

White Paper

# Meat: The Future

## A Roadmap for Delivering 21<sup>st</sup>-Century Protein

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# Foreword



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The provision of universally accessible and affordable, healthy and sustainable protein (21<sup>st</sup>-century protein) is critical to human nutritional needs and meeting the 2030 Sustainable Development Goals (SDGs), as well as keeping within the Paris Climate Change Agreement targets.

Currently, animal-based protein provides 40% of the world's protein supply through meat, fish and dairy products such as eggs and milk. Other non-animal-based sources, including fruit, vegetables, pulses, nuts and cereals, provide the rest. However, as meat-based protein (for instance, beef, lamb, pork and chicken) is tasty, protein rich and energy dense, it is the preferred or aspirational way for a significant part of the global population to consume protein. Consequently, as the population grows and the world becomes richer and more urbanized, demand for meat-based protein is growing fast. Globally, by 2050, the projected demand for meat-based protein is set to double compared to today.<sup>1</sup> In emerging economies, this demand will rise even faster.

Against this context, the World Economic Forum launched a dialogue series entitled *Meat: The Future*. This set out to explore:

- How effective our current global protein provision system is when assessed against the parameters of being universally accessible and affordable, healthy and sustainable
- How tenable it is for our current global protein provision system to grow as forecasted, under business-as-usual approaches, while also meeting the SDGs and Paris Climate Agreement targets
- If it is not tenable, where – and how – the current global protein delivery system would need to change
- How to develop a roadmap of the most effective possible drivers of that change in order to provide the required system transition in a relatively short time frame and at the scale required

The Forum released a white paper [\*Meat: The Future. Time for a Protein Portfolio to Meet Tomorrow's Demand\*](#) at the Annual Meeting in January 2018 to help set the scene.

Based on existing literature reviews, the *Meat: The Future* white paper suggested it would be difficult to grow the current global system for animal-based protein supply to match future demand and keep within the SDGs and Paris Climate Agreement targets. For example, according to the UN's Food and Agriculture Organization (FAO), total emissions from global livestock today represent 14.5% of all anthropogenic greenhouse gas (GHG) emissions.<sup>2</sup> The need for grazing land and for arable land to grow animal feed is the single greatest driver of deforestation, with major consequences for biodiversity loss.<sup>3</sup> These impacts – were they to double as demand doubles – illustrate that business as usual is not an option for the future of the global protein delivery system.

The *Meat: The Future* white paper introduced three pathways for change to illustrate where the system would need to change: accelerating alternative proteins, advancing current production systems and enabling consumer behaviour change. To investigate the topic further, a series of multistakeholder meetings and workshops were held during 2018 at which these potential pathways for change were explored.

These included sessions at the following World Economic Forum global and regional events:

- Annual Meeting, Davos, Switzerland, in January
- World Economic Forum on Latin America, Sao Paulo, Brazil, in March
- Annual Meeting of the New Champions, Tianjin, China, in September
- Sustainable Development Impact Summit, New York, in September

In addition, two specific workshops were held:

- *Meeting the Paris Climate Targets and Beyond: Technologies for Future Food Systems* at the World Economic Forum's Centre for the Fourth Industrial Revolution in San Francisco, USA, in April, in collaboration with Chatham House Hoffman Centre
- *Exploring Pathways for Sustainable Feedstock: Technologies, Enabling Ecosystems and Collaborations* at the World Economic Forum's headquarters in Geneva, Switzerland, in November, in collaboration with Forum for the Future



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Head of Meat: The Future, Head, Business Strategy and Engagement, Centre for Global Public Goods

In total, more than 250 leaders from across the business, civil society, academia and research, governmental, finance and technology sectors have been engaged in these various discussions to explore and validate options in the three pathways for potential change. The World Economic Forum is extremely grateful to all of those who participated in these various discussions.

In addition, two original knowledge pieces were commissioned as part of this initiative:

- [\*Alternative Proteins\*](#), Oxford Martin School, Oxford University, United Kingdom
- [\*Options for the Livestock Sector in Developing and Emerging Economies to 2030 and Beyond\*](#), International Livestock Research Institute (ILRI), part of the Consultative Group of International Agricultural Research (CGIAR), Nairobi, Kenya

The World Economic Forum is grateful to the scientists and researchers at Oxford Martin and ILRI who have developed these original analyses for the Meat: The Future dialogue.

