

Putting intensive farming out to pasture

Can alternative proteins reduce farmed animal suffering?

Jake Shepherd
Aveek Bhattacharya

SMF

Social Market
Foundation

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Aveek is co-editor of the book *Political Philosophy in a Pandemic: Routes to a More Just Future*.

ABOUT THIS REPORT

This report draws on 10 semi-structured interviews with people who either work directly in the alternative protein sector or have a significant professional interest in it. Among the participants, some are actively involved with alternative protein companies to contribute to the market's development, while others serve as more distanced observers or researchers. Interviews took place during July and August 2023. A full list of participants is provided in the appendix.

The report also incorporates data gathered from an SMF survey of industry experts, including the same cohort of interview participants and their colleagues. The survey was designed using the Delphi method, an iterative survey technique consisting of multiple waves that tries to identify consensus among experts. The survey was in the field in August 2023.

EXECUTIVE SUMMARY

This report is the third and final part of our series on the relationship between alternative proteins and animal welfare

- Alternative proteins are analogues of conventional meat, dairy, seafood or egg products, produced using novel technology and/or production processes to avoid rearing live animals.
 - They are typically plant-based, fermented and/or cell-cultivated.
 - Some class insect-based products as alternative proteins, though this should be resisted, given the ethical implications of insect farming.
- Our first report in this series investigated the state of farmed animal welfare, concluding that reducing consumption of intensively farmed chicken should be our primary focus.
- The second looked at public attitudes, and found:
 - Most people agree that eating less meat is desirable, though they need support and guidance to turn that sentiment into behaviour change.
 - Alternative proteins can play a role in helping people to eat less meat – especially those already sympathetic to animal welfare.
- This report considers how likely alternative proteins are to achieve a meaningful shift in eating habits, and what the implications would be for animal welfare, drawing on public forecasts, interviews and a ‘Delphi method’ survey of experts.

Alternative proteins have grown quickly, but their impact has been modest so far

- The market for meat alternatives has seen rapid expansion – 400% in the UK in the last decade – and billions are being invested, including by governments around the world.
- A decline in sales in 2022 has stalled momentum. It remains unclear whether this is a blip or an indicator that the market has peaked.
- This is deeply concerning, given that alternative proteins still represent at best only 1% of the global meat market, and the number of factory farmed chickens in the UK is set to rise by around a quarter in the next decade without a radical change.

Supply-side improvements – making the product cheaper and tastier – are generally seen as the key to future growth

- The clear majority of our expert panel said that the supply side is a bigger constraint on growth than the demand side.
 - The general view is ‘build it and they will come’ – though a minority perspective is that shifting social norms is more important.
- Everybody we surveyed said that improving taste, price, and nutrition was important, if not critical, to success.

- Realising those improvements will require product innovation, and in particular increased manufacturing capacity to achieve scale and efficiency.
- In turn, investment in capital infrastructure and research and development should increase the odds of success in these areas.
- Regulation and policy can nurture the market – or smother it.
 - 85% of respondents said that the regulatory environment is important or critical to the growth of alternative proteins.
 - As things stand, delays in approvals from the Food Standards Agency, and potential restrictions on labelling, are an obstacle to progress.

Forecasts suggest some additional growth is likely – though they vary wildly on how much

- Industry forecasts for the global market share of alternative proteins in the next couple of decades range from 4% to 60%.
- Experts we spoke to are similarly divided – their forecasts for 2040 range from 3% to 70%, with an average prediction for alternative proteins to make up around a third of the market.
- Much of this growth is expected to come from improvements in plant-based products, which are expected to comprise a third of the alternative protein market in 2040, and the development of hybrid meat alternatives (also expected to take around a third).

Cultivated meat could be game-changing... if it can be scaled up

- All the same, the development of cultivated meat is widely regarded as the key contingency in terms of alternative protein growth.
 - In our survey, the forecast market share of alternative proteins falls from 32% to 14% in a scenario where cultivated meat fails to scale and achieve cost competitiveness.
- Yet many independent analysts are sceptical this will ever be achieved, and say that “extreme” technical barriers – including thermodynamics, cell metabolism, bioreactor capacity, ingredient costs, and facility construction – mean cultivated meat will *never* be cost competitive.

The growth of alternative proteins will almost certainly prevent farm animals from being reared in lower welfare conditions

- The evidence so far suggests that consumers of alternative proteins buy less meat.
 - The extent to which this meat comes from lower welfare animals is unclear, and it is critical for animal welfare that chicken replacements receive as much focus as beef, which has a higher emissions and land-use impact.
- With the majority of UK meat coming from factory farmed sources, it should not take much more growth and continued displacement to reduce consumption of lower welfare meat, and save millions of animals from suffering.

- If alternative proteins were to reach the 30% market share predicted by respondents for 2040, it would result in over 300 million fewer animals being raised in factory farms and slaughtered each year.
- However, given the trend growth in chicken consumption, we estimate alternative proteins will have to take a 35% meat market share to ensure no more factory farmed chickens are slaughtered in 2040 than today.
- This assumes that insects do not become a substantial source of alternative protein – our experts forecast insects to account for 3% of alternative proteins by 2040, which could mean billions of additional intensively farmed animals.
 - We recommend that the alternative protein sector distance itself from insect farming, as it raises ethical concerns that could be catastrophic for animal welfare.
 - Though insect sentience is imperfectly understood, there is enough indicative evidence that insects can suffer that a precautionary approach is preferable.
 - In any case, most insect farming looks set to be used to produce animal feed, and so seems more likely to support rather than displace the farming of birds and mammals.

The government can – and should – do more to support the alternative protein sector, primarily by easing regulation

- Though the main barriers to the growth of the alternative proteins market are for firms to sort out – improving the technology to refine the product and make it more economical – the government can do more to support them.
- Streamlining regulation for novel foods ought to be a particular focus – 88% of experts said that this would make a very significant difference.
- The government can also catalyse more public investment in open source research and development.
- There is also some support for public subsidy of the retail price of alternative proteins to make them cheaper.
- Stricter farm animal welfare regulations and informational measures would nudge consumers towards alternative proteins – but 88% of our experts said they would only make a small or modest difference.

Public investment in alternative proteins is risky – but worthwhile given the prize at stake

- Public investment in research and development can help improve quality and efficiency – but as with any investment, there are no guarantees.
 - With cultivated meat in particular, it is unclear whether the technology will develop like solar power (where costs have fallen dramatically, aided by publicly funded research or subsidy) or nuclear fusion (perennially just beyond our grasp).

Animal welfare advocates should promote policies that support the growth of alternative proteins

- Alternative proteins are unlikely to displace the core activities of animal welfare organisations – pushing for policies that directly improve farm conditions.
- However, putting their weight behind alternative proteins is a ‘low cost, low regret’ activity that ought to supplement their other objectives, given the huge potential to save animals from low welfare lives.

CHAPTER ONE – INTRODUCTION

Raising live animals for food – meat, dairy and eggs – creates all manner of problems for society, certainly on the scale that we currently do it. It creates environmental challenges, both through pollution from farming and through greenhouse gas emissions. It increases the potential for public health risks, through zoonotic diseases, transmitted from animals to humans. And, as we laid out in a previous report, it condemns billions of animals worldwide to lives of suffering and misery.¹

The prospect of getting functionally identical foodstuffs without the use of animals – their environmental toxins, pathogens and physical and psychological pain – therefore seems miraculous. And yet that is the prospect that alternative proteins present us. Alternative proteins – proteins produced by plant or animal cells, or by way of fermentation – have the potential to transform our food systems. This report explores how likely such a transformation really is, and what needs to happen to bring it about.

Alternative proteins tend to be analogues of conventional meat, dairy, seafood or egg products. They typically involve some form of novel technology and/or production process to replicate the properties of animal-based products, but without requiring the rearing of live animals. It is common to distinguish three types of alternative proteins:²

- **Plant-based:** products derived from plant protein, such as soy or pea.
- **Fermented:** products deriving their protein content partially or entirely from a fermentation process, such as the use of mushroom mycelium or soy leghaemoglobin.
- **Cultivated:** products derived from animal cells that have been fed a growth medium and developed into muscle or fat cells via tissue engineering.

In our discussion here of alternative proteins, we do not include conventional whole plant products that are high in protein (e.g. beans and pulses). Though these foodstuffs are important substitutes for animal products in our diets, their lack of novelty means they do not raise the same political and policy issues as the other products we cover in this report.

Insect-based products which utilise insects such as crickets, mealworms, and ants as protein sources, are also sometimes considered alternative proteins, though they obviously do not meet our definition of avoiding the use of live animals. Moreover, due to the ethical implications of insect farming (discussed below), it is our preference to exclude them from the alternative protein category.

Most alternative proteins on the shelves just now are plant-based (e.g. burgers and sausages made from plant proteins), though Quorn, one of the longest standing alternative protein brands, uses fermentation. Cell cultivated meat is not yet generally available, though Singapore and the US have approved certain products for sale.

In addition to these pure forms, there is increasing discussion of the possibility of **hybrid** products – those that blend plant-based proteins with cell-cultivated (or potentially conventional meat, though we do not discuss that possibility here).³ For example, plant-based bacon could be ‘enriched’ with cultivated fat from animal cells.⁴

This is the third and final report in our series exploring the relationship between alternative proteins and animal welfare. The first, published in May, explored the current state of animal welfare in food production in the UK.⁵ It concluded that the most practical and tractable way to think about animal welfare is to identify factory farming – the use of highly intensive methods – with lower welfare. This approach implies that farm animal welfare is overwhelmingly an issue of intensively farmed meat chickens: of the 155 million factory farmed animals in the UK at any given time, 98% are poultry. Moreover, the vast majority of meat chickens reared for slaughter – some 95% – are factory farmed.

The second report, published in September, explored public attitudes in the UK to animal welfare and alternative proteins.⁶ It found that despite politicians' reticence to address the topic, there is widespread recognition of the problems associated with animal agriculture and dissatisfaction with the status quo. 57% of people believe that the country should eat less meat, and 58% have taken steps to eliminate or reduce their own meat consumption. 83% say they care about farmed animal welfare, and 61% have at least some discomfort with the way animals are treated on farms. 66% say they would pay more for meat from higher welfare animals.

That report found that alternative proteins are already helping some consumers to reduce their consumption of animal products, though only 26% of people say they are satisfied with the existing products on the market. In particular, animal sympathisers – those that want to do better by animals but struggle to convert those positive inclinations into action – are most enthusiastic about the prospect of new and improved alternative proteins. More generally, we found strong support for efforts to refine and develop alternative proteins – 62% of people would support public investment in alternative proteins research.

In this third report we dig deeper into the alternative proteins market to understand how it has developed over recent years, to try and anticipate what its future trajectory might be, and to understand the likely implications for animal welfare. We have done this by means of a review of the relevant literature, a series of interviews with market observers, and a survey using the 'Delphi method' to try and identify consensus among experts.

The rest of the report is structured as follows:

- **Chapter Two** reviews recent trends in the alternative proteins market, mapping its growth in the UK and elsewhere to see whether it has yet made a dent on the conventional meat industry.
- **Chapter Three** outlines the key accelerators and brakes that will determine the future success of the alternative protein market, to try and identify what factors will really make the difference to its development.
- **Chapter Four** summarises forecasts for the alternative protein market, to try to identify how big it could get in the coming years, and under what conditions.
- **Chapter Five** then explores the likely impact of the growth of alternative proteins on animal welfare, and how the market needs to develop to make a difference to animal lives.

- **Chapter Six** concludes by discussing implications for policymakers and advocates, asking what, if anything, they ought to do to support the shift from lower welfare animal products to alternative proteins.

CHAPTER TWO – TRENDS IN ALTERNATIVE PROTEIN CONSUMPTION

Much of this report involves prognostication – trying to anticipate where alternative proteins might be headed and how that trajectory might be altered. Before we get to the question of where we are going, we start by explaining where we are now, in 2023. Drawing upon existing literature and data and interviews with industry experts and observers from across the alternative protein sector, conducted in July and August 2023, this chapter aims to provide an overview of the alternative proteins market, establishing the current levels of consumption of alternative meat products internationally and in the UK.

The alternative protein market has grown substantially in recent years

There has been rapid growth in the global alternative protein industry over the past decade. As Figure 1 below indicates, plant-based protein is currently the most developed alternative protein product category, with others in their nascent stages of development. Data collected by Euromonitor and published by the Good Food Institute (GFI) shows the global plant-based meat and seafood market grew 118% from 2017 to 2022, surging from \$2.8 billion to \$6.1 billion.⁷

“When I think about how far the industry has progressed in five years, it really has come on leaps and bounds.” – Catherine Tubb, Director of Research, Synthesis Capital

Data showing the precise size and dimensions of the UK’s alternative protein market is limited. Nonetheless, according to Statista, meat alternatives have grown rapidly – by 400% – between 2014 and 2023.⁸ As elsewhere, plant-based meat is the UK’s most mature alternative protein product category.⁹

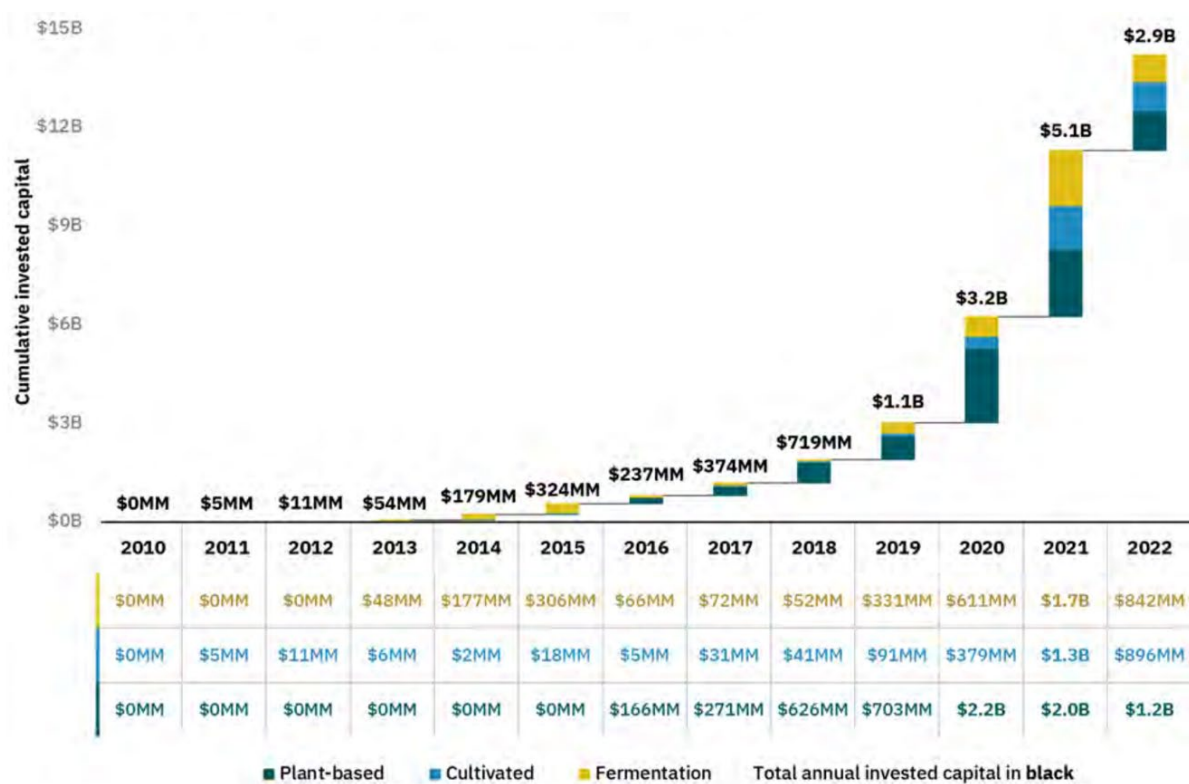
It has been buoyed by significant private investment

Driving this growth has been a substantial influx of investment. Between 2010 – when annual capital invested was negligible – and 2022, \$14.2 billion was raised by alternative proteins companies. By the end of 2022, all-time investments in plant-based proteins reached \$8 billion; for cultivated and fermentation-derived they approached \$3 and \$4 billion, respectively.¹⁰

British companies raised £212 million in 2021,¹¹ and nearly £300 million in total since 2006.¹² Since 2012, the UK has invested around £43 million in R&D for developing alternative proteinsⁱ.¹³

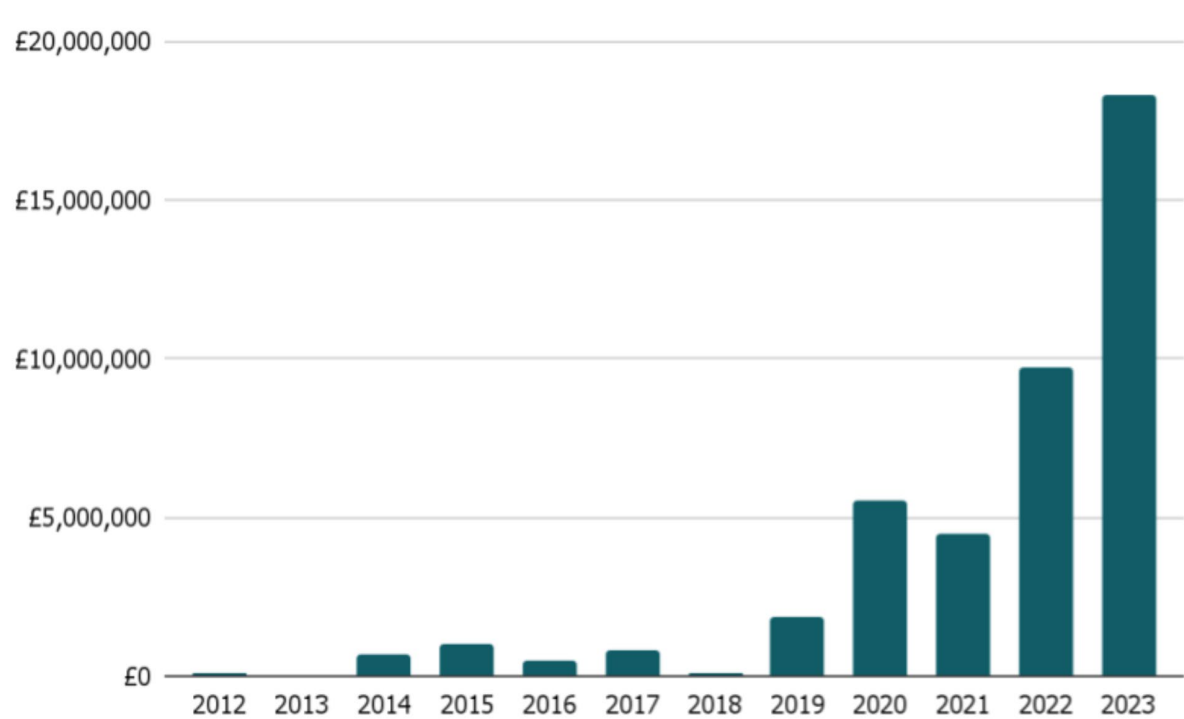
ⁱ Includes plant-based, fermentation-made and cultivated meat, seafood, eggs and dairy.

