How does the fresh prepared meals sector respond to the nature and climate crisis to deliver real impact and create a blueprint for future change?

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Table of Contents

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Introduction

Oscar Mayer is taking a bold step towards fostering a sustainable prepared meals sector. By spearheading a project that convenes key stakeholders from across the food system, the company aims to answer a pressing question:

"How does the fresh prepared meals sector respond to the nature and climate crises to deliver real impact and create a blueprint for future change?"

To support this vision, Small World Consulting (SWC) has been tasked with conducting in-depth research and delivering a comprehensive report alongside a presentation at the February 4th, 2024 event. This work will delve into the food sustainability challenge, the role of the prepared meals sector, and actionable recommendations for driving systemic change. Using Oscar Mayer's own products as illustrative examples, the report will provide a blueprint for transformation, serving as the foundation for an inspiring campaign that could shape the future of the sector.

SWC brings its extensive expertise to this collaboration, with a strong track record in sustainable food and land systems, informed by both cutting-edge academic research and practical tools to assess food system impacts. Through this partnership, Oscar Mayer aims to lead by example, showcasing how the prepared meals industry can respond effectively to the climate and ecological crises while delivering meaningful change. While Oscar Mayer has provided input and guidance on the report, the opinions presented here are those of Small World Consulting.

Big Picture Context

Over the course of human history, our relationship with energy has defined our growth, innovation, and societal evolution. For millennia, energy use has steadily increased, with humanity consuming more energy almost every year than the year before. Between 200 and 50 years ago, energy use grew at just 1% annually. However, in the last 50 years, this rate has accelerated to an average of 2.4% per year. Once, our energy consumption had little discernible impact on the planet's vast, resilient systems. But today, we find ourselves in the Anthropocene – an era where humanity's scale and influence are reshaping Earth's fragile systems in profound and dangerous ways.

A century ago, even our most drastic actions could not threaten the planet's stability. Fifty years ago, we recognised that certain catastrophic scenarios, like nuclear war, could. Now, we face a stark reality: unless we actively work to mitigate our impact, we risk irrevocably damaging the planet. This shift into the Anthropocene challenges the very foundations of our societies. Our structures, values, and ways of thinking, developed when humanity was small and Earth was vast, must now adapt to a reality where our actions profoundly influence the global environment.

This report explores how the unchecked growth of humanity's energy use and greenhouse gas emissions has exacerbated a multidimensional crisis. Far from addressing climate change effectively, we have accelerated toward it. Global CO_2 emissions continue to rise, showing little response to policies and interventions thus far. Methane emissions, once stable, are climbing faster than ever, driven by warming wetlands, melting permafrost, and agricultural activities. The impacts of this trajectory are increasingly visible: wildfires, droughts, hurricanes, flooding, and other extreme events dominate headlines and strain ecosystems and communities worldwide.

What we face is not merely a climate crisis but a "polycrisis" – a web of interconnected challenges that includes ecological degradation, economic inequality, biodiversity loss, environmental pollution, and the erosion of resilience in food and energy systems. Addressing this polycrisis demands a paradigm shift in how we approach every aspect of society: politics, media, business, economics, technology, education, and inequality. It also requires a critical re-examination of the values and thinking that guide our decisions, both as individuals and as a global society. Climate scientists are sounding increasingly urgent alarms about the accelerating risks we face, with the *2024 State of the Climate Report* providing[1] This growing concern underscores the need for immediate and transformative action to address these profound challenges.

Food Emissions Context

The food system is a major driver of climate and ecological crises, contributing through greenhouse gas emissions, deforestation, water depletion, and nutrient pollution. Without significant mitigation efforts, these impacts could become 50–90% worse by 2050.[2]

Food Myth: Food miles are the biggest issue for the food system.

Many believe that the distribution of food – how it is transported – is the largest contributor to its carbon footprint. This misconception likely stems from the widespread awareness of the challenges in decarbonising the transport sector. However, the global food system's significant impact often goes under-discussed. In reality, food miles are rarely critical. Looking at the example of a bottle of wine, for example, transport is only responsible for about 3% of the total carbon footprint.

The environmental impact of food can vary significantly depending on what we eat and where it is sourced from, illustrating the complexity and global connectivity of the food system. For example, beef sourced from South America often drives deforestation there, releasing stored carbon, destroying habitats, and reducing biodiversity. Yet even domestically produced beef in the UK can indirectly contribute to these issues, as cattle feed like soy is frequently linked to deforested regions overseas.[3] The intertwined crises of biodiversity loss and climate change further threaten food security by undermining crop yields and driving unsustainable agricultural intensification. Building a more sustainable food system is essential to breaking this cycle.[4]

[1] Ripple, W. J., Wolf, C., Gregg, J. W., Rockström, J., Mann, M.E., Oreskes, N., Lenton, T. M., Rahmstorf, S., Newsome, T. M., Xu, C., Svenning, J.-C., Cardoso Pereira, C., Law, B. E. & Crowther, T. W., "The 2024 state of the climate report: Perilous times on planet Earth," *BioScience*, Volume 74, Issue 12, December 2024, Pages 812–824, https://doi.org/10.1093/biosci/biae087.

[2] Springmann, M. *et al*., 2018. "Options for keeping the food system within environmental limits." *Nature,* 562(7728), pp. 519-525.

[3] Poore, J. & Nemecek, T., 2018. "Reducing food's environmental impacts through producers and consumers." *Science,* 360(6392), pp. 987-992.

[4] Scheelbeek, P. F. *et al*., 2018. "Effect of environmental changes on vegetable and legume yields and nutritional quality." *Proceedings of the National Academy of Sciences,* 114(26), pp. 6804-6809.

Food and drink account for about a quarter of the average person's carbon footprint in the UK, highlighting the critical role of dietary choices in reducing greenhouse gas emissions. The journey from field to fork reveals significant inefficiencies in how calories flow through the global food system. Figure 1 highlights how human-edible crops and non-human-edible resources are distributed and ultimately transformed into the food we consume. Out of the total crops grown globally, only a fraction is consumed directly as food. A substantial portion is lost during harvest and storage, or repurposed for non-food uses such as biofuels.

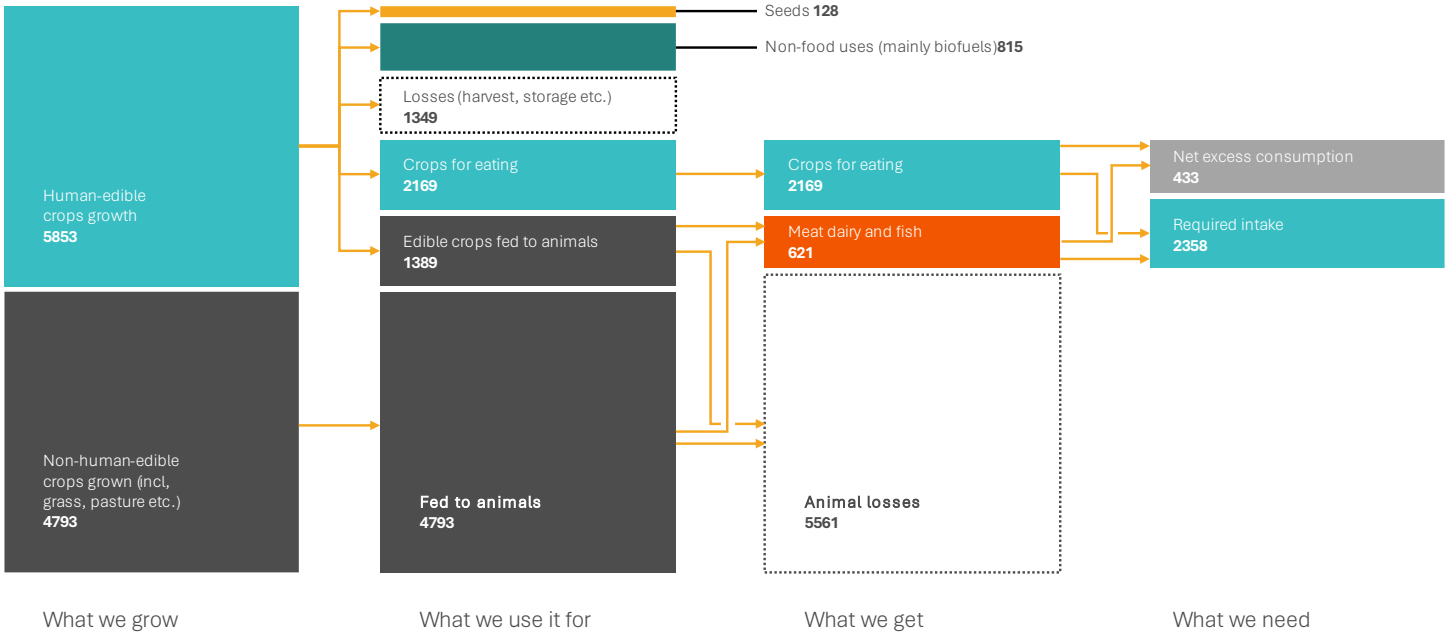

Figure 1. The global flow of calories from field to fork. Source: Berners-Lee et al. (2018). Updated by Rosie Saxton and Tom Higgs in 2023 using more recent global data.