This paper represents a summary of the findings from these various workshops and research papers; it also offers some suggested next steps – a roadmap of the most effective drivers of change to provide the required system transition in a relatively short time frame and at the scale required.

The World Economic Forum's Centre for Global Public Goods is grateful to the ClimateWorks Foundation for its support of the Meat: The Future initiative, which is hosted as a dialogue by the World Economic Forum System Initiative on Shaping the Future of Environment and Natural Resource Security in collaboration with the System Initiative on Shaping the Future of Food. Meat: The Future also forms part of the Fourth Industrial Revolution for the Earth project, hosted by the World Economic Forum System Initiative on Shaping the Future of Environment and Natural Resource Security, with support from the MAVA Foundation.

# Executive summary

Academic analysis shows it will be impossible for a global population of 10 billion to consume the amount and type of protein typical of current diets in North America and Europe<sup>4</sup> if we want to achieve the UN Sustainable Development Goals (SDGs) and meet the 2015 Paris Climate Agreement.

To get on track by 2030, with full delivery by 2050, requires a transformation in the global system for protein provision; this will likely follow a decade of transition where existing and future methods of meat and protein provision overlap and where new approaches (both animal-based and beyond) disrupt and displace the old. This evolutionary process may both learn from and draw parallels with the energy transition we are currently undergoing, as renewables and other low-carbon energy systems start to scale and replace 20<sup>th</sup>-century fossil fuel-based energy systems.

There is no silver bullet or single solution for this transformation; instead, progress is simultaneously needed across multiple areas if society is to be successful in finding ways to deliver on the growing protein needs for human health while maintaining a healthy planet. The transformation of today's global system for protein provision will require progress along three interconnected pathways to deliver on tomorrow's global protein needs: *alternative proteins*; *current production systems*; *consumer behaviour change*.

The future offers plenty of innovation potential in this regard, and the technological advancements of the Fourth Industrial Revolution present significant tools to make these pathways a reality. Two new reports highlight how emerging and existing technologies can provide critically needed technical solutions for these pathways. *Alternative Proteins*, prepared by the Oxford Martin School, explores how advances in food processing through to highly sophisticated biotechnology have created new products that closely mimic the experience of eating traditional animal-based protein. *Options for the Livestock Sector in Developing and Emerging Economies to 2030 and Beyond*, prepared by the

International Livestock Research Institute (ILRI), discusses how smallholder livestock systems can use technology and other tools to deliver on the growing demand in emerging economies while transforming the livelihoods of some of the globe's most vulnerable populations. Beyond the research, multistakeholder dialogues have highlighted how new feed technologies (such as insects, alga and micronutrition) and technology-based systems for growing feed (data science, microbiome technologies for plants and soil) can provide lower-environmental-impact feedstock solutions for current industrial-scale livestock and poultry producers.

To exploit these innovations and technologies, and make the necessary progress along these three pathways by 2030, requires a collective set of strategies that go beyond market-based technical solutions; these need to be able to accelerate transformative change in today's global system for protein provision quickly and at scale, but in a socially and politically inclusive manner.

Four specific strategies for delivering 21<sup>st</sup>-century protein through to 2030 have consequently been identified, illuminating the most effective "drivers of change" within this context. These strategies suggest a roadmap for delivering 21<sup>st</sup>-century protein:

- 1. Highlighting the multiple benefits to society of transforming today's protein systems**
- 2. Promoting pathways to achieve cost parity across choices that deliver on multiple benefits**
- 3. Pursuing an intentional "Transition Decade" using narratives**
- 4. Developing innovation ecosystems and collaboration platforms for research and action**

This paper explores this roadmap in further detail.

# A Roadmap for Delivering 21<sup>st</sup>-Century Protein

Delivering 21<sup>st</sup>-century protein by 2030, and as we approach a population of 10 billion by 2050, will require unprecedented collaboration by stakeholders and sectors, and an unparalleled ambition that stretches to every human being on the planet as they make their daily food choices.

Transformation will simultaneously be required across three pathways (see Figure 1), areas that highlight where the current global protein system will need to change.

