





# Critical Transition 5.

## Diversifying Sources of Protein

| <br>Diversifying Protein Supply | <br>Better Futures Additional Investment Requirements 2030 (USD billions) | <br>Better Futures Business Opportunity (USD billions) | <br>Economic Prize from Hidden Cost Reductions (USD billions) |       |
|--|--|---|--|-------|
|  | 2030   | 2030  | 2030   | 2050  |
|  | \$15 - 25  | \$240   | \$240  | \$480 |

Rapid development of diversified sources of protein would complement the global transition to healthy diets, with all its advantages. Over the next decade, three categories of alternative proteins can be scaled up: plant-based meat substitutes, proteins from insects, algae and worms, and proteins grown in the laboratory or “clean meat”. These could compete with traditionally raised beef and other animals on price, offering consumers competitive alternatives to meat and dairy that will often be better for human and planetary health. Their development could also reduce demand for crops to feed to animals, cut land and water use and reduce methane and carbon emissions.

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## Goals and benefits

These diversified sources of proteins are new products, but which are facing new challenges. For example, it is not necessarily the case that non-animal sources of protein are good for human health, and they should be kept to the same standard as other products in respect of, for instance, HFSS (high in fat, sugar and salt) content. But it is safe to assume that experiments with alternative proteins will continue, and that they will deliver the following benefits.

- **Environment.** Alternative meats at scale will reduce requirements for agricultural land, lower the pressure on forests and other natural ecosystems and create space for more ecosystems restoration.
- **Health.** Increasing the supply of affordable proteins will contribute to human nutrition and health, with particular benefits for child and maternal health in poorer households.
- **Food security.** Alternative proteins can be produced in a wide range of locations using new technology. This means they could improve food security in food-importing regions. For example, many protein-importing countries in the Middle East could be excellent locations for producing laboratory-based insect and algae proteins.

The annual economic gain from this transition is an estimated \$240 billion by 2030, and \$480 billion by 2050. A reduction in public health costs of \$130 billion a year by 2030 would be the biggest driver of the gain. The economic gains associated with this transition could scale rapidly as technologies improve and costs fall, mirroring developments in the renewable energy sector.

How might this play out in practice? Alternative meats are likely to be the visible disruptors of consumer markets. Some disruption is already evident in the rapid expansion of products from Beyond Meat and Impossible Burger. However, other forms of alternative protein are likely to disrupt less visible business-to-business markets much more. For example, single-cell animal products (insulin, globulin, whey, gelatine) are easier to produce in the laboratory than ground beef, steak, or milk, and will soon compete on price with proteins used in protein-fortified foods. At the same time, protein products derived from highly processed insects, algae and worms will become more broadly marketable, ranging from finely milled protein flour to Omega 3 and protein products for aquaculture feed.

Consumers will not see these changes in business-to-business protein supply, making it feasible that alternative proteins will significantly alter the economics of industrial red meat and dairy production without any major changes in consumer preferences. By some estimates, laboratory-grown alternatives to animal products such as insulin, globulin and milk proteins (whey, casein) could potentially be only a decade away from cost competitiveness, with more complex meat products a few years behind, making them a target for the various laboratory-based protein start-ups that have been growing rapidly.<sup>110</sup>

The insect protein market is also becoming established and has now reached an estimated worth of almost \$1 billion.<sup>111</sup> The combination of high nutritional value, ease of production, safety attributes (for example, the low risk of transmitting animal diseases to humans) and simple substitution for proteins used to fortify existing food products is contributing to the market's growth. Asia, where many consumers already accept insects as food, is the largest regional market with crickets as the single largest insect protein source. However, growth is accelerating around the world, including in sub-Saharan Africa and the United States.

Near-unlimited production of insects at very low life-cycle costs is possible, but not yet proven. There is some risk that critical know-how, once discovered, will quickly become or remain private intellectual property patented by particular big food brands, similar to new discoveries in the pharmaceutical sector. That would be unfortunate in a world that needs high-quality generic supplies of alternative proteins.

Laboratory-based alternative protein technologies may be potentially the most disruptive. But they face the risk that consumers will reject them, much as they have rejected genetically modified organisms in some markets. This could be a risk even in the out-of-sight business-to-business market.