Furthermore, a considerable proportion of edible crops is fed to animals, yet only a small percentage of the calories consumed by animals is returned to the human food chain as meat, dairy, and fish. For example, nearly 5,500 kcal per person per day is fed to animals, yet just 594 kcal per person per day returns to the human food chain as meat, dairy, and fish. This represents a conversion efficiency of only about 12%. This low efficiency in converting plant-based calories into animal products means that much of the potential nutritional value is lost.

The global flow of protein (Figure 2) mirrors many of the inefficiencies seen in calorie distribution. While a smaller proportion of the protein in crops grown is diverted to non-food uses, significant inefficiencies remain. For instance, the protein delivered to humans as meat, dairy, and fish represents 43% of the protein in human-edible crops fed to animals. This is higher than the equivalent figure for calories (34%) but still results in a net loss of 51 grams of protein per person per day, exceeding the global average recommended daily allowance.

Although animals can transform inedible resources like grass and pasture into valuable nutrition, the practice of feeding human-edible crops to animals reduces the overall supply of nutrients available for direct human consumption. This inefficiency, particularly in industrialised meat and dairy production, challenges the sustainability of the global food system and highlights the need for alternative approaches to meet both nutritional and environmental goals. Reducing food waste, particularly at the consumer stage, which is the predominant source in Europe, represents a major opportunity to lower emissions from the food system. Dietary shifts are equally crucial: while eliminating meat, dairy and fish entirely is not necessary, a significant reduction in their proportion within our diets over the next few years is essential to reduce the global food system's carbon footprint.[5]

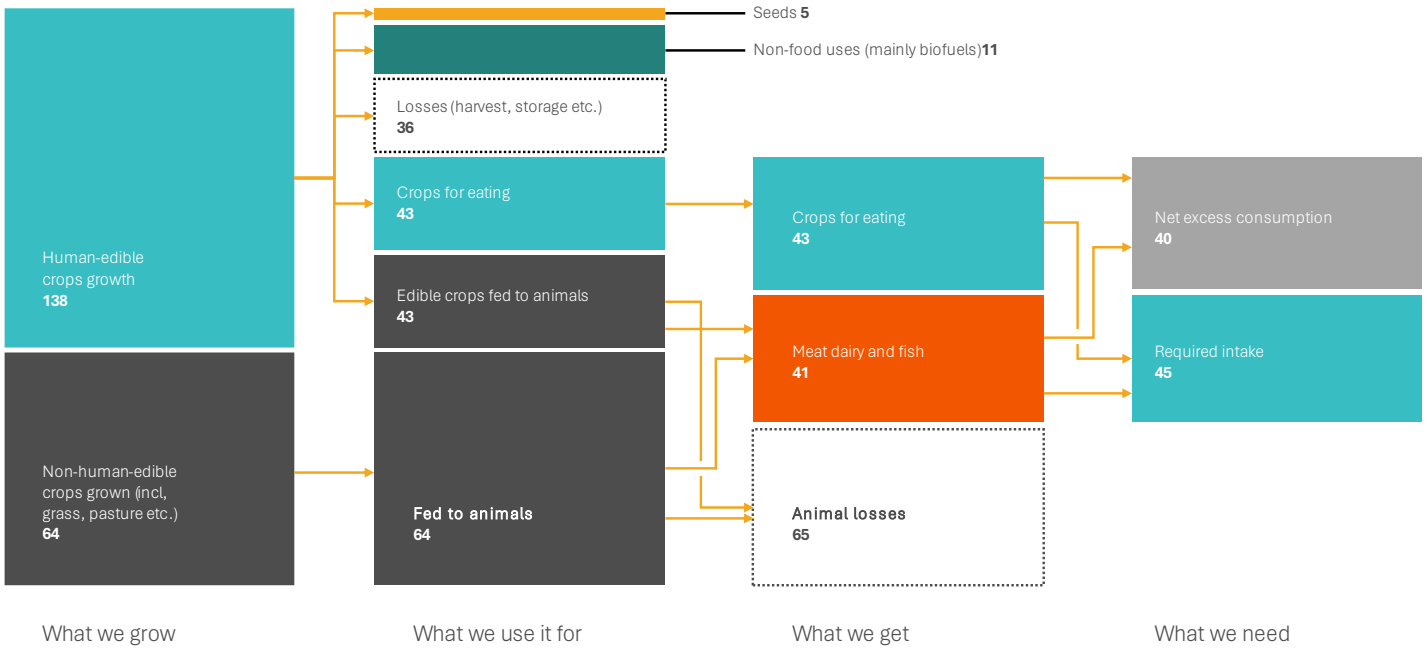

Figure 2. The global flow of protein from field to fork. Source: Berners-Lee et al. (2018). Updated by Rosie Saxton and Tom Higgs in 2023 using more recent global data.

The Prepared Meals Sector

Ready meals play a crucial role in the UK's food sector, with a wide variety of chilled and frozen curries, pies, pasta dishes and more, filling supermarket shelves ready to be quickly heated at home. The UK stands as Europe's largest consumer of ready meals and ranks second globally, following the US. This extensive consumption brings a significant carbon footprint and various other environmental impacts. Annually, the UK's ready meal consumption generates 12.89 Mt CO_2 equivalent, accounting for 15% of the UK's food and drink sector emissions.[6]

[5] Berners-Lee, M. *et al*. "Current global food production is sufficient to meet human nutritional needs in 2050 provided there is radical societal adaptation." *Elem Sci Anth* 6 (2018): 52.
[6] Rivera, X. C. S. & Azapagic, A., 2019. "Life cycle environmental impacts of ready-made meals considering different cuisines and recipes." *Science of the Total Environment,* Volume 660, pp. 1168-1181.

Ingredients

One major factor influencing environmental impact is the ingredients used in ready meals.[7] Plant-based ingredients often have significantly lower environmental impacts, and there has been a notable increase in plant-based meal options in supermarkets over the past four years. However, 65% to 70% of ready meals still contain meat, driving up the emissions of the sector.[8]

Food Myth: Local is always better
Buying local is often assumed to be the best choice for the environment, but this is not always the case. The climate impact of food depends not just on where it is grown, but *how* it is grown. For example, a 250g punnet of strawberries grown locally and in season has a footprint of around **490g** CO_2e. However, if the same strawberries are grown locally but out of season in an energy-intensive hothouse, the footprint skyrockets to **3.65kg** CO_2e – comparable to flying strawberries in from South Africa.

Ingredient substitution is just one approach to mitigating environmental impacts. Life Cycle Assessment (LCA) studies, for example, highlight that sourcing choices can also play a crucial role in determining a product's overall environmental footprint.[9] However, it is not just about what goes into the meal; every other aspect of the product also matters. From the packaging materials used and the transportation required to deliver meals to the point of sale, to the energy-intensive preparation processes (both in factories and at home), the waste generated, and even the marketing strategies employed to influence consumer choices, all these factors contribute to the broader environmental and social impacts of having prepared meals in our food systems.

Although each element of prepared meals contributes to environmental and societal impacts, not all aspects carry the same weight. Figure 3 shows one way to conceptualise where the priorities for the sector currently lie, or perhaps where they should lie. The scoring provided here is, of course, subjective. The exact numbers could spark endless debate, and different stakeholders may prioritise these areas differently. However, for the purposes of this report, let us take these scores as a working assumption to explore what they reveal about the sector's challenges and opportunities. This mapping highlights how numerous factors, from ingredients to messaging, intersect across three broad areas: climate, nature, and health. It is a simplified but useful lens through which to consider where the most impactful changes could be made.

If the aim is to make a meaningful impact, ingredients must take centre stage. They are not just the foundation of what we eat but also the biggest lever for improving health, reducing climate impact, and protecting nature. Animal-based products, due to their associated land use, methane emissions, and resource-intensive production, dominate the environmental footprint of a meal[10]. Plant-based alternatives, by contrast, offer significant benefits, reducing greenhouse gas emissions and conserving biodiversity by minimising land use and deforestation. The health

[7] Cucurachi, S., Scherer, L., Guinée, J. & Tukker, A., 2019. "Life cycle assessment of food systems." *One Earth,* 1(3), pp. 292-297.
[8] Eating Better, 2021. *Ready Meals 2021 Snapshot Survey,* s.l.: s.n.
[9] Rivera, X. C. S., Orias, N. E. & Azapagic, A., 2014. "Life cycle environmental impacts of convenience food: Comparison of ready and home-made meals." *Journal of Cleaner Production,* Volume 73, pp. 294-309.
[10] Rivera, X. C. S. and Azapagic, A. "Life cycle environmental impacts of ready-made meals considering different cuisines and recipes." *Science of the Total Environment* 660 (2019): 1168-1181.

benefits of plant-based ingredients are equally critical, as they can reduce the risk of chronic diseases linked to meat-heavy diets.[11]

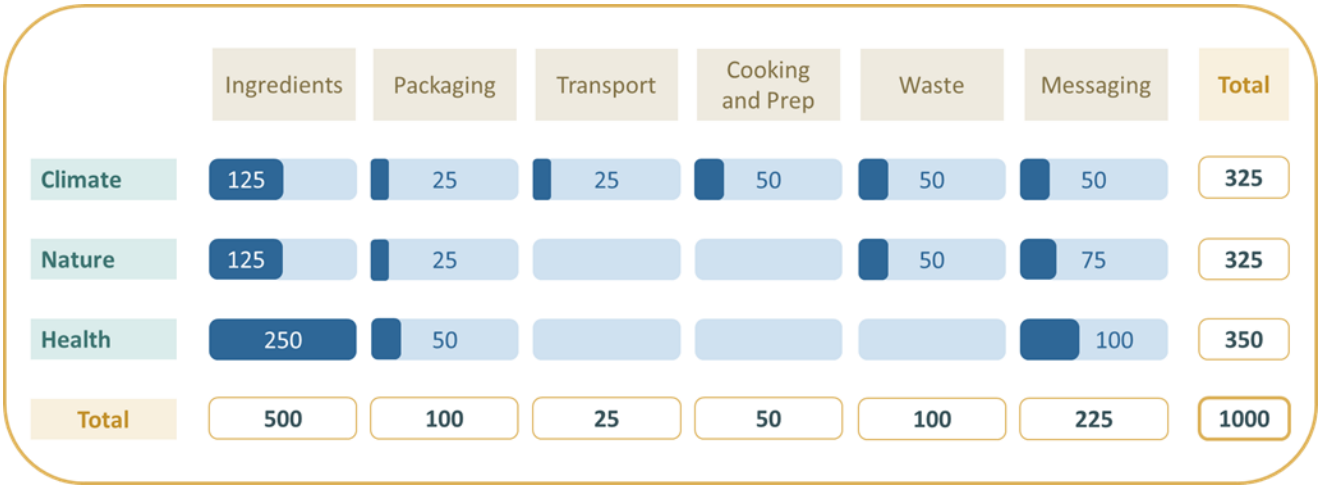

Figure 3. Priorities for the prepared meals sector: A rough map

Retail and Packaging Waste

But that is not to say that other elements do not matter. Packaging and waste, while smaller in their overall impact, still present meaningful opportunities. Think about all those single-use plastics that could be avoided with smarter planning and design. We are only just beginning to fully understand the detrimental impact of our excessive use of plastics, not only on ecosystems and the health of other species but also on our own health[12]. Meanwhile, the growth rate of plastic is even higher than that of CO_2, and as a material, plastic is even more persistent. This makes it an increasingly urgent concern that will need to be addressed in the near future.

Plastic: What do we need?

- More studies on the health impacts of heating food in plastic containers.
- Advice informing consumers not to heat the plastic tray with foodstuffs in it. This could include a health warning, in the same way that meals warn of salt/fat/sugar content.
- Serious talks with suppliers on their 'biodegradable' or 'compostable' plastics. Ask for proof and consider whether the described end-of-life scenario is likely.
- No overstatement of the ability of products to disappear, when they likely will not.
- Engagement with consumers about the correct way to dispose of each material in the product in order for it to fulfil its biodegradable claims.

[11] Dimbleby, H. "National Food Strategy: The Plan." (2021).
[12] Stevens, S., Bartosova. Z., Völker, J., Wagner, M. "Migration of endocrine and metabolism disrupting chemicals from plastic food packaging." *Environ Int.* 2024 Jul;189:108791. doi: 10.1016/j.envint.2024.108791. Epub 2024 May 31. PMID: 38838488.

Transport, while often perceived as a significant contributor to the carbon footprint of food products, generally has a negligible impact compared to other life cycle stages, such as production or processing. However, this changes dramatically when transport involves air freight, which can result in substantially higher emissions. Therefore, while transport is usually a lower priority in emissions reduction strategies, it should not be overlooked, especially when products are air freighted.[13]

Another crucial element of food supply chains here is the use of refrigeration, both while ingredients or meals are in transit and then once they are in stores waiting to be purchased. Chilled supply chains, while necessary for maintaining food quality, also contribute to increased emissions due to the most commonly used refrigerants being greenhouse gases themselves. This impact is particularly evident at the retail stage, where the emissions footprint of chilled meals is 15% higher than that of frozen meals. The higher emissions are primarily due to increased usage and leakage of refrigerants from open refrigerators in retail outlets, along with higher waste rates in the chilled supply chain.[14]

Meal Preparation and Food Waste

Additionally, the process of cooking and preparing a meal groups together two different steps along the journey from farm to table. Prepared meals are usually batch-cooked in highly efficient food manufacturing plants that can further improve their efficiency by using heat recovery systems, proving more efficient than home cooking.[15] However, it is important to consider the reheating stage when assessing the overall environmental impact. While LCAs typically compare like-for-like cooking processes, i.e. factory cooking versus home cooking from scratch, they may not include the reheating process in that calculation. If reheating is accounted for, the carbon impact varies significantly depending on the method used. For example, reheating in a microwave, which is highly energy-efficient, adds minimal emissions to the meal's overall footprint. In contrast, reheating in an oven, especially for extended periods, can contribute significantly more emissions and might offset some of the efficiencies gained in the factory cooking process.[16] Ultimately, the overall impact depends on the appliance used and the fuel source powering it (e.g. gas versus electricity).

In addition to these stages, waste also plays a crucial role. Ready meals typically result in more packaging material than meals prepared from fresh ingredients at home. On the upside, however, they are also often associated with higher rates of recycling and reuse of industrial waste. In contrast, home-cooked meals may produce less packaging waste but can lead to significant food waste. The detrimental effects of plastic waste from packaging on the natural environment were briefly discussed earlier, but food waste can be equally harmful. Beyond its pollution of ecosystems, food waste is a significant source of greenhouse gas emissions, primarily through

[13] Chen, W. *et al.*, 2021. "Environmental impacts of animal-based food supply chains with market characteristics." *Science of the Total Environment,* Volume 783, p. 147077.
[14] Rivera, X. C. S., Orias, N. E. & Azapagic, A., 2014. "Life cycle environmental impacts of convenience food: Comparison of ready and home-made meals." *Journal of Cleaner Production*, Volume 73, pp. 294-309.
[15] Calderón, L. A. *et al*. "Environmental impact of a traditional cooked dish at four different manufacturing scales: from ready meal industry and catering company to traditional restaurant and homemade." *The International Journal of Life Cycle Assessment* 23 (2018): 811-823.
[16] Cimini, A. & Moresi, M. (2017). "Energy efficiency and carbon footprint of home pasta cooking appliances." *Journal of Food Engineering*, 204, 8-17.

decomposition in landfills and the additional resources needed for more food production to replace what is wasted.[17]

Messaging and Perception of Prepared Meals

And then there's messaging, a surprisingly powerful factor. People tend to respond most strongly to messages centred around human health, so the way meals are marketed and labelled can have a ripple effect, shaping consumer choices and even influencing perceptions of sustainability.[18]

Recognising this interplay between perception, messaging and action, Oscar Mayer, in collaboration with Bulbshare, conducted a consumer survey to better understand public attitudes towards prepared meals and their wider environmental and societal implications. Using questions designed by SWC, the survey explored topics such as food accessibility, sustainability, and changing consumer priorities. The findings provide valuable context, and will be referenced throughout this report to inform discussions on the state of the prepared meals sector and how it is perceived. A full overview of the results can be found in the Appendix.

One of the survey questions asked participants: *"How do you think climate change will affect your access to tasty, healthy food in the future?"* (Figure 4). The responses, based on a sample of 274 individuals, suggest that more than a third of respondents are concerned about negative impacts, reflecting a broader public awareness of the vulnerabilities in food supply chains due to climate change. However, over 30% of respondents are also unsure, underscoring the need for clearer communication and education about the relationship between climate resilience and food systems.

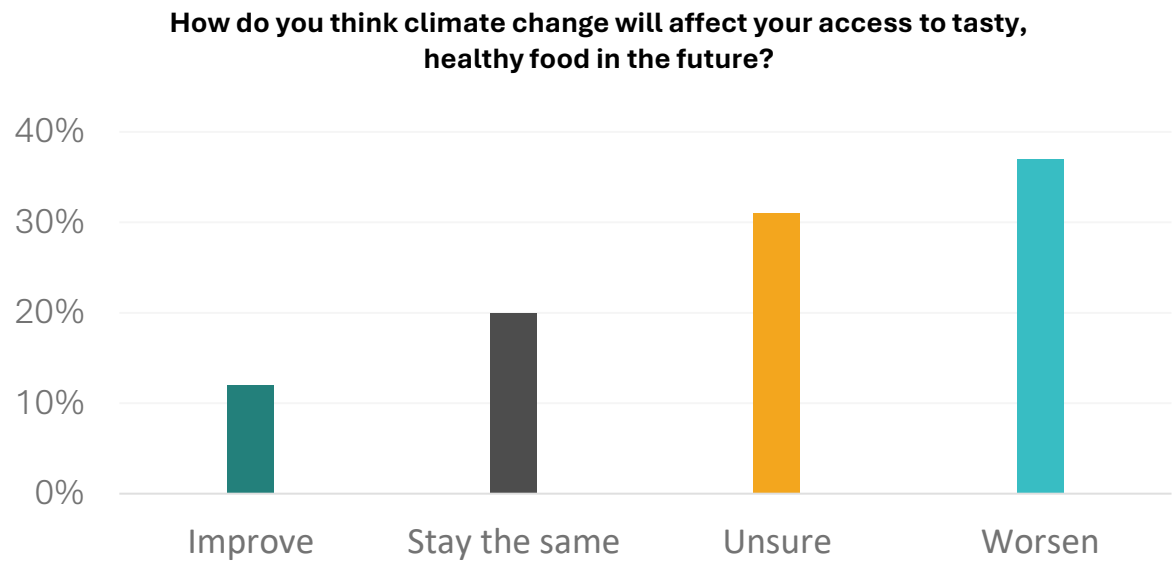

Figure 4. Survey results: Climate change and food.

[17] Hanssen, O. J. *et al.*, 2017. "Environmental profile, packaging intensity and food waste generation for three types of dinner meals." *Journal of Cleaner Production,* Volume 142, pp. 395-402.
[18] Macdiarmid, J. I., Cerroni, S., Kalentakis, D., & Reynolds, C. (2021). "How important is healthiness, carbon footprint and meat content when purchasing a ready meal? Evidence from a non-hypothetical discrete choice experiment." *Journal of Cleaner Production*, 282, 124510.

Food Myth: Transport is the biggest contributor to prepared meal carbon footprints.

The bias about transport miles and their associated carbon footprint was also evident in the Bulbshare survey, where more than half of respondents incorrectly identified transport as the largest component of the carbon footprint in a ready meal's supply chain. Few considered the much larger impacts of ingredients, manufacture, and other stages.

In reality, ingredients alone account for the majority of emissions, followed by contributions from retail, distribution, manufacture, preparation, and packaging. Addressing ingredient sourcing and production offers a far greater opportunity for reducing food-related greenhouse gas emissions than focusing solely on transport.

The survey results reveal complex and, at times, contradictory attitudes towards prepared meals. When asked about their healthiness, responses reflected significant scepticism: only 10% of respondents believed ready meals are "always" healthy, and a majority (52%) responded "not usually" (Figure 5). This wariness aligns with broader concerns about the nutritional quality of convenience foods, and highlights both the opportunity for and the challenge of improving the health credentials of prepared meals while communicating these improvements effectively.

The issue of meat and dairy consumption also emerged as a key theme, with 71% of respondents agreeing to some extent that these are necessary for a healthy, tasty diet (Figure 6). However, 20% disagreed, reflecting a growing openness to alternative protein sources. This divide mirrors broader societal debates about the role of animal-based foods in sustainable diets, suggesting that while traditional views still dominate, the door is opening for plant-based innovation. Notably, this shift represents a significant change over time – just ten years ago, the percentage of respondents disagreeing with the necessity of meat and dairy would likely have been much smaller, highlighting a gradual but important cultural shift.

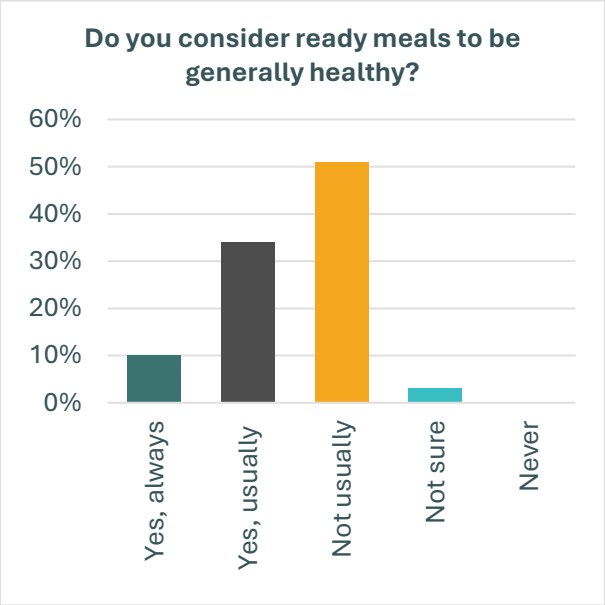

Figure 5. Survey results: Ready meals and health.

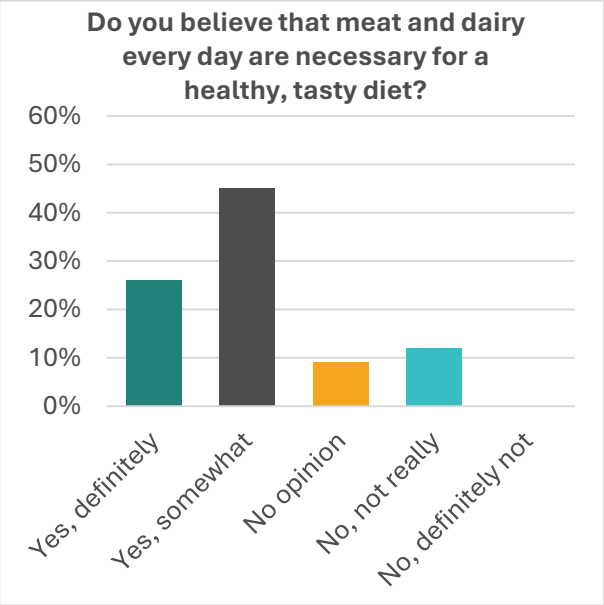

Figure 6. Survey results: Diet and health.

Opinions on plant-based ready meals provided further insight into these evolving perceptions (Figure 7). While 71% of participants agreed or strongly agreed that plant-based meals can be as healthy as meat-based ones, fewer (62%) felt they could be just as tasty. This gap underscores a persistent challenge: while health benefits are increasingly acknowledged, perceptions of tastiness remain a barrier to wider adoption. Interestingly, 64% agreed that it is easy to buy healthy, tasty, prepared meals in general, but this figure drops to 49% for plant-based options, highlighting a perceived accessibility gap in the plant-based ready meal market. Notably, both figures are higher than the percentage of respondents (44%) who believed ready meals are "always" or "usually" healthy, suggesting that there is a bit of a mismatch between peoples' responses when asked about the overall healthiness of prepared meals vs. specifically asking about meat and plant-based options.

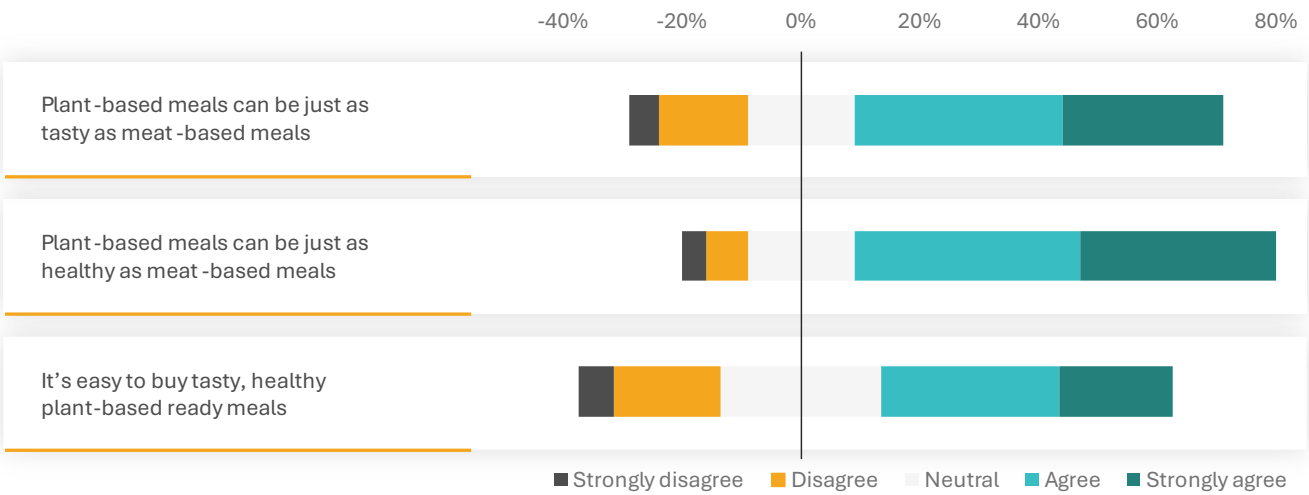

Figure 7. Survey results: Opinions on ready meals' healthiness and flavour.

Trust in ingredient quality also varied, with 61% expressing trust in the quality of plant-based ready meal ingredients compared to 56% for meat-based options (Figure 8). This trust disparity, though modest, reveals another apparent contradiction: while a majority view ready meals with scepticism regarding their health credentials, trust in the quality of their ingredients remains relatively high. This suggests that consumers distinguish between ingredient quality and overall healthfulness, potentially influenced by perceptions of processing or additives in ready meals.

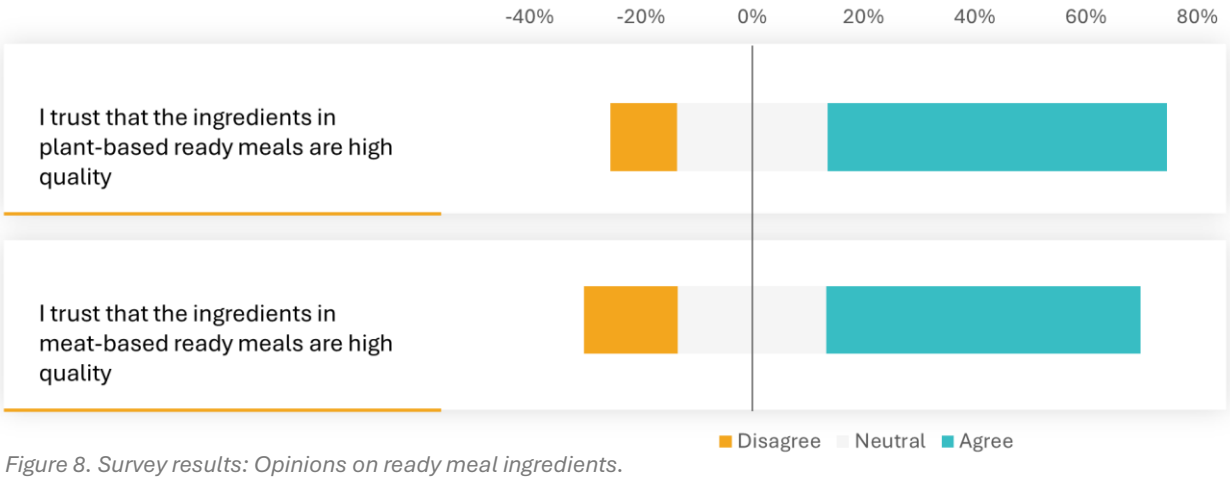

Figure 8. Survey results: Opinions on ready meal ingredients.

Presently, there is both a grain of truth in public concerns about prepared meals, and significant potential to address misconceptions. By focusing on creating healthier, more sustainable meals and improving communication about these advancements, the industry can better respond to consumer priorities. This sets the stage for a deeper exploration of prepared meals at their best and worst, while considering how they can evolve to meet environmental, social, and nutritional challenges.

Prepared Meals at their Best and Worst

Worst

At their worst, prepared meals illustrate some of the most pressing challenges and contradictions within our modern food system. Many prepared meals rely on recipes that lean heavily on environmentally intensive ingredients such as meat and dairy, which are associated with significant greenhouse gas emissions, deforestation for grazing, methane from livestock, and the immense water and energy footprint of feed crops. If sustainability is not prioritised, these meals will continue to exacerbate the environmental pressures already weighing heavily on global food systems.

The production process, while efficient in delivering vast quantities of food, can sometimes come at a high cost. Farmers, under pressure from supermarkets and manufacturers to produce uniform ingredients at the lowest possible prices, can find themselves pushed towards unsustainable practices, such as monocropping or industrial livestock production. These approaches deplete ecosystems, reduce biodiversity, can often have a poor track record on animal welfare, and overall increase the environmental footprint of food production. At the same time, this economic model often leaves farmers vulnerable to fluctuating markets and financial insecurity, eroding the resilience of rural communities and undermining their ability to adopt more sustainable, diversified farming methods. At the manufacturing level, inefficiencies and waste occur, from resources lost during processing and storage to overproduction of meals to keep up with the demands of filling supermarket shelves. Packaging is another persistent issue, with excessive quantities of materials that are rarely recyclable, biodegradable or made from recycled content. This contributes to a growing waste problem, exacerbating the environmental footprint of products marketed as a convenient solution.

Food Myth: Transport does not matter at all

While the contribution of transport emissions is often overestimated in discussions about food's carbon footprint, it is equally incorrect to assume these emissions do not matter at all. The method of transport plays a crucial role. Ships, for example, are highly efficient at moving large quantities of food over long distances, while planes are exceptionally carbon-intensive.

Take asparagus as an example. A 250g pack grown locally and in season has a footprint of around 0.25kg CO_2e. However, if that same pack is airfreighted from Peru, the footprint surges to 4.7kg CO_2e – a dramatic increase caused entirely by the use of planes. The key takeaway: transport emissions are not the dominant factor in most food's carbon footprint, but they can be significant when high-emission methods like airfreight are involved.

Socially, prepared meals can contribute to a growing disconnect from food. In their most problematic forms, they replace the act of cooking with convenience, leaving fewer opportunities for individuals to develop food literacy and cooking skills. Over time, this can lead to a lack of knowledge about nutrition, sustainability, and the origins of what we eat. In fast-paced modern lifestyles, this convenience can inadvertently reinforce unhealthy eating habits and a lack of mindfulness about the broader impact of our food choices. Nutritionally, the risks associated with prepared meals are clear. At their worst, these meals rely on extensive processing to enhance flavour, extend shelf life, and reduce costs, often at the expense of health. High levels of salt, sugar, and saturated fats are common, contributing to diet-related illnesses such as obesity, diabetes, and heart disease, which disproportionately affect marginalised and lower-income communities. While prepared meals are often marketed as affordable, ultra-low-cost options, many compromise both quality and nutrition, leaving consumers with fewer healthy choices. Conversely, premium prepared meals, which may offer better nutritional profiles, are frequently priced out of reach for lower-income households, exacerbating inequities in access to nutritious food, and perpetuating disparities between who is and is not at risk from the triple burden of malnutrition.

Culturally, the proliferation of mass-produced prepared meals risks eroding regional food traditions and culinary diversity. Recipes designed for broad appeal may disregard the richness of local ingredients, seasonal availability, and traditional cooking methods. This standardisation can lead to a loss of cultural identity and a diminished appreciation for the stories and heritage embedded in food.

To summarise, at their worst prepared meals embody a “business as usual” mindset – one that prioritises efficiency, scale, and profit over sustainability, equity, and health. This is not intended as a critique of any one manufacturer or product; nor is it a claim that all prepared meals exhibit these flaws. Instead, it serves as a reminder of the underlying challenges that persist in the food system, and the potential pitfalls when convenience is pursued without regard for its broader consequences. To build a better food future, these issues must be addressed with care and a commitment to creating meals that nourish both people and the planet. By reimagining what prepared meals can be, there is an opportunity to demonstrate how convenience and sustainability can go hand in hand, offering a glimpse of the potential they hold at their best.

Best

At their best, prepared meals offer a vision of what a sustainable, equitable, and healthy food system could look like. They go beyond convenience, transforming into solutions that nourish individuals, support communities, and care for the planet. These meals embrace sustainable ingredients, relying on plant-based proteins, seasonal produce, and crops grown using regenerative agriculture. They prioritise partnerships with local producers, ensuring fresher, higher-quality ingredients while supporting regional economies and reducing the environmental impact of long-distance transportation.

Packaging, often a weak point in the industry, becomes part of the solution. Instead of excessive or wasteful materials, the best prepared meals utilise reusable or returnable containers, creating systems that encourage consumers to return packaging for refills or recycling. Where this is not

feasible, compostable or recyclable alternatives could be used. However, it is important to note that innovative packaging solutions are only as good as the infrastructure that supports them. There is no guarantee, for example, that compostable material will be composted unless there are measures to ensure that it will be directed to an industrial composting site with the right conditions to break down the packaging matter. Moreover, these containers serve an educational purpose, featuring information about the environmental benefits of the meal or tips for reducing food waste. Clear labelling and digital tools such as QR codes allow consumers to trace the journey of their food, revealing the origins of ingredients, the farming practices behind them, and the meal's overall carbon footprint. Packaging thus evolves from sleek marketing into a tool for consumer awareness and empowerment. This dual approach of providing convenience while fostering food literacy can help to rebuild a connection to what is on the plate.

Prepared meals at their best ensure affordability without compromising on quality or nutrition. By harnessing efficiencies in production and portion control, they make healthy, sustainable food accessible to all income levels without exacerbating food waste. They cater to diverse dietary preferences and cultural traditions, offering a rich variety of meals that celebrate global cuisines, making sustainable diets irresistible and inclusive. For individuals who cannot or prefer not to cook, such as elderly people or those with disabilities, these meals provide essential nourishment while allowing the end-consumer to maintain their independence. They relieve pressure on loved ones, offering a reliable way to ensure balanced, healthy diets without sacrificing taste.

The perfect prepared meal is not just food; it is a vehicle for change – making sustainable diets more appealing and offering a model of how thoughtful design can create a healthier food system for both people and planet.

Vision for the Prepared Meals Sector

The prepared meals sector currently stands at a crossroads. There are opportunities for the sector to be uniquely positioned to lead the transformation toward a more sustainable, resilient, and equitable food system. Building on the earlier exploration of "Prepared meals at Their Best" and the insights drawn from the Oscar Mayer consumer survey, this section outlines a vision of what the sector could aim for to contribute to the changes needed.

The survey highlighted significant doubts about the healthiness of prepared meals, with only 10% of respondents believing they are "always" healthy. However, it also revealed an openness to plant-based alternatives, with 71% agreeing these can be as healthy as meat-based options, though concerns about taste and accessibility persist. These findings signal both the hurdles that need to be overcome and the immense potential of the sector to reshape its role. The perception of ready meals as overly processed and nutritionally deficient is deeply rooted, and while it may not be entirely dispelled, it can be mitigated. Improvements in recipes – focusing on the use of whole ingredients, reducing additives, and prioritising nutritional balance – could help shift the narrative. Transparent communication about ingredient sourcing, preparation methods, and nutritional value might also foster greater consumer trust. While prepared meals will inherently remain processed to some extent, there is scope to move away from the most heavily processed options.

While trust in the quality of ingredients was relatively high in the survey, this trust is on increasingly shaky ground given the growing media attention around ultra-processed foods in the

UK. This scrutiny poses a potential risk to the prepared meals sector, as consumers may begin to associate all processed foods, regardless of quality, with negative health impacts. Progress on both health and sustainability will therefore be demonstrated consistently. By embracing transparency, not just in labelling but in storytelling about the origins of ingredients and the care taken in production, the sector could bridge the gap between consumer perceptions and reality. Manufacturers of prepared meals can also leverage their position in the supply chain and the efficiency of large-scale food manufacturing to advocate for more sustainable farming practices and to reduce food waste, not only during production but also with the consumer through better portion control and educating consumers about waste.

One of the most exciting opportunities lies in normalising plant-based options. While the survey showed a growing openness to alternative proteins, many respondents still regard meat and dairy as essential for healthy and tasty food. This is where prepared meals can shine. By offering diverse, flavourful, and culturally inclusive plant-based options, the sector can help reframe sustainable diets as exciting, satisfying, and accessible. Plant-based ready meals, when done well, can make the idea of eating sustainably feel less like a compromise and more like a celebration of taste and variety.

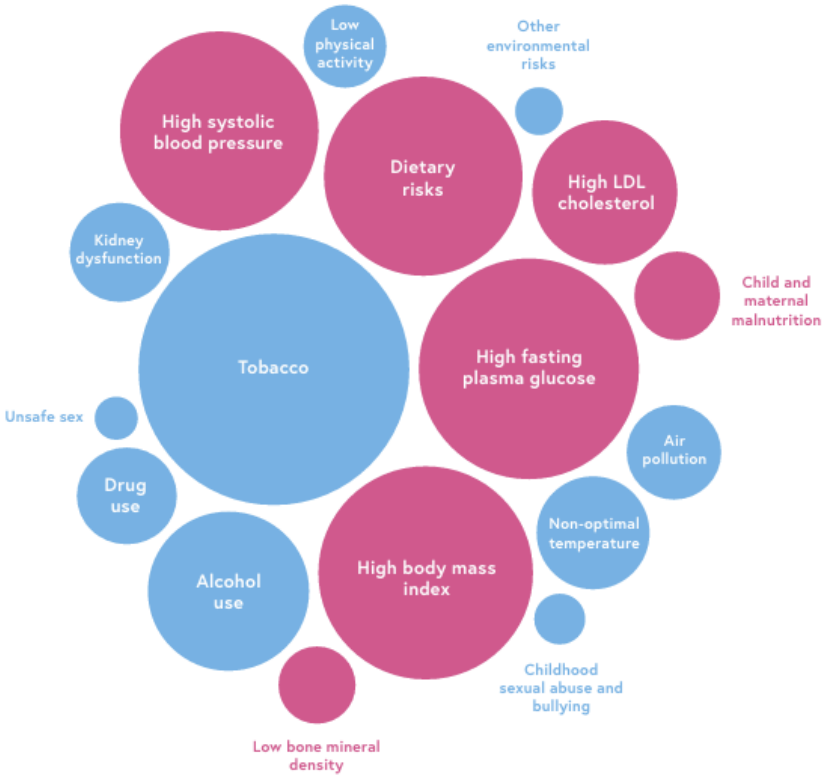

Figure 9. Proportion of years lost to avoidable ill health and death by cause. Reproduced from Dimbleby, H. (2021).

In helping people to consume less meat while still supplying a nutritious and tasty selection of food, the prepared meals sector can also help to make meaningful contributions towards improving human health. As the illustration in Figure 9 shows, diet is a significant factor in many of the diseases and health risks modern society is dealing with. The UK's National Food Strategy highlights the staggering cost of poor diet on both individual well-being and public health systems, with diet-related illnesses such as type 2 diabetes and obesity not only contributing to human suffering but also threatening to overwhelm healthcare services like the NHS. A shift towards wholefoods and plant-based eating could play a pivotal role in alleviating these pressures, as such foods are widely linked to lower risks of many chronic illnesses.[19]

[19] Dimbleby, H. (2021). National Food Strategy: The Plan.

Beyond the meals themselves, the prepared meals sector has the power to educate and inspire. The survey revealed uncertainty among consumers about the impact of climate change on food systems, highlighting a need for clearer communication about the vulnerabilities and opportunities within our food supply. Packaging and labelling can play a transformative role here, moving beyond mere functionality or marketing, instead becoming a tool for fostering food literacy and rebuilding a connection between people and what they eat. This will go hand in hand with addressing the negative environmental impacts of the packaging itself by moving away from single-use plastic to more reusable or truly biodegradable concepts. Demonstrating such action and building a consistent narrative on the climate and ecological emergencies is key to making sustainability efforts credible to consumers.

Food Myth: "Food is not wasted if it is composted or fed to animals"
A sustainable food system depends on minimising food waste at every stage. However, there are widespread misconceptions about what counts as food waste. The reality is this: as far as greenhouse gas emissions and resource efficiency are concerned, food is wasted unless it is eaten by humans.

Feeding surplus food to animals, composting, anaerobic digestion, or even incineration are common methods of utilising food that does not make it onto a plate. While these options may recover some value, they do not eliminate the significant resource waste or GHG emissions already embedded in the food's production, processing, and transport – and some of these methods release additional emissions of their own.

The prepared meals sector can play a vital role in reducing food waste by addressing systemic issues, like rejecting food for purely aesthetic reasons, and improving processes to ensure that more food ends up where it belongs: on people's plates, not in bins. Achieving a truly sustainable food system means striving for "zero waste", even if some unavoidable losses are inherent.

However, no single actor can transform the food system alone. The prepared meals sector must champion collaboration, bringing together producers, policymakers, retailers, and consumers to align around shared goals of sustainability and equity. By acting as a hub for this cooperation, the sector can help to overcome the fragmented nature of food supply chains and drive progress at scale.

Comparing Three Prepared Meals

We assessed the carbon footprint and nutritional value of Oscar Mayer's three most popular prepared meals, along with three vegetarian or vegan alternatives. The original recipes were beef lasagne, beef cottage pie, and fish pie. The alternatives we compared with were a vegetarian lasagne, replacing the beef with a combination of lentils, mushrooms and sweet potatoes; a vegan cottage pie, replacing the beef with a combination of lentils, beans, mushrooms and courgettes; and a vegan tikka masala. Since the carbon footprint of a prepared meal is dominated by the choice of ingredients, the footprint of the meat-free alternatives is much lower, especially since beef and farmed fish have particularly high carbon footprints compared to other meats such as chicken and pork. See the graph for the results of the carbon footprint calculations, broken down by production stage.

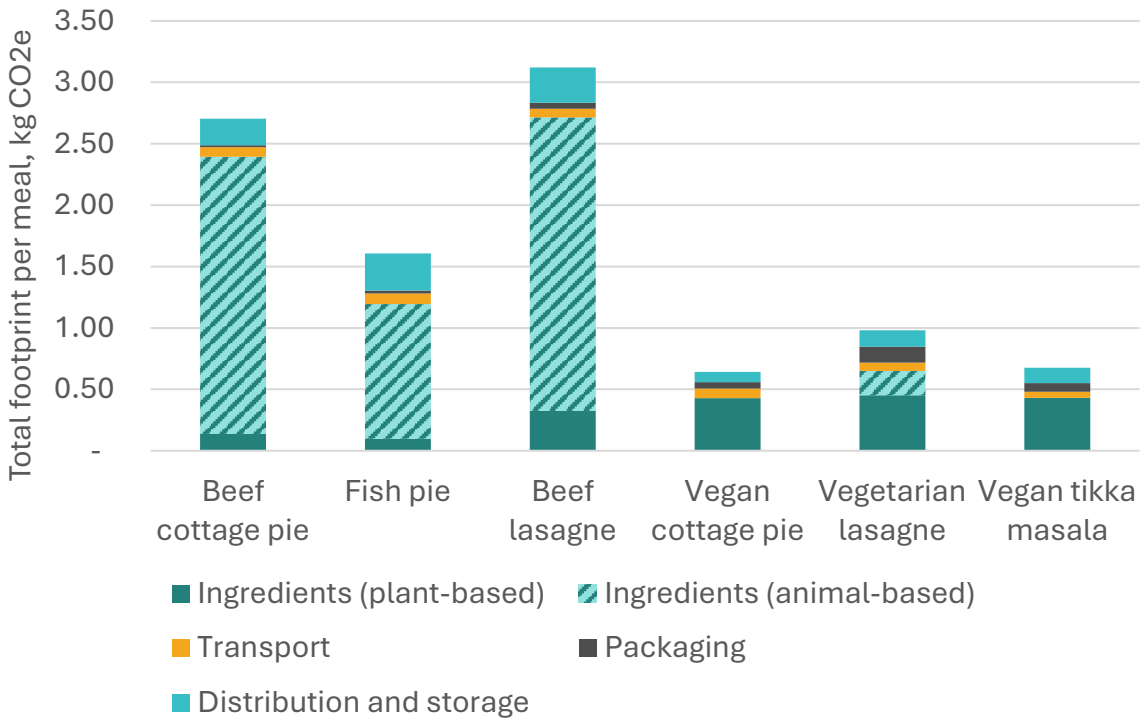

Figure 10. Comparing the carbon footprint of different prepared meal recipes.

Table 1. Comparing the nutritional profile of the six different prepared meal recipes.

	% of recommended intake per serving			
	Energy	Protein	Iron	Zinc
Cottage pie – beef	46%	>100%	68%	>100%
Fish pie	54%	>100%	25%	72%
Lasagne – beef	53%	>100%	96%	>100%
Cottage pie – vegan	31%	89%	71%	90%
Lasagne – vegetarian	36%	>100%	88%	>100%
Tikka masala – vegan	60%	97%	73%	98%

Nutritionally, the meat-free alternatives did not perform particularly better or worse than the original recipes (Table 1), although the data on iron content of the vegan meals has not been adjusted based on the differing bioavailability of iron in plant-based foods. Since the vegan cottage pie and vegetarian lasagne meals have been adapted by Small World Consulting rather than a chef or food scientist, it would doubtless be possible to further tweak these recipes if nutritional improvements were required without affecting the overall large reductions in carbon footprint.

Prepared Meal Calculator

A key element of this project was the development of a beta version of a **Menu Calculator** that integrates carbon footprint, cost, and nutrition data. This tool allows Oscar Mayer to evaluate the environmental and nutritional trade-offs of its prepared meal offerings while considering affordability for consumers. By combining these three critical dimensions, the calculator helps to illustrate how products can be optimised across multiple variables, enabling the creation of sustainable, healthy, and affordable meal solutions.

Next Steps for the Sector

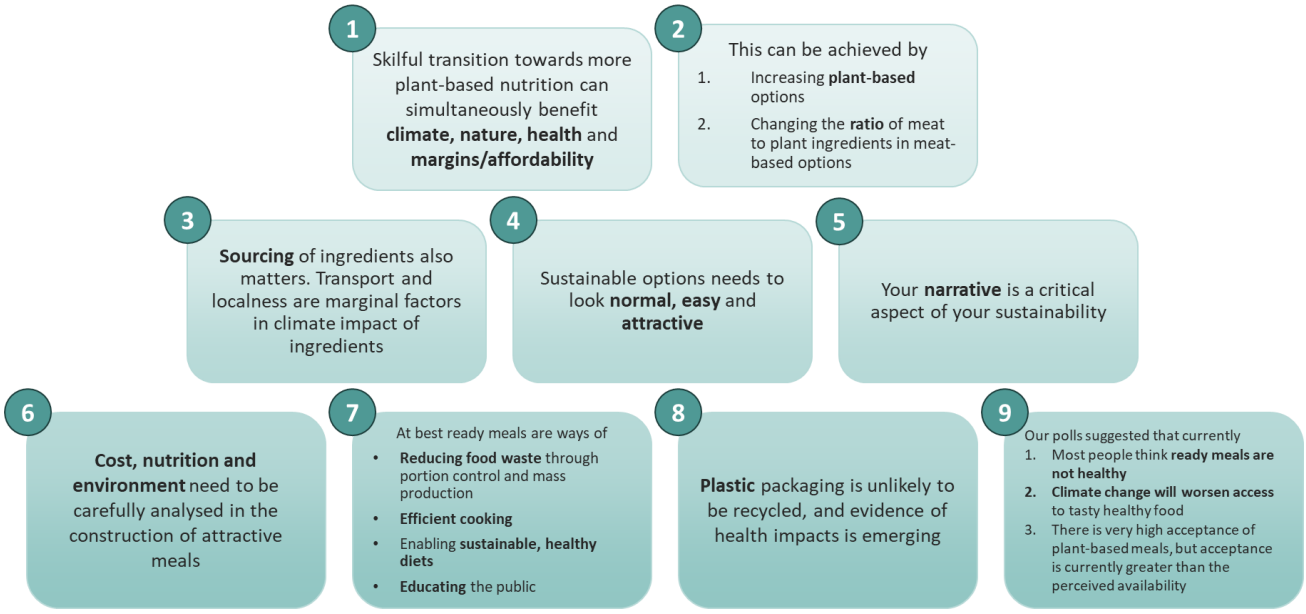

Figure 11. Next steps for the prepared meals sector.

The prepared meals sector is uniquely positioned to lead the way toward more sustainable and health-conscious food systems. As this report has repeatedly highlighted, the global and local food systems face numerous challenges: issues that are mirrored within the prepared meals sector. This sector plays an increasing role in the food we consume, offering convenience for our busy lives. However, addressing the environmental, climate, and health impacts of this sector requires rethinking our relationship with food, much like how many are reconsidering their relationship with travel or consumer goods like fashion in their pursuit of sustainability. A shift towards degrowth, slowing down, and being conscious of our consumption is essential – and this mindset also applies to the prepared meals industry. Yet, as we've noted, there are undeniable advantages to the convenience and accessibility that ready meals provide. Striking a balance between the challenges, opportunities, and necessary transformations for the sector will demand innovation and collaboration across all stakeholders. This section aims to outline priorities and next steps for the sector in moving towards the vision of a more environmentally and health-conscious way of feeding people, and serves as a conclusion to this report.

1. **Skilful transition towards more plant-based nutrition can simultaneously benefit climate, nature, health and affordability**
2. **This can be achieved by:**
    - **Increasing plant-based options**
    - **Changing the ratio of meat to plant ingredients in meat-based options**

One of the most impactful steps the sector can take is to champion plant-based nutrition. This doesn't necessarily mean eliminating meat altogether, but instead skilfully shifting toward plant-forward meals. Offering more plant-based options and creatively adjusting the ratio of meat to plant ingredients in traditional dishes can significantly lower greenhouse gas emissions. For example, a lasagne with reduced beef content and added lentils or mushrooms could deliver comparable taste while being more sustainable and affordable. These changes benefit not only

the climate but also consumers' health and meal affordability, making them a win for all stakeholders.

3. **Sourcing of ingredients also matters. Transport and localness are marginal factors in climate impact of ingredients**

Sourcing ingredients sustainably is another critical consideration. While the transportation and localness of ingredients receive much attention, the environmental impact of food production itself far outweighs these factors. Prioritising ingredients grown using regenerative agricultural practices and avoiding products linked to deforestation, such as unsustainable soy or palm oil, can greatly enhance the environmental credentials of prepared meals. Clear communication of these efforts, through transparent labelling or storytelling, can build consumer trust and reinforce the brand's sustainability narrative.

4. **Sustainable options need to look normal, easy and attractive**

Sustainable food options, such as plant-based meals, are often still perceived as a niche or alternative choice compared to mainstream options. However, ready meals have the potential to challenge and change this perception. For sustainable diets to become more widely adopted, they must be seen as just as accessible, convenient, and enjoyable as traditional meals. This means that plant-based or environmentally friendly meals need to be presented in a way that appeals to a broad audience by offering familiar flavours, attractive packaging, and easy preparation.

5. **Your narrative is a critical aspect of your sustainability**

When considering how the food system contributes to the climate and ecological emergencies, we often focus on the direct impact of food production and consumption. However, an equally important factor is how we talk about, and therefore think about, our food and its origins. For example, increasing transparency in food supply chains can help reconnect people with the source of their meals. Many consumers are unaware of the carbon impact of their food or hold misconceptions about where the majority of emissions occur in the supply chain, as highlighted by the "food myth" boxes throughout this report. Education plays a crucial role in addressing these gaps, and the ready meals sector is in a strong position to drive this awareness and change.

6. **Cost, nutrition and environment need to be carefully analysed in the construction of attractive meals**

As noted by Garcia-Garcia *et al*. (2021), the sustainability of a prepared meal starts at the very beginning of its development. They state, "Most sustainability analyses are currently done after the food product is designed and not during the food product development process. Nevertheless, embedding sustainability considerations in the new food product development (NFPD) process has significantly more potential to improve the overall sustainability of the food business"[20]. Tools like the menu calculator developed by SWC for Oscar Mayer, as introduced in this report, are examples of valuable resources that can help identify environmental and nutritional impacts at the design stage. While it's not about expecting any one company to fully disclose every calculation, the learnings and methodologies behind such tools should be shared transparently across the industry. By adopting these approaches early in the development

[20] Garcia-Garcia, G., Azanedo, L., & Rahimifard, S. (2021). "Embedding sustainability analysis in new food product development." *Trends in Food Science & Technology*, *108*, 236-244. https://www.sciencedirect.com/science/article/pii/S092422442030738X

process, the sector can make more informed decisions that balance cost, nutrition, and sustainability, ensuring that environmental and health considerations are not an afterthought but integral to the meal creation process.

7. **At best, ready meals provide ways of:**
    - **Reducing food waste through portion control and mass production**
    - **Cooking efficiently**
    - **Enabling sustainable, healthy diets**
    - **Educating the public**

Making these changes will also require a deeper rethinking of ready meals' broader role in food systems. At their best, prepared meals offer unique advantages, including controlled portion sizes, which reduce food waste, and energy-efficient mass production. They can also support public health by enabling affordable, balanced diets. Companies have an opportunity to frame their products as tools for education, highlighting benefits like carbon savings or the nutritional value of plant-based options. With thoughtful design and messaging, ready meals can move from being seen as a convenient fallback to a positive driver of sustainable, healthy living.

8. **Plastic packaging is unlikely to be recycled, and evidence of health impacts is emerging**

Plastic packaging remains a significant challenge for the sector. Not only is most plastic packaging unlikely to be recycled, but evidence is also emerging about its potential health impacts, further complicating its use. Addressing this issue requires bold investment in alternative materials, such as compostable or fully recyclable solutions, while maintaining transparency with consumers about progress and challenges. A decisive shift away from plastic would enhance the sector's sustainability credentials and align with consumer demand for cleaner, healthier products.

9. **Our polls suggested that currently:**
    - **Most people think ready meals are not healthy**
    - **Climate change will worsen access to tasty healthy food**
    - **There is very high acceptance of plant-based meals, but acceptance is currently greater than the perceived availability**

The urgency of these shifts is underscored by public sentiment and environmental realities. Polling data suggests growing concern about the accessibility of tasty, healthy food as climate change worsens. However, there is also high acceptance of plant-based meals, which demonstrates both an opportunity and a challenge: consumers are more open than ever to these options, but they must be readily available and attractive, hence easy to choose.

A 2024 study on the EU prepared meals sector reinforces these findings. It demonstrates that healthier and more sustainable options can be made affordable, potentially reducing greenhouse gas emissions by 48 million tonnes of CO_2e annually. Moreover, aligning prepared meals with established health guidelines could significantly alleviate the burden of diet-related diseases on public healthcare systems.[21]

[21] European Public Health Alliance (2024). "Making prepared foods healthier and more sustainable." https://epha.org/making-prepared-foods-healthier-and-more-sustainable/

Through innovation, transparency, and a commitment to sustainability, the prepared meals sector has the potential to transform its reputation and impact. By delivering meals that are good for people, the planet, and businesses, the industry can redefine what prepared meals stand for: convenience, health, and sustainability in equal measure.

Appendix

Oscar Mayer, in collaboration with Bulbshare, conducted a consumer survey to better understand public attitudes towards prepared meals and their wider environmental and societal implications. Using questions designed by SWC, the survey explored topics such as food accessibility, sustainability, and changing consumer priorities.

Do you consider ready meals to be generally healthy?	
Yes, always	10%
Yes, usually	34%
Not usually	52%
Never	1%
Not sure	3%
Do you believe that meat and dairy every day are necessary for a healthy, tasty diet?	
Yes, definitely	26%
Yes, somewhat	45%
Neutral/no opinion	9%
No, not really	12%
No, definitely not	8%
Not sure	0%
Do you agree with the following statement? "Plant-based meals can be just as tasty as meat-based meals."	
Strongly agree	27%
Agree	35%
Neutral	18%
Disagree	15%
Strongly disagree	5%
Do you agree with the following statement? "Plant-based meals can be just as healthy as meat-based meals."	
Strongly agree	33%
Agree	38%
Neutral	18%
Disagree	7%
Strongly disagree	4%
Do you agree with the following statement? "It's easy to buy tasty, healthy ready meals."	
Strongly agree	22%
Agree	42%
Neutral	20%
Disagree	12%
Strongly disagree	4%
Do you agree with the following statement? "It's easy to buy tasty, healthy plant-based ready meals."	
Strongly agree	19%
Agree	30%
Neutral	27%
Disagree	18%
Strongly disagree	6%
Do you agree with the following statement? "I trust that the ingredients in meat-based ready meals are high quality."	
Strongly agree	16%
Agree	40%

Neutral	27%
Disagree	13%
Strongly disagree	4%
Do you agree with the following statement? "I trust that the ingredients in plant-based ready meals are high quality."	
Strongly agree	18%
Agree	43%
Neutral	27%
Disagree	9%
Strongly disagree	3%
Which part of a ready meal do you think has the biggest carbon footprint?	
Ingredients	6%
Manufacture	22%
Packaging	10%
Preparing	5%
Retail	4%
Transport	53%
How do you think climate change will affect your access to tasty, healthy food in the future?	
Improve	12%
Stay the same	20%
Unsure	31%
Worsen	37%