Putting British success on the menu

Time for a UK alternative proteins strategy

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SMF Social Market Foundation

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ABOUT THIS REPORT

This report draws on a private roundtable convened by the Social Market Foundation with expert stakeholders in March 2022. The session was held under Chatham House rule. Participants included members of both houses of parliament, government officials, academic experts, and representatives from the food industry and public policy. Whilst the views of participants helped to inform the contents of this report, the views expressed here are those of the author alone.

EXECUTIVE SUMMARY

This report calls on the UK Government to adopt a comprehensive policy stance on alternative proteins (APs) – food products deriving their protein content from non-animal or non-traditional sources. It builds on a previous Social Market Foundation paper which cautioned against more interventionist measures aimed at reducing meat, dairy and seafood consumption. Informed by the views of policymakers, industry, academics and other stakeholders, we make the case that government should help to expand consumer choice and catalyse a consumer-led transition to more sustainable forms of protein.

We discuss the potentially wide-ranging benefits of alternative proteins but recognises the significant barriers that stand in the way. Many of these barriers are amenable to proactive, long-term policymaking. However, at present, UK policy in this space is fragmented and inaction from government risks offshoring opportunities.

The promise of alternative proteins

- Alternative proteins are a more efficient means of getting protein into our diets than animal-based foods.
- Despite the weight of environmental evidence, the government has not seized alternative proteins as an opportunity for helping the UK achieve its legally-binding environmental targets. We argue that a broader case may be required to convince policymakers.
- The expansion of the AP market was considered an inevitability by many attendees at our roundtable. The UK is one of the largest consumer markets for plant-based foods, valued at $1.5 billion in 2020 having doubled since 2016.
- The UK AP sector is heterogenous. It includes cutting-edge companies developing cultivated meat and established international plant-based brands. Last year British AP businesses attracted over £150 million of capital investment.
- There is some evidence that APs could contribute to economic growth and green job creation. Whether this represents a net gain to employment – given potential losses in agriculture and food processing – is uncertain.
- The primary role for APs in the UK's food transition, at least for the time-being, is to transform processed meat-based convenience foods—a major component of our diet, whether we like it not. One potentially significant consequence of this is the disruption of intensive agricultural systems, which could lead to major gains to animal welfare.
- There is an opportunity for alternative proteins, alongside 'traditional' plant-based proteins, to play an important role in our food system harmoniously with more extensive agricultural practices.
- UK farmers cannot transition overnight to growing crops for APs, but new cultivars suitable for our growing environment are becoming more common. The forthcoming Genetic Technology (Precision Breeding) Bill represents a significant opportunity for plant innovation to support APs.

But there are barriers to transitioning to greener, kinder and more efficient sources of protein

- Ensuring that alternative proteins reach price parity with conventional animal-based foods and are widely available and appetising is vital.
- At present, some AP producers are capturing a premium from ethical consumers who are willing and able to pay extra. Some production processes – notably those using cellular technologies – are either commercially uncompetitive or unviable.
- There are encouraging signs that more products are achieving price parity: Tesco's plant-based beef burgers now retail at 13% cheaper than the meat equivalent. However, some more premium products still retail at almost triple the price of the animal-based equivalent (excluding carbon cost and effect of agricultural subsidies).
- Some consumers may be resistant to meat alternatives: recent polling has found that four in ten people (42%) could not be encouraged to try plant-based products.
- There are concerns that alternative protein products currently on sale do not match the nutritional profile of their counterparts. The evidence base comparing like-for-like products is limited but growing and showing signs that APs can match animal-based foods.
- Rhetorical arguments that APs are processed convenience foods are a common feature of the discourse surrounding the protein transition; improving the nutritional and health properties of APs will be important for mitigating these concerns.

Whitehall inertia risks the UK missing out on the transition to alternative proteins

- Current AP policy is underdeveloped in the UK. The most substantial commitment has been to review the UK's novel food regulations post-Brexit.
- Other nations are much further ahead, with France, the Netherlands, Germany, Denmark and Finland amongst those European countries who have already set out protein strategies.
- In recent months, Denmark has earmarked $168 million of R&D for plant-based foods and China has signalled a move towards cultivated meat in its latest Five-Year Agricultural Plan.
- At present, there is no clear policy ownership of alternative proteins in Whitehall, but many government departments and bodies have a role to play including BEIS, DEFRA, the Cabinet Office and the FSA.

Recommendations

The Government's Net Zero strategy pledges to work "with the grain of consumer choice" as the UK decarbonises. This report argues that government should adopt a policy position that expands consumer choice and the market for alternative proteins. A failure to act soon risks the UK falling behind international competitors, foregoing opportunities for British businesses, and hindering the transition to greener diets.

Recommendation 1 – BEIS should be tasked with developing a UK alternative protein strategy with cross-departmental input

- **Within 12 months, the Government should develop and publish a UK alternative proteins strategy**, led by BEIS, with cross-departmental input.
- The strategy should adopt a long-term perspective and consider the wide-ranging possibilities and challenges arising from the protein transition.
- The Minister for Science, Research and Innovation should be held accountable for the AP strategy's success.

Recommendation 2 – commission an innovation needs assessment for alternative proteins

- Public R&D can play an important role in incubating pre-competitive technologies and ensuring that those with commercial potential reach the consumer market at a viable price point.
- Taking BEIS' Energy Innovation Needs Assessment as a blueprint, the government should commission an innovation needs assessment for APs.
- This should scope out spend-to-date on innovation, what gaps exist that the UK is well-placed to exploit and estimate what level of public R&D funding would be necessary for the UK to become an international competitor in APs.

Recommendation 3 – supermarkets should publicly disclose what proportion of protein sales come from plant-based products, striving to reach 30% by 2030

- Voluntary, business-led disclosures can help to establish new norms and stimulate market competition.
- Protein sale disclosures would be a first step, but sector-wide Scope 3 emissions reporting should be viewed as the end-goal.

Recommendation 4 – leverage the power of the public sector

- £2.4 billion is spent annually on food purchasing for the public sector, though this figure is likely to be higher as the most recent estimate is from 2010.
- The current Government Buying Standards carry no mandatory provision regarding the protein composition of food sold in the public sector.
- Reforming these standards could help accelerate the transition to APs, cutting food systems emissions and improve animal welfare outcomes, with regulations on welfare described as "weak" under current rules.

Recommendation 5 – improve public data on animal-based protein consumption

- Several consumer surveys track the consumption of meat, dairy and seafood in the UK, notably DEFRA's Family Food Survey (FFS) and the National Diet and Nutrition Survey (NDNS). These estimates show considerable variation.
- Without reliably understanding trends in consumption of animal-based foods, government may struggle to calibrate and evaluate policy.
- The government should review existing public statistics clarifying which it believes to be the most reliable, and produce an annual monitoring report based on the best available retail sales data.