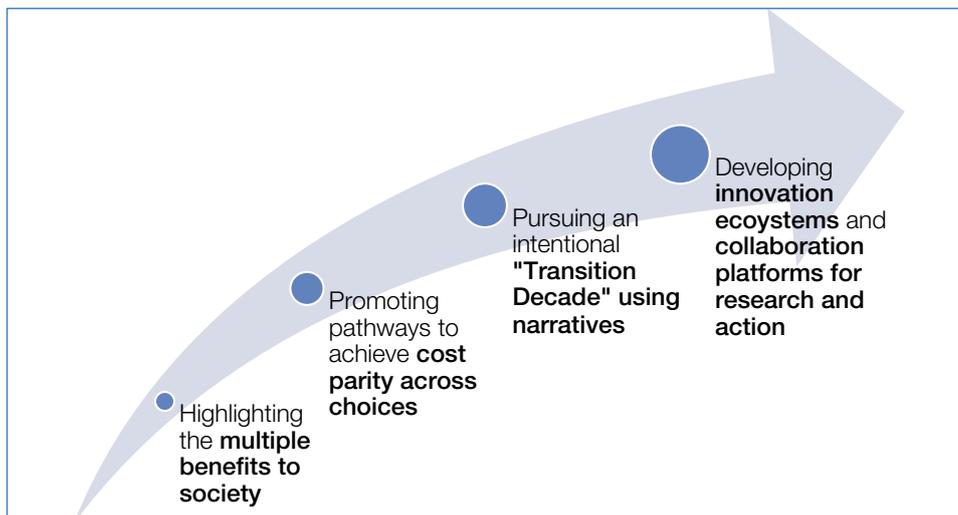
**Figure 1:** Pathways to 21<sup>st</sup>-Century Protein Delivery

Pathways to 21 <sup>st</sup> -Century Protein Delivery: (illustrative examples below)		
Accelerating Alternative Proteins	Advancing Current Production Systems	Driving Consumer Behaviour Change
<ul style="list-style-type: none"> <li>– Meat replacements (e.g. plant burger)</li> <li>– Cultured/lab-grown</li> <li>– Insects</li> <li>– Alga-based</li> <li>– Fungi-based</li> <li>– Traditional processed plant-based (tofu, seitan etc.)</li> <li>– Traditional plant-based alternatives (peas, beans, nuts, jackfruit etc.)</li> <li>– Meat “extenders” (plant or other) as a partial substitute</li> </ul>	<ul style="list-style-type: none"> <li>– Sustainable animal feedstocks</li> <li>– Novel animal feedstocks</li> <li>– Sustainable intensification</li> <li>– Use of food and industry waste streams</li> <li>– New breeds of cattle</li> <li>– Reduction in antibiotic use</li> <li>– Land use and elimination of deforestation</li> <li>– Manure and slurry management</li> </ul>	<ul style="list-style-type: none"> <li>– Flexitarian diets</li> <li>– Diversification within per capita diet</li> <li>– Right-sizing of diet (shift towards protein equity per capita)</li> <li>– Reduction of food waste</li> <li>– Cost and access parity</li> </ul>

To drive transformation across these pathways, four strategies for delivering 21<sup>st</sup>-century protein have been identified. These strategies present a roadmap (see Figure 2) as to how society might provide the required system

transition in the relatively short time frame necessary to meet the SDGs and the Paris Agreement, and at the scale required to meet the needs of 10 billion people and the planet as a whole.

**Figure 2:** A Roadmap for Delivering 21<sup>st</sup>-Century Protein



## 1. Highlighting the multiple benefits to society

Here we look at the multiple benefits to society of transforming today's protein systems.

Protein, which may appear isolated at first glance, sits at the intersection of many agendas (see Figure 3). Presenting a multi-outcome justification for redesigning protein provision over the next decade is therefore critical to achieving the SDGs and the Paris Agreement targets. Illustrating how change will positively affect societal outcomes across health, environment and social inclusion will enable a faster and smoother protein-system transition than, for instance, justifying a change strategy on environmental or climate-action grounds alone.

To illustrate the multiple benefits of the pathway of alternative proteins, for example, the research for this initiative undertaken by Oxford Martin begins to quantify the positive impact for health outcomes in addition to the well-studied environmental factors. The analysis also contextualizes meat consumption in the context of providing a more diverse blend of proteins. It highlights that replacing a single daily portion of beef (and to a lesser extent both

pork and chicken) with the studied alternatives (beans, pulses, mycoproteins, nuts etc.) can reduce diet-related mortality in high-income and upper-middle-income countries by up to 5%, while simultaneously reducing greenhouse gas emissions. This can have significant economic effects on the cost of healthcare provision. In lower-middle-income and lower-income countries, where food and nutrition insecurity is prevalent, the research also offers strategic guidance. It shows that, as demand for meat-based protein consumption grows over the coming decades with a growing population and the emergence of a significantly expanded middle class, there will also be powerful public health drivers as well as global environmental drivers to ensure this trend does not simply follow the North American and European pattern of high meat-based protein consumption. Rather, a "leapfrog" to a more diversified aspirational protein system can be achieved.

