Cleaner Food Systems 3 (2026) 100021

Contents lists available at ScienceDirect

Cleaner Food Systems

journal homepage: www.sciencedirect.com/journal/cleaner-food-systems

Still niche? Stakeholder perspectives on growing the plant-based meat and plant-based dairy industries

Katie Major-Smith [a,b,*], Gregory Borne [a,c], Laura Wallis [a], Debby Cotton [a]

[a] Sustainability, Creativity and Innovation Research Group, Plymouth Marjon University, Plymouth, PL6 8BH, UK
[b] Department of Food Science, Aarhus University, 8200, Aarhus, Denmark
[c] Cornwall Business School, Falmouth University, Falmouth, TR11 4RH, UK

ARTICLE INFO

Keywords:
Plant-based meat
Plant-based dairy
Sustainable food
Stakeholders
Motivations
Challenges
Multi-level perspective

ABSTRACT

Shifting towards plant-based diets is a crucial aspect of mitigating climate change. As part of this transition, growing the plant-based meat and plant-based dairy industries has significant potential to reduce the environmental impacts of the food system in Western countries. To date, little research has examined the systemic challenges faced by stakeholders involved in developing and supporting these industries. By applying a multi-stakeholder perspective, our study addresses this gap in the literature, exploring the factors influencing industry growth. Semi-structured interviews were conducted with 15 respondents representing consumers, manufacturers and retailers. Reflexive thematic analysis was applied, identifying seven overlapping themes applicable to both industries. Findings indicate that support for plant-based products is often grounded in sustainability goals and belief that newer plant-based alternatives can effectively meet consumer expectations. However, industry growth is restricted by complex structural challenges, including the influence of the meat and dairy sector, negative consumer perceptions, and the high financial risk of investing in these emerging alternatives. Stakeholders identified two key changes needed: greater industry investment and more effective strategies to stimulate consumer demand. Applying the multi-level perspective (MLP) to interpret findings suggests that the plant-based meat and plant-based dairy sectors are still operating as niche industries, and that sector growth depends on changes at both the niche and regime levels to fully integrate plant-based meat and plant-based dairy into the food system. This research contributes original insights into the dynamics of sustainable food system transformation by foregrounding stakeholder experiences across multiple points in the value chain.

1. Introduction

Meat and dairy are among the most environmentally damaging foods produced (Poore and Nemecek, 2018). Occupying 77% of agricultural land (Ritchie and Roser, 2024), livestock production degrades diverse landscapes, including tropical forests (Barona et al., 2010) and grasslands (Michalk et al., 2019), and is a key driver of biodiversity loss (Tilman et al., 2017). It also contributes significantly to climate change, with animal agriculture being responsible for 58% of the food sector's total greenhouse gas emissions (GHG) (Poore and Nemecek, 2018) and contributing 16.5% of all global anthropogenic GHG emissions (Twine, 2021). Despite the environmental damage caused by livestock production, global demand for meat and dairy has resulted in sector expansion, with meat production (excluding fish and seafood) quadrupling since 1961 (Ritchie et al., 2023) and milk production increasing by 77% between 1992 and 2022 (FAO, 2025). This demand is predicted to continue growing, with global meat consumption expected to increase by 12% by 2033 and milk production anticipated to grow by 1.5% annually during the next decade (OECD & FAO, 2024).

To address the environmental damage caused by meat and dairy production, and to help make the food system more sustainable, a societal transition to plant-based eating is needed. The environmental benefits of a plant-based diet (which excludes or mostly excludes animal products; Hargreaves et al., 2023), are large, with plant-based food consumption causing less greenhouse gas emissions, land damage and biodiversity loss than meat and dairy-based diets (Aleksandrowicz et al., 2016; Henry et al., 2019). For example, when examining the food-related GHG emissions of over 55,000 meat-eaters, pescatarians,

* Corresponding author. Department of Food Science, Aarhus University, 8200, Aarhus, Denmark.
E-mail addresses: katie.major-smith@food.au.dk (K. Major-Smith), greg.borne@falmouth.ac.uk (G. Borne), lwallis@marjon.ac.uk (L. Wallis), dcotton@marjon.ac.uk (D. Cotton).

https://doi.org/10.1016/j.clfs.2026.100021
Received 21 October 2025; Received in revised form 10 February 2026; Accepted 20 February 2026
Available online 21 February 2026

vegetarians and vegans, Scarborough et al. (2014) found that individuals practicing a fully plant-based diet (vegan diet) were responsible for the lowest GHG emissions (2.89 kg CO_2e/day), followed by vegetarians (3.81 kg CO_2e/day) and pescatarians (3.91 kg CO_2e/day), while eating meat (>100g per day) resulted in the highest amount of GHG emissions (7.19 kg CO_2e/day). This was supported by more recent research by Scarborough et al. (2023), who showed that the GHG emissions of a vegan diet were 25.1% of those caused by a high meat diet. The vegan diet was also less water intensive, caused less eutrophication and was responsible for less biodiversity loss. As the environmental impact of a vegan diet is much lower than other diet types, eliminating animal products from the diet could substantially help meet the Paris Agreement targets to limit warming to 1.5° (UNFCCC, 2016), with Kim et al. (2020) predicting that it could reduce carbon footprints per capita by an average of 70% across 140 countries. This transition is particularly important for Western consumers since the Global North releases twice the amount of food-related GHG emissions than developing countries (Tubiello et al., 2021), is responsible for emitting most of the total global food carbon budget (Loken and DeClerck, 2020), and has contributed significantly to climate change (Walker and King, 2008). Despite the need for Western countries to support the adoption of plant-based diets, reducing meat (hereby defined as flesh from all animals including fish and seafood) and dairy consumption can be challenging, and innovative approaches to foster a plant-based food transition in this region are needed.