CHAPTER ONE – INTRODUCTION

Feeding 10 billion people by 2050[1] – and doing so from food systems already experiencing the effects of climate change[2] – is one of the 21st Century's most complex policy challenges. Appetite for animal protein is at the heart of that problem. In a business-as-usual scenario, modelling estimates indicate that global demand for animal-based food will grow by 68% between 2010-2050.[3] Continued dependency on animal agriculture, responsible for at least 14.5% of global greenhouse gas emissions (GHG) [i], for the supply of the world's protein is almost certainly incompatible with the Paris 1.5°C target.[4] This is to say nothing of the negative externalities associated with certain livestock systems and patterns of meat consumption, including risk of zoonotic disease emergence,[5] biodiversity loss[6] and increased risk of morbidity and mortality.[7] [8] In April 2022, the Intergovernmental Panel on Climate Change (IPCC) recognised for the first side the importance of demand-side mitigation strategies, including reduced consumption of animal-based foods, if we are to remain within planetary boundaries.[9]

In the UK, reliance on animal protein threatens the likelihood of achieving the government's 2050 Net Zero target. This has been recognised by the Committee on Climate Change[10], the National Food Strategy[11] and the Energy Systems Catapult[12]. At present, diet has gone unacknowledged in the UK Government's Net Zero Strategy (NZS). Perhaps tellingly, a government-commissioned report discussing behaviour change policies to reduce meat consumption, released at the same time as the NZS, was deleted within minutes of publication online.[13]

The Government's current stance is to leave the question of dietary change and Net Zero to consumers and the market. And whilst there is some evidence[14] that consumers are turning away from meat – particularly red meat – this evidence remains inconclusive and future trends uncertain.[15] What is widely recognised, however, is that the UK will miss the Committee on Climate Change's initial target[16] to reduce meat and dairy consumption by 20% by 2030. Based on DEFRA's Family Food Survey data, achieving this target would involve meat consumption decreasing by around four times the speed that it did between 1980-2015; in-home consumption has actually increased by 2.15% since 2015.[17]

Broadly there are two categories of policy lever that government can pull to reduce how much meat and dairy we eat: [18]

1. Restricting or eliminating the choice to consume animal-based foods.
2. Expanding the choice of alternatives to animal-based foods.

The former includes policy instruments such as 'meat taxes' and campaigns to reduce animal protein consumption. A previous Social Market Foundation paper has discussed the political toxicity of these options. [19] The latter option is more compatible with the economic logic and values of western governments. Importantly, these levers are not

[i] This figure continues to be recognised by the United Nations but has been contested. For more, see Twine, R. (2021). Emissions from Animal Agriculture—16.5% Is the New Minimum Figure. *Sustainability*, 13(11), 6276. https://doi.org/10.3390/su13116276

mutually exclusive. In fact, it is likely that the viability of restricting or eliminating choice is contingent on a heterogenous market of alternatives.

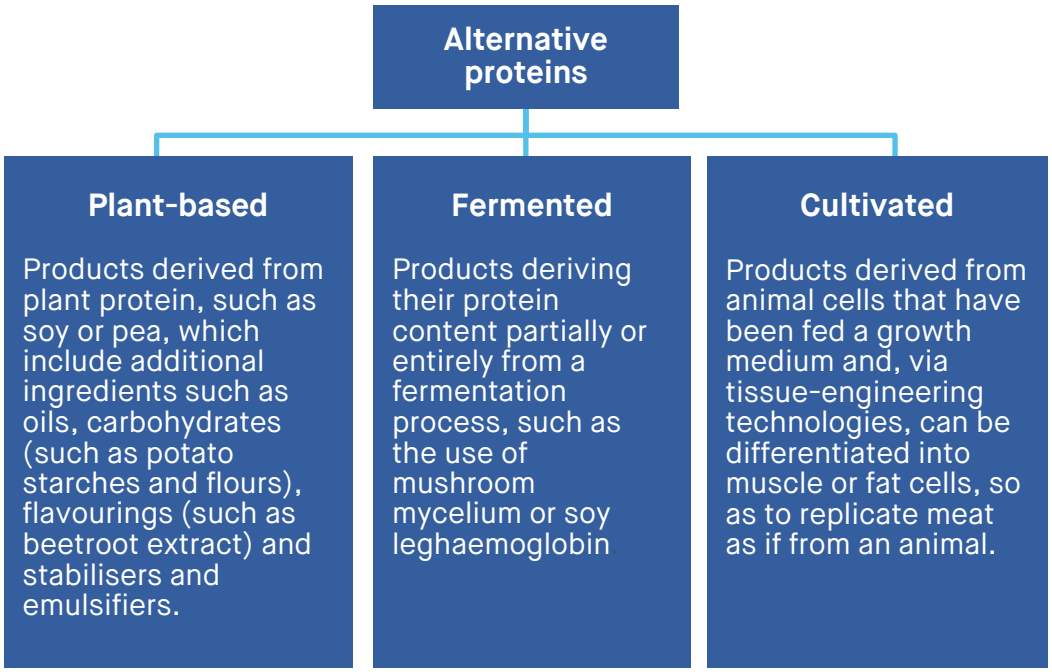
Alternative proteins (see Box 1) – represent an important opportunity to expand consumer choice. Their capacity to disrupt the meat, dairy and seafood sectors rests on being a greener, kinder and more efficient way of putting protein on people's plates. The UK and global markets have grown considerably in recent years, albeit from a low base. If net zero diets are to become a reality for British households, alternative proteins will be a key piece of the puzzle, alongside reduced food waste and more environmentally-friendly land use systems.

This report considers what role alternative proteins can play in the UK's food system transition and what role – if any – the UK government should play in trying to stimulate an AP market. It draws on findings from a private roundtable convened by the Social Market Foundation with expert stakeholders in March 2022. The session was held under the Chatham House rule. Participants included members of both houses of parliament, government officials, academic experts, and representatives from the food industry and public policy.

Terminology – what do we mean by alternative proteins?

In this report, we refer to alternative proteins as those protein-rich food products which derive their protein content from non-animal (e.g. plants) or non-traditional (e.g. insects or animal cells) sources. By alternative proteins, we therefore mean the final product that consumers purchase, not the isolated protein content. This is an important distinction, particularly with regards to the health properties of different protein molecules, but one which we make to align with how policymakers are addressing the issue. We also use the phrase sustainable proteins and alternative proteins interchangeably.

Many AP products are analogues of conventional meat, dairy and seafood products. They typically involve some form of novel technology and/or production process to replicate the cooking properties, sensory experience and nutritional profile of animal-based products. For the purpose of this paper, we follow a commonly made distinction between plant-based[20], fermented[21] [22] and cell-cultured products[23].



CHAPTER TWO – THE PROMISE OF ALTERNATIVE PROTEINS

Alternative proteins are a more efficient means of getting protein into our diets than animal-based foods. The evidence that APs use less land, less water and produce fewer GHG emissions than animal protein is increasingly robust.[24] [25] [26] [27] [28] There is a dual dimension to their climate mitigation potential.[29] Firstly, displacement of meat products by alternatives directly reduces emissions. Since methane (CH_4) makes up a significant proportion of the emissions profile of animal agriculture, a swift reduction in consumption can 'buy time' in the fight against climate change: CH_4 is much more atmospherically damaging than CO_2 but has a far shorter half-life.[30] This means that cutting CH_4 emissions can cause the amount of GHG in the atmosphere to actually fall as the stock of CH_4 breaks down and is not replaced. By contrast, cutting CO_2 emissions can only stabilise the level of GHG in the atmosphere.

Secondly, APs can also free up land used for animal agriculture (grazing and feed production). In the UK, 85% of land used for food is associated with meat and dairy, but only produces 48% and 32% of total protein and calories for human consumption respectively.[31] Transitioning this land can contribute to other environmental objectives such as habitat restoration, carbon sequestration, and biodiversity recovery. We should consider too that the environmental benefits of APs are likely to grow over time, owing to efficiency improvements in production processes and the decarbonisation of inputs – primarily from the decarbonisation of the energy supply.