The research undertaken by ILRI, meanwhile, offers a reflection on the importance of the livestock sector in emerging and developing economies, where the livelihoods of over half a billion people depend entirely or partially on farm animals and where food insecurity is highly prevalent. Within this context, some of the solutions that may make

**Figure 3:** Protein at the Intersection of Multiple Agendas

Agenda:	Primary Challenges
Food	<ul style="list-style-type: none"> <li>- By 2050, the projected demand for meat and protein is set to double today's numbers</li> <li>- Meat, dairy, eggs and fish currently provide 40% of the world's protein supply and 18% of its calories<sup>5</sup></li> </ul>
Environment	<ul style="list-style-type: none"> <li>- Livestock generates just under 15% of the total CO2 equivalent greenhouse gas emissions a year</li> <li>- The single greatest driver of deforestation is the need for grazing land and for arable land to grow animal feed<sup>6</sup></li> <li>- Future demand for feed requires ~280 million hectares of additional land<sup>7</sup></li> </ul>
Health	<ul style="list-style-type: none"> <li>- More than 800 million people are malnourished</li> <li>- Overconsumption of meat contributes to growing rates of obesity and a higher risk of non-communicable diseases</li> <li>- Non-therapeutic antibiotic use has brought unintended consequences</li> </ul>
Livelihoods	<ul style="list-style-type: none"> <li>- More than 1 billion people are involved in livestock value chains, with more than half dependent on livestock for their livelihoods<sup>8</sup></li> <li>- Poor nutrition results in 11% of GNP lost annually in Africa and Asia<sup>9</sup></li> </ul>

sense in high- and upper-middle-income countries could do more harm to many people's livestock-dependent livelihoods than good. To this end, the research shows how making use of the great diversity of current livestock systems in developing economies, engaging in widespread stakeholder engagement at all levels, and harnessing "circular economy" approaches and the latest technologies can both improve the productivity of the livestock sector in poorer countries and advance the sector's contribution towards wider progress in sustainable and equitable development in line with the SDGs and the Paris Agreement. In one example, the research notes that good grassland management which enhances forage production could also sequester up to 150 megatons of CO<sub>2</sub> equivalent annually while promoting livelihood and food security. In another example, cassava peel, which is generally viewed as an environmentally hazardous waste product, could instead be converted into 5 million tonnes of high-quality feed per annum in Kenya alone, offering the dual benefits of waste and environmental mitigation while increasing livestock productivity through high-quality feed. Both examples showcase the multiple benefits stemming from singular changes to these livestock systems.

In contrast, for developed-world livestock and poultry production systems highly dependent on industrial feed, new technologies offer the exciting potential to continue providing highly accessible and affordable animal-based protein with significant reductions in the environmental footprint. For instance, enhancing micronutrition for ruminants through one novel feed compound has been found to reduce enteric methane from cows by a minimum of 30%.<sup>10</sup> Another technology that uses the plant microbiome and data science has been shown to increase protein content for feed crops on the same land footprint,<sup>11</sup> thereby lowering land requirements and increasing productivity in the animal feed system. These technologies, while currently limited in adoption, offer tremendous opportunities to deliver impacts at scale across multiple development goals.

## 2. Promoting pathways to achieve cost parity

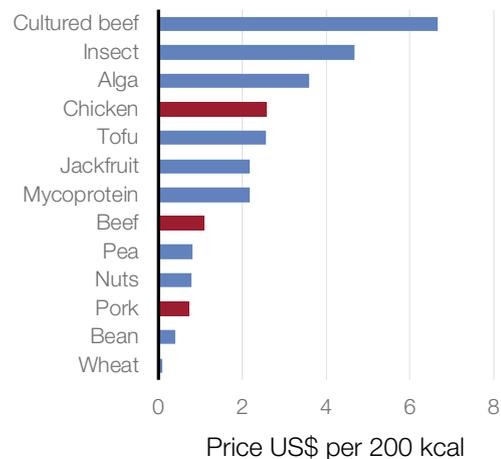
The focus here is on promoting pathways to achieve cost parity across choices that deliver on multiple benefits.

