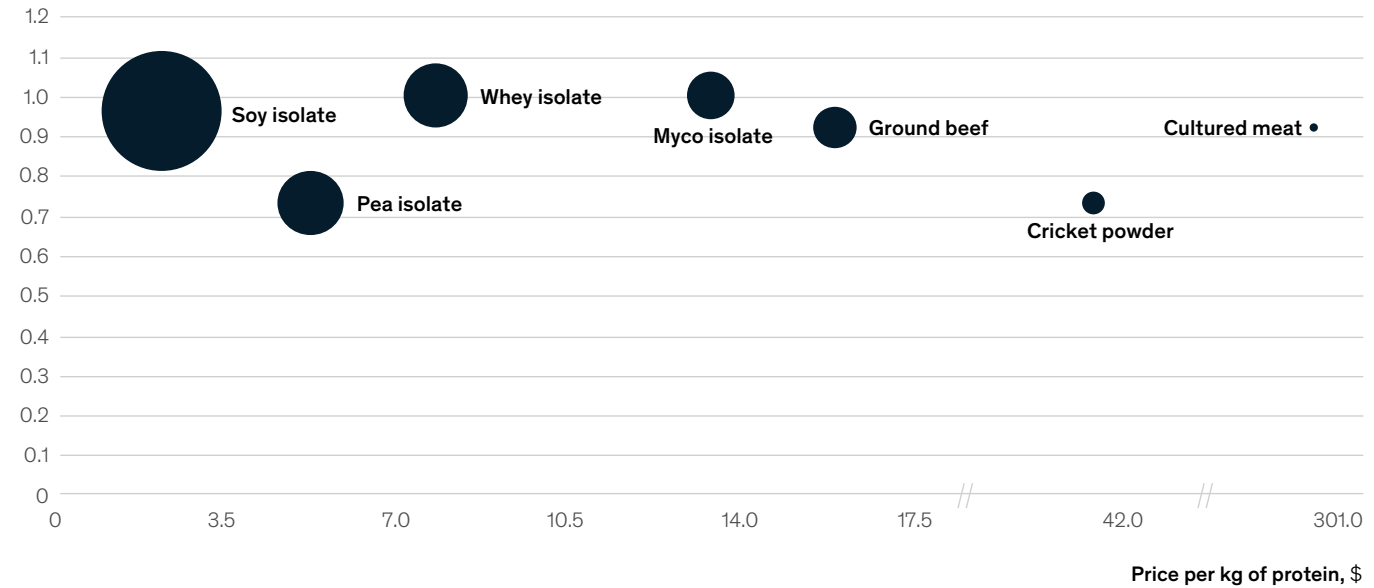
Exhibit 5

**Soy and pea protein are the most competitively priced alternative proteins.**

**Protein alternatives price vs PDCAAS**

 Bubble size represents PDCAAS per price, 8

**Protein digestibility-corrected amino acid score**



Source: *Dietary protein quality evaluation in human nutrition: Report of an FAO Expert Consultation*, Food and Agriculture Organization, Food and Nutrition paper, number 92, March/April 2011, fao.org.

additional capacity: Roquette announced a \$400 million project in Manitoba, while Archer Daniels Midland announced its own facility in North Dakota. For production to be economically feasible, food developers must identify a high-value application for pea starch, which makes up 60 percent of the pea volume but is not used in pea protein-based products. If the protein is sold but not the starch, or if the starch is sold at a low price point, then it becomes difficult for the process to be economically feasible. Thus, producers could make a profit by selling this protein if they don't lose money on the starch. Producers of mainstream products such as veggie burgers who rely on soybean protein are likely to enjoy lower input cost and more stable feedstock supply. However, high-end products will likely use pea protein to cater to consumer expectations of a niche ingredient, which is a product that touts health claims and is on sale at a premium price.

Companies aiming to break into the pea-protein market should focus on producing a quality product with a minimal taste and color profile—a current challenge for producers. Improved processing technology and carefully developed pea protein sources will be critical to capturing market share. In fact, some industry players are already investing in an innovative seed technology to increase protein content.<sup>19</sup> The demand for pea protein is expected to continue growing; analysis of online search query data shows that pea protein experienced a 30 percent CAGR from 2004 to 2019, suggesting that investing in this protein alternative will be worth the effort.

**Cultured meat**

The cultured-meat industry is well positioned for the future, even with major technical challenges to overcome, including the difficulties in the development of an immortal cell line, the recycling

<sup>19</sup> "Roquette invests in Israeli seed breeding company Equinom," *Roquette*, October 17, 2018, roquette.com.

of culture media (the blood plasma used to produce the cells),<sup>20</sup> small molecules to replace growth factors, and different reactors of design. Major progress has been achieved over the past five years. The industry received backing from innovators (including Bill Gates and Richard Branson) as well as industry players (such as Tyson Foods and Cargill).<sup>21</sup>

However, the price of cultured meat has already decreased significantly in the past nine years (the first lab-grown hamburger cost \$325,200 in 2013 and then decreased to around \$11 in 2015; one company estimates that by 2020 costs will be about \$2.30 to \$4.50 a pound).<sup>22</sup> Industry leaders expect the product to enter the retail market in the next three to five years, with a preliminary introduction to consumers through high-end restaurants. However, the product may appeal to a limited segment mainly concerned with animal welfare and the environment rather than health, limiting the potential consumer market. If mass production is successful, this technology is best positioned to replace beef, since it is not as cost effective as conventional poultry production.

Animal protein will likely continue to dominate the market driven by key advantages such as customer familiarity. However, there is room at the table for plant-based products as evidenced by growing shifting customer concerns around traditional meat protein. Companies are already investing in alternative proteins technology and will continue to do so in the coming years. And players that can market high-end products made from soy protein are likely to capture the largest margins. For CPG companies to win market share in the long term, they must place their bets and invest in the capabilities needed to meet their marketing strategy and the target consumer segments. Overall, alternative proteins present an exciting development for the entire food industry.

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<sup>20</sup> Culture media is a medium used in microbiological laboratories to grow different types of microorganisms—the medium comprises sugars, salts, and amino acids.

<sup>21</sup> "Tyson Foods invests in cultured meat with stake in Memphis Meats," Tyson Foods, January 29, 2018, tysonfoods.com.

<sup>22</sup> Peters, "Lab-grown meat."

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