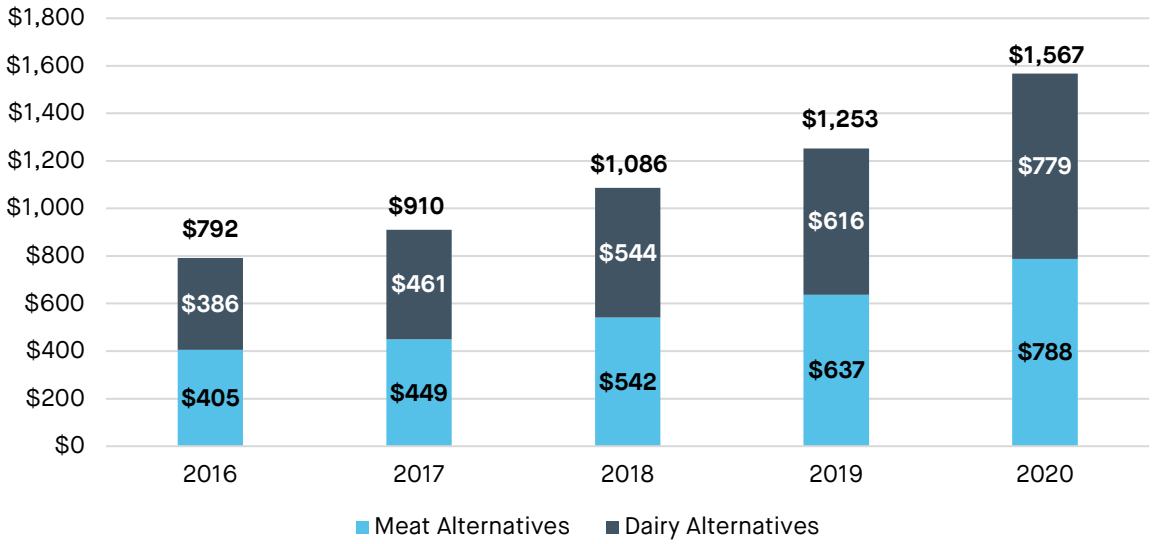
Yet the weight of evidence about the environmental benefits alone of APs appears to be insufficient to neutralise what one roundtable attendee characterised as "a very toxic debate" about the future of livestock farming and meat consumption. Another noted that advocates were "articulating the environmental benefits very clearly" but, as has been echoed in a recent study[32], they have failed to adequately address the socio-economic effects of dietary transitions. This chapter therefore surveys the potential of APs beyond their environmental credentials.

An economic opportunity?

Contributors to our roundtable session broadly agreed that the growth of the UK AP market is, at least to some degree, inevitable.[ii] Retail sales of plant-based meat in western Europe grew by 19% to $2.6 billion in 2021.[33] The UK is one of the largest consumer markets for alternatives. Nielsen data indicate that the volume of plant-based food sales increased by 67% between 2018-2020 in the UK, the second fastest growth of any European country after Germany.[34] A similar trend is highlighted by US Department of Agriculture research (Figure 1), with the value of the meat and dairy alternatives market doubling between 2016-2020.

[ii] There is some evidence that sales of plant-based alternatives are slowing – the US market effectively stagnated in 2021.

Figure 1: UK market worth of meat and dairy alternatives, 2016-2020 ($ million)



Source: Kantar, cited by USDA.

Participants at the session characterised the expansion of the AP market as an economic opportunity that the UK could either exploit, or risk missing out on:

> *"As a country, do we want to be part of it? Do we want to be part of what is going to happen? Or do we want to sit and wait and see what happens?*
>
> *"We need to have a vision for what we want for the UK in this sector. Do we want a healthy alternative protein sector? What does that mean for the economy in terms of new jobs and green manufacturing here? And how does that help UK businesses grow in scale?"*

At present, the majority of AP products for sale in the UK are domestically produced and the market is relatively heterogenous in terms of producers. It includes established UK firms (e.g. Marlow Foods/Quorn), mid-sized brands (e.g. Moving Mountains, Meatless Farm), and supermarket own-label ranges (e.g. Sainsbury's Plant Pioneers). 'Traditional' meat companies are also diversifying and investing in alternatives: UK-based red meat producer ABP recently launched a plant-based subsidiary and a number of brands.[35] A number of meat, dairy and seafood analogues are imported from the EU, particularly the Netherlands. As the market matures and technology develops, well-capitalised companies elsewhere such Mosa Meat, Eat Just, and Impossible Foods[iii] will likely play an expansive role. One attendee pointed out that "Big Meat" companies, including Tyson Foods[36] and Cargill[37], were already investing in start-ups and bringing alternative protein brands to market; JBS, the world's largest meat company, has recently acquired the Dutch-based plant-protein brand Vivera for around $400 million.[38]

[iii] This research has been sponsored by Impossible Foods but conducted independently.

A clear policy direction from the UK could incentivise private investment and persuade international brands to produce here, whilst supporting British businesses to export their products and technologies. As one attendee acknowledged, a lack of action may offshore some of that opportunity: "we can either accept that it will happen to us and other countries will deliver it, or we can do something". Another participant suggested that exponential growth of the market wasn't guaranteed, but nevertheless it remained an open question as to how much of any "economic upside [of APs] arises in the UK".

> **"As a country, do we want to be part of it...or do we want to sit and wait and see what happens?**

The offshore wind sector is an instructive comparison case here.[39] The commitment of direct public investment and subsidy via the Contracts for Difference (CfD) scheme has leveraged substantial private investment; as of 2020, the UK had installed 42% of Europe's total offshore wind capacity.[40] State support for the sector has been so fundamental that a WTO case has recently been brought against the UK by the EU, suggesting that the CfD scheme has imbalanced global capital investment in offshore wind too far in the UK's favour.

It is important to recognise that alongside the economic opportunity of APs, there is also a fiscal cost of inaction. The OBR's 2021 Fiscal Risk report highlights that unmitigated climate change would see the debt-to-GDP ratio reach 289% by 2100.[41] Prevention is cheaper than the cure, and a transition to more sustainable proteins presents an effective means of mitigating biodiversity loss, pressure on land and water, and GHG emissions. And the OBR is clear that a proactive policy approach will minimise the fiscal impact of climate change: the net cost to the state in an early action scenario is estimated at £344 billion which, spread across three decades, represents 0.4% of GDP a year. [42]

How large is the potential economic upside of a strong alternative protein sector?

Striking headlines about market growth and technological developments can make it hard to see the wood for the trees when assessing the scale of economic opportunity accruing from alternative proteins. In the UK, only a limited number of assessments have been made about what APs could mean for jobs, investment and economic growth:

- **National Food Strategy**[43] - modelling estimates suggest 10,000 new factory jobs (equivalent to 10.5% of total employment in meat processing[44]) and 6,500 jobs secured in agriculture for input production (equivalent to 1.4% of total agricultural employment[45]). A separate study indicates that salaries and work conditions are notably better than for comparative roles in the meat sector.[46]
- **Oxford Economics**[47] - between 4,400–8,300 employed in the cultivated meat sector by 2030 (equivalent to 4.6%-8.7% of total current employment in meat processing), with £290-574 million in gross value added in nominal terms.
- **Good Food Institute** - £155 million capital investment in UK-based AP companies in 2021, up by 290% from previous year.[48]

Additionally, we can build up a picture based on economic assessments from other nations:

- **Australia** – modelling from Food Frontier[49] suggests that under a conservative scenario (where conventional meat remains the primary choice for most consumers, and plant-based consumptions is at 2.4kg per year), total full-time employment in the plant-based meat sector is estimated to grow from 547 to 2,100 jobs and total value-added would grow from AUS$50.4 million to AUS$398 million. Under a 'moderate' scenario (where per capita consumption increases to 6.1kg per year) total employment would grow to 6,026 and total value added of AUS$1.1 billion to the economy.
- **United States** – the Breakthrough Institute suggest that if existing estimates of close to ten-fold market growth by 2030 are realised, and "robust" federal funding for loans and R&D made, 200,000 jobs would be created.[50]

It is best to view these estimates as illustrative rather than conclusive. A number of hypotheticals are in play, including the viability and scalability of new technologies, displacement of employment in farming and processing, and sustained consumer demand for and acceptance of APs. A useful reference point, however, is a recent social life cycle assessment – a way of measuring the socio-economic impact of a product over its lifetime – which suggests that novel plant-based and animal-based products have broadly similar socio-economic performance.[51]

In the absence of more robust data, it is difficult to say clearly whether APs represent a significant net gain to UK plc. Nevertheless, the buoyancy of the UK consumer market[52] [53], forecasts of substantial global market growth[iv] and the risk of foregoing employment and investment to other countries should motivate UK policymakers to give strong consideration to how they can maximise opportunities of the protein transition.