Historically, the consumer value equation has had three dimensions – cost, choice and convenience:

**The historical consumer equation<sup>13</sup>:**  
 Consumer value = cost + choice + convenience

While these dimensions have evolved with new technology, cost remains a central component of the value for consumers.<sup>12,13</sup> For protein consumption in high- and upper- and middle-income countries, the Oxford Martin research shows that, at current prices, available alternative proteins (including well-established alternatives such as tofu and mycoproteins) are *not* currently competitive with beef and pork, both of which sit in the lowest band of pricing versus the alternative proteins (see Figure 4). Over the past 50 years, the meat-based protein industry has pursued highly effective strategies to lower costs for the consumer, thereby delivering tremendous access, albeit with the creation of unintended health (i.e. overconsumption) and environmental consequences for society. Accordingly, unless policy interventions promote the competitive pricing of protein alternatives in relation to traditionally produced meat-based protein, the cost factor of the consumer value equation will not necessarily incentivize consumers to diversify their diets with alternative protein choices that optimize benefits across health, nutrition and the environment.

**Figure 4: Estimated Current Prices of the Different Food Types<sup>14</sup>**



Estimated current prices of the different food types

Building off the first strategy in the roadmap, how might highlighting the multiple benefits to society of transforming today's protein systems help inspire government support for investment in 21<sup>st</sup>-century protein to help achieve cost parity? Could Europe, the United States and China – regions where per capita consumption of meat is highest or growing most strongly, for example – promote a policy and investment strategy to encourage investment in and transition towards alternative proteins and sustainable feedstocks (as just one example of advancing current production systems) within the global protein delivery system? The aim here would be to help drive down technology costs, increase adoption and adjust consumer-

facing prices through scaled investment strategies and the promotion of feed-in tariff equivalents. In the case of promoting plant-based protein alternatives, as another example, could the promise of accelerating progress towards a twin public-good goal of improved health and environmental outcomes potentially prompt cross-ministerial support to further galvanize investment?

Subsidizing alternatives is one option to balance out pricing signals among protein options and enable the alternative protein market to grow as a result. Subsidies can also support the transformation of traditional meat production through greater investment in sustainable production to distinguish their products from those produced at a lower standard along this dimension. While calls for a meat “tax” have resonated with advocates and media outlets, crucial lessons from consumer responses to energy and fuel taxes driven by environmental policy objectives alone should be taken into account. The case of protein is increasingly complex given the balance across environments, livelihoods and health; it is important to recognize that a tax has the potential to incrementally harm those who are most nutritionally and financially vulnerable, and some stakeholders suggest that subsidies for currently more expensive protein alternatives and more sustainably produced animal-based products may present an equalizing solution.

Crucially, farmers as well as consumers have to be engaged in “win-win” ways to alter the cost/price dimensions of more sustainable or diversified pathways in the protein system transition. For farmers, feed for livestock and poultry represents one example of a vital input where more sustainable or circular models – for instance, that of insect-based feed – offer huge opportunities to reduce the environmental footprint. These options – whether novel or simply more sustainable versions of existing feed – often come with a higher price tag and a lack of incentives for adoption. For smaller enterprises in particular, where feed can account for 70% or more of total production costs (less so for larger enterprises that benefit from economies of scale),<sup>15</sup> without cost support, farmers simply won’t be able to afford newer feedstock options that deliver increased sustainability and reduce ecosystem loss (deforestation, biodiversity loss etc.). To this end, policy and finance innovations targeted at livestock farmers of all sizes can help promote scaled adoption of beneficial feedstock solutions. In another example, there is a growing effort to value ecosystem services/benefits provided by the natural environment. Here, the recent announcement by the UK government to reward farmers for managing their land more sustainably with payments for the provision of public goods<sup>16</sup> presents an illustration of a “win-win” solution, managing costs to the farmers and enabling them to transform their production to one with a lower environmental footprint.

Across all three pathways, much can be learned about innovation in the areas of cost and pricing – and the policy

mechanisms that can help promote “tipping-point change” – from clean-energy transition. The accelerating shift since the turn of the century from a mainly fossil-based energy system to a renewable energy mix – which has occurred in different ways and through differing policies in higher- and lower-income countries – against the backdrop of dramatically falling technology costs for solar and wind, offers an interesting analogue for achieving cost parity.