Figure 1: Global alternative protein invested capital



Source: Good Food Institute.

Figure 2: Total UKRI funding for sustainable protein R&D



Source: UKRI Gateway to Research, GFI Europe analysis. Note: 2023 covers the period up to May 2023 only.

Governments are also supporting growth

Like any emerging market, the alternative proteins sector needs a nurturing policy environment – and ideally public funding – to thrive. An increasing number of governments have obliged. In 2022 alone, the following nations made significant steps to support their alternative protein markets:¹⁴

- **Denmark**, in its ambition to become a plant-based powerhouse, outpaced other countries by making investments of around DKK 675 million (\$99.4 million) to advance its plant-based industry, including a ‘green proteins’ strategy.¹⁵
- **Canada**, also looking to become a plant-based leader, invested over CAD 171 million (\$127 million), focusing on commercialisation and building its domestic market. It expanded its support for alternative proteins to include precision fermentation and cultivated meat for the first time.¹⁶
- **The Netherlands**, which is renowned for its innovation in farming, announced a record-breaking €60 million investment in cellular agriculture. The programme will help fund new research, workforce training, and commercialisation in the sector.¹⁷
- **In the United States**, the Food and Drug Administration completed its first premarket consultation for a cultivated meat product, making it the second country after Singapore (which permitted the sale of a cultivated meat product in 2020¹⁸) to give a company – UPSIDE Foods – the ‘green light’ to produce cultured meat, opening the door for sales. In 2023, a second company, GOOD Meat, Inc., was provided the green light from the FDA.¹⁹ Both UPSIDE and GOOD Meat received approval from the Department of Agriculture at the same time, allowing them to sell cell-cultivated chicken commercially in the US.²⁰
- **Israel**, already a world leader in alternative proteins, pledged over \$26 million to a range of different research projects and infrastructure developments. That included the launch of the largest ever government-backed cultivated meat consortium, involving food producers and academic labs.²¹

This is to name but a handful of examples, with many more governments – for example, South Korea, Sweden, and China²² – also taking action to fund, research, and scale up their production of alternative proteins. Taken together, these strides underscore a global trend towards the widespread support of alternative proteins.

“In terms of capacity and regulation, we’ve seen really interesting moves behind the scenes. I think the big news this year has been the approval in the US for selling cultured meat, which is incredible.” – Catherine Tubb, Director of Research, Synthesis Capital

Countries have also been working together to support protein innovation. From an economic perspective, alternative proteins provide nations with a new impetus for growth and the opportunity to establish a foothold in the ‘new protein economy’.²³ And in the face of global issues such as climate breakdown, public health risks, and food scarcity, multinational entities are starting to recognise the role of alternative proteins as a viable solution to mitigating risk.²⁴ From the World Health Organisation to COP27, summits, reports, and consultations are being introduced at the highest level of politics, all with the aim of developing the regulation and trade of meat alternatives – signalling a firm commitment to the nurturing of the sector.²⁵

Britain has also expressed ambitions to develop a thriving alternative protein sector

Alternative proteins now feature regularly in UK national policy and debate around our food system. The foremost example is the government-commissioned National Food Strategy (NFS), which has made the economic, moral, and environmental case for the transitioning to sustainable options.²⁶

“The government should be a tailwind. Alternative proteins fit well with the UK’s strengths. Tech, science, biotech. We have a good farming history. It feels like the UK could be in a really good position.” – Catherine Tubb, Director of Research, Synthesis Capital

The NFS acknowledges that one way to help consumers reduce their meat consumption is to provide them with (competitively priced) alternatives. With this in mind, and to keep up with international policy trends, it has recommended that government invest in the transformation of the food system, including the establishment of a £75m fund for alternative protein start-ups and £50 million for an alternative protein innovation cluster.²⁷

A key recommendation of the NFS is a 30% reduction in meat consumption by 2032. However, this target has not yet been taken forward by government, leading some campaigners, including Henry Dimbleby (who led the review and has subsequently quit his role as the UK’s food tsar), to question the government’s commitment.²⁸ The government does not have a comprehensive policy stance on alternative proteins,²⁹ and Environment Secretary Therese Coffey was dismissive of the industry in her recent Conservative Party Conference speech, saying “Fake meat might be okay for astronauts, but when people think of a meat feast, I want them to be thinking about great Welsh lamb, our Aberdeen Angus beef, our Saddleback pork”.³⁰

That said, some parts of government, and in particular its arm’s-length bodies, have been more favourable towards alternative proteins:

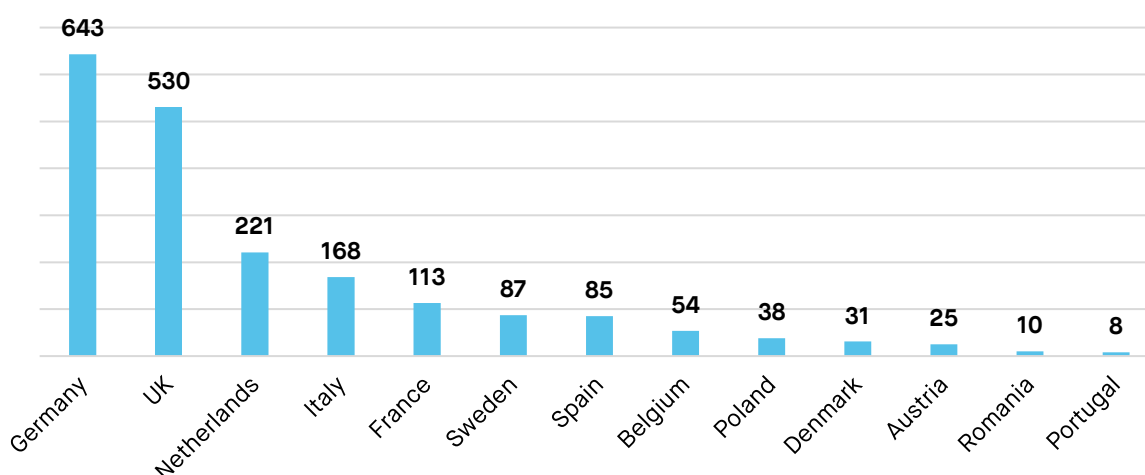
- In **June 2022**, the Government Food Strategy pledged to spend at least £120 million on improving the food system, including on alternative protein research.³¹
- In **September 2022**, the Biotechnology and Biological Sciences Research Council, together with Innovate UK, committed to spend £20 million on “capacity building, research, innovation, and business-led commercialisation” in the alternative protein industry.³²
- In **March 2023**, the Genetic Technology Bill, allowing the development of precision breeding techniques, including that of new alternative protein products, passed into law.³³
- In **April 2023**, the government invested £12 million in a new research centre to grow alternative proteins such as cultivated meat.³⁴
- In **August 2023**, the Biotechnology and Biological Sciences Research Council and Innovate UK announced a £15 million grant to establish a new Innovation and Knowledge Centre (IKC) to support alternative protein innovation. Four IKCS are currently active in the UK.³⁵

- In **September 2023**, reports suggested that the UK is set to sign a bilateral agreement with Israel to boost collaboration on cell-cultivated meat and fast-track regulatory approvals.³⁶

The UK has become a European leader

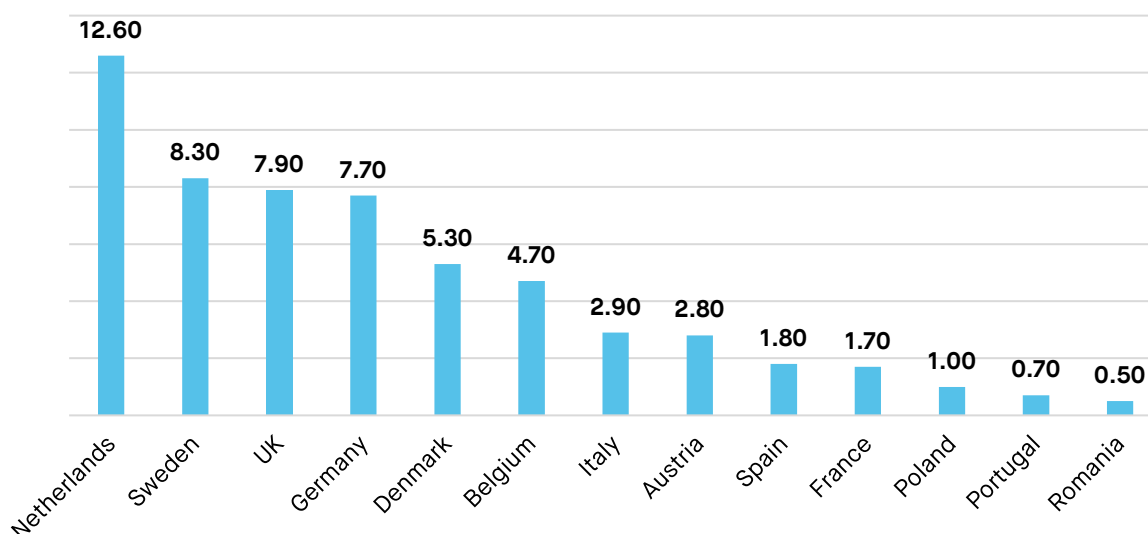
According to retail sales data provided by Nielsen and published by the GFI, the UK is now a prominent player in the European plant-based meat alternative market. Although Germany is the biggest market (€643 million), the UK has the second highest position in sales (€530 million) and is considerably ahead of the Netherlands, the third biggest market (€221 million).³⁷

Figure 1: Europe-wide plant-based meat sales by country (€ millions), 2022



Source: Good Food Institute.

That position is slightly flattered by Britain's large population, but the UK (€7.90) also has the third-highest average spend per capita on plant-based meat, trailing behind only the Netherlands (€12.60) and Sweden (€8.30). This suggests a significant level of consumer interest in meat alternatives within the domestic market.³⁸

Figure 4: Europe-wide average plant-based meat spending by country per capita (€), 2022

Source: Good Food Institute.

But stalling growth and investment has halted its momentum

Alternative proteins have experienced substantial growth in recent years. However, declining sales and a deceleration in investment have raised concerns about the long-term future of the movement.

“The alternative protein market is not subsidised, and it has been hit by crises. It has plateaued recently. There are lots of headwinds.” – Anonymous

For instance, the value of plant-based meat sales in the UK declined by 8% in 2022.³⁹ This can partly be explained by issues specific to the alternative proteins market, with some of this fall merely reversing the exuberance of recent years. It is also a consequence of broader macroeconomic trends – in particular, higher interest rates – reducing global investment across multiple sectors, hitting technology firms particularly hard.⁴⁰ The cost of living crisis, which appears to have reduced meat consumption more broadly, is also likely to have hit relatively premium alternative protein products particularly hard.⁴¹

Yet it demonstrates the fact that progress is not inevitable, and poses questions about whether we have hit ‘peak alternative proteins’. This was highlighted in a recent *Guardian* podcast, which contemplates whether plant-based food has indeed “lost its sizzle”.⁴²

“It’s an interesting time for the industry. Since 2018, there’s been a lot of progress. But in the last couple of years, there’s been disappointing sales growth.” – Chris Bryant, Director, Bryant Research

For all the growth in investment, the UK may nevertheless be falling short of what is needed. The GFI has recommended that the government invests between £245 million (at a minimum to sustain progress) and £390 million (to be internationally competitive) in sustainable protein R&D between 2025-2030. However, just a third of the £75 million earmarked for start-ups and research has been utilised so far, while the £50 million pledged for an innovation cluster is only partially met by the Engineering and Physical Sciences Research Council-funded £12 million Cellular Agriculture Manufacturing Hub.⁴³

“From a cultivated and fermentation perspective, there is excitement. But those technologies are still not at scale. Plant-based is much more established, but consumers aren’t regularly purchasing products.” – Jo Raven, Director of Thematic Research and Corporate Innovation, FAIRR initiative

These setbacks could be considered fleeting market ‘blips’. It is entirely plausible that sales and investment will rebound in the coming years, placing Britain back on its upward growth path. But such downturns do raise concerns about the long-term performance of the market, especially if the public are not yet consistently buying alternative protein products. Might the market have peaked, at least with products in their current form?

It is unclear whether alternative proteins have done much to improve animal welfare

The primary concern of this report is to understand the impact of alternative proteins on the meat market and, crucially, what the implications might be for animal welfare. As things stand, those implications are open to question. While there are some signs of improvement, it is unclear whether alternative meat products are making any significant difference to the lives of animals.

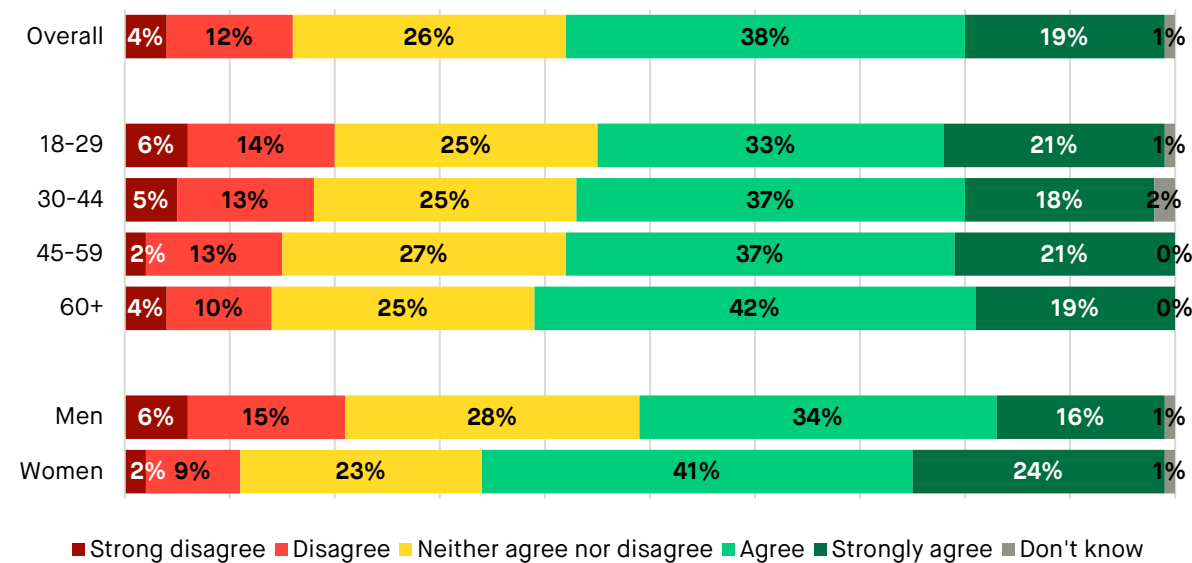
Shifting public attitudes provide some grounds for optimism

In the following chapter we delve deeper into the factors that are poised to further propel the alternative proteins market. One of the most significant is demand, with many people becoming more aware of – and concerned about – the health, ecological and welfare impacts of traditional meat. This perspective shift is particularly pronounced in Western countries, where meat substitutes are increasingly being seen as a healthier, more sustainable, and ethical source of protein.⁴⁴

“The pull factors in alternative proteins are moving in the right direction. They are getting better and cheaper and healthier year on year as they develop.” – Chris Bryant, Director, Bryant Research

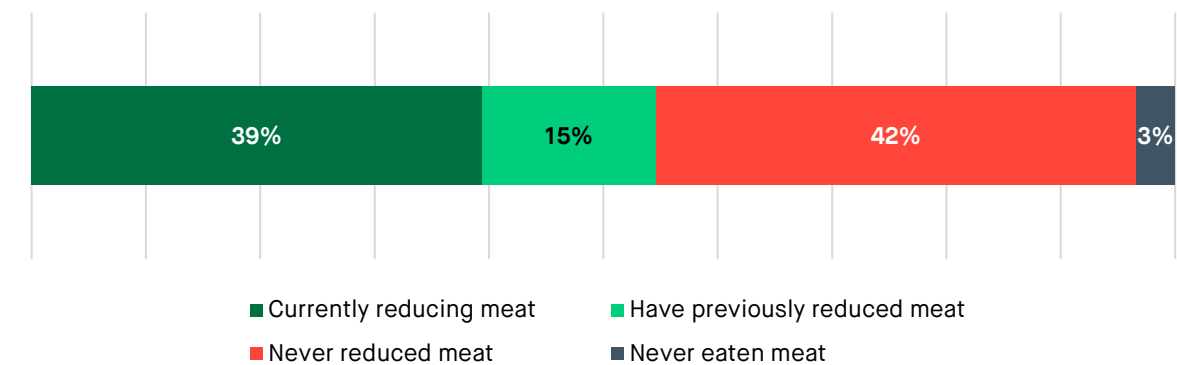
In the second phase of this project, the SMF explored British attitudes to eating meat.ⁱⁱ Our findings also revealed a shift in consumer preferences, with growing discomfort around meat-heavy diets and greater openness to more sustainable options. 57% of the country believe that most people should eat less meat – only 16% disagree – while 58% of people have taken steps to eliminate or reduce their own meat consumption. We also found that 19% of the population can be segmented as ‘meat lovers’ – the remaining 81% are persuadable. What once may have been a fringe goal or idea now appears to be mainstream. This ought to be good news for farm animals.⁴⁵

Figure 5: “In general, most people should try to eat less meat”



Source: SMF.

Figure 6: “Are you currently trying, or have you ever tried, to reduce your consumption of meat?”



Source: SMF.

ⁱⁱ See the SMF report, *Chewing it over: Public attitudes to alternative proteins and meat reduction*, for full analysis exploring public attitudes towards meat reduction.

Nevertheless, alternative proteins have only achieved a small share of an ever-growing meat market

These trends hold a lot of promise. People's opinions, consumption patterns, and government policymaking all seem to be moving towards a more sustainable food system, boding well for the long-term growth of the market. But as things stand, the overall impact of alternative proteins is modest at best.

The present market value of \$6.1 billion for global plant-based meat and seafood in 2022⁴⁶ stands in stark contrast to the total meat market, which reached \$1.4 trillion that same year.⁴⁷ This means alternative proteins currently account for less than 1% of the global market.⁴⁸ The UK does a bit better: in 2022, plant-based meat had a 3% share of the pre-packaged meat category.⁴⁹

Meanwhile, meat production continues to expand. The Food and Agriculture Organization of the United Nations (FAO) has projected that the global meat market will grow from 360 million tonnes (2022) to 455 million tonnes in 2050 – a 26% increase – to meet growing demand.⁵⁰ Jefferies anticipates the industry to almost double in the next 20 years, reaching \$2.7 trillion by 2040.⁵¹

As we have pointed out in previous research, a greater number of animals are set to suffer in the years ahead – particularly chickens, the animal we have identified as representing the biggest welfare concern.⁵² Unless there are significant changes in the treatment of farm animals in the UK, we expect the factory farmed broiler (chickens reared for meat) population to grow by 23%, increasing from 119.7 million to 147.3 million by 2032.⁵³ Assuming this growth rate persists for the next decade, there will be approximately 181.2 million chickens by 2042. That is an additional 61.5 million chickens in the UK reared under lower welfare standards, an astronomically high number that represents increased animal suffering – and, in terms of sheer scale, a lot for alternative proteins to compete with.