Innovation, R&D and competitive advantage

It is often raised that the quality, price competitiveness and nutritional profile of alternative proteins needs to improve. At present, some production processes – notably those using cellular technologies – are either commercially uncompetitive or unviable. Innovation will be essential: estimates from the ClimateWorks Foundation suggest that annual global spending on public R&D and commercialisation needs to increase to $4.4 billion and $5.7 billion respectively.[54] The pace is quickening in the international race to meet this demand for innovation. Last year, the SMF highlighted the risk to the UK of losing out to nations funding protein innovation clusters (e.g. Netherlands and Canada) and those directly supporting AP start-ups (e.g. Israel).[55] Since the publication of that paper, further innovation policy developments include:

- **Netherlands** – an initial €60 million government investment to support the development of a cellular agriculture ecosystem.[56]
- **Denmark** – $168 million earmarked for plant-based R&D, including $100 million Plant Fund announced in April 2022, as part of a new climate deal approved by all major political parties.[57] [58]

[iv] Estimates of growth to 2030 vary considerably: Emergen Research, $38 billion; EY Food and Agriculture $77-153 billion; Bloomberg Intelligence, $162 billion.

- **Qatar** – state-funded Doha Venture Capital and Qatar Free Zones Authority have partnered with novel food company Eat Just to build a ~$200 million commercial facility for cultivated meat products.[59]
- **China** – latest Five-Year Agricultural Plan includes a provision for innovation to support cultivated meat development.[60]

One participant at the roundtable noted that "public R&D plays such a different role to private R&D", since it is non-duplicative, open-access and can focus on pre-competitive technologies. This shoulders the burden of financial risk that start-ups may not be able to bear and signals intent from government to investors. A noteworthy case in the UK context is cellular agriculture company Ivy Farm, a spin-out of Oxford University that uses tissue-engineering technology developed at Oxford. It aims to bring products to market next year and has recently completed a £16 million funding round to build a pilot R&D facility.[61] Mycoprotein company 3fBio (ENOUGH) is a further example, beginning at the University of Strathclyde and since securing €42 million in Series B venture capital funding.[62]

These cases bear the hallmarks of British innovation success stories but only represent the start of what is required for the UK to maximise the economic upside of alternative proteins. This is particularly the case for cultivated and precision-fermentation technologies which will come online over the coming decade. A strong partnership between research funders, universities, entrepreneurs, investors and government is required if the UK is to reduce fragmentation in the R&D ecosystem and maximise the likelihood of growing leading AP companies and the domestic market. Green export opportunities also loom large: Beyond Meat's deal to supply patties for McDonald's *McPlant* burger illustrates the potential that global food service brands have to carry APs to new markets at a huge scale.

An opportunity to disrupt intensive meat production and improve animal welfare

The alternative protein sector has predominantly emerged around convenience food. By 'convenience', we refer broadly to food products that are easily accessed and reduce the time and effort spent purchasing, preparing and consuming food (often pejoratively referred to as 'junk food'). [v] Two reasons explain the convergence of APs and convenience. Firstly, the current state of technology and production limits the variety of products that can be manufactured to mainly analogues of ground meat products, nuggets and ready meals. Secondly, APs tap into shifts in diet driven by the outsourcing of food production from the home. Between 1980-2019, the amount of carcase beef, lamb and pork eaten per capita in UK homes fell by 63%, whilst

[v] 'Convenience food' is often synonymous with 'junk' or 'fast' food – those food products with high negative externalities such as suboptimal nutritional content. Many convenience foods do fall into this category but academics emphasise that this is a much broader category than contemporary discourses sometimes suggest. For more see: Jackson, P., & Viehoff, V. (2016). Reframing convenience food. Appetite, 98, 1–11. https://doi.org/10.1016/j.appet.2015.11.032

consumption of meat-based ready meals, convenience and takeaway meats increased by 201%, making up almost a quarter of the meat consumption.[63]

The health, environment and social costs of convenience foods are a perennial of our national conversation about diet.[64] Many highlight the need to transition to planetary health diets (see

Figure 2), where meat and dairy would be mostly traded out for traditional plant proteins and higher consumption of fruit, vegetables and whole grains.[65] No doubt this would be the ideal transformation of our food system. But it butts up against the reality of modern western food culture—underscored by convenience and declining time undertaking 'foodwork'.[66] In the UK it has been estimated that today the average person derives only 26.5% of their daily energy intake from home-cooked food.[67] As the NFS states: "we have to recognise how people actually behave, rather than just wishing they would behave differently".[68]

Figure 2: Eat-Lancet Commission's Planetary Health Diet

Source: Eat-Lancet Commission[69]

The primary role for APs in the UK's food transition, at least for the time-being, is to transform the protein and fat content of processed meat-based convenience foods—a major component of our diet, whether we like it not. One potentially significant benefit of this is the disruption of intensive agricultural systems. As one roundtable described it:

> *"Kill industrial, high-intensity meat; that's where alternative proteins are likely to be successful. In Britain people have a romantic sense of how meat is made. They like happy cows in fields. We don't like the reality of pig or chicken production so we ignore it."*

> **"Kill industrial, high-intensity meat. That's where alternative proteins are likely to be successful.**

UK livestock production spans a wide continuum from high welfare, extensive systems (mainly cattle and sheep) to welfare-compromising intensive systems (mainly chicken and pig). 95% of the UK's 1.1 billion broiler chickens slaughtered every year are reared in intensive indoor units[70] [71], bred with genetic traits best suited to the fastest possible weight gain irrespective of animal health and suffering.[72] Bureau of Investigative Journalism findings indicate a 25% increase in intensive farms since 2011, almost all of which are pig (24%) and poultry (73%).[73] More than 1,000 such farms exist in the UK[74] and intensive systems are deeply unpopular way of producing protein with the public. YouGov polling from February 2022 highlighted that three in four respondents (78%) were "strongly opposed to the use of typical factory farming practises to produce cheap food".[75] Residents in close proximity to intensive farms, for example in Herefordshire and Shropshire where an estimated 25% of broilers are raised[76], have complained of foul smells and river pollution.[77] It was highlighted at the roundtable that, from a land-use perspective, intensive animal agriculture is highly efficient but "you get the best of both worlds" with alternative proteins: land efficiency and no animal suffering.