Moore’s Law transformations in technology costs can ultimately prevail if support to scale alternative protein and more sustainable animal production are initially encouraged through public-private initiatives – similar, perhaps, to how Germany promoted feed-in tariffs for solar electricity and China promoted widespread production and investment in solar and wind-power generation during the first decade or so of this century. According to the International Renewable Energy Agency (IRENA), solar photovoltaic (PV) electricity costs have dropped by 75% since 2010 and are expected to halve again by 2020.<sup>17</sup> With every doubling of cumulative installed capacity, prices have fallen by 20% due to economies of scale and technology improvements. For example, a German PV rooftop system cost roughly 14,000 euros per kW (\$16,065/kW) in 1990. At the end of 2015, the price was less than 10% of that amount at 1,300 euros per kW (\$1,491/kW), according to IRENA.<sup>18</sup> These results stemmed from early policy enablers in Germany promoting the scaled installation of PV. Because of these early efforts, scaled investment has occurred and subsidies for renewables are now no longer needed. Today, the global weighted average cost spectrum for solar PV now stands at about 6 to 10 US cents per kWh. By comparison, the current cost spectrum for fossil-fuel power generation ranges from 5 to 17 US cents per kWh.<sup>19</sup> After a decade or so of energy transition, and with initial policy support, it can be argued that renewables have now addressed the cost/price dimension in relation to fossil fuels and are well on their way to achieving scale (other technology barriers such as storage notwithstanding).

Applying the same approach to alternative proteins and technologies that support more sustainable animal production could similarly reduce costs to the consumer and/or farmers, propelling cost parity in these areas to increase adoption and drive economies of scale over time. Cultured meat presents one clear example: What could this technology look like in a decade with an active partnership from governments to ensure affordable access for all to such technologies, alongside support to bend the curve on the technology’s emissions through renewables and local production? Similarly, how might the emissions of cattle, pork or chicken be reduced with government support for lower-emission feedstock systems, such as enhanced micronutrition, or insect- or alga-based feed, when livestock, poultry or aquaculture farmers have more affordable access to such technologies?

### 3. Pursuing an intentional ‘Transition Decade’ using narratives

The aim here is to explore the pursuit of an intentional “Transition Decade” strategy from 2020–2030, using evidence-based narratives to shift today’s global system for protein provision to one in line with meeting the SDGs and the Paris Climate Agreement.

The transition of today’s protein delivery system from a largely meat-based focus to a wider range of alternatives will play out in different ways around the world. However, a reliance on the market alone or a hope that individual technologies, unconnected projects or even financing or policy innovations including subsidies will break through and tip the global system will likely not be enough to create the scale or speed required to provide universally accessible and affordable, healthy and sustainable protein in line with the SDG and 2015 Paris Climate Agreement targets by 2030.

In fact – unlike the energy transition – even technology, financing and policy solutions together may not be enough.

This is because of the inherently personal and cultural nature of food, and in particular the special place of meat in human diets and livelihoods. Suggesting that Argentinians or Texans should eat less beef, for example, would take a brave politician. Likewise, in Kenya, where the livestock subsector employs 50% of agricultural labour and has the highest employment multiplier,<sup>20</sup> how might a politician react to suggestions to replace farms with labs to grow meat?

The unique emotional and cultural politics of food, particularly of meat, means that another important strategy to accelerate the transition will be required. This relates to narratives.

Common narratives – the stories we tell each other about food – and the political economy that these narratives encourage provide a view of what may be influencing individual and policy-makers’ intrinsic beliefs on where the benefits or risks of positively disrupting today’s global protein provision system may lie. Starting from a common evidence base and framing the opportunities using narratives that are both honest and which resonate with people’s aspirations and critical needs will be essential in enabling accelerated transition. The Oxford Martin research gives us insight into these dynamics. For example, is the existing narrative for alternative proteins of “It’s better for the environment” as effective across all consumer classes as one that could speak to values that may resonate with more immediate consumer benefits – for instance, “It’s cheaper and healthier”?

Different markets will likely require different entry points. Take, for example, cultured meat. In late 2017, China initiated investment in the technology, signing a \$300 million deal with start-ups in Israel.<sup>21</sup> In addition to providing a potential path towards price parity for Chinese consumers, this deal perhaps illustrates a multi-benefit intention of reducing the environmental footprint<sup>22</sup> of its population’s consumption while shoring up its food-security independence through diversified sourcing in the longer run. But these technology and financing mechanisms alone will not guarantee that consumers will aspire to eat these lab-grown proteins. Here, the Oxford Martin research notes China, as a region where there is significant public preoccupation with food safety, may benefit from narratives about the controlled environment provided by cultured meat to offset these concerns for the consumer.