1.1. Plant-based meat, plant-based dairy and the multi-level perspective (MLP)

Sectors driving an innovative approach to the sustainable food issue include the plant-based meat and plant-based dairy industries. By developing products which look and taste like meat and dairy but are made from plants, these industries are pivotal in promoting plant-based eating and encouraging meat and dairy reduction by offering substitutes for these products (Messina et al., 2023). These plant-based alternatives are more accepted among western consumers compared to other alternatives, such as cultured meat (Begho and Zhu, 2025), and seem to be substantially more sustainable than their counterparts. For example, the total environmental impact of plant-based meat burgers, including land use, energy use and global warming potential, is six to seven times lower than beef burgers (Smetana et al., 2021), while a Beyond Meat or Impossible Foods branded plant-based burger reduces land use, water use and GHG emissions by 87-96% compared to the beef equivalent (Kustar and Patino-Echeverri, 2021). Although producing plant-based meat substitutes can be water intensive (Van Mierlo et al., 2017), water use is still lower than making meat counterparts (Santo et al., 2020). This is similar for plant-based dairy, with most products being less resource intensive, requiring less land and water, and emitting up to 67% less GHG than dairy equivalents (Carlsson-Kanyama et al., 2021; Poore and Nemecek, 2018).

While plant-based alternatives to meat and dairy are not new, with plant-based substitutes traditionally used in Asian cultures, such as items made of tofu or tempeh and soy milk (He et al., 2020; Mylan et al., 2019), they have recently become popularised in Western societies (Mylan et al., 2019). This has caused rapid industry growth, with the plant-based meat sector estimated to be worth USD$6.1 billion in 2024, while plant-based milk was valued at USD$22.4 billion (Good Food Institute, 2025). Both industries are expected to continue growing, with plant-based meat predicted to increase 19.4% annually between 2024 and 2030 (Grand View Research, 2024) and plant-based dairy 12.7% between 2025 and 2030 (Grand View Research, 2025). This growth is illustrated through companies like Gold&Green Foods, whose new plant-based meat product sold out 11 minutes after it launched (Saari et al., 2021), and Oatly, which is estimated to be worth $10 billion and is now available in 20 countries across Asia, Europe and North America (Krampe and Fridman, 2022). This has led to large investments in these industries (Choudhury et al., 2020) and the acquisition of smaller companies by large corporations, including Unilever purchasing The Vegetarian Butcher in 2018 and Paulig buying most of Gold&Green Foods shares in 2016 (Saari et al., 2021).

Despite this unprecedented growth, plant-based meat only makes up 1% of the global meat market (Trefis Team, 2022) and plant-based milk 11% of the European milk market (Good Food Institute, 2023). Understanding the challenges these industries experience is in its infancy, with limited research exploring issues inhibiting growth across the supply chains or examining why stakeholder support continues despite low consumer demand. However, these insights are important for promoting the continued expansion of these sectors; despite future growth projections, plant-based meat sales have begun decreasing in some Western countries, including USA (Good Food Institute, 2024), indicating that the estimated trajectory of plant-based alternative markets is not stable. A large challenge is likely the dominant status of meat and dairy, which receive stronger governmental and industry support than plant-based alternatives. This is evident through the amount of supermarket shelving dedicated to meat products, which is larger than plant-based alternatives (Gravely and Fraser, 2018), the government subsidies provided to animal agriculture (FAO, UNDP, UNEP, 2021), and the prohibition of labelling plant-based dairy with dairy-based terms (search as 'milk', 'butter' and 'yogurt'; Gambert, 2019). These factors influence stakeholder support for plant-based meat and plant-based dairy and limit the role that these sectors play in aiding the transition to more plant-based eating.