An opportunity to contribute to the agricultural transition

Participants at the roundtable were mostly unanimous that forging a direct link between alternative proteins and the UK's post-Brexit farming and land-use reforms was not a politically tenable position. Nevertheless, it was recognised that the APs should be considered in the context of changes to agriculture. One participant emphasised that the AP sector needed to secure its "social license to operate" and "take concerns very seriously about…the impact on rural livelihoods". Whilst the assumption may be that alternative proteins pose an existential threat to farming, the section above sets out that it is unpopular, intensive systems that APs are most likely to disrupt. It is plausible that cultivated meat could in the long-term displace 'whole-cut' meat products, though this remains a subject of lively debate.[78] [79] A UK-based study has recently been announced that will consider whether cultivated meat is a threat or opportunity for UK farmers.[80]

In the meantime, there is an opportunity for alternative proteins, alongside 'traditional' plant-based proteins, to play an important role in our food system harmoniously with more extensive agricultural practices. This was recognised by one participant at our roundtable:

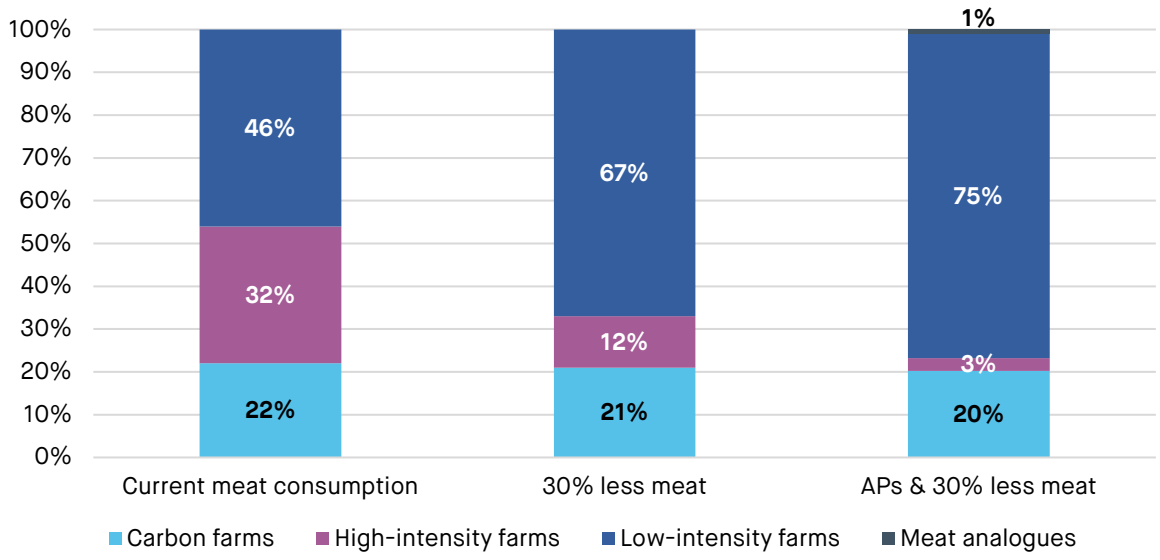
> *"There is room in the alternative proteins space to look at how they can be used to make livestock production more sustainable…there's loads of opportunities there. I think that framing…allows for the right of existence of both livestock producers as well as the alternative protein sector"*

Modelling estimates conducted for the NFS (Figure 3) indicate how displacement of meat and dairy with APs can help to rationalise the Government's pursuit of its 'public money for public goods' approach to agriculture. Land currently used for grazing or

feed production could be turned over to practices supporting the government's environmental objectives, such as reversing biodiversity decline by 2030. Livestock farming would remain part of the landscape – "we are not going to have the removal of all cows and all sheep", as one participant put it – but herd sizes and overall livestock numbers would fall. This could lay the foundation for UK farmers to continue producing high-quality, high-welfare meat and dairy without a risk to food security, and potentially even counteract the UK's dependency on imported animal products.[81]

Of course, alternative proteins are not produced from thin air. Plant-based products rely on agrifood crops, such as soya and pea, already used in vast quantities to sustain intensive agricultural systems; in 2019, 4.2 million tonnes of soybean equivalent was imported to the UK, 75% of which is used for animal feed and animal-based products.[82] Reducing dependency on unsustainable imported animal feed, ideally shortening those supply chains considerably, and moving towards domestically-grown agricrops used for feed and alternative proteins should be the objective here. That is far easier said than done: UK farmers cannot transition overnight to growing the staple ingredients of APs but crops and species suitable for our growing environment are increasingly prevalent and commercialisable.[83] Oats[84], soya[85] and hemp[86] have been earmarked as opportunities, although their success as a staple of growers' rotations is likely to be dependent on sustained agri-R&D. But given that the market for products using sustainably-sourced plant-protein is capturing a significant premium, this could be an opportunity for UK arable farmers to commercialise innovate plant breeds. That opportunity has only grown with the announcement that the Government will fast-track the Genetic Technology (Precision Breeding Bill) in the wake of Russia's invasion of Ukraine.

Figure 3: Models of agricultural land use (England)



Source: National Food Survey, Evidence Pack[87]

CHAPTER THREE – THE BARRIERS FACING ALTERNATIVE PROTEINS

A steady stream of headline figures about the rapid growth of the alternative protein market may give the impression that our novel food future is already upon us. As discussed already, participants at our roundtable agreed that the proliferation of APs is, to a greater or lesser extent, an inevitability. But the market is growing from a low base. In 2021, UK households spent £37.5 billion on meat, dairy and fish, compared to £1.5 billion on vegetarian and plant-based alternatives.[88] In this chapter, we focus on the barriers that could prevent alternative proteins from moving much beyond this 4% market share.

Taste, affordability and convenience

There is strong evidence that quality, price and availability are the fundamentals of food choice.[89] [90] Whilst consumers may have motivations regarding health, sustainability and provenance (e.g. ethical concerns), these are moderated by the wider food environment and subordinate to taste, affordability and convenience. Ensuring that alternative proteins reach price parity with conventional animal-based foods and are widely available and appetising is vital if they are to play a role in transitioning food systems. It was highlighted by one roundtable participant that:

> *"Alternative proteins won't be successful unless they are tasty, cheap and probably a little bit healthier than the foods they replace."*

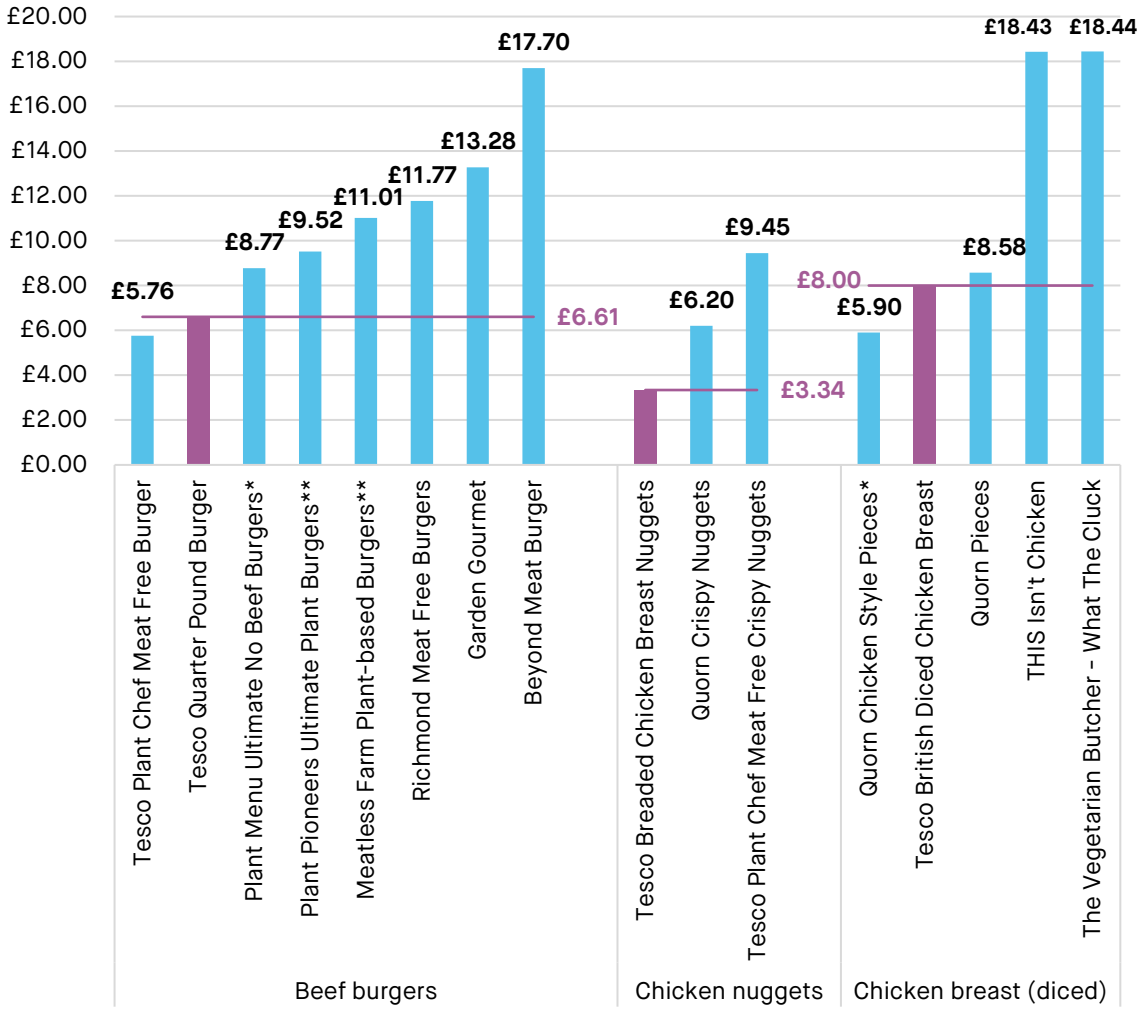
At present, some AP producers are capturing a premium from ethical consumers who are willing and able to pay extra for protein. This premium has been estimated at 32% for plant-based burger patties compared with animal-based equivalents, although the UK is much closer to parity than many other countries.[91] The picture is starker for cultivated meat products. Current estimates suggest production costs are between 100 to 10,000 times higher than the benchmark for comparable animal meat products. [92] Whether cellular meat can be scaled sufficiently is a question of considerable debate. British entrepreneur Jim Mellon has boldly suggested it will take five years to reach price parity[93], whilst a widely-discussed technical economic assessment by CE Delft has suggested 2030 is plausible.[94] However, some experts are sceptical of these more optimistic timelines. [95] Answering this question is beyond the scope of this paper, but a conservative assumption would be that in the short-medium term, cellular agriculture is far less likely to be an effective instrument for reducing food systems emissions than plant-based and (precision) fermentation APs.