In contrast, in the United States, perhaps further lessons could be learned from the energy transition. For instance, could the initial market entry point for the “technoscientific” nature of cultured meat be “ultra” meat, akin to the high design spec and higher price point of some electric cars? Once high-end consumers become attuned to specific benefits, a new product range could then be introduced with a lower price point while accentuating similar luxury benefits.

These examples illustrate narratives aimed at furthering consumer adoption and the political economy these stakeholders influence. History would suggest stakeholders would also produce counter-narratives aimed at curbing consumer adoption; this is why a science-based approach stemming from a common evidence base will be so critical to underpinning narratives in this space. Left to the market, these narratives may start to compete, confusing the consumer. Coordinated public-private efforts and intergovernmental engagement may be required to develop and “own” both a global narrative on the protein transition, and specific regional narratives, along the lines of how other global public health or education agendas are promoted.

Interestingly, and as noted in the reports and workshops, for the foreseeable future the traditional animal-based protein and alternative protein sectors will coexist and can complement one another. As in the fossil-fuel economy, might some major players in the more traditional meat-based protein sector see an innovation opportunity in the global marketplace and move faster than others? One would expect to see new collaborations and, in fact, several unexpected associations have emerged. Pursuing an intentional “Transition Decade” strategy through to 2030, with joined narratives across the traditional and emerging sectors, will be critical to giving technology, financing and policy solutions the lift needed to ensure 21<sup>st</sup>-century protein is both aspirational and accessible at scale.

#### 4. Developing innovation ecosystems and collaboration platforms

The focus here is on developing innovation ecosystems and collaboration platforms for research and action, based on a common objective but attuned to taking different approaches in different geographies and cultures.

The discussions this year across four continents combined with the commissioned research findings underscore the fact that, while common in their drive to improve global public good outcomes, the acceleration and scaling of various options within the protein delivery system is inherently going to be a local affair.

Therefore, one uniform initiative or fund will not be effective at the speed and scale needed to meet the SDGs and the Paris Agreement. Rather, it will require innovation coupled with a platform-based approach for action. These will be aligned on a common objective but with a network of regional system change hubs focused on different blends of protein options attuned to local cultural framing and preferences.

The [World Economic Forum's Innovation with a Purpose](#) initiative has emphasized that for technologies such as those providing alternative proteins or alternative feedstocks to be successful at scale, a vibrant *innovation ecosystem* is needed – one where governments, companies, innovators and end users can collaborate to support and improve technology innovations across their life cycles, particularly in underserved communities. Building an effective innovation ecosystem, particularly as it relates to developing countries, can ensure support in unlocking and developing markets in a number of areas. These include: the development of new business models; encouragement of appropriate financing mechanisms; mitigation of unintended consequences; and facilitation of support for relevant policy incentives.

Many stakeholders suggested that a lot can potentially be learned from the creation and evolution of the Consultative Group for International Agricultural Research (CGIAR) system of networked research-for-development crop research centres, created in the 1970s to help address the food crisis through advancing the green revolution in different regions around the world and through diversified, locally resonant crops. Could a 21<sup>st</sup>-century variant on the CGIAR model (which was itself a public-private-funded initiative supported by major philanthropic foundations) be developed: a consultative group for international protein options acceleration (CGIPA), for example?

Such international accelerators and systems could be designed to create a public-private network of technology, policy and financial innovation hubs – each working within regionally appropriate narratives – to accelerate the transition and market built towards the global system of protein delivery we will need by 2030 and beyond. In addition to national and regional options, global alignment across hubs will be crucial. The current protein system relies heavily on global supply chains; therefore, exploration of how to accelerate such a global transition given cross-border issues and trade policies will be critical to the success of transformation.

# Conclusion

In conclusion, 2018 has been a year of bringing leaders to the table to raise the future of protein on the leadership agenda, through framing the challenge, identifying pathways and highlighting new research.

As we begin 2019, it is arguably time to move these discussions into a solutions-based agenda, drawing on the above roadmap. Can a platform for action be created to accelerate the journey towards the universally accessible and affordable, healthy and sustainable protein delivery system of the future, which we now know we need, if we are to meet the SDGs and deliver on the Paris Agreement targets?

We invite you to join us to find out.