The implications of the animal meat industry's growth trajectory are significant. 'Business as usual' will not be able to meet demand without compromising climate objectives and maintaining the intensive farming of animals. Embracing new food solutions thus represents an opportunity: reduce the manifold risks associated with livestock farming, while continuing to provide the population with sustenance. For that to happen, several key conditions must first be met.

CHAPTER THREE – ACCELERATORS AND BRAKES OF GROWTH

In the following chapter, we present forecasts that outline the potential future size of the alternative protein market. Those estimates are far from uniform. This is because different projection paths, and the methods used for calculating them, rely on varying ‘accelerators’ and ‘brakes’ that impact the trajectory of growth.⁵⁴

As articulated by the Good Food Institute, our focus should not solely be on the market’s top line numbers, but on the crucial assumptions that shape those projections. Instead of simply asking how the market will grow, we should also be thinking about the type of world in which it will develop.⁵⁵

This chapter aims to do precisely that, considering the key conditions that are needed for the market to flourish. We also confront potential roadblocks that may stand in the way of the alternative meat movement, identifying the limiting factors that could hinder its growth. Because, while expansion has thus far been rapid, alternative proteins have a long way to go.

We consulted public forecasts and surveyed experts to identify the key drivers of the alternative proteins market

This chapter assesses projections found in the literature and presents findings drawn from primary research. For the latter, we employed the ‘Delphi method’, a survey technique that synthesises the views of experts in successive rounds.

In the first survey round, participants – alternative protein experts from different backgrounds including academia, venture capital, grant making, non-profits and alternative protein production – were asked to share their opinions on different scenarios and concepts related to the alternative protein market. We invited those we interviewed to complete the survey, and to share it with relevant colleagues. The second and final round invited participants to revisit their responses, this time having seen the responses to the initial survey. Utilised in healthcare and other settings, this approach is deployed to gauge future trends, scenarios, and demand. It is also used to consolidate a group consensus on key ideas, which is particularly useful for market predictions and narrowing different forecasts.⁵⁶ The surveys were conducted in August 2023.

The Delphi method does have some limitations. The first concern is around hypothetical bias. Market trends and consumer behaviour are incredibly difficult to predict, which is likely to lead to speculative, rather than robustly empirically grounded, responses. Secondly, our survey sample is small and includes several individuals from within the alternative protein industry, many of whom are working to advance the market. It’s plausible that some responses may not be fully representative and could potentially carry a positive bias.

Due to the Delphi method’s iterative nature, another issue that arose was that some respondents participated in the initial survey (n=15) but not the subsequent round (n=8). This will have affected the consistency of the sample, disrupting the consensus-building process. The results of this survey should therefore be considered with caution.

Expert opinion tends to see overcoming supply side constraints as more significant to alternative protein than generating demand

Obstacles to the growth of alternative proteins can be divided between those on the supply side (e.g. production economics, technological progress, investment) and those on the demand side (consumer acceptance, social norms, the political environment) conditions. Across our interviews, there was some debate over which of these constraints are more significant, which represent the limiting factors on progress. Those who emphasise the supply side argue that product price, quality, scalability and efficiency are critical. They represent a 'build it and they will come' outlook: if the scientists and businesses can develop a good, available, affordable product, they will be able to find plenty of willing buyers.

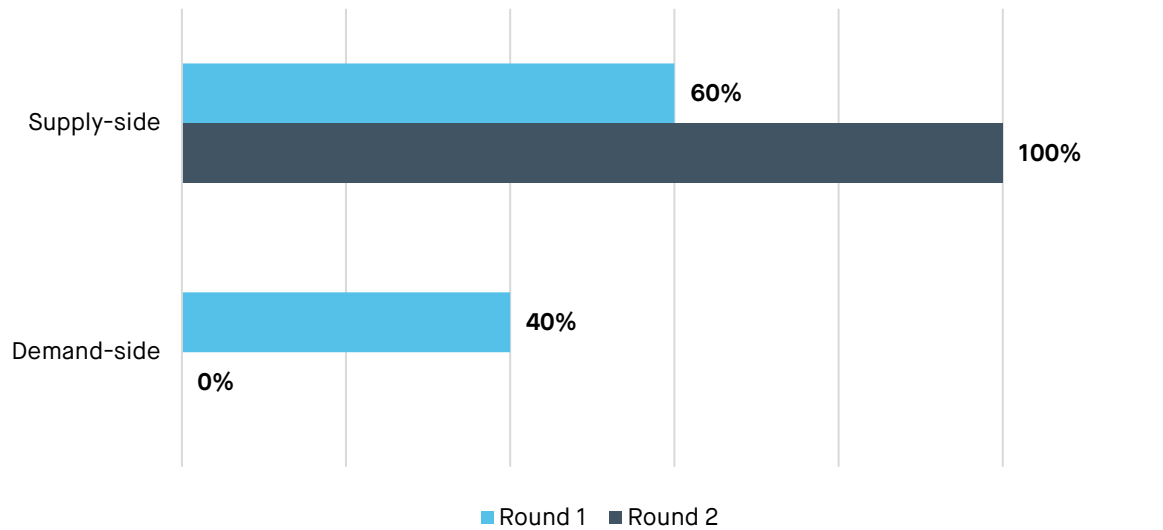
"The two big ones are quality and price. If those go in the right direction, then basically you can expect the demand to follow." – **Chris Bryant, Director, Bryant Research**

At the same time, there are others that argue that the demand side cannot be taken for granted. Alternative protein products have to be aligned with expectations, and some consumers may be unwilling to embrace change. Regardless of how technologically advanced or efficient the supply side may be, if norms, cultures and associations do not move in the right direction, there will be a strict limit on growth.

"The psychology of animal product consumption is a really complex cultural-biopsychosocial phenomenon. It's not a simple 'which one is cheaper?' kind of situation." – **Jacob Peacock, Research Manager, Rethink Priorities**

The majority of those interviewed for this research identified supply side conditions as being most important for the consumer uptake of alternative proteins. Though there was some scepticism, the prevailing sentiment was that supply side dynamics are paramount to success. In the second round of our survey of experts, there was complete consensus (though as noted above, this is likely because some adherents of the demand-side view dropped out of the research).

Figure 7: “Which is more important to the growth of the alternative proteins market, supply or demand-side drivers?”



Source: SMF expert survey.

The supply side consists of three distinct yet interconnected production drivers: product quality, manufacturing capability, and investment.

The foremost driver, product quality, is the ultimate goal. But that relies on production economics, and the ability to scale up the production of alternative products in technologically advanced labs or factories. This, in turn, relies on investment, as it is difficult to expand manufacturing capability (and to engage in the necessary research and development to refine the product) without adequate capital.

Taste and price parity is widely thought to be necessary for success

'Taste and price parity' is a common slogan within the alternative protein world and literature, regularly cited as the key requirement for producers to compete effectively with conventional meat products. The GFI has highlighted that most forecasters believe improved product features – namely taste, texture, nutrition, and cost – will be the most important driving force for the adoption of alternative proteins and compete in the meat market,⁵⁷ and most of the people we interviewed agree.

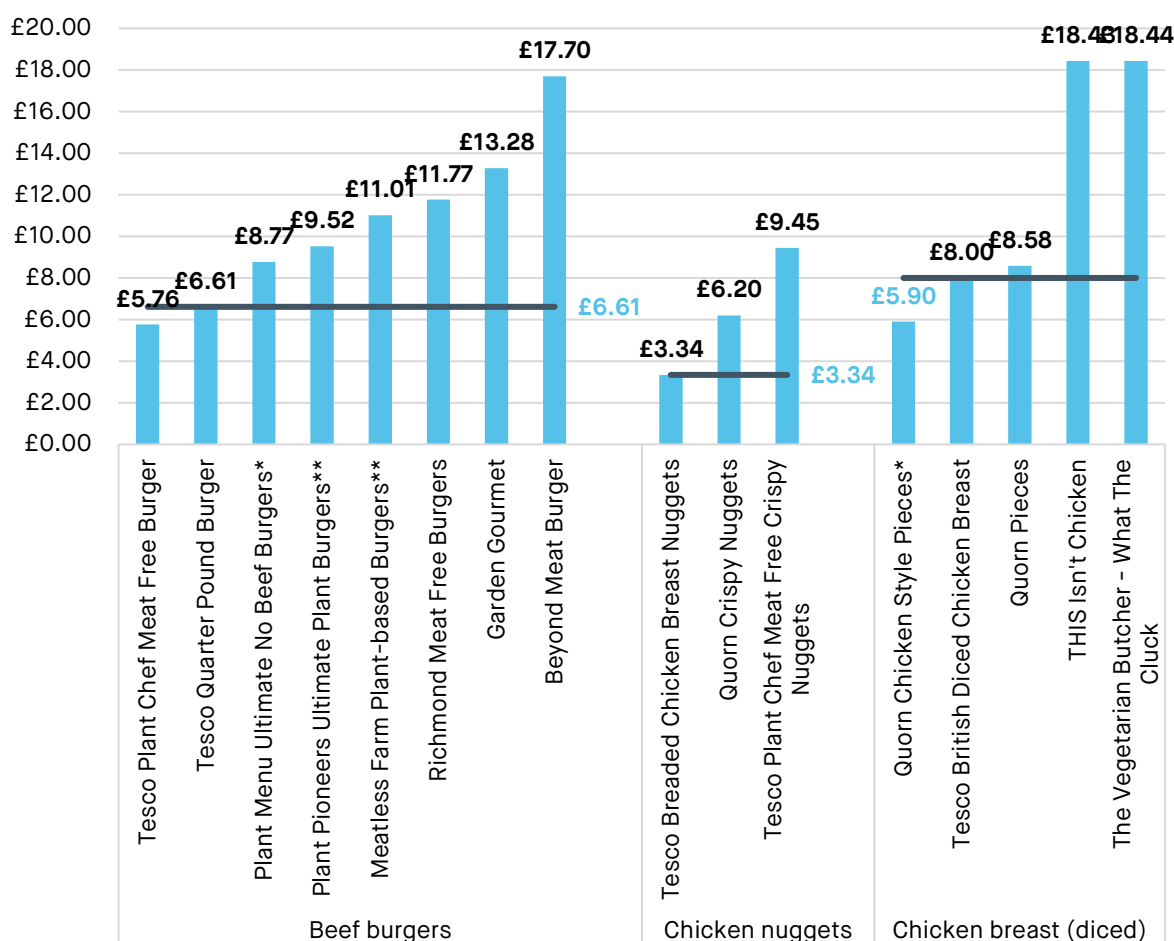
“You need to get product right. You only have one shot with the consumer.” –
Jo Raven, Director of Thematic Research and Corporate Innovation, FAIRR initiative

Our previous report exploring public attitudes to alternative proteins found that a significant minority of consumers (26%) say they are satisfied with existing products on the market.⁵⁸ But according to Synthesis Capital, these early adopters of alternative proteins are primarily driven by social or environmental reasons, rather than the product itself.⁵⁹ With only a quarter of the public convinced by alternative proteins, products need to get better in order to gain wider consumer acceptance. That means achieving comparable – or even superior – quality and price parity to conventional products.

“A lot in practice comes down to cost. Expecting flexitarians to pay more for something that isn’t as tasty or authentic is a pretty tall order. If the alternatives get cheaper, there’ll be a lot of folk relieved that it’s easier to shop in line with their values.” – Tom MacMillan, Professor of Rural Policy & Strategy, Royal Agricultural University

Even plant-based meat, the forerunning alternative product, does not yet fully replicate the experience of eating conventional meat, while it remains more expensive.⁶⁰ SMF analysis of supermarket prices (Figure 8) published last year shows there is a significant premium attached to plant-based beef and chicken products.⁶¹ More recent SMF data has revealed that 44% of the public think alternative proteins are unaffordable.⁶² The cost of living crisis and inflationary pressures exacerbate this high price problem, giving consumers less of a reason to buy sustainably.⁶³

Figure 8: Supermarket retail price comparison of plant-based products to meat equivalents, £/kg



Source: SMF. Note: Prices from 08/04/2022 taken from Tesco.com unless noted as ** for Sainsbury's.co.uk. Products marked * are frozen.

No matter how you cut it, the alternative meat industry faces a significant challenge in providing products that can match the taste and affordability of traditional meat. However, there is a beacon of hope and a valuable lesson to be learned from the success of the alternative dairy industry.

Data provided by Statista shows that milk substitutes' global revenue increased by around \$6 billion between 2018 and 2022 alone,⁶⁴ which is roughly equivalent to the total value of the world's entire plant-based meat and seafood market.⁶⁵ In the UK, Mintel research has revealed one in three Britons now drink plant-based milk,⁶⁶ and in 2022 it had a 7% market share of the total milk category⁶⁷ – higher than the 3% plant-based share of the meat market.⁶⁸

According to one expert we interviewed, a key part of alternative dairy's success comes down to the taste of its products. Even though they remain more expensive than normal milk, because the product is 'right' there is a significant chunk of consumers that are willing to pay for it on a repeating basis. There is also a variety of alternative milk products – such as oat, almond, soy, cashew, coconut – available with different flavours and textures, making it easier for people to find a product they enjoy. This points to the importance of taste and variety in developing alternative protein products, and suggests it may be a bigger incentive than price, at least among higher-earning consumers.

"Dairy alternatives have done a really good job. They have good market share and have got the products right." – **Jo Raven, Director of Thematic Research and Corporate Innovation, FAIRR Initiative**

Availability and convenience are also important to sustained growth

To compete with and displace animal products, alternative proteins must be available on supermarket shelves and restaurant menus, and expand to cover the range of occasions and locations that animal products currently address. Despite expansion of recent years, the availability and range of meat-free options remains something of a challenge for those seeking to eat less meat.⁶⁹ Increased availability and diversification will likely follow advances in product innovation.⁷⁰

To a substantial extent, this depends on the decisions of retailers. Yet some suggest there is uncertainty over whether supermarkets, particularly larger stores – "retail juggernauts" – will decide to adopt the next generation of alternative proteins, as they have the last one. It was suggested that retailers have so far embraced alternative proteins in large part because they are seen as premium products that draw in more affluent consumers with high spending power – and, critically, consumers that will choose their retailer on the basis of alternative protein selection. It is to be seen whether they will be so willing to take risks on new cheaper products aimed at the lower end of the market.

"Someday, retailers will have to be convinced that they can de-list some meat items and still generate enough sales from the plant-based items that take their place." – **Abhi Kumar, Program Associate, Open Philanthropy**

The indications so far are fairly encouraging. In 2020, Tesco set a target to increase alternative protein sales by 300% by 2025.⁷¹ Yet this is off a relatively low base, and the target was set before the recent slowdown in alternative protein sales. Whether retailers will keep up the momentum and continue to push alternative protein products remains a key question.

“How do we reward consumers for making the right choices? I think big food has a big role to play in terms of positively reinforcing and rewarding their customers.” – **Jo Raven, Director of Thematic Research and Corporate Innovation, FAIRR Initiative**

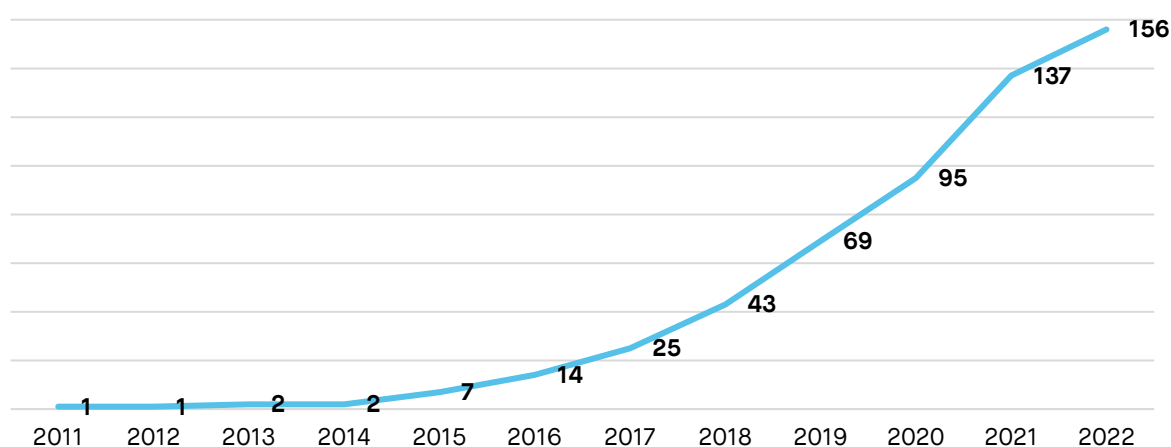
Cultivated meat is the product most likely to improve taste but the economics of scaling up are challenging – some think impossible

Cultivated meat, also known as cultured meat or cell-based meat, is produced by culturing animal cells in a controlled environment. Such products are considered to offer a market advantage as they are “bio-identical” to those found in animals, therefore mimicking the authentic taste and texture of conventional meat more closely than any other alternative protein product.⁷²

“What’s great is that, with cultivated meat, you can tailor the nutritional profile.” – **Tasvi Shah, Head of Strategic Products, Ivy Farm**

Globally, there has been a consistent year-on-year increase in the number of publicly announced cultivated meat companies (Figure 9). In 2022, \$896 million was invested in cultivate meat companies, 32% of all investment (\$2.78 billion, 2016-2022).⁷³ But in the UK, cultivated meat markets are still in their infancy. Similar to many other countries, as innovative products they are subject to rigorous novel food approval processes outlined by the Food Standards Agency, and are not yet available for sale.⁷⁴

Figure 9: Total number of publicly announced cultivated meat companies, by year founded



Source: Good Food Institute. Note: Includes all publicly announced cultivated meat companies the GFI is aware of, but it may not include all cultivated meat companies founded in 2022.