"Alternative proteins won't be successful unless they are tasty, cheap and probably a little bit healthier than the foods they replace.

One roundtable participant put this plainly: "The cheap thing is what is going to drive this". And there is some cause for optimism on this front. Over the last three years, all UK supermarkets have introduced or expanded their own-label plant-based range, whilst scaled-up alternatives are competing with equivalent meat products.

Figure 4 shows that Tesco's plant-based beef burgers retail 13% cheaper than the meat equivalent. Quorn's fresh chicken pieces are 7.2% more expensive than the equivalent diced chicken breast, whilst its frozen version is 26.2% cheaper.

Figure 4: Supermarket retail price comparison of plant-based products to meat equivalents, £/kg



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

Competition amongst own-label supermarket ranges is likely to be an important step towards price parity. Tesco is pledging to increase its alternative protein offering by 300% by 2025,[96] whilst both Sainsbury's and Tesco are now reporting their percentage of protein sales from plant-based products (10 and 12% respectively).[97] Nevertheless, Figure 4 does demonstrate a significant premium captured by many APs, with some retailing at almost triple the price of the animal-based equivalent. One roundtable attendee noted that it is "remarkable how expensive some of the relatively unprocessed alternatives to meat and dairy are, and that feels like a problem at the minute", but these products were "amenable to innovation". Finally, any fair price comparison should account for the carbon cost excluded from retail price; under these calculations, APs become vastly more competitive.[98]

Consumer appetite

Given the marked growth in the UK AP market in recent years, it is reasonable to assert that there is genuine consumer appetite for alternatives to meat, dairy and seafood such that they could disrupt animal-based foods. This is supported by polling findings conducted for the Food Standards Agency in December 2021[99], which found that:

- 90% of respondents had heard of plant-based proteins, 80% cultivated meat, and 68% insect protein.
- Two-thirds (67%) were either very/somewhat willing or had already tried plant-based proteins; 34% said they were very/somewhat willing to taste cultivated meat.
- Health (39%), environmental (36%), ethical (26%) and greater food choice (26%) were amongst the most common motivations amongst those willing to try plant-based proteins.
- 29% considered cultivated meat to be very/somewhat unsafe; 20% said the same for insect protein.

Evidence from a Belgium-based study has found that current consumer satisfaction with meat alternatives increased from 44% to 51% between 2019-2020. Amongst those reporting that products did not meet their needs, taste (28.3%), texture (18.5%) and healthiness (10.9%) were the most commonly reported reasons for dissatisfaction. [100] Regression modelling for the study suggests being younger, female and vegetarian/vegan was predictive of greater satisfaction with APs.

We might extrapolate from this that some consumer groups – those who are more affluent, driven strongly by ethical and environmental beliefs, and open to plant-based or 'flexitarian' diets – are the low-hanging fruit that the AP sector has so far siphoned off. Other consumers will be more resistant: 42% of respondents to the FSA survey said nothing could encourage them to try plant-based products.[101] These individuals may be driven by more than just structural barriers like cost and availability. Here, cultural and psychological barriers come into play, such as 'meat attachment'[102] – driven by hedonism, affinity, entitlement and dependence – and food neophobia, the fear of trying new foods.[103] Recent international polling suggests that the UK has one of the highest proportions (37%) of "reluctant resisters" – consumers for whom financial considerations are not the primary motivating factor – to reducing meat consumption.[104] More broadly, despite changes in eating habits, Britain's food heritage remains nonetheless largely meat-centric.[105] A literature review conducted for the Good Food Institute suggests that promoting APs as delicious, easy to prepare, cheaper and healthier than conventional meat can be sufficiently convincing for the majority of people.[106]

Health and nutrition

The latter point may be particularly important. It was noted by several roundtable participants that APs faced a challenge regarding nutritional content and production processes:

> *"I think you have to address the health issues very clearly as well. Because there is a concern that this is an ultra-processed, unhealthy alternative"*

> *"Unfortunately, the products that the industry is currently making are vegan junk food."*

Broadly, these points can be distilled down into two health-related criticisms, to which there are both substantive and rhetorical dimensions:

1. The nutritional profile of conventional animal-based foods cannot be matched by analogues.
2. Alternative proteins are 'ultra-processed' food.

There is robust evidence from a systematic review of randomised control trials that plant-based diets are beneficial for physical health outcomes, although insufficient evidence on cognitive and mental effects.[107] Modelling analysis for the World Economic Forum suggests that across six health risk factors replacing beef with a type of plant-based protein reduces diet-related mortality, and the most positive effects tend to be found in wealthier countries.[108] However, much of the evidence base here is not drawn from studies of novel alternatives, but rather plant-based *diets* in the more conventional sense. One study has concluded that claims made about the health properties of plant-based meat may be "misleading", whilst there have been no studies completed on the health effects of eating cultured meat.[109]

A forthcoming literature review, shared with the SMF for this research, has highlighted a total of 33 studies that directly compare plant-based alternatives with their animal-based counterparts.[110] Only one study compared products available on the UK market, finding that alternatives broadly have a more favourable nutrient profile, though contain excess salt.[111] Similar studies have been conducted in Germany and the United States reporting similar results. [112] [113] Overall, research that directly compares the nutritional profile of alternative protein products with conventional animal-based food comparators remains in its infancy. Whether this evidence-base is conclusive or not, fear of nutritional deficiencies is a line often adopted by actors who are sceptical of or hostile towards meat analogues. Last year, the Chief Executive of the National Sheep Association told the *Daily Mail*: "it is easy to say let's stop eating meat and wind down the UK's livestock industry, but do we really know what impact that would have on people's long-term health?"[114] Similarly, the NFU regularly promotes its *Facts About British Red Meat and Milk* 'myth-busting' briefing, with a focus on health and nutrition.