## Priority actions

To a large extent, the diversification of protein supply could be self-scaling. It already attracts venture and corporate capital. There are no insuperable regulatory barriers, although many products will need the equivalent of U.S. Food and Drug Administration (FDA) approval in key markets. Business and consumer users appear to be open to the potential benefits. And as these businesses scale, they are likely to lower their costs, making them naturally competitive with traditional protein sources.

That said, there are a number of measures that could help the entrepreneurs driving this market to achieve faster growth, with all the essential consumer and workforce safeguards in place. To boost the right kind of investment in alternative proteins, governments, the private sector and consumer groups can work on the following priorities.

### **Increase research and development (R&D) spending for public knowledge**

Public sector support for R&D in alternative proteins should increase on condition that the resulting intellectual property remains in the public domain. In principle, alternative proteins could make a significant contribution to equity by lowering the cost of proteins and making them affordable for low-income consumers. But there is a risk that most of the R&D will focus on products targeted at developed economies and higher-income consumers, similar to the pharmaceutical industry. Public support for R&D in this area should focus on the search for alternative proteins that might have large benefits for lower-income consumers.

### **Build consumer trust**

Consumers will have legitimate concerns about the safety and health effects of new food ingredients, especially laboratory-grown and synthetic proteins. These could be a particular challenge to this transition. Governments and the private sector must act to assure consumers that alternative proteins reaching the market are safe and healthy. Developing regulatory standards for this new sector will be key. In parallel, a strategic redirection of public food procurement towards introducing alternative protein products in hospitals, schools, prisons and the armed forces can help to build public confidence in the market. Having long-term public contracts to bid for would help to establish alternative protein businesses as well.

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## Support the meat industry workforce

According to the North American Meat Institute, the US meat industry directly employs nearly 800,000 people.<sup>112</sup> Many jobs in the meat industry could be at risk from the expansion of a more diversified protein market. Support will be needed for displaced workers in the meat industry to help them move to jobs elsewhere, possibly in the more diversified and expanding local food economies described in critical transition 9.

## Investors protect themselves from stranded asset risk

It is not clear to what extent alternative proteins will disrupt the food industry. This market is only just beginning to grow. However, the risk metrics currently used by food investors almost certainly underestimate the potential scale the diversification of protein markets could reach relatively quickly, the number of assets at risk of being stranded and the extent and nature of resistance from incumbents. Investors need to prepare themselves for these dynamics by strengthening their risk analysis and reallocating capital in line with the results if need be.

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### BOX 30

## Commercial development of insects as a source of proteins

Fishmeal is the fish feed ingredient most favoured by aquaculture today. However, as seen in Critical Transition 4, demand for this product has driven overfishing and damage to ocean ecosystems. Soy is the main alternative, but expanding production of soy increases demand for farmland, driving clearance of rainforests.

Insect-derived nutrients can provide a sustainable alternative source of feed for the aquaculture industry.<sup>113</sup> Insect breeding is highly efficient in the following ways:

- **Land use.** Insects require little land area per tonne produced.
- **Water use.** Producing insects requires significantly less water than other livestock rearing.
- **Climate impact.** Insect-breeding emits minimal GHGs.
- **Zero waste.** Besides the nutrients retrieved from insects, by-products such as compost and skins can all be used as raw materials for other industries or as fertiliser. Insects can be fed ingredients produced from food waste and have high feed-conversion efficiency.

Protix is the first company delivering insect-derived proteins reliably and in large enough volumes to serve the fish industry. Having gone from start-up to large-scale producer in ten years, Protix is an example of how quickly alternative proteins might scale.<sup>114</sup>

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## References

110. RethinkX. Forthcoming. Rethinking Food and Agriculture 2020-2030.
111. Reuters, November 2018. <https://www.reuters.com/brandfeatures/venture-capital/article?id=64359>
112. American Meat Institute (n.d.). *The Amazing Meat & Poultry Supply: A Snapshot*. American Meat Institute
113. FAO. 2013. *Edible insects: future prospects for food and feed security*. FAO Forestry Paper 171. Available online at: <http://www.fao.org/3/i3253e/i3253e05.pdf>
114. Protix. See: <https://protix.eu/for-our-planet/>