Although plant-based products are currently paving the way – vegan meat alternatives are already mass produced and available on the market – cultivated meat holds significant promise for the growth of the alternative protein market.⁷⁵ Some experts we spoke to see it as the ‘winning’ product of the future. In the media, there have been bold claims about the inevitability of these products, suggesting that cheap, accessible cultivated meat is rapidly approaching supermarket shelves.⁷⁶

“It will be much more difficult to get there without cultivated meat.” – **Chris Bryant, Director, Bryant Research**

Others are more sceptical of cultivated meat's potential, raising concerns around the technical and economic complexities of scaling up. The success of cultivated meat heavily relies on cost and scalability, but complicated manufacturing processes, cost to scale, and issues around regulation (discussed below) currently serve as bottlenecks. Only available in the US and Singapore, it is likely that cultivated meat's initial entry to the market will be offered at a premium price – potentially deterring consumers.⁷⁷

"I think that's going to take a lot longer, because unfortunately, you still have to build capacity. It's not a software business. It's not easy to scale up." –

Catherine Tubb, Director of Research, Synthesis Capital

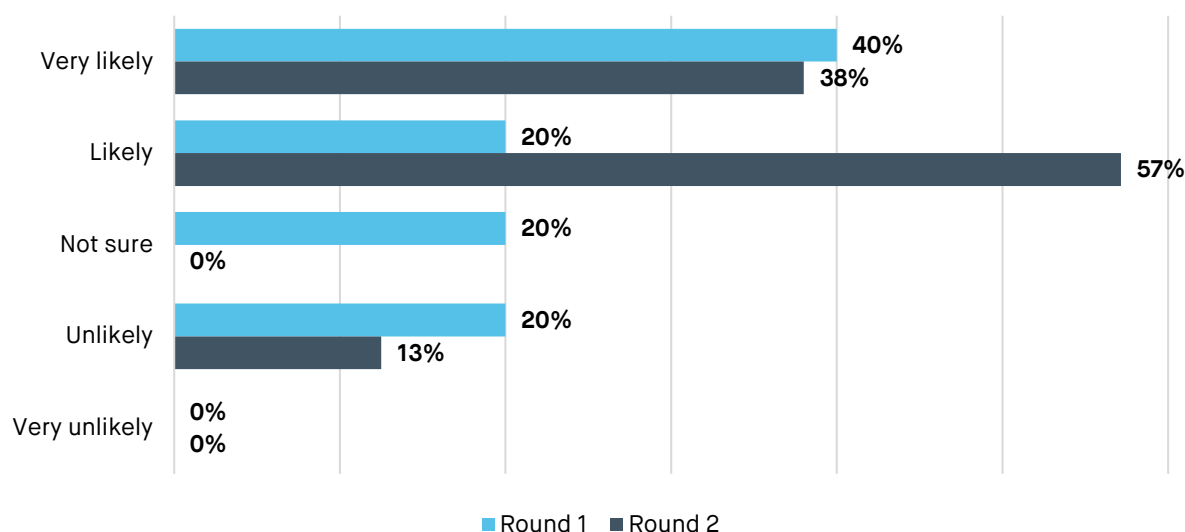
David Humbird, a chemical engineer who has produced perhaps the most thorough analysis of the feasibility of cultivated meat, offers a particularly sober view. He argues the techno-economics that underpin it are fatally flawed, and that cultivated meat will probably *never* be a cost-competitive food. Humbird describes the route to cost-competitive cultivated meat as blocked by a "Wall of No...And it's a fractal no. You see the big no, but every big no is made up of a hundred little nos".⁷⁸ These hurdles range from thermodynamics, cell metabolism, bioreactor design, ingredient costs, and facility construction, as well as other factors.⁷⁹ In a separate report, Humbird has said the cost of cultivated production will always be too high for cultured meat to be economically viable.⁸⁰

By this account, the possibility of a transformational cultivated meat solution appears unlikely. Given Humbird's concern, along with some reservations held by experts we interviewed, there is a credible risk that scaling-up efforts fail completely and stakeholders are harbouring unrealistic expectations regarding its potential success. According to Rethink Priorities analysis, many predictions about timelines for cultured meat have resolved or are expected to resolve incorrectly, suggesting "very systematic overconfidence" overall.⁸¹

That said, our survey respondents remain optimistic, and believe cultivated meat has a good chance of scaling achieving cost competitiveness within the next 20 years. Again, given the professional interest that many of our participants have in the success of alternative proteins, we should treat these responses with a bit of scepticism.

"We'll get there. The fact that as a whole industry we have got so far so quickly – it's promising." – **Tasvi Shah, Head of Strategic Products, Ivy Farm**

Figure 10: “How likely do you think it is that cultivated meat can be scaled up to compete with conventional meat products at a comparable price by 2040?”



Source: SMF expert survey.

Those with greater confidence that cultivated meat can achieve scale point out that many ‘growth factors’ (the nutrients required to grow cells) have declined substantially in price, and that there is progress in the necessary R&D to produce cheaper ones.⁸² They also argue that some firms are making progress in engineering cells to produce fewer toxins like ammonia which limit their growth.⁸³

Perhaps the greatest challenge facing cell-cultivated meat is building necessary infrastructure to adequate standards. There are at least two issues here. First, the sheer scale of investment required. According to one prominent estimate, it would cost \$450 million to establish a facility that would account for a fraction of a percent of total US meat production, and require bioreactor capacity equivalent to a third of the biopharmaceutical industry.⁸⁴ Second, the specifications of these facilities: how carefully cells need to be protected from contamination – and as a consequence, whether they need to be kept in food-grade or pharmaceutical-grade conditions. Pharmaceutical-grade conditions will be substantially increase the cost, and make scale much more challenging.⁸⁵ Here too, optimists point to innovative forms of production that require only parts of facilities to be at pharma-grade, and argue that the cost of bioreactors is likely to fall with scale.⁸⁶ More speculatively, it has been suggested the cell-cultivation could occur without bioreactors – through technologies like 3D printing or encasing in spheres or tubes.⁸⁷

It is beyond our scope and expertise to adjudicate the scientific and engineering debate, which is in any case somewhat speculative. All we can say with confidence is that there is significant uncertainty, and risk that cultivated meat fails to achieve its promise.

Investment in R&D spurs development, increasing the odds of success

Investment fuels innovation. Alternative protein projections often assume that increased investment will lead to higher-quality, more affordable products, creating a loop of technological advancement, expansion, and further investment – perpetuating growth.

As discussed in Chapter Two, there has been significant investment in the alternative proteins industry in recent years (Figure 1). This includes support from the animal agriculture industry. For instance, JBS, the biggest meat company in the world, has invested \$100 million in alternative protein development, including its own cultivated meat company and pilot facility. It is not just morally motivated start-ups wading into the market – established multinational corporations are also embracing the shift to alternative proteins.⁸⁸

“Investment can keep growing if we maintain the momentum on regulatory progress. Different products, techniques, and companies will be at different levels of readiness, but all are constrained by regulation. Even ambitious, pro-innovation regulators can be slow-moving, often due to underfunding.” –

Andrew Bennett, Policy Principal, Form Ventures

A thriving sustainable protein ecosystem depends on investment, including in research and development. If the UK wishes to advance its scientific and technical capabilities, speeding up product development, R&D spending is required.⁸⁹ The UK’s Net Zero Research and Innovation Framework notes that, given R&D is inherently pre-competitive, publicly funded investment is deemed more suitable than private equity for driving such activity.⁹⁰ However, as previously mentioned, the extent to which the government commits to meeting the UK’s investment needs remains uncertain. In the words of the GFI, “more support is essential”.⁹¹

Another challenge for investors is the potential risk of building a successful alternative protein ecosystem. Should the sector struggle with the required scale-up of cultivated meat production, for example, it may become challenging to justify further investment. If it fails, existing investment could end up being a complete waste. From an environmental sustainability or animal welfare perspective, that may be money better spent on funding other solutions.⁹²

“There is a big question in terms of putting more R&D into the system. How much further does that go? We don’t know exactly what the returns are going to be, but given the preliminary success of companies like Impossible and Beyond, it is a bet worth taking.” – **Abhi Kumar, Program Associate, Open Philanthropy**

Box 1: Public investment in sustainable markets

Developments in other ‘alternative’ or ‘green good’ markets show that government assistance can help to drive growth. As comparable examples of disruptive sustainable products, renewable energy and electric vehicles were “written off” as ever competing with their non-eco competitors. But once government helped to expand the market, prices fell faster than expected.⁹³

At one point achieving just 1% penetration (2015 and 2017, respectively), the International Energy Agency now believes renewable energy will form the foundation of the future energy system, while car manufacturers have since pledged to produce 100% electric vehicles by 2035. The GFI argues that, by learning from the successes (and challenges) of sustainable markets like renewable energy and electric vehicles, the alternative protein industry can benefit significantly from government investment.⁹⁴

Social and political factors can make progress smoother

Supply-side factors are crucial because they directly influence a company’s ability to produce goods. Production, reduced costs, improved quality, and greater competitiveness all help to contribute to (or hinder) industry growth. But there are also external factors that can either positively or negatively impact the market’s future trajectory.

The public must grow to accept alternative products, though consumer behaviour is hard to predict

On the demand side, changing attitudes towards the environmental and ethical dimensions of alternative proteins and product quality are intricately tied to the consumer’s acceptance of alternative protein products. However, it will take time to achieve the “tipping point” that catalyses exponential growth. Though progress is ongoing, demand is currently impeding adoption, rather than propelling it.⁹⁵

As outlined by McKinsey, the deep psychological and cultural ties people have to conventional meat is a double-edged sword. On one hand, it presents an opportunity for consumers to participate in a new kind of meat market offering a wide range of sustainable products. On the other, consumers are deeply familiar with the taste and texture of meat, with high uptake thus relying heavily on the supply-side improvements in taste and cost outlined above.⁹⁶

But consumer psychology is incredibly complex and difficult to predict. Analysis by Rethink Priorities has examined the relationship between the price and sales of margarine and butter as an illustration of how plant-based and animal-based products might relate to one another. Most studies find, as expected, that margarine is a substitute for butter. Yet in some contexts cheaper margarine appears, perversely, to lead to *higher* sales of butter. It is unclear exactly why this might be, but it could be that cheaper margarine simply means that people have more money left over to spend on butter, or that habits are so ingrained that margarine is just added to butter.⁹⁷ Similar research published by the Humane League has found that while the growth of plant-based milk in the US has coincided with a decline in sales of dairy milk, the observed relationship between plant milk prices and dairy milk sales is inconsistent.⁹⁸ Putting these findings together, they suggest that the assumption that cheaper alternative proteins will automatically and mechanically lead to lower consumption animal-based products is naïve, and that relationship obtains only sometimes.

“Available evidence doesn't really support strong and consistent price substitution.” – **Jacob Peacock, Research Manager, Rethink Priorities**

A separate Rethink Priorities report has rejected the ‘price, taste, and convenience (PTC) hypothesis’ (i.e. the theory that the supply side is the key constraint on growth).⁹⁹ It collects evidence from ‘hypothetical discrete choice experiments’, where people are asked to choose whether they would prefer to buy otherwise identical plant-based or conventional meat products, and finds that in almost every case, only a minority – typically 20-30% – would opt for the plant-based product. It also shows that, in field experiments where retailers have introduced alternative protein products at equal price to conventional meat, they have only seen a relatively small proportion switch.

The paper draws on such findings to argue that PTC is not the primary factor in food choices, and that social and psychological factors are as, if not more, important influences. As such, it suggests that most people would continue eating animal meat even if alternative proteins became competitive on these criteria – though it emphasises that further research is needed. A limitation of existing studies is that attitudes and preferences may be conditioned by the products currently on sale, and may shift with different ones – though the idea that new, better products would be a game changer is inevitably speculative and unfalsifiable until those new products emerge.

Fundamentally, there is still a degree of public scepticism towards some novel proteins. In 2022, the Food Standards Agency found that 43% were unwilling to try cultivated meat, while 34% expressed willingness.¹⁰⁰ Our own survey, published earlier this year, shows 39% would be willing to try cultivated meat.¹⁰¹

Polling results from a study conducted by GlobalWebIndex, in collaboration with the RSPCA, underscore a similar point: due to personal preferences, some consumers will never want to change their eating habits. 20% said they do not see the purpose of considering a reducetarian diet, for example – in line with the 19% of ‘meat lovers’ we found in our survey earlier this year.¹⁰² This presents a significant psychological barrier to adoption that alternative protein producers will have to address.

“The ‘ick factor’ might be a challenge. But it won’t stop the industry.” – Tasvi Shah, Head of Strategic Products, Ivy Farm

The regulatory and policy environment can nurture the market – or smother it

In the UK, innovative food products like precision fermented and cultured meat have not yet received regulatory approval from the Food Standards Agency. Deloitte has assessed the Novel Foods Regulatory Framework, noting that the UK's departure from the European Union provides the government with the opportunity to revise regulations independently, without the need for consensus from other EU nations. This autonomy would present a significant advantage in the global market.¹⁰³ However, Deloitte also acknowledges that UK regulations could be more finely tuned, introducing novel foods to the market without prolonged approval procedures.¹⁰⁴

“The brakes are around regulation. Regulation around food is an arduous process, which it should be, but there’s a risk of things getting backed up. The FSA has so many food and CBD [cannabidiol] applications on their desk.” – Catherine Tubb, Director of Research, Synthesis Capitalⁱⁱⁱ

Limited funding and inadequate resources have contributed to delays in the Food Standards Agency’s (FSA) authorisation process.¹⁰⁵ Though nowhere near as extreme as Italy’s plans to ban cultivated meat, a decision rooted in the preservation of Italy’s “food heritage”,¹⁰⁶ expert interviews indicate that the current regulatory environment is a significant roadblock the growth of the alternative protein market.^{iv}

“There is a bottleneck right now. Cultivated meat companies or those that feed into the value chain are struggling with getting the FSA to be agile. The regulator needs to adapt their process to ensure critical innovation is not stifled in the UK.” – Tasvi Shah, Head of Strategic Products, Ivy Farm

Teething problems are to be expected, and regulatory change takes time.¹⁰⁷ As detailed in Chapter Six of this report, government can play a vital role in helping to facilitate the development of alternative proteins by making regulatory processes smoother and by introducing new policies. From making investments in alternative proteins to taxing conventional meat, from enforcing stricter farm animal welfare regulations to promoting public information, there are a number of approaches the government can take to accelerate market growth. Failure to take action may stifle it.

“Regulatory innovation could be really impactful. It’s certainly a blocker, and therefore fixing it would be a major kind of accelerant” – Andrew Bennett, Policy Principal, Form Ventures

ⁱⁱⁱ The challenges of novel foods regulation and CBD is discussed in an SMF blog, *Opportunities and constraints of the emerging CBD market*.

^{iv} In August 2023, Israeli start-up, Aleph Foods, became the first company to submit a novel foods application to launch cultivated meat products in the UK to the FSA. Aleph expects the review process to last between 12 and 24 months.

Challenges in the livestock industry could shake up the market

Again, supply-side industrial factors are likely to play the foremost role in driving adoption. But there are also changes to farming practices in alternative protein's counterpart industry, livestock meat production, that may also impact uptake.

According to global management consulting firm Kearney, agribusiness faces significant challenges in the coming years in meeting the growing world demand for meat, and keeping prices low:¹⁰⁸

- **The land challenge:** arable land, the availability of natural resources and yields are shrinking as a result of global warming. Urban development and population growth compound these issues.
- **The intensification challenge:** conventional agricultural production methods are starting to reach their limits, and solutions for making conventional meat more efficient are almost exhausted.
- **The livestock challenge:** public health issues (including an increase in the prevalence of zoonotic diseases¹⁰⁹) and scandals have contributed to consumers' decreased appetite for factory-farmed products. The use of antibiotics in animal farming may also trigger antibiotic resistant pathogens, causing further risk to human health.

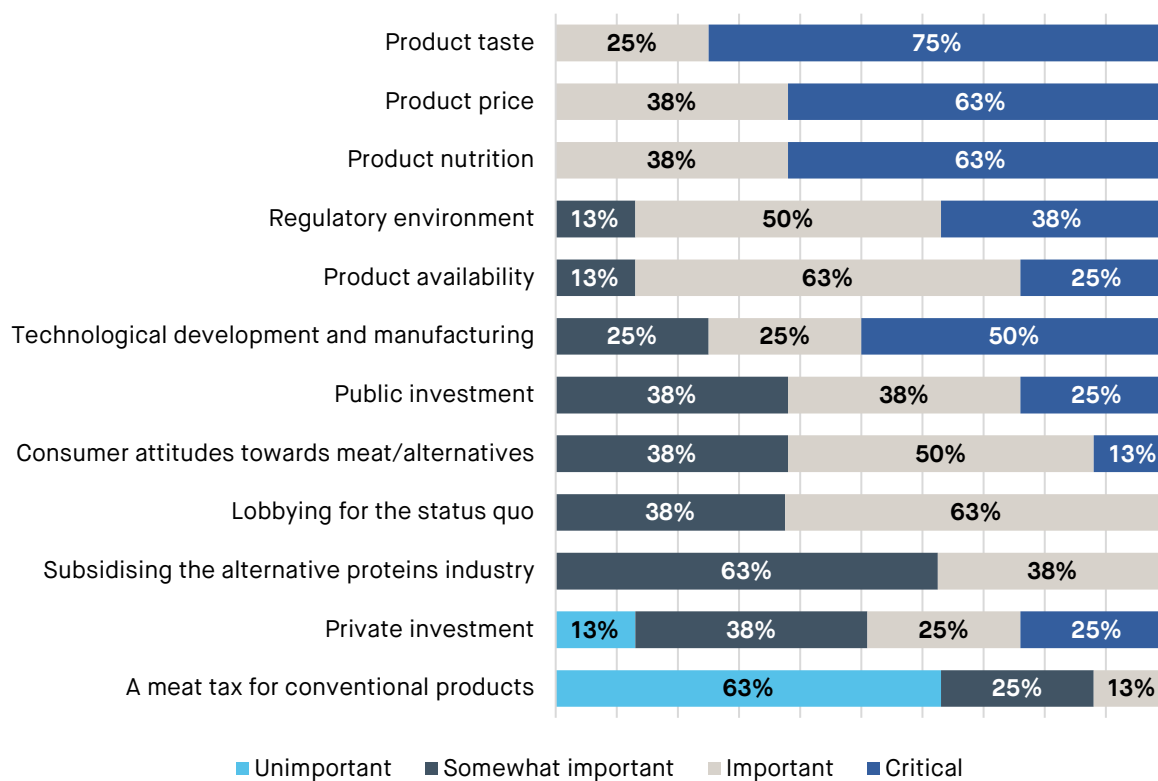
EY has offered a similar appraisal, contending that the environmental and social opportunities presented by alternative proteins may prompt farmers to consider diversified portfolios.¹¹⁰ Additionally, the burgeoning alternative protein market could introduce complexities and reduce cost-effectiveness in conventional production. If alternative proteins significantly increase their market share, animal products would need to increase their profit margins – raising prices to the detriment of conventional producers. But as one interviewee highlighted, this could lead to an industry-led consumer backlash.

“The meat industry is tying meat to the local person and the local economy. For example, ‘Support British’. How do you convince consumers to make choices that they may believe is not supporting the economy or is not putting their local farmer out of business?” – Jo Raven, Director of Thematic Research and Corporate Innovation, FAIRR Initiative

RethinkX, an independent think tank that forecasts technology-driven disruption, offers a particularly bearish view on the future of livestock farming. It predicts the cost of alternative proteins will be five times cheaper by 2030 and 10 times cheaper by 2035, while surpassing animal products in terms of taste, nutrition, and variety. Consequently, by 2030, alternative products are anticipated to have a profound impact on the animal farming industry. Rethink believes the number of cows in the US will collapse by 50%, with other livestock industries potentially facing a similar fate.¹¹¹

“If we look at trends such as healthier eating and all the pressures that are also on livestock, fresh water, land use, and emissions, I think that naturally we will see the shift away from animal based meat.” – Anonymous

Figure 11: “How important do you expect each of the following factors to be in influencing consumer adoption of alternative proteins?”