An important dimension of these rhetorical arguments is that alternative proteins are "processed" foods. It is no secret that a significant proportion of what consumers eat today – including many meat, dairy and seafood products – are highly processed. Producing plant-based foods does require refinement and the incorporation of other ingredients, such as fats, colourings, flavourings, emulsifiers and water. Perhaps because plant-based products remain new foods in the minds of many consumers, they are perceived as highly processed by some consumers, a criticism appended – rightly or wrongly - to view that APs are 'junk food'.[115] Robust research, for example from systematic reviews or controlled trials, to firmly establish the health impacts of eating APs and efforts to improve nutritional profiles will be an important step forward.

The alternative protein sector will also need to be proactive with its efforts to counteract criticisms about processing.

CHAPTER 4 – A STRATEGIC APPROACH TO ALTERNATIVE PROTEINS

Going with the grain of consumer choice

Dan Barber, one of the world's top chefs, adopts the view that transforming food systems should not be about sacrifice and frugality, but pleasure and hedonism. The idea of eating less runs against the grain of contemporary consumer culture, whilst the ubiquity of cheap animal protein, and its centrality to western food culture, makes widescale behaviour change extremely challenging.

But inaction is also not an option if the UK Government is serious about meeting its 2050 Net Zero target. We began this report by stating that there were broadly two categories of policy levers government can pull to promote sustainable diets:

1. Restrict or eliminate the choice to consume animal-based foods.
2. Expand the choice of alternatives to animal-based foods.

For both categories, there are interventions that can be targeted upstream, midstream and downstream, illustrated in Figure 5 below:

Figure 5: Examples of policy interventions aimed at reducing animal protein /increasing plant-based protein consumption

Interventions that aim to restrict/eliminate choice

- Fiscal disincentives to eat animal-based foods (upstream)
- No meat days in food service outlets or menu restrictions (midstream)
- Informational campaigns (downstream)

Interventions that aim to promote choice

- Plant-based protein targets for food retailers (upstream)
- Increasing availability and visibility of alternatives in food service outlets (midstream)
- Informational campaigns (downstream)

Source: SMF analysis

It was noted by a roundtable participant that downstream measure such as carbon labelling on food packaging can carry public support, but they lack effectiveness. This view is reflected in a government-commissioned report on net zero behaviour change, conducted by the Behavioural Insights Team and deleted shortly after publication in October 2021[116]. It concluded that:

> *"effective diet-related interventions will lie at the intersection of upstream and midstream strategies, with a lesser role for downstream interventions targeting individual hearts and minds".*

This report takes the view that upstream and midstream interventions that restrict or eliminate choice are unlikely to be a politically feasible first step. A worst-case scenario is that this descends into a culture war, freezing political ambition for reducing the climate impact of diets. Plausibly, they may become viable – and

necessary – if the UK fails to make progress on decarbonising the food system. However, for the time-being, this report takes the view that those upstream and midstream policies which promote consumer choice and can carry political support should be pursued. The overarching aim should be to work with business and shape the market for alternatives to create what the BIT report calls an "enabling environment". This aligns with the Government's commitment, set out in the Net Zero Strategy, to a climate strategy that works "with the grain of consumer choice".[117] A consumer-led transition to more sustainable dietary habits was also recognised as the appropriate way forwards by one of our roundtable attendees:

> *"We have to do it in a way in which the public do see themselves as making proper choices...people don't want to be told they can't do all of these things. What they want is to have the opportunity, the ease and opportunity, to choose. And the government needs to provide real leadership".*

UK alternative protein policy lacks direction and is lagging behind international competitors

The expanding alternative protein market represents a real opportunity to push the boundaries of consumer choice and support the decarbonisation of diets. Government policy can accelerate and steer this transition, accruing benefits set out in chapter 2, or it can maintain a relatively passive approach.

To date, the UK has made two policy statements that have a bearing on APs:

- **Net Zero Strategy** (2021) – recognises that the UK has a strong domestic market and alternative proteins can become "another great British food export that competes internationally", but does not address the potential for APs to reduce GHG emissions.[118]
- **Benefits of Brexit policy paper** (2022) – sets out a commitment to review the UK's novel food application and regulatory process.[119]

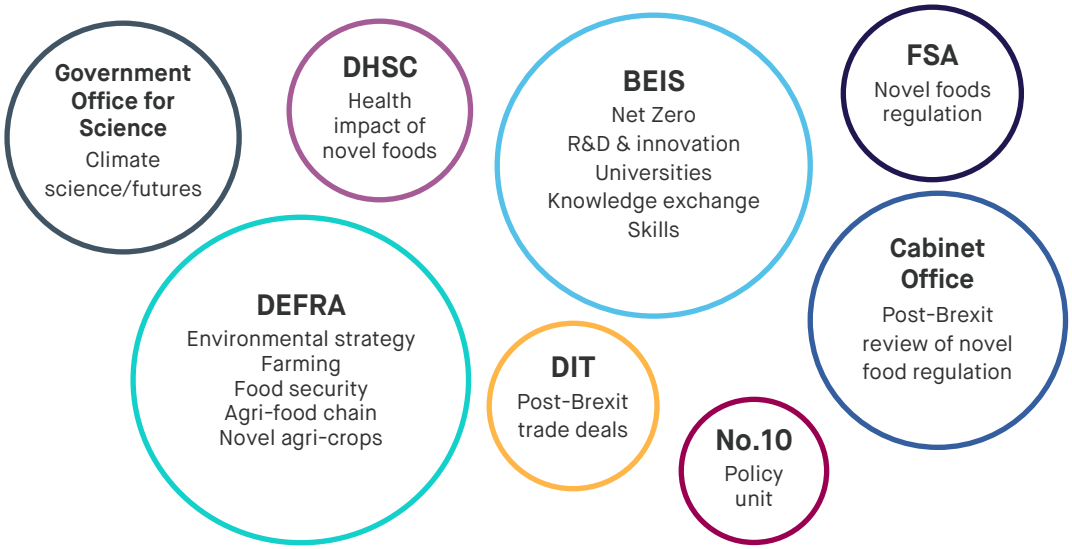
Reviewing novel food standards is a welcome step, particularly in the cultivated and precision-fermentation sectors. Simplifying applications, improving communication between the Food Standards Authority and increasing the pace of regulatory approval without compromising standards is likely to attract investment in alternative proteins.

But regulation is only a small part of a much larger picture that spans agriculture, food retail and service, R&D, trade and so on. Other nations are recognising both the complexity of alternative protein policy and the opportunities. France, the Netherlands, Germany, Denmark and Finland are amongst those European countries who have already set out protein strategies[120]. These national plans include wide-ranging objectives on diversify protein crop production, incubating AP innovative businesses, improving supply chain efficiency, and developing impactful R&D ecosystems. In December 2021, France and Austria issued a declaration[121] calling on the European Commission (EC) to develop an EU plant-based protein strategy including protein crops for food.

Meanwhile, the UK's approach is characterised by fragmentation and an absence of strategic direction. Siloisation is not an unusual problem in policymaking - a recent

Institute for Government report has warned of ministers creating departmental 'fiefdoms'. [122] This problem is arguably particularly acute with alternative proteins, given the way that it cuts across departmental and ministerial portfolios (Figure 6), and has received little consideration from the centre of government. Roundtable participants agreed that there was a lack of overall policy ownership in Whitehall and inertia risked opportunities slipping through the cracks of government machinery. Additionally, the absence of a government response to the National Food Strategy was seen as frustrating future policymaking in this space, although the protein transition should primarily be considered a matter of industrial strategy.