# Endnotes

1. World Economic Forum, *Meat: The Future – Time for a Protein Portfolio to Meet Tomorrow’s Demand*, January 2018, <https://www.weforum.org/whitepapers/meat-the-future-time-for-a-protein-portfolio-to-meet-tomorrow-s-demand> (link as of 7/1/19).
2. <http://www.fao.org/news/story/en/item/197623/icode/> (link as of 7/1/19).
3. World Economic Forum. *Meat: The Future Series – Alternative Proteins*, 2019, <https://www.weforum.org/whitepapers/meat-the-future-series-alternative-proteins> (link as of 8/1/19).
4. Ibid.
5. World Economic Forum. *Meat: The Future Series, Options for the Livestock Sector in Developing and Emerging Economies to 2030 and Beyond*, 2019, <https://www.weforum.org/whitepapers/meat-the-future-series-options-for-the-livestock-sector-in-developing-and-emerging-economies-to-2030-and-beyond> (link as of 7/1/19).
6. World Economic Forum. *Meat: The Future Series – Alternative Proteins*, 2019.
7. Wirsenius, S. et al. (2010). “How Much Land Is Needed for Global Food Production under Scenarios of Dietary Changes and Livestock Productivity Increases in 2030?”, *Agricultural Systems*, 103, 621–638. doi:10.1016/j.agsy.2010.07.005.
8. World Economic Forum. *Meat: The Future Series, Options for the Livestock Sector in Developing and Emerging Economies to 2030 and Beyond*, 2019, <https://www.weforum.org/whitepapers/meat-the-future-series-options-for-the-livestock-sector-in-developing-and-emerging-economies-to-2030-and-beyond> (link as of 7/1/19).
9. Ibid.
10. <https://www.dsm.com/corporate/science/climate-energy/methane-reduction.html> (link as of 7/1/19).
11. <https://www.indigoag.com/pages/news/2018-wheat-satellite-data> (link as of 7/1/19).
12. Cost and price are used interchangeably in this paper.
13. [http://www3.weforum.org/docs/IP/2016/CO/WEF\\_AM17\\_FutureofRetailInsightReport.pdf](http://www3.weforum.org/docs/IP/2016/CO/WEF_AM17_FutureofRetailInsightReport.pdf) (link as of 7/1/19).
14. World Economic Forum. *Meat: The Future Series – Alternative Proteins*, 2019, <https://www.weforum.org/whitepapers/meat-the-future-series-alternative-proteins> (link as of 8/1/19).
15. World Economic Forum. *Meat: The Future Series, Options for the Livestock Sector in Developing and Emerging Economies to 2030 and Beyond*, 2019, <https://www.weforum.org/whitepapers/meat-the-future-series-options-for-the-livestock-sector-in-developing-and-emerging-economies-to-2030-and-beyond> (link as of 7/1/19).
16. World Economic Forum. *Meat: The Future Series – Alternative Proteins*, 2019, <https://www.weforum.org/whitepapers/meat-the-future-series-alternative-proteins> (link as of 8/1/19).
17. <https://www.solarpowerworldonline.com/2018/01/solar-pv-costs-expected-cut-half-2020/> (link as of 7/1/19).
18. [https://www.huffingtonpost.com/adnan-z-amin/post\\_10557\\_b\\_8600240.html](https://www.huffingtonpost.com/adnan-z-amin/post_10557_b_8600240.html) (link as of 7/1/19).
19. <https://www.solarpowerworldonline.com/2018/01/solar-pv-costs-expected-cut-half-2020/> (link as of 7/1/19).
20. World Economic Forum. *Meat: The Future Series, Options for the Livestock Sector in Developing and Emerging Economies to 2030 and Beyond*, 2019, <https://www.weforum.org/whitepapers/meat-the-future-series-options-for-the-livestock-sector-in-developing-and-emerging-economies-to-2030-and-beyond> (link as of 7/1/19).
21. <https://www.independent.co.uk/news/world/asia/china-israel-trade-deal-lab-grown-meat-veganism-vegetarianism-a7950901.html> (link as of 7/1/19).
22. Cultured meat is a technology in its infancy. While the current life-cycle analyses (LCAs) of emissions from cultured meat are relatively high, there are substantial opportunities to reduce emissions through renewable energy sources and the potential of collapsing supply chains through production based on urban “breweries”. World Economic Forum. *Meat: The Future Series – Alternative Proteins*, 2019, <https://www.weforum.org/whitepapers/meat-the-future-series-alternative-proteins> (link as of 8/1/19).



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