Source: SMF expert survey; n=8.

CHAPTER FOUR – FORECASTING THE FUTURE ALTERNATIVE PROTEIN MARKET

Having explored the current consumer market penetration of alternative proteins, as well as the key factors likely to shape its trajectory, we now turn our attention to forecasts projecting the market share of the sector in the coming years, and how that might affect demand for conventional meat products. Like the preceding chapter, this part of the report draws upon both the alternative protein literature and the small-scale survey of experts we conducted.

Forecasts projecting the trajectory of the market suggest some growth is likely – though they vary wildly on how much

Predicting the future, especially when we're discussing technological change, is challenging. To give us a sense of what is possible, there are a number of analogous food and drinks markets we can look to for an indication of what happens when a new and disruptive technology takes off. We have already mentioned the analogy to plant-based milks, which have already achieved a 7% share of the total milk category in the UK.¹¹² Margarine is another, better established, alternative to an animal product with a 15% share of the global fats and oil industry.¹¹³

Most ambitiously, alternative proteins could even replicate the journey of the chicken industry, which has grown by 70% since 1990 to become “the rich world’s most popular meat”.¹¹⁴ From the early 1980s to the mid-1990s, poultry’s share of total meat consumption in the UK rose from around 15% to over a quarter.¹¹⁵ This was driven in large part by economics – more efficient production processes (i.e. the growth of factory farming) meant chicken became relatively cheaper, albeit at dramatic cost to animal welfare. Chicken sales were also boosted by perceptions of ‘white meat’ as more healthy than red meat.¹¹⁶ That example suggests that substantial changes in diet are possible if alternative proteins can get the economics right.

We have to maintain realistic expectations, but alternative protein market forecasts identified in the literature project continued growth. Below, we unpack some of those estimates, including the drivers that underpin them, using insights by prominent market analysts as examples.

EY (2030, 5-10%)

Identifying rapidly improving cost and quality as critical drivers, EY estimates alternative proteins’ 2030 market share as a range of 5-10%. They argue the cost of production is likely to fall below that of conventional protein, with the cost of alternative protein production expected to be less than \$5 per kilogram, while the global average meat price is expected to increase to \$5.20 per kilogram. In other words, EY expects alternative proteins to achieve price parity – and indeed to be cheaper than conventional meat – within a decade. The “disruptive market signals” that they expect to support the growth of the market include: major supply chains releasing and scaling alternative protein products; regulatory approvals on novel ingredients; and cost reductions in cultivated production inputs.¹¹⁷

Synthesis Capital (2030, 10-20%)

Following an S-curve pattern, Synthesis believes alternative proteins, like many other technologies, food products, and pharmaceuticals of the past,¹¹⁸ will see slow growth in the early years. This will be followed by rapid growth in the late 2020s and 2030s – where market share reaches the adoption tipping point – before approaching saturation.

“We think the tipping point is going to be reached in 2030, reaching about 10% to 15% of adoption across the whole market. That’s when the writing is on the wall. By that point you’ve proved you can make a product.” – **Catherine Tubb, Director of Research, Synthesis Capital**

Believing that taste and cost parity with animal proteins will be achieved in the mid-2020s – a bold target given the current position of the market, providing only a few years to catch up to profiles of traditional animal meat – Synthesis predicts that cheaper and better products will drive demand, investment in capacity and infrastructure will drive supply, and regulation will move in support of the market. These factors should reinforce one another, creating a series of virtuous cycles, propelling growth. Meanwhile, Synthesis expects traditional animal-based products to face a “death spiral” of increasing costs, lower demand, a loss of investment, and meat companies consequently facing bankruptcy.¹¹⁹

Jefferies (2040, 4-18%)

In their base case, alternative proteins will take 9% market share by 2040, according to Jefferies. As it is already producing commercial quantities, Jefferies expects the plant-based category to scale first, though cultivated meat has the potential to grow quickly from a small base if it can reduce costs and overcome manufacturing bottlenecks.

“There’s definitely more product developments to come. I also think the changing shape of the industry is going to favour plant based economically. It’s more resource efficient.” – **Chris Byrant, Director, Bryant Research**

In a bear case (i.e. a more pessimistic scenario), low consumer adoption rates and harsh policy environments mean that alternative proteins could only reach 4%. The bull (optimistic) case, where a tax on traditional meat (discussed in Chapter Five) is implemented by governments, helps alternative proteins reach 18% market share.¹²⁰

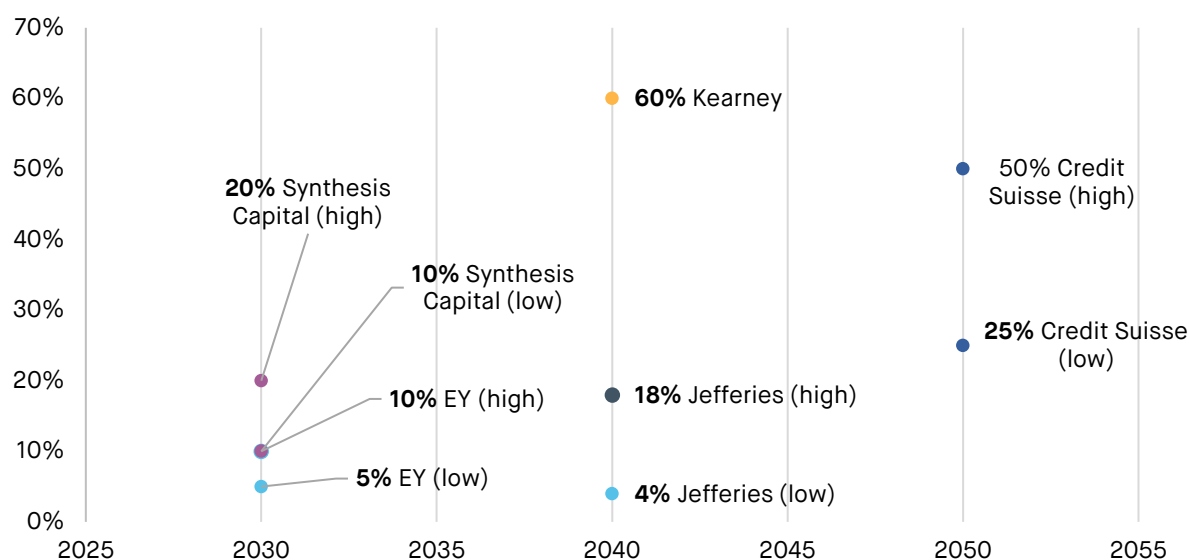
Kearney (2040, 60%)

Global consulting firm Kearney predicts that 60% of all meat will be either plant-based or cell cultivated in 2040. The firm expects vegan alternatives to lead the transition until 2030, with cultured products dominating in the longer term due to technological progress innovating the product to such an extent that it closely mimics taste and texture of conventional meat. Kearney estimates that, by 2040, 35% of all meat will be cultured, and 25% will be vegan. It says both the environmental and animal welfare harms caused by industrial farming will contribute to consumers’ growing preference for alternative meat.¹²¹

Credit Suisse (2050, 25-50%)

Propelled by converging influences, including pressure for lower carbon emissions and targets to cut obesity, Credit Suisse predicts an “inevitable” shift to sustainable diets. In its conservative growth scenario, alternative proteins could reach 25% of the market by 2050. While the driving forces are unspecified, its blue sky scenario envisions strong growth potential, anticipating a market penetration of 50%. Credit Suisse expects traditional industry players, including global meat corporations, to continue broadening their portfolios to include alternative proteins.¹²²

Figure 12: Alternative protein forecasts



Source: SMF.

There's some scepticism, but experts are also positive about the future

Due to the positive drivers cited above – changing consumer preferences, environmental concerns, technological advancements, investment, and government support – almost every individual interviewed for this research expected that the alternative protein sector will continue to grow.^v

“It’s hard not to see the wind being behind it.” – **Tom MacMillan, Professor of Rural Policy & Strategy, Royal Agricultural University**

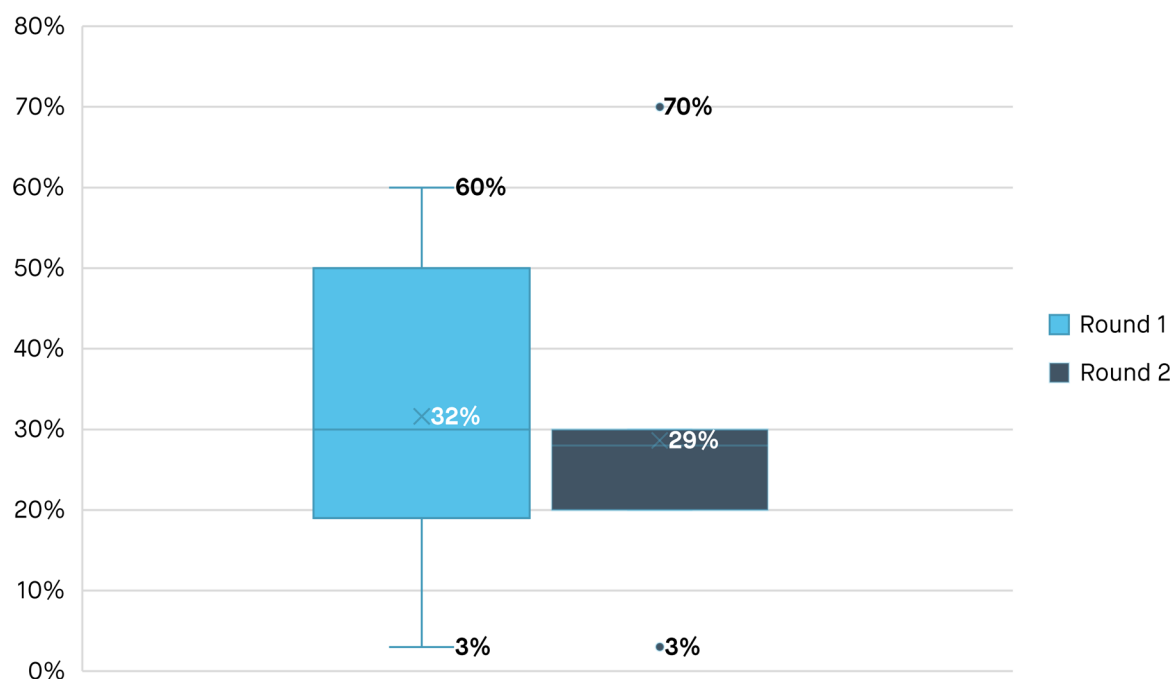
As illustrated above (Figure 12), alternative protein forecasts can be wildly different, each hingeing upon different factors and conditions. The market share projections we have highlighted for 2040 range from 4% to 60%, for example. Our survey respondents were similarly divided, with experts’ predictions ranging from 3% to 70%.

“Alternative proteins will continue to grow. But maybe not at the pace that some people predict.” – **Jo Raven, Director of Thematic Research & Corporate Innovation, FAIRR Initiative**

^v This may be explained, in part, to the composition of the sample, which mostly consists of industry stakeholders actively engaged in the development of the market – potentially carrying a positive bias.

This provides limited insight. The transition to alternative meat could be transformational, marginal, or anywhere in between. According to the experts surveyed, the sector is expected to make up 29% of the market by 2040 on average, which would imply a dramatic acceleration in the growth. Even the most sceptical observer expected the market to more than treble (though to remain relatively small). When it comes to alternative proteins, perhaps the only thing we can be confident of is our uncertainty.

Figure 13: “What share of the global meat market do you expect alternative proteins to make up in 2040?”



Source: SMF expert survey; n=8. Mean, maximum, minimum and quartiles displayed.

It is important to note that, in our survey, we asked experts for their global predictions in order to align with the aforementioned market forecasts, rather than asking them to predict what will happen in the UK specifically. Given the international perspective of most of our participants, we felt this would be a more reasonable question than expect them to have a close understanding of the UK market. This may be somewhat conservative, given the UK's position as something of an alternative protein leader – as we have seen, alternative proteins currently constitute around 1% of the total meat market globally, but 3% in the UK.

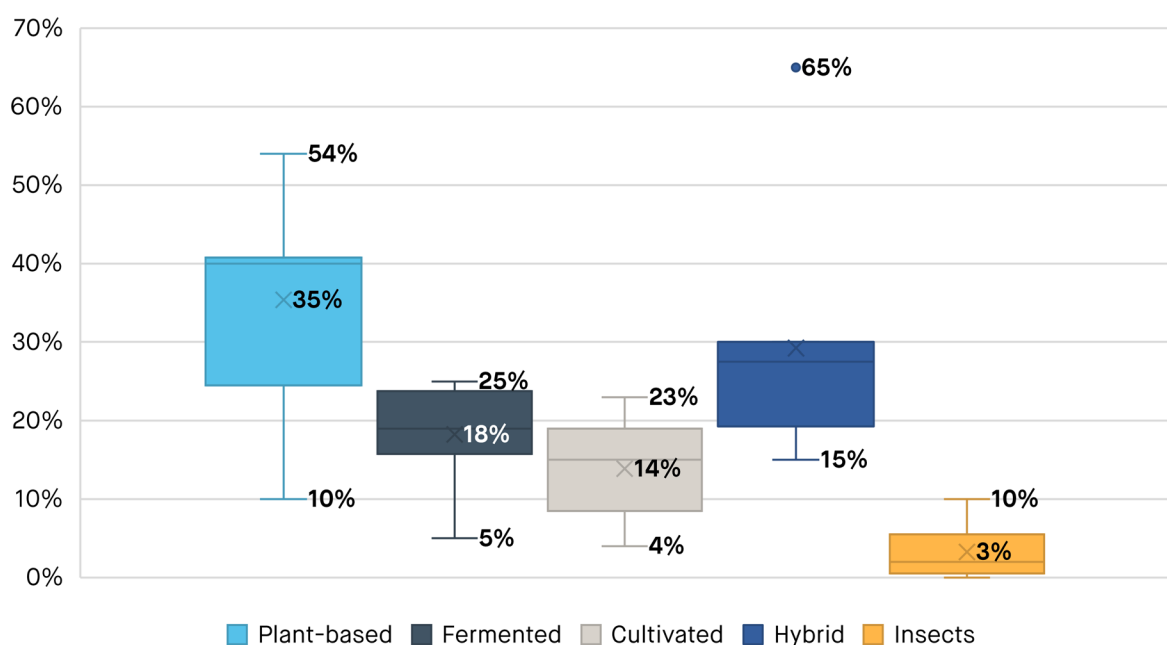
Plant-based and hybrid products are expected to lead the charge

With their market predictions in mind, respondents were asked how they thought the alternative proteins market would be split between different production methods in 2040. Much like forecasts by Jefferies and Kearney, plant-based products (35% average) emerged as most likely to drive growth over the next two decades. This is equivalent to capturing 10% of the entire meat market, which would represent significant growth compared to where plant-based is today at around 1% of the meat market.¹²³

"I think plant based is going to be cheaper than animal products before cultivated is on the market." – **Chris Byrant, Director, Bryant Research**

Plant-based products are closely followed by hybrid (29%), then fermented (18%), cultivated (14%), and insect-based (3%) products. This order is plausible, given the early lead and visible presence of plant-based alternatives in the market today. Combining the forecast share of the meat market from alternative proteins in the previous section with this forecast share of alternative proteins for plant-based products implies substantial growth in the plant-based category. Plant-based products are predicted to achieve a maximum share of 54%. With the other categories falling behind in experts' prognoses, it appears these products are anticipated to be at the forefront of the market for the foreseeable future.

Figure 14: "How will that share be split between plant-based, fermented, cultivated, hybrid, and insect-based products?"



Source: SMF expert survey; n=8. Mean, maximum, minimum and quartiles displayed.

In terms of growth potential, however, hybrid appears to be the product with the most promise, with expectations that it could capture as much as two-thirds (66%) of the alternative protein sector by 2040. The average estimate is that it will account for a third of the market, similar to plant-based products. Hybrid products, which combine different protein sources and technologies, seemingly have the potential to catch up to or even surpass the popularity and growth of plant-based products in the future. This was a view expressed during interviews, with some industry experts contending that plant-based options could be eclipsed by the enhanced taste and flavour profiles of newer alternatives as technology continues to advance.

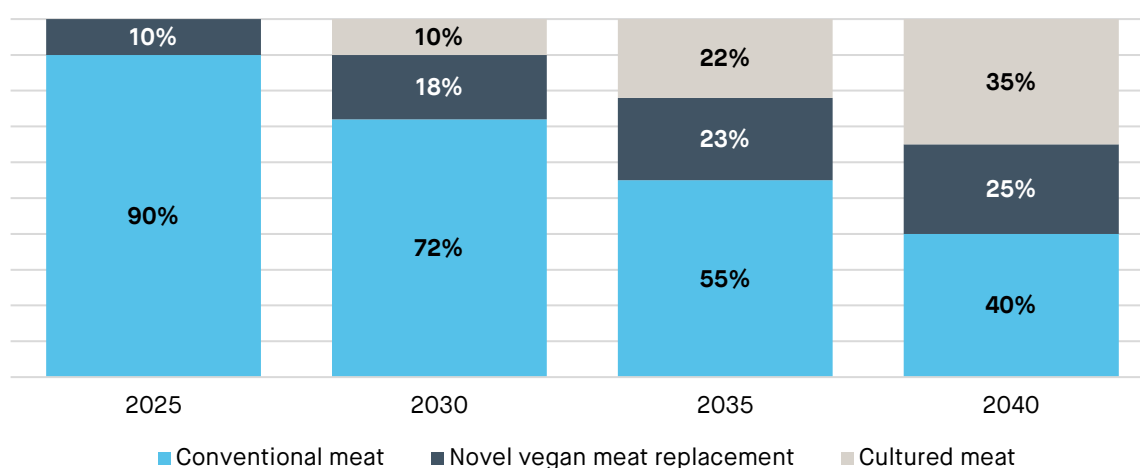
"We don't necessarily see the value in another plant-based burger." – **Catherine Tubb, Director of Research, Synthesis Capital**

Hybrid meat's fortunes are intimately linked to the development of different production technologies. For example, if cultivated meat production ramps up, it is likely that hybrid products will become more common, helping to improve the taste and texture of plant-based products. If plant-based production improves, the chances of hybrid products improving increase, too. Because it relies on a mix of technologies in order to succeed, if any other class of production were to encounter setbacks or even fail in the coming years, it would surely have implications for the advancement of hybrid products. As we have seen these is a particular risk around cultivated meat, which is shrouded by considerable technical, regulatory, and consumer uncertainties around scaling up.

Cultivated meat could be game-changing... if it can be scaled up

As discussed above, cultivated meat is tipped as the product most likely to improve the taste of alternative proteins, and therefore holds significant promise for the growth of the market. According to Euromonitor, it will make up 10% of the overall meat market by 2040.¹²⁴ Barclays believes it will achieve double that – 20% – within the same time period.¹²⁵ R&D specialist GovGrant thinks cultivated meat will have 10% market share by 2030 and 35% by 2040 – a bigger share than novel vegan meat replacements and almost as much as conventional meat.¹²⁶

Figure 15: Forecast breakdown of global meat consumption



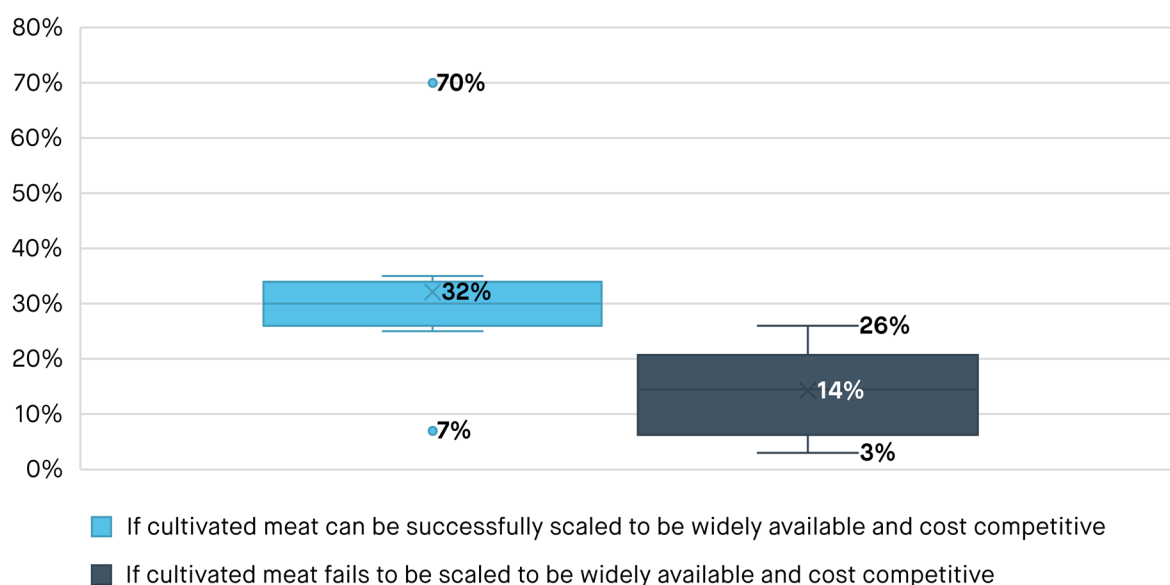
Source: GovGrant.

In the eyes of some analysts, it seems cultured meat is due to become a significant player in the global market. SMF survey respondents were considerably less optimistic, expecting cultivated meat to achieve 14% share of alternative proteins, equivalent to 4% of the total meat market, with a maximum estimate of 23% (equivalent to 7% of experts' average projection).

"I think plant-based products will continue to spur growth. From a scaling perspective, cultured doesn't seem very tangible right now." – **Anonymous**

When questioned about the potential market share of alternative proteins in the event of cultivated meat failing to scale up, participants said it will take up 14% on average, with an upper limit of 26%. In a scenario where scaling is successful, the average response more than doubled to 32%, with the possibility of reaching as high as 70% – a staggering proportion. Conversely, a cultivated meat industry that scales successfully could contribute a minimum of 7% to alternative proteins' overall market share. Again, we asked surveyed experts for their global meat market predictions, considering them a reasonable proxy for shaping projections relevant to the UK.

Figure 16: “What share of the global meat market will alternative proteins hold in 2040 under the following scenarios?”



Source: SMF expert survey; n=8. Mean, maximum, minimum and quartiles displayed.

While growth is expected, the exact size of the future market remains uncertain

These estimates and predictions provide us with some valuable insights. First, perspectives vary considerably. There is significant variation in how different analysts and experts perceive the future, whether that be with regard to alternative proteins generally or to specific product categories such as cultivated meat. There are multiple valid viewpoints, each shaped by different approaches and assumptions.

Second, the market is sensitive to industry developments and catalysts. Between scenarios that cultivated meat fails or succeeds to scale, for example, there is a substantial increase in market share estimates, from 14% to 32% or higher. This implies the industry's future could end up hinging on pivotal events or breakthroughs, particularly with regard to what is supposedly the most lifelike alternative to conventional products: cultivated meat.

There also remains a great deal of risk. That participants acknowledge the possibility of alternative proteins reaching a market share as high as 70% or as low as 3% points to considerable uncertainty associated with these projections. It also implies that the success of drivers such as supply-side developments will play a critical role in determining market outcomes.

Finally, it is clear alternative proteins hold significant transformative potential. Despite the sense of uncertainty, both forecasters and experts recognise the possibility of alternative proteins capturing significant market share, even at the lower end of the range. This indicates alternative proteins can, if all goes well, be a viable disruptive force.

CHAPTER FIVE – CAN ALTERNATIVE PROTEINS IMPROVE ANIMAL WELFARE?

Now that we have explored the possible future directions of the emerging alternative protein market our next step is to examine their implications for animal welfare. This is the central concern of this report, and represents the culmination of research conducted across the past three.

Below, we estimate the reduction in animal suffering that could reasonably be expected under different market scenarios, including the animals that can expect to see the greatest gains. Crucially, we explore the different policy measures that government can introduce to support the growth of the alternative protein industry, while also discussing the potential role of animal welfare organisations such as the RSPCA, who sponsored this report.

It is unclear how far alternative proteins will displace conventional meat products – though the indications so far are positive

As discussed throughout this report, the alternative proteins market, despite its potential, remains shrouded in considerable uncertainty. We do not know how big it will be, if cell cultivated products will be able to scale up within a reasonable timeframe, or whether the public are fully prepared to adopt a new way of eating.

A similar doubt is around displacement, and which conventional products alternative proteins will potentially replace. This is critical to the debate. Without displacement, alternative proteins will have little discernible impact on the lives of animals, no matter how much the sector may grow.

The evidence so far suggests alternative proteins will supplant or supplement existing products

It is theoretically possible that alternative products will not effectively reduce demand for traditional animal meat. Rather than being purchased as substitutes, they can become additional items in people's shopping baskets. For instance, if one person decides to replace a beef burger with a plant-based burger, this choice clearly reduces their consumption of traditional animal meat. In another situation, however, someone might select alternative chicken to enhance a vegetarian meal they were already planning to enjoy. Some people may even supplement their meat-heavy diets with additional protein. In these cases, alternative proteins fail to contribute to displacement or advance animal welfare objectives.

As discussed above, the prevailing sentiment is that once novel products begin reaching taste and price parity with conventional meat they will naturally start to displace them. But some have doubts over whether alternative proteins, even if they become competitive on price, taste, and convenience, will act as substitutes for animal proteins. Due to complex social and psychological factors, people may continue consuming traditional meat regardless of how the market develops.¹²⁷

“Substitution is important, but a hard question to answer. Furthermore, what is being substituted really matters too.” – **Abhi Kumar, Program Associate, Open Philanthropy**

Analysis of existing research by Bryant Research suggests the contrary, indicating that some consumers do indeed shift towards alternatives and reduce their meat consumption.¹²⁸ A longitudinal UK study has shown that people who increased their consumption of plant-based alternatives were significantly more likely to have decreased their consumption of meat, for example.¹²⁹ Consumer data from Belgium has also suggested many do in fact buy alternative proteins as substitutes, not supplementary items.¹³⁰ Evidence from the US has revealed that reductions in the price of plant-based meat lead to reductions in cattle production.¹³¹

While there may be some lingering doubts regarding alternative proteins' role in displacing traditional animal products, the available evidence appears to outweigh such scepticism. That said, several questions remain which hold considerable implications for how far displacement can occur. How will rates of displacement change if products reach parity of quality? Do different products and product features displace more effectively than others? What does effective displacement even look like (protein content, weight of meat, the number of slaughtered animals)? These are key issues that carry significant implications for alternative proteins' impact.

There is mixed evidence as to which conventional meat products alternative proteins replace, and whether these are higher or lower welfare – though at least some displacement of chicken seems to have occurred

There is also the crucial question of which conventional products alternative proteins are most likely to replace. The answer has significant implications for the welfare of farm animals, and the same reduction in overall meat consumption could have quite different implications depending on what sort of meat people cut back on.

Available market evidence is limited, though it suggests complex product-specific behaviour. For example, retail data from 2022 has shown that plant-based meats tend to be bought alongside beef and pork, and usually as a substitute for chicken, turkey, and fish.¹³² Given that the latter are more likely to be intensively reared, that would suggest that alternative proteins are benefitting animal welfare and displacing lower welfare meat. On the other hand, another study has found that consumers who buy plant-based meat are more likely to have otherwise bought beef (49%) than chicken (38%).¹³³ Mintel research has found most consumers of alternative products (83%) still incorporate some red meat or poultry into their diets, though it is unclear in what quantities.¹³⁴

The difficulty is that patterns of behaviour in the current market, with only a fraction of the potential alternative proteins developed and available, may not be a good guide to its future direction. While there are some grounds for encouragement that chicken (and hopefully lower welfare chicken) is being displaced, there is no certainty that this pattern will necessarily continue.

As the animal most likely to be reared under lower welfare standards, meat chickens represent the biggest welfare concern. Our research has showed that 98% of factory farmed animals in the UK are poultry, and that over a billion are slaughtered every year, dwarfing all other animals – with the vast majority being broiler chickens. From an animal welfare standpoint, it only seems logical that alternative products are targeted to conventional chicken products. As we said then, “the crucial imperative is to resist and to reverse the dramatic growth of the intensive chicken industry”.¹³⁵

“There are far more beef alternatives than there are chicken, fish, and egg alternatives. If you're trying to maximise the welfare change, you would hope to see more of those.” – **Chris Bryant, Director, Bryant Research**

However, this may be at odds with efforts to combat climate change and reduce beef consumption, which is the most carbon-intensive animal product. Many companies are focused on producing beef replacements in order to promote environmental sustainability. Anecdotally, it seems most ‘flagship’ products thus far have been beef substitutes, though equally, there a number of chicken substitutes on the shelves and in shopping baskets.

If this trend continues, resulting in better quality and increased availability of alternative beef products, there could be negative consequences for progressing animal welfare goals. Equally, if chicken alternatives become the desirable product of the future, that would steer consumption towards poultry replacement potentially at the expense of environmental objectives. In other words, the substitution of some products may conflict with other priorities.

“If you're a consumer doing this for climate reasons, or even health reasons for that matter, beef is probably the thing you're going to be removing. Some of these products are doing better for animal welfare, but not so much for climate, and vice-versa.” – **Abhi Kumar, Program Associate, Open Philanthropy**

It is currently unclear which direction market drivers and consumer preferences are headed. Again, price and taste are important factors that could significantly influence public choice between beef, chicken, and other meat substitutes. If chicken alternatives become more appetising and affordable than other options, that would incentivise consumers to buy them. However, intensive farming is driven by the public’s demand for hyper-efficient, cheap meat, especially chicken.¹³⁶ Though chicken products are likely to be processed – think chicken nuggets, rather than sirloin steaks – and therefore plausibly easier to replicate in terms of taste and texture, chicken alternatives have a long way to go to displace those lower quality products on price alone. If lower welfare chicken is the target, then addressing affordability is imperative.

“The reason why we are focused on beef and pork is because of the environmental argument. Within an animal welfare lens, chicken probably should be the number one target. I think both are important reasons.” – **Tasvi Shah, Head of Strategic Products, Ivy Farm**

As we've discussed, it is unclear how soon it will be before the alternative sector can scale up to match the efficiency of conventional meat production. It may take some time for the cost of alternative chicken products to become competitive. There's a possibility that alternative chicken products remain pricey, potentially displacing more expensive, higher-welfare chicken options and leaving lower-welfare practices in place. As a consequence, higher-income consumers could be those more likely to afford higher welfare meat, disproportionately leaving lower-income households with lower-quality, lower-welfare products. Market accessibility and addressing economic equity could be critical, as it means alternative protein products are available to a wide range of consumers and can more effectively displace a wider range of traditional meat products.

There are further complexities in displacement dynamics

Achieving substitution and eliminating the use of lower welfare animals is a huge task. Above all, it requires consumers to fundamentally switch their diet. Another challenge is that the livestock industry encompasses a vast value chain, as animals are reared not only for their meat but other animal-derived products – from leather and suede to insulin and heart valves to shaving creams and antifreeze. Depending on the species, non-meat animal products comprise between 25% and 37% of an animal by weight.¹³⁷

Displacement becomes even more complex when considering these other products. They raise questions about the extent to which alternative protein can effectively replace the use of livestock, and if there are additional parts of the value chain they should be targeting beyond conventional meat products. Some interviewees wondered whether alternatives could be used in pet food, for example.

"Where's the percentage of animal going? A lot of a cow is going into a beef burger. Some of it is going into leather. But then there's a lot of other off cuts and waste. That's a big value chain." – **Catherine Tubb, Director of Research, Synthesis Capital**

Cultivated meat may involve the use of farmed animals but on a small scale with modest welfare implications – certainly relative to conventional farming

Unlike plant-based or fermented products, cultivated meat does rely on products taken from live, farmed animals. Animals can come into the production process at two points: cell lines and culture media. The first refers to the original cells used to grow the cultivated meat, taken by biopsy from a live or recently deceased animal. One approach involves continuously sampling cells, taking a new biopsy for each batch. These biopsies are fairly small – one estimate is that just 500mg are needed to produce 5000kg of beef. Using this process, subjecting one cow to a 10-minute procedure could save 20 cows from rearing and slaughter, and with 20 biopsies over their life, that single cow could prevent 400 cattle ever having to be reared on conventional farms.¹³⁸ That figure could be increased further if cells are banked and immortalised, removing the need for continuous sampling – a process that would be more efficient and potentially reduce the demands on live animals even further.

Culture media – in which cells are placed and nourished as they grow – could also come from animal products. The pharmaceutical industry has tended to use fetal bovine serum as a medium, a byproduct of the meat industry, gathered from slaughtered pregnant cows. Yet cultivated meat companies have tended not to use fetal bovine serum, which, as well as raising ethical issues, tends to be extremely costly and less effective than non-animal-based alternatives. A range of companies have developed serum-free media specifically for the cultivated meat industry.¹³⁹ Some of the components of these media could in theory come from waste by-products from farms, but there does not seem to be any desire from cultivated meat companies to partner with the agricultural industry in this way.

Overall, then, cultivated meat requires very little involvement from farmed animals to produce large quantities of meat – with one relatively small procedure potentially replacing the need for hundreds of animals to be raised and slaughtered. Both in terms of the invasiveness and welfare impact on the animals that might need to be biopsied and on the scale of numbers, it seems clear that cultivated meat represents a substantial welfare gain on conventional farming.

The growth of insect farming presents a particular risk to animal welfare

Insects present another significant ethical consideration. As another potential substitute for conventional meat products, they are often bracketed with alternative proteins – though as mentioned above, our preferred definition would rule out products dependent on rearing live animals. However, compared to plant-based, cell-based or fermented products, they carry the potential for significant negative effects on animal welfare.

Our understanding of insect welfare, including their capacity for suffering, is extremely limited, with a paucity of research on the topic. On the one hand, there are reports of insects continuing their normal behaviour even when severely injured, which suggests they are not being deterred by severe pain,¹⁴⁰ and studies which find honeybees show no desire for painkillers when hurt.¹⁴¹ On the other hand, fruit flies are willing to endure electric shocks to get things they want, and show signs of anxiety and depressed states.¹⁴² We do not know much about insect brains, but there is some evidence they have sensory receptors and can respond to pain relief and antidepressants.¹⁴³

While uncertainty exists, our interpretation of the balance of this evidence is that it is more likely than not that insects *can* suffer. At the very least, there is a strong argument for a precautionary approach. If insects do indeed feel suffering, their sheer numbers suggests that mass farming could cause harm on a massive scale. For that reason, we propose distancing insect protein from the alternative protein banner.

This position is all the more justified by the fact that insect farming as it currently exists is typically supportive of – rather than an alternative to – conventional meat production. There seems little prospect of humans eating insects in large quantities, at least outside East and South East Asia, where insects currently are consumed. Elsewhere, farmed insects are generally fed to other animals.¹⁴⁴ Insect rearing facilities largely focus on producing animal feed, and their lobbying efforts and investors tend to be most focused on farming inputs rather than the smaller and more regulated human food market.¹⁴⁵

Already, it is estimated that over a trillion insects globally are reared and killed on farms globally.¹⁴⁶ The average response to our survey suggested that insects would account for 3% of the alternative protein market – with some putting the figure as high as 10%. That would imply substantial growth, and potentially a moral calamity. Lewis Bollard – program director of farm animal welfare at Open Philanthropy Project – has said that “the rise of industrial insect farming reminds me a bit of the rise of industrial chicken farming in the 1930s and industrial fish farming in the 1980s. In both cases, proponents touted the incredible efficiencies of their new systems, and gave little regard to the apparently dumb creatures they would be farming. As a result, new industrial farming systems expanded almost unopposed – until they were far too powerful to unwind”.¹⁴⁷ While it is unclear what sorts of conditions are conducive to the welfare of farmed insects, that uncertainty means that there is substantial potential for harm. There are, for example, no restrictions on how insects may be slaughtered – at present, they can legally be boiled, roasted, frozen or minced.¹⁴⁸

Animal welfare advocates should therefore be vigilant, and resist efforts to grow insect farming. In recent years, the European Union has expanded the list of insects that can be included in animal feed, though the UK has not yet followed suit.¹⁴⁹ Organisations like the WWF – which in other respects advocates for policies supportive of animal welfare – have endorsed increasing the use of insect protein in animal feed, on environmental grounds.¹⁵⁰ Such measures could pose a grave threat to animal welfare.

Should the market for alternative proteins grow, the benefits for animal welfare could be substantial

To demonstrate the potential impact of alternative proteins, we conducted an analysis showing how the number of animals slaughtered from UK factory farms might change in different market scenarios.^{vi} This exercise builds upon estimates created during the first phase of this project, where we quantified the scale of farmed animal welfare using Department for Environment, Food & Rural Affairs (Defra) livestock statistics.

That report utilised population and slaughter data to provide a comprehensive view both of the number of farm animals living in the UK at any given time and the number of animals processed for meat across the year. In this analysis, we have chosen to focus on slaughter. As the end product that reaches consumers via supermarket shelves, slaughtered animal meat is what alternative proteins seek to replace. In quantifying the number of animals that are processed for meat production, slaughter data provides a clear picture of the actual impact alternative proteins might have on animal welfare. It also allows us to include fish in the analysis, as population numbers are less appropriate for them.

^{vi} In that research, we decided to use factory farming as a proxy for lower welfare. We accept this is a crude distinction, and may oversimplify the nuanced landscape of different farming production methods. Our rationale for using factory farming as the only feasible, if imperfect, way of quantifying animal suffering is explained in full in that first paper.

A meaningful increase in alternative protein market share – of the scale most anticipate – could mean millions fewer animals in factory farms

Table 1 displays the number of factory farmed animals slaughtered each year in a range of different scenarios, altering two variables: the growth in demand for animal meat and the increasing market share of the alternative protein sector. These estimates assume that alternative proteins displace factory farmed meat at the same rate as other forms of meat – or alternatively, the market share can be read as alternative proteins' share of the 'lower end' of the market encompassing factory farmed meat. This is a big assumption, given some of the uncertainty over displacement discussed above, but it should be emphasised that this analysis is intended to be illustrative. Our factory farm calculations reflect available Defra data,¹⁵¹ covering chickens, turkeys, pigs, cattle and calves, and lambs and sheep, as well as fish slaughter numbers provided by Fishcount.¹⁵²

Overall, the table shows that even a small increase in alternative proteins' share of the meat market would have a significant impact on welfare standards. For example, if alternative proteins were to capture 10% of the market (a plausible scenario according to surveyed experts), the current 1.1 billion factory farmed slaughters would decrease to 982 million, translating to more than 100 million lives spared. If alternative proteins were to reach the 30% market share predicted by respondents for 2040, it would result in over 300 million fewer slaughters.

Table 1: Alternative proteins' impact on UK factory farm slaughters

		Factory farm slaughter growth					
		0%	10%	20%	30%	40%	50%
Alternative protein market share	0%	1,090m	1,120m (+109m)	1,440m (+349m)	1,872m (+781m)	2,620m (+1,530m)	3,931m (+2,840m)
	10%	982m (-109m)	1,080m (+10m)	1,296m (+206m)	1,685m (+595m)	2,358m (+1,268m)	3,538m (+2,448m)
	20%	873m (-218m)	960m (-130m)	1,152m (+62m)	1,497m (+407m)	2,096m (+1,006m)	3,145m (+2,055m)
	30%	764m (-327m)	840m (-250m)	1,008m (-82m)	1,310m (+220m)	1,834m (+744m)	2,751m (+1,661m)
	40%	654m (-436m)	720m (-370m)	864m (-226m)	1,123m (+33m)	1,572m (+482m)	2,358m (+1,268m)
	50%	545m (545m)	600m (-400m)	720m (-370m)	936m (-154m)	1,310m (+220m)	1,965m (+866m)

Source: SMF analysis. Includes both terrestrial and fish slaughter estimates. Increase or decrease compared to today in brackets.

These estimates underscore the potential of the alternative protein market to significantly reduce the number of animals reared in lower welfare conditions. However, they also highlight the uphill struggle to undo factory farming given its current scale and increasing demand for meat. For example, a 40% growth rate in demand for cheap meat (which increased by around 14% in the past decade) would need to be accompanied by over 50% market share for alternative proteins just to keep animal welfare where it is today. As a very rough rule of thumb, for every percentage point increase in demand for meat, the alternative protein market share will have to be 1.5 percentage points higher.

It will have to expand by 35% to reverse current trends

The meat industry is indeed positioned for growth in the coming decades. Extrapolating population trends from the previous decade (2012-2022)¹⁵³ – fish is not included as longitudinal data is unavailable – our analysis suggests the number of animals reared under lower welfare conditions destined for slaughter is set to increase by around 20% over the next ten years. If that trend continues for another ten years, it would lead to a further 20% increase, a cumulative growth of over 40% by 2040.

If we assume no change in the proportion of animals that are factory farmed, a 40% increase would imply that the number of lower welfare slaughter animals will increase from 1.1 billion to 1.6 billion over the next two decades. That is an additional 500 million lives spent suffering before ultimately being killed – an astonishing figure, given the already vast scale of factory farming in the UK.

If the UK does not improve its treatment of farmed animals, welfare will decline significantly. However, the extent of that decline varies between different species. For instance, the slaughter of turkeys has decreased by 46% while lambs and sheep have declined by 3% in recent years. Conversely, broiler chickens have experienced an increase in slaughter counts (21%), along with pigs (11%) and cattle and calves (3%). The slaughter count for broilers, which constitute the vast majority of all factory farm slaughters, is set to increase by an additional 492 million.

Table 2: Factory farm slaughter trends

	2022	2032	2042	10-year % change
Chickens	1,061m	1,283m	1,553m	+21%
Turkeys	8.9m	4.8m	2.6m	-46%
Pigs	3.8m	4.2m	4.7m	+11%
Cattle and calves	0.3m	0.3m	0.3m	+3%
Lambs and sheep	0.1m	0.1m	0.1m	-3%
Terrestrial total	1,074m	1,293m	1,557m	+20.4%

Source: SMF analysis. Unable to display all cells. Fish not included as longitudinal data is unavailable.

Table 3 below demonstrates the impact of alternative proteins on UK factory farm slaughters under different scenarios, assuming current growth trends continue to 2040. Again, it shows potential for significant improvements, with even modest market growth resulting in the prevention of millions of animals having to live under factory farm conditions. Crucially, these figures also highlight the threshold at which current trends start to reverse, when the state of play gets better than what it is now.

Our analysis indicates that alternative proteins would need to achieve a 35% market share to initiate such a reversal, with the total counts of terrestrial and chicken slaughters declining from current figures, but remaining slightly above a billion. This suggests that 35% market penetration is the target required to radically impact animal welfare. Positively, this broadly corresponds with survey expectations, where the market was expected to reach 30% share by 2040 on average.

Table 3: Number of UK factory farm slaughters by alternative proteins' market share, assuming current growth trends continue to 2040

	0%	20%	30%	35%	40%	50%
Chickens	1,553m	1,242m (-311m)	1,087 (-466m)	1,009m (-544m)	932m (-632m)	776m (-777m)
Turkeys	2.6m	2.1m (-0.5m)	1.8m (-0.8m)	1.7m (-0.9m)	1.6m (-1.0m)	1.3m (-1.3m)
Pigs	4.7m	3.7m (-1.0m)	3.3m (-1.4m)	3.0m (-1.7m)	2.8m (-1.9m)	2.3m (-2.4m)
Cattle and calves	0.3m	0.2m (-0.1m)	0.2m (-0.1m)	0.2m (-0.1m)	0.2m (-0.1m)	0.1m (-0.2m)
Lambs and sheep	0.1m	0.1m (-0m)	0.1m (-0m)	0.1m (-0m)	0.1m (-0m)	0.1m (-0m)
Terrestrial total	1,561m	1,249m (-312m)	1,092m (-468m)	1,014m (-546m)	936m (-624m)	780m (-780m)

Source: SMF analysis. Fish not included as longitudinal data is unavailable.

However, this may understate the scale of the challenge. Table 3 excludes fish due to a lack of trend data, whereas Table 1 included fish. Notice that in Table 1 a 40% increase in demand requires alternative proteins to achieve over 50% market share in order to offset that growth. Thus, if demand for fish grows substantially, alternative proteins will have to do even better.

Millions of animals could be spared lower welfare lives, the majority of them chickens

A bigger alternative protein market, displacing a greater share of conventional meat, would have different effects by species. Chickens, representing the vast majority of terrestrial livestock slaughters, are poised to experience the most substantial benefits. As displayed in Table 3, achieving the 35% penetration threshold in 2040 (assuming that chicken is displaced at the same rate as other products) would reduce the number of chicken slaughters by 544 million. Greater market share would result in even larger reductions, marking significant advancements in animal welfare.

As we have already discussed in detail, the trajectory of the alternative protein market remains highly uncertain. There is significant variation in how different analysts and experts perceive the future, with predictions ranging from as low as 3% to as high as 70%. It is entirely possible the alternative protein market never reaches the 35% reversal threshold. But that does not necessarily mean alternative proteins would have no impact whatsoever.

Even modest reductions in factory farm slaughters would carry huge consequences for the welfare of chickens. Table 4 below illustrates the gains that could be made for the welfare of chickens under different market scenarios. The smallest of gains could result in millions of lives spared – emphasising the potential value of alternative proteins that substitute for lower welfare chicken.

Table 4: Alternative proteins' impact on UK factory farm broiler slaughters

		Factory farm broiler slaughter growth					
		0%	10%	20%	30%	40%	50%
Alternative protein market share	0%	1,061m	1,167m (+106m)	1,400m (+339m)	1,820m (+759m)	2,548m (+1,488m)	3,822m (+2,762m)
	10%	955m (-106m)	1,050m (-10m)	1,260m (+199m)	1,638m (+577m)	2,293m (+1,232m)	3,440m (+2,379m)
	20%	849m (-212m)	933m (-128m)	1,120m (+59m)	1,456m (+395m)	2,039m (+978m)	3,058m (+1997m)
	30%	743m (-318m)	817m (-244m)	980m (-81m)	1,274m (+213m)	1,784m (+723)	2,676m (+1,615m)
	40%	636m (-425m)	700m (-361m)	840m (-221m)	1,092m (+31m)	1,529m (+468m)	2,293m (+1,232m)
	50%	530m (-531m)	583m (-478m)	700m (-361m)	910m (-151m)	1,274m (+213m)	1,911m (+850m)

Source: SMF analysis. Assumes optimum displacement.

CHAPTER SIX – POLICY AND ADVOCACY IMPLICATIONS

The primary concern of this report is to explore whether alternative proteins can improve the welfare of UK farm animals. Our estimates suggest the sector has huge potential, and any gains it makes could result in millions – potentially hundreds of millions – of animals being spared lives lived under horrendous conditions. If it reaches 35% penetration within the next two decades, it could reverse the one-way ratchet of worsening animal welfare we have experienced for years.

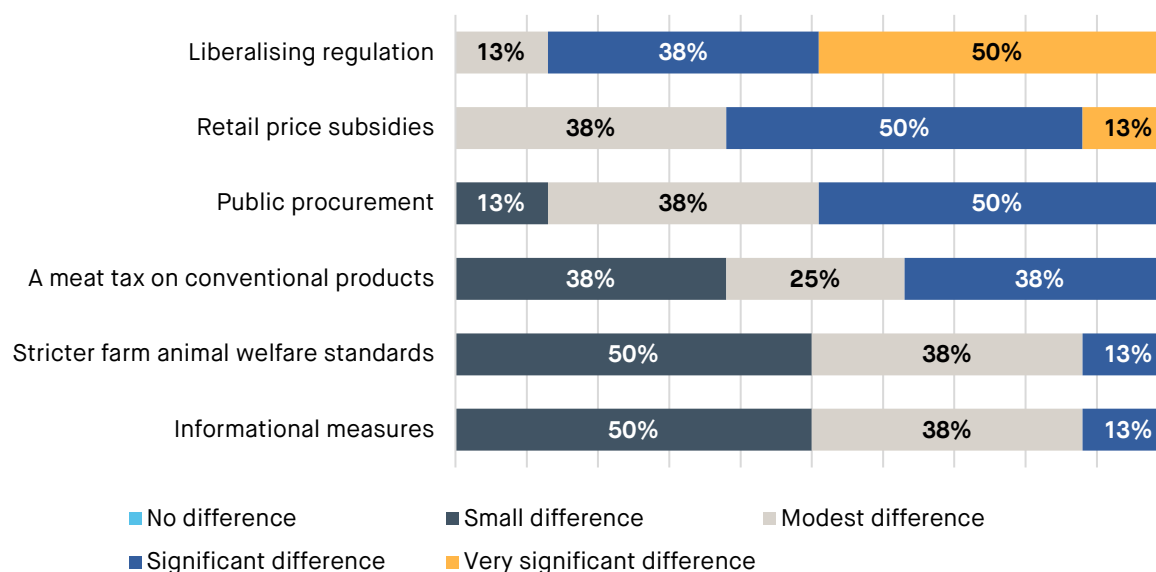
But as we have discussed throughout this report, the future of the industry, though promising, remains highly uncertain. How big the alternative protein sector eventually gets, and how big a difference it makes to animal welfare, depends on a range of factors. The main barriers to the growth of the alternative proteins market, our evidence suggests, are for firms to address – refining their products to make them tastier and making the technological improvements and investments necessary to make them cheaper. Yet we have also seen that a supportive policy and advocacy landscape could help accelerate the growth of alternative proteins and a restrictive approach could smother it.

There are levers the government can pull to smooth the transition

Political leadership has an important role to play. Whether through direct financial investment or policy support, government can significantly impact the development of the market and influence public opinion. Our second report, as we discuss below, found that the majority of people are open to government action to champion and support alternative proteins. Yet policymakers have been reluctant to confront the issue of meat consumption.¹⁵⁴

There are a range of policy options at government's disposal that could help smooth the transition to alternative meat. According to surveyed experts, any of these interventions would make a difference to the development of the alternative proteins market. However, improving regulation is seen as the most promising, followed by retail price subsidies and making greater use of public procurement. By contrast, the anticipated impact of stricter farm animal welfare regulations and informational measures is seen as more modest.

Figure 17: “How big a difference can the following policy interventions make to the development of the alternative proteins market?”



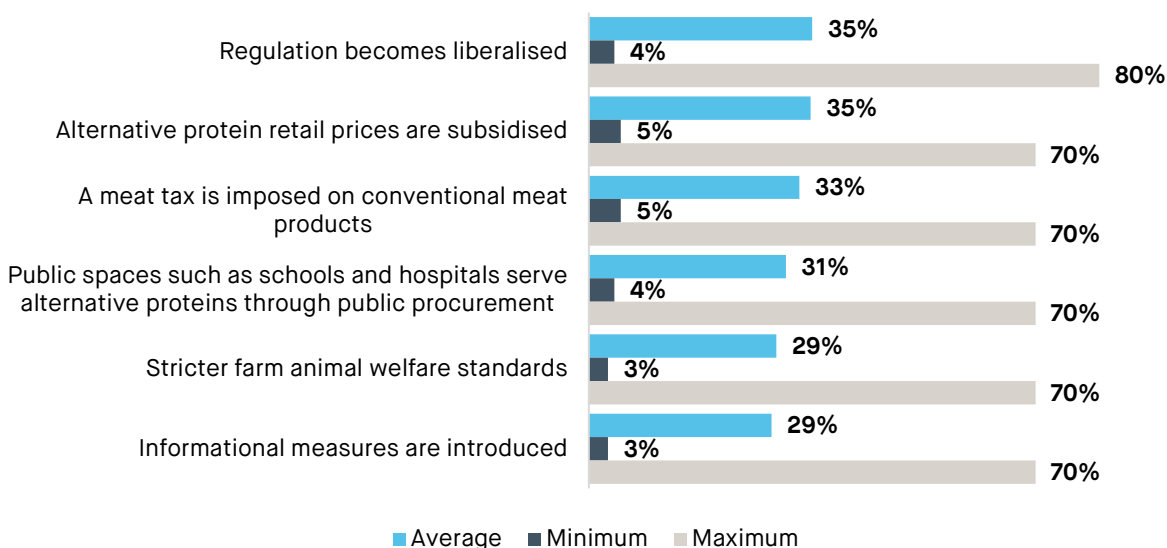
Source: SMF expert survey; $n=8$. Note: The numbers in the graph do not add to 100% because of rounding.

That said, our survey reinforced the message that specific policies play a relatively marginal – though certainly non-trivial – role in determining the shape of the alternative protein sector. Figure 18 shows the forecast market share of alternative proteins conditional on specific policies being enacted. Recall that the average unconditional forecast was 29%. Liberalised regulation or retail price subsidies would push this up six percentage points to 35%.^{vii} Higher animal welfare standards and informational measures would make essentially no difference to people’s alternative protein market share forecast.

The modest size of these effects could be because these policies are to some extent ‘priced in’ – if the original forecast included a high probability expectation of certain measures coming in, getting certainty on them would not change things substantially. Yet this suggests experts think there may not be as much to play for on policy as it might first appear. At the same time, six percentage points of market share is not to be sniffed at – that represents millions of animals’ lives each year. Moreover, this represents an average figure in expectation – in reality, the impact of policy changes may turn out to be far greater.

^{vii} Note that these conditional forecasts are independent. We cannot add together the six percentage point boost of subsidies and improved regulation to get 12%.

Figure 18: “What do you expect alternative proteins' share of the global meat market be in 2040 if the following policy interventions were to be introduced in the next five years?”



Source: SMF expert survey; n=8.

Liberalising regulation is considered to be the most impactful policy measure

Earlier in this report we identified regulation as a significant roadblock to the growth of the alternative protein market. The current framework involves delayed approval procedures for the sale of innovative foods such as cultivated meat, and carries the risk of creating production bottlenecks in the future.

SMF survey participants view liberalised regulation, making alternative meat products easier to get onto the market, as the policy approach with the greatest potential impact on market growth. 88% believe it will have a significant or very significant difference, and 13% think it will make a modest difference.

“The UK could genuinely be world leading. But reality will bite in terms of the regulatory aspect of developing alternative proteins.” – Abhi Kumar, Program Associate, Open Philanthropy

Though some funding will be required, this measure would be relatively low cost and, from a political perspective, relatively straightforward. While relaxing regulations may raise concerns about food safety, there are ways to do this in a way that ensures minimal risk to public health. Indeed, as recommended by Deloitte, there is no need for a complete overhaul of novel food regulation, but rather further refinement and streamlining.¹⁵⁵

In practice, a better regulatory system is likely to involve three things. First, better resourcing of the Food Standards Agency (FSA). To a significant extent, the current delays are not because existing requirements are too onerous, but because the capacity does not exist to apply them in a timely manner.

Second, steering clear of unnecessary regulatory obstacles, often politically motivated and introduced in bad faith. Italy's proposal to ban cultivated meat altogether is the clearest example of such action,¹⁵⁶ but the UK government is considering restrictions on how companies can describe plant-based dairy alternatives, banning terms like "mylk" and "sheese".¹⁵⁷ Actually implementing such measures clearly undermines the market for alternative proteins (indeed, that is often their thinly veiled objective), but just floating such ideas can have a scarring effect on business and investor confidence.

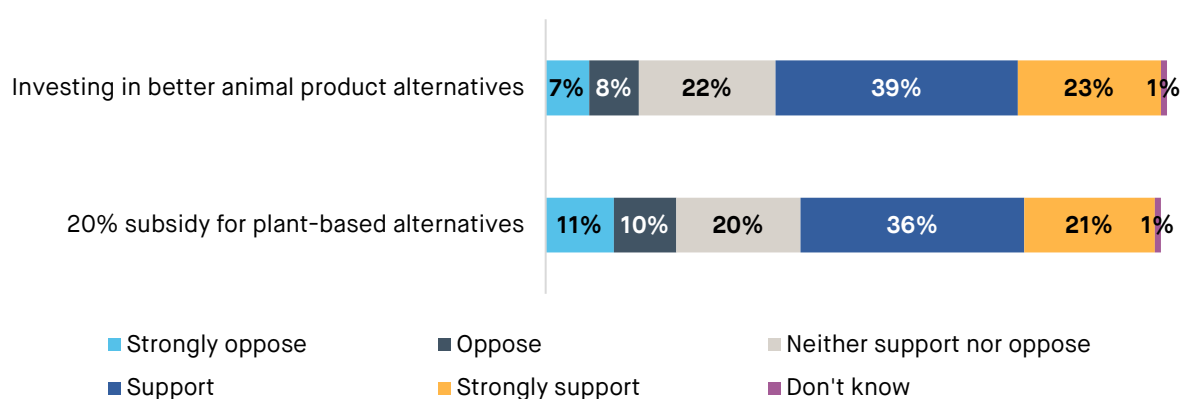
Third, reforming the regulatory process itself.¹⁵⁸ The FSA can be more open and flexible with alternative protein companies. This might involve better support and clearer guidance for firms to help them navigate the regulatory process. It could also take the form of pre-application consultations, whereby firms submit draft safety dossiers for preliminary feedback before making a full application. The FSA could accelerate approvals for products accepted in peer countries with appropriately high food standards. For example, it could fast track products cleared by EU or US agencies, and seek to support British firms in export markets by trying to agree reciprocal agreements. This would have the additional benefit of reducing duplication of activity for firms and regulators.

Retail price subsidies are supported by experts and the general public

The second most influential policy intervention in the eyes of survey participants is the introduction of retail price subsidies. A substantial 63% thought subsidies would make a significant or very significant difference to the development of the alternative protein market, and 38% believed it would make a modest difference.

Our previous research has revealed considerable public support for public investment in alternative proteins, with 62% in favour of financial investment in better animal alternatives and 58% backing a subsidy for alternative meat products.¹⁵⁹ Crucially, such subsidies would help to mitigate concerns the public may have regarding the affordability of alternative meat.

Figure 19: Support for policies to promote alternative proteins



Source: SMF. Note: The numbers in the graph do not add to 100% because of rounding.

Some interview participants also raised the prospect of discontinuing or diverting subsidies offered to the livestock industry. According to *Financial Times* analysis, farms with grazing livestock rely on subsidies for more than 90% of their profit.¹⁶⁰ The animal activist movement, Animal Rising, has claimed the UK government spends around £1.5 billion a year subsidising livestock farming, a much larger sum than what it has committed to the alternative protein sector.¹⁶¹ Under the ongoing reforms to farm subsidies, some of this money will be used to support animal welfare, paying for annual vet check-ups and grants for investment in equipment, technology and infrastructure to support health and welfare of livestock.¹⁶² In addition, some campaigners have called for a shift to subsidy for alternative proteins as well.¹⁶³

“Stop promoting industries like the livestock sector. That is going against the Green Deal in the EU and all the other Net Zero and environmental policy priorities.” – Anonymous

Public procurement can help alternative proteins gain a foothold in the market

The public procurement of alternative proteins entails government departments and other public sector organisations purchasing and incorporating alternative protein products into their food supply chains. In practical terms, this involves places such as schools and hospitals routinely offering alternative meat options as part of a deliberate effort to promote sustainable eating.

This is considered to be the third most impactful policy option presented to survey respondents, with 88% saying it would make either a significant or modest difference to the alternative protein market. Increased demand would help to make the sector grow, making such products more widely available to a broader audience.

“I’d suggest serving plant-based proteins at schools, labs, and hospitals. It’s an easy, softer way of entering the market.” – Catherine Tubb, Director of Research, Synthesis Capital

There is evidence that public bodies that serve food could help people to change their diets. For example, a study conducted in University of Cambridge cafeterias found that doubling the number of vegetarian meals available from 25% to 50% increased sales by 41%, 62%, and 79% across three different outlets.¹⁶⁴ These results are supported by similar trials conducted at the University of Oxford.¹⁶⁵

A recent report by the University of Exeter and sustainability consultant Systemiq branded public sector food service a “super leverage” opportunity. It says “using public institutions to purchase alternative proteins in large quantities would rapidly increase demand and help producers to achieve economies of scale, thereby lowering costs.” According to the paper, this would not require significant expenditure, but the redirecting of existing budgets away from conventional animal products.¹⁶⁶ This echoes the SMF’s call in a 2022 report to leverage the power of the public sector by providing alternative protein in its food service.¹⁶⁷

A meat tax on conventional products would be effective, but it is controversial

The most targeted meat reduction policy comes in the form of a ‘meat tax’. This would increase the cost of animal meat, and would be likely to deter consumers from buying it. However, while survey respondents consider it to be effective – 63% believe it would make a modest or significant difference – it is very unpopular.

Resistance to the idea of a meat tax is apparent across different sources of polling data,¹⁶⁸ including our own survey research. We found a clear majority of the public would be opposed: 69% said they are against it, with just 16% in favour.¹⁶⁹ British politicians, most prominently Prime Minister Rishi Sunak,¹⁷⁰ have ostentatiously rejected the proposal.¹⁷¹ Almost everybody in the field sees meat taxes as toxic and infeasible, for many years to come:

“I think a meat tax is a non-starter. It will create pushback and a lot of outcry.”

– **Anonymous**

As we discussed in our previous report, resistance to a meat tax is not necessarily a bad thing for animal welfare.¹⁷² While it would likely reduce meat consumption overall, by increasing the price of animal meat it could inadvertently drive some consumer demand away from more expensive, higher welfare products to cheaper ones – such as lower-welfare chicken. It would be possible to design such a tax so that it was applied only to lower-welfare animal products – but that would likely raise environmental objections as it would likely incentivise people to buy products like beef over chicken.

“From an animal perspective, I think there's a good chance that it is counterproductive. If we get a meat tax, which is either on environmental or health grounds, it's likely to fall heavy more heavily on red meat and therefore nudge people towards poultry, which of course, is a bad thing for animals.” –

Chris Bryant, Director, Bryant Research

Stricter farm animal welfare standards is an obvious solution

The most direct route to improving animal welfare is to implement more stringent farm standards. The Animal Welfare (Livestock Exports) Bill proposed in the recent King’s Speech is set to improve things slightly by banning live exports for fattening and slaughter – though it is unlikely this will have had a meaningful effect on the alternative protein market.¹⁷³ Other areas where regulations could be tightened include increasing minimum space requirements for farm animals and banning cages, restricting or outlawing practices like beak trimming and tail docking, and ending the confinement of pregnant pigs to farrowing crates.

Stricter welfare standards could indirectly support the alternative protein sector, by raising the cost of conventional meat, and thus increasing the price competitiveness of alternatives.

“We have to raise the bar when it comes to animal husbandry, animal welfare.”

– **Anonymous**

However, this was not seen by our expert participants as a very significant influence on the success of alternative proteins: 88% said it would only make a small or modest difference. It is unclear why our Delphi participants were so sceptical, given that significantly stronger welfare regulations would be bound to have an impact on the relative price of alternative proteins compared to conventional products. The most likely explanation is that participants doubt that governments will pass regulations tough enough to have such a significant effect as to substantially shift prices.

Campaigners have long called for the reform of UK farming methods. Recent evidence shows the British public is also in strong support of higher animal welfare standards. In 2018, YouGov polling found 82% support farmers receiving government subsidies for animal welfare. A 2022 poll, also by YouGov, found 71% want the government to pass more laws to improve animal welfare.¹⁷⁴ SMF research has also revealed a strong appetite for tougher standards, with 91% saying they would prefer stricter policies and 59% supporting a ban of all factory farming.¹⁷⁵

Both major political parties have been hesitant to commit to such changes.¹⁷⁶ While the Conservative Party has expressed its intent to address a range of farm animal welfare issues, progress has thus far been limited. Indeed, the RSPCA has produced a list of 15 broken promises by the current government, including the failure to consult on banning the use of cages, the reversal of plans to outlaw live exports (before reintroducing them this month), and the U-turn on welfare labelling.¹⁷⁷ Labour has endorsed the respectful treatment of animals, though its policies focus primarily on preventing fox hunting and trophy hunting, with little mention of farm animals. With a general election looming, this slow pace of progress may persist – potentially leaving farm animal welfare standards unaddressed.

Education and informational measures can help raise awareness among consumers

When consumers understand more about what they eat and the impact of their food choices, this could lead to greater consumption of alternative proteins. Educational efforts can help to raise awareness about the benefits of alternative proteins. Yet experts we surveyed see this as the least effective policy option for advancing the alternative protein market. The majority believe it will only make a small or modest difference (88%). That said, most believe it can play a role:

“Information campaigns have been pivotal for driving narratives and nudging behaviour. For example, with smoking, the government has flipped the narrative in a relatively short space of time, through a combination of education, messaging, and price nudges.” – **Tasvi Shah, Head of Strategic Products, Ivy Farm**

Measures could include public awareness campaigns and labelling standards. An informational campaign is seen as an effective way of changing the narrative around alternative proteins, much like smoking or recycling campaigns of the past. Labelling might refer to an animal welfare score that rates meat products according to the conditions animals were raised in. As well as helping consumers to make informed dietary choices, such approaches can also help to drive competition in a ‘race towards the top’ with companies vying for better, more ethical products. As mentioned above, the current government had committed to consulting on such a labelling scheme, before reversing course.

One potential issue is a lack of standardisation and clarity on alternative food labels. For instance, the Alternative Proteins Association has highlighted potential uncertainty in designations for various products, such as those derived from cultivation or fermentation. It has recommended the development of a ‘protein tracker’ that authenticates the origin of alternative proteins by, for example, labelling all ‘meat’ products as cultivated, plant-based, or animal-based, serving as certificates that provide transparent information to consumers. This would help to mitigate confusion in the alternative protein market.¹⁷⁸ This transparency will not necessarily be to the short-term benefit of all alternative protein products – some may benefit from consumer confusion. Yet it is likely to support the sector in winning trust and legitimacy in the long run.

Public investment in R&D can help increase the chances of success

A significant policy ask for those wanting to support alternative proteins – and potentially one of the most challenging given its expense – is greater public investment in alternative protein research and development. We have seen throughout this report that technical improvements in alternative proteins will be necessary to drive quality up and cost down. R&D is our best bet to achieve them. The private sector is already investing billions, but there are particular benefits to the creation of open source knowledge and incubation of pre-competitive technology, which can only come from publicly funded research.

In Chapter Two and Chapter Three, we delved into the uncertainty surrounding the government’s commitment to the UK’s alternative protein sector. Nevertheless, arm’s-length funding bodies are pouring more money in – UK Research & Innovation (UKRI) has funded £43 million of projects, with 65% of this funding allocated between January 2022 and May 2023. Yet more is needed if the UK is to keep up with peer countries. GFI have suggested that it will take £78 million *a year* to truly compete.¹⁷⁹

GFI analysis has mapped the emerging alternative protein ecosystem in the UK, highlighting ongoing research in plant-based, fermentation, and cultivated meat technologies across the country. It has also highlighted considerable untapped potential in the sector. As such, GFI have put forward nine policy recommendations to foster a thriving innovation environment, including spending on academic grants, business grants, researcher networks, studentships, and pilot facilities. GFI emphasises that “further investment in public R&D is a critical component for catalysing the ecosystem”.¹⁸⁰

“I think governments have some role in publicly stimulating research.” – Abhi Kumar, Program Associate, Open Philanthropy

When survey respondents were asked about the factors they deemed most significant in influencing consumer adoption of alternative proteins, public investment ranked seventh out of 12 drivers. 38% of respondents considered it important, while 25% regarded it as critical. This makes some sense: drivers such as product quality and technological development are more fundamental to success and growth. However, it is important to recognise those drivers are in large part dependent on investment.

However, this is not a deterministic relationship – there is no automatic guarantee that R&D spending will produce results. It should be clear from this report so far that alternative proteins are anything but a sure bet. That is always the case with investment, which is invariably risky, but it is particularly so given the huge technical barriers facing cultivated meat.

Policymakers weighing spending on alternative proteins research should see it like buying raffle tickets: there are no certainties, but the more they buy, the more likely they are to succeed. Another analogy – one that advocates of alternative proteins like to employ¹⁸¹ – is to compare the alternative proteins sector to the parallel sustainable energy market. With the right support and backing, particularly investing in early stage open access research, as well as support and incentives for scaling up, it has the potential to achieve relative success.

The share of British electricity from renewables rose from 3% to 40% between 2000 and 2022.¹⁸² This growth has been driven by the sort of dramatic cost reductions cultivated meat is trying to achieve. The price of electricity derived from solar power declined 89% between 2009 and 2019.¹⁸³ With enough ‘raffle tickets’, similar achievements may be possible for alternative proteins.

On the other hand, we should be alert to the possibility that cultivated meat turns out to be like a different type of clean energy: nuclear fusion. Like cultivated meat, a technology with vast promise, but forbidding technological barriers, for decades it has been tantalisingly beyond our grasp. It is a long-running joke that “fusion is always 30 years away”.¹⁸⁴ Scalable, economically viable cultivated meat might similarly always be just around the corner but never quite arrive.

That makes it somewhat concerning that research funding for cultivated meat recently overtook that of plant-based meat.¹⁸⁵ While the greater potential for cultivated products to match conventional meat for taste means that it is worth risking some money on, this should not lead to neglect of the more established technologies, which can still be refined. In particular, GFI has argued that UK funding for precision fermentation is low relative to peer countries.¹⁸⁶

Animal welfare advocates should promote policies that support the growth of alternative proteins

Policymakers can do a lot, then, to support the development of the alternative proteins. Whether they end up doing so will depend in large part on the actions of campaigners, and whether they put the government under pressure to take the steps it needs to in order to enable the transition away from animal products. As we demonstrated in Chapter Five of this report, alternative proteins have the potential to significantly impact the wellbeing of farm animals in the UK, sparing the lives of millions of animals reared in lower welfare conditions. That should focus the minds of advocacy groups.

“RSPCA are a visible animal welfare campaign group, alternative proteins should be part of their remit.” – Anonymous

We argue that organisations such as the RSPCA should take an active role in championing policies that support the growth of alternative proteins. Government has thus far been reluctant to wholeheartedly commit to alternative proteins. Though less politicised research agencies have been funding work to advance the technology, politicians have yet to be convinced that it is a vote winner. Interviewees told us that alternative protein companies tend to refrain from openly advocating animal welfare objectives to avoid being entangled in toxic debates and so-called culture wars surrounding the issue.

“The animal welfare topic is a controversial one. We don’t want to bring up feelings of guilt, but instead abundance and choice.” – Tasvi Shah, Head of Strategic Products, Ivy Farm

That being the case, campaigners should bridge the gap by emphasising the animal welfare benefits of alternative proteins. This would help promote the sector from another angle, sending a similar message to the public and to the government, but with greater impact coming from organisations that are not among the ‘usual suspects’. However, closer engagement could also keep alternative protein producers on track, reminding them of the importance of developing products that substitute for the most harmful lower-welfare products.

In practice, this might mean focusing on public information campaigns and raising awareness of farm animal suffering. These are things that advocacy groups already do. But in the words of one interview participant, they are not yet part of the “alliance” of organisations that actively promote and shout about the transition to alternative meat. Other activities might include calling for changes to novel food regulation processes, as well as monitoring and producing evidence on the development of the sector.

“Specifically, they should focus on production, not demand. For example focusing on public information campaigns and neglected policies, pushing on regulation, calling for more research, and being part of the alliance.” – Anonymous

Some argue that instead of pursuing technological solutions like alternative meat, society should prioritise more ethical and sustainable practices within traditional animal farming systems, such as improved living conditions and reduced antibiotic use. In particular, concerns around scaling-up have led experts to question if alternative proteins are a false solution to achieving sustainability goals.¹⁸⁷ We see less of a tension between the two – it is not either/or but rather both/and. Our view is that campaigners putting their weight behind alternative proteins is (in the language of the Climate Change Committee) a “low-cost, low-regret” activity that ought to supplement their other objectives, given the huge potential to save lives and limited resource and opportunity cost.

“Increase awareness of animals suffering so people make more of an effort to eat less meat. The alternative protein industry doesn’t want to lead with that messaging, companies don’t want to have that negative association. There’s a ripe gap for hammering on that messaging.” – **Chris Bryant, Director, Bryant Research**

But they shouldn’t abandon their existing animal welfare priorities

Because they have the potential to contribute to the same ultimate objective and can significantly mitigate animal welfare issues, promoting alternative proteins should be included in the scope of activities undertaken by animal welfare organisations. But they should not displace the core activities of animal welfare organisations – pushing for policies that directly improve farm conditions.

While alternative proteins have great potential, it would be premature and unwise for welfare organisations to go all in on them. Due to the substantial uncertainty surrounding the sector’s success, to shift too far could inadvertently compromise the welfare of animals. From the perspective of animal welfare organisations and their supporters, such a course of action could be disastrous.

Advocates should start to work to raise the profile of alternative proteins. But they must not abandon their existing responsibilities to improve animal welfare in the UK, campaigning for more stringent farming standards.

“I think the most natural fit is going to be animal welfare standards. That’s probably something that their existing supporters expect them to do.” – **Chris Bryant, Director, Bryant Research**

As one interviewee highlighted, this would leave a significant gap in the market – and would have prevented the achievement of vital measures like the Animal Welfare Act and Kept Animals Bill.¹⁸⁸

“If animal welfare charities aren’t doing the classic animal work, who is going to do it? The challenge is that it could go off the radar.” – **Jo Raven, Director of Thematic Research and Corporate Innovation, FAIRR initiative**

Gaps or inadequacies in animal welfare advocacy could potentially leave animals – including farm animals reared for meat – with fewer safeguards against cruelty. Advocating for alternative proteins must be carefully balanced to ensure that essential aspects of animal welfare are not compromised.

There may be occasions when conventional animal welfare priorities, such as raising farm standards, might come into conflict with promoting alternative proteins. For example, farm subsidies could be redirected towards animal welfare interventions or funding for alternative protein research. Such judgements are finely poised: in our view, they largely come down to risk tolerance – devoting resources to animal welfare offers a more certain, but smaller gain, whereas alternative proteins are a riskier bet with a more positive outcome if it comes off.

In practice, though, we suspect such trade-offs are more hypothetical than real. Our expectation is that those seeking to promote animal welfare have the capacity to support alternative proteins without compromising much on their core objectives. Alternative proteins should be part of the discussion, another element of the toolkit to create a more compassionate and sustainable food system.

APPENDIX: RESEARCH PARTICIPANTS

Name	Title	Organisation
Catherine Tubb	Director of Research	Synthesis Capital
Andrew Bennett	Policy Principal	Form Ventures
Jacob Peacock	Research Manager	Rethink Priorities
Chris Bryant	Director	Bryant Research
Tasvi Shah	Head of Strategic Products	Ivy Farm
Abhi Kumar	Program Associate, Farm Animal Welfare	Open Philanthropy
Tom MacMillan	Professor of Rural Policy & Strategy	Royal Agricultural University
Jo Raven	Director of Thematic Research & Corporate Innovation	FAIRR Initiative

Two participants asked to remain anonymous.

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