Figure 6: Map of government departments and arms-length non-ministerial government bodies with remits related to alternative proteins



Source: SMF analysis

Recommendations

The window of opportunity remains open for the UK to play a leading role in the global transition to sustainable proteins. As this report sets out, the scale and shape of the transition remains unknown but is amenable to influence from effective policymaking. A failure to act soon risks the UK falling behind international competitors, foregoing opportunities for British businesses, for attracting overseas businesses and investors, and hindering the transition to greener diets. This report, informed by the views of academics, businesses, policy experts and politicians, argues that **government must do more to catalyse a consumer-led transition in dietary behaviours.**

Recommendation 1 – BEIS should be tasked with developing a UK alternative protein strategy with cross-departmental input

Within 12 months, the Government should develop and publish a UK alternative proteins strategy, led by BEIS, with cross-departmental input from the Cabinet Office, DEFRA, DHSC, DIT and the FSA. The strategy should adopt a long-term perspective and consider the wide-ranging possibilities and challenges arising from the protein transition. As a policy area, alternative proteins should be centrally owned by BEIS but a culture of cross-departmental working should be fostered. For instance, DEFRA will need to input on piloting and commercialising speciality and precision-bred agri-

crops, and the Cabinet Office's Brexit Opportunities Unit and the DIT may be best-placed to identify green export opportunities. Giving BEIS overall responsibility ensures that APs are treated foremost as a question of industrial strategy. The Minister for Science, Research and Innovation should be held accountable for the AP strategy's success.

Recommendation 2 – commission an innovation needs assessment for alternative proteins

The protein transition is unlikely to be a success without sustained and strategic innovation. This includes incubating pre-competitive technologies and ensuring that those with commercial potential reach the consumer market at a viable price point. A number of countries have taken a step ahead of the UK on innovation, for example by supporting the development of protein R&D clusters. As one attendee at our roundtable observed, public-funded R&D not only aids in overcoming foundational barriers (e.g. cost, taste, scalability) but also sends a "sends a signal that the UK is interested in this space…by having a stake, you attract capital". The National Food Strategy has recommended that the Government spend £125 million on AP R&D, including a £50 million innovation cluster akin to those found in other countries like the Netherlands. Certainly this would be a welcome investment. But there is potential that it contributes to what is already a relatively fragmented R&D system. £125 million also represents only a small fraction of what is likely to be required when compared to Climateworks Foundation's estimated annual investment of $4.4 billion in global public R&D for APs.[123]

We therefore recommend that as part of developing a UK alternative protein strategy, **BEIS should commission an innovation needs assessment**. This should scope out spend-to-date on innovation, what gaps exist that the UK is well-placed to exploit and estimate what level of public R&D funding would be necessary for the UK to become an international competitor in APs. The government has a blueprint for what this could look like in the form of the innovation needs assessment commissioned for the energy sector by BEIS, published in 2019.[124] This initiative produced a series of sub-sector innovation needs reports and a database of innovation and business opportunities, allowing the UK government and investors to identify key priorities. Additionally, BEIS should commission a systematic review on the socio-economic impact of alternative proteins, given the current lack of robust evidence, particularly regarding job creation and economic growth.

Recommendation 3 – supermarkets should publicly disclose what proportion of protein sales come from plant-based products, striving to reach 30% by 2030

The food retail sector is a key vehicle for transitioning the food system. The growing plant-based category is an opportunity for retailers to expand consumer choice and meet ambitious carbon targets. Competition to drive down prices, particularly through the rise of supermarket own-label ranges, is essential for ensuring APs are viable competitors with conventional meat, dairy and seafood. However, there is more that food retailers can do to support the protein transition.

A lack of political will means that the government is unlikely to commit to the National Food Strategy's target of reducing meat and dairy consumption by 30% by 2030.

Whilst this is clearly unfortunate, the target remains a useful guide for industry. **We recommend that, following the examples of Tesco and Sainsbury's, UK supermarkets should strive for 30% of all protein sales to be from plant-based products by 2030, publicly disclosing the composition of protein sales annually.** This is different to the NFS target in that it does not stipulate that meat and dairy must fall. However, it is in-keeping with our view that expanding consumer choice should be the overarching goal for alternative proteins policy.

Voluntary, business-led disclosures can help to establish new norms and stimulate market competition. Protein sale disclosures would be a first step, but sector-wide Scope 3 emissions reporting should be viewed as the end-goal. Given that UK supermarkets are now readily adopting net zero targets, publishing Scope 3 emissions should not be viewed as an intrusive new standard. Additionally, food retailers can consider new ways of boosting the visibility of alternative proteins on shelf. For instance, a US-based trial has suggested that plant-based meat sales increased by 23% when products were placed in proximity to conventional meat products (compared with control stores).[125] Although not a silver bullet – and certainly one that carries risk of a negative response from some stakeholders – positionality is an important part of allowing consumers to faithfully compare the cost of meat, dairy and seafood with analogues.

Recommendation 4 – leverage the power of the public sector

Several participants at our roundtable highlighted that the public sector can play a key role in reducing animal protein consumption. Indeed, there is evidence that public bodies who serve food on their premises such as schools and hospitals can aid in dietary transitions. A study conducted in University of Cambridge cafeterias found that doubling the number of vegetarian meals available from 25-50% increased vegetarian sales by 41%, 62% and 79% across three outlets,[126] a finding broadly supported by similar experimental trials at Oxford.[127] Research published by Eating Better suggests that 80% of public sector caterers have already committed to reducing meat content on their menus and almost half (48%) had introduced a meat-free day.[128] These are welcome trends but rely on voluntary action on behalf of caterers. We note that the Dasgupta Review of the economics of biodiversity has highlighted how food service can drive the transition to more sustainable diets.[129]

£2.4 billion is spent annually on food purchasing for the public sector, though this figure is likely to be higher as the most recent estimate is from 2010; the government should publish an up-to-date figure with urgency.[130] The House of Commons Environment, Food and Rural Affairs Committee has found that the current Government Buying Standard (GBS) are not being used effectively. [131] The GBS carry no mandatory provision regarding the protein composition of food sold in the public sector, only that main meals containing beans/pulses should be made available once a week. One avenue of reform would be to introduce new rules on plant-based proteins. This need not lead to restrictive policies like meat-free days but should be viewed as an opportunity to widen consumer choice. Given that the GBS on the quality of meat have been criticised by the RSPCA as "weak", this may be a concrete example of how alternative proteins can disrupt low quality, low welfare animal-based foods. [132] Finally,

it is plausible that in schools in particular normalising plant-based protein may lead to long-term culture change.

Recommendation 5 – improve public data on animal-based protein consumption

Several consumer surveys track the consumption of meat, dairy and seafood in the UK, notably DEFRA's Family Food Survey (FFS) and the National Diet and Nutrition Survey (NDNS). Ad hoc polls also capture consumer trends and dietary habits. What these data produce is a confusing picture: according to some polls, flexitarian[133] and vegan[134] diets are increasingly common and NDNS analysis indicates that meat consumption fell sharply (17%) between 2008-2019.[135] But the FFS[136] suggests a stagnation in meat consumption over the last five years, a trend supported by OECD-FAO data[137] and data from Agriculture and Horticulture Development Board[138]

Without knowing reliably the trajectory of consumption trends, policymakers may struggle to calibrate interventions appropriately and evaluating policies may be difficult or inaccurate. For instance, if new supermarket protein sales targets and public procurement rules were adopted, it is important to be able to evaluate the effectiveness of these interventions. Additionally, meat consumption statistics are a hot topic in the media and if handled uncritically could misinform the public about the direction of trends. **We therefore recommend that the government reviews existing public statistics on animal-based food consumption, clarifying which it believes to be the most reliable, and produce an annual monitoring report based on the best available retail sales data**. Scotland's alcohol strategy monitoring and evaluation programme can provide a useful blueprint regarding the latter point.[139]

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