Sustainably transforming the global food system is a complicated and lengthy process which is multi-dimensional and involves numerous actors (Köhler et al., 2019; Markard et al., 2012); to help understand factors affecting plant-based meat and plant-based dairy growth in promoting this change, the multi-level perspective (MLP) can be applied. This socio-technical transition approach considers how sustainable transitions (large-scale transformations that restructures society to address sustainability issues; Lachman, 2013) occur and reflects the disruption that the widespread adoption of plant-based meat and plant-based dairy would have on the current food system. By highlighting the complexities of driving large-scale transformation (Geels and Schot, 2007), the MLP suggests that sustainable transitions evolve through a series of phases, starting with experimentation and ending with market dominance if successful, and occur through the interplay of processes at three levels: 1) niche level, where activities of innovation occur in a protected space from dominant rules; 2) regime level, which are shared rules that support the structure of existing socio-technical systems and are influenced by societal, cognitive and political factors, and; 3) landscape level, which is the wider context that the niche and regime levels operate in, such as macroeconomic trends, climate change

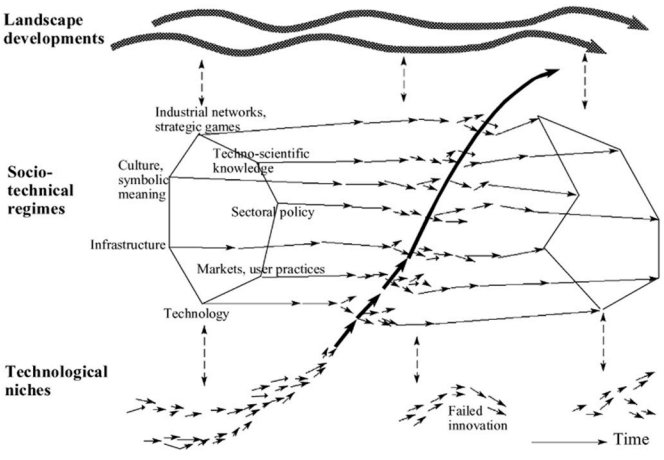

Fig. 1. A visual of the MLP showing the interplay of processes at the niche, regime and landscape levels. Image taken from Geels (2002).

and societal concerns (see Fig. 1; FGeels, 2011; Geels et al., 2023a).

Plant-based meat and plant-based dairy appear to be operating as niche sectors within the broader food industry, but understanding in more detail how these sectors function is important for identifying possibilities for scaling up. Disrupting an entrenched socio-technical system with the magnitude of our current food ecosystem is challenging for any niche industry as it requires shifts not only within the industries themselves but also in the broader landscape that shapes the food system (Geels, 2011; Geels and Schot, 2007). Systemic barriers can restrict a niche industry's ability to achieve mainstream integration, and potentially inhibit their growth and long-term existence (Smith et al., 2010). Nonetheless, niche sustainable food industries are important in supporting sustainable transitions, encouraging the production and consumption of sustainable products, thus understanding how these sectors can be better supported is vital. Current steps towards growing plant-based alternatives include: companies incorporating plant-based meat sales into their sustainability commitments (FAIRR, 2021); retailers placing dairy and plant-based substitutes together (Bocken et al., 2020); and pricing strategies for plant-based foods to make them more affordable (Good Food Institute, 2022). However, plant-based food industries are relatively new and evolving sectors in the Global North and there is currently a lack of literature offering a detailed understanding of these niche industries. Specifically, we need to gain insights from stakeholders at various points in the value chain to better understand factors influencing sector support and to identify how to support growth of these emerging sectors. Only then can we strengthen industries and support them in expanding throughout the mainstream food market while contributing to the wider sustainable transformation of our food system. The present study addresses that gap by applying a multi-stakeholder perspective to answer the following research question: what are the motivations for, and challenges of, producing and consuming plant-based meat and plant-based dairy, and the key changes needed in these industries to enhance growth?

2. Materials and methods

2.1. Sample

Interviews were conducted with 15 participants representing consumers, plant-based meat and plant-based dairy manufacturers and food retailers; nine respondents were interviewed about plant-based meat and nine about plant-based dairy (three respondents participated in interviews on both plant-based food types). The job roles of most manufacturers and retailers focused on sustainability or product development, and consumers' intake of plant-based dairy or plant-based meat varied (see Table 1).

To determine which stakeholder groups to include, a stakeholder analysis using an influence/interest matrix was conducted. While several stakeholder groups were identified, those perceived as being influential and having high industry interest were targeted (Reed et al., 2009). This is because these stakeholder groups have been key in driving these sectors forward and can shed light on the industries' current status, with manufacturers and retailers making substantial investment and effort in growing these sectors, while consumers drive demand through their purchasing behaviour. Furthermore, previous research has not yet explored these stakeholders in tandem in the context of these industries.

The 'information power' model was applied to determine how many individuals to contact in each stakeholder group. This model helps calculate sample size in qualitative research by using several factors to estimate the strength of information gained during data collection, including depth of participants' experience and anticipated quality of discussion (Malterud et al., 2016). As industry participants were expected to have detailed sector knowledge, two interviews from each stakeholder group were deemed sufficient. However, all invited stakeholders willing to participate were included, hence more than two interviews per stakeholder group took place. To identify retailers and manufacturers to contact, a list of western-based companies was compiled and ranked by size and market share. Purposive sampling was used to ensure participants had expertise of plant-based meat and/or plant-based dairy (e.g., by working directly with these products and not with other products produced and sold by the company instead) and to capture variation across key stakeholder groups. Individuals were identified using online resources, such as LinkedIn and company websites and reports. Individuals responsible for their company's sustainability work were initially targeted due to their sustainability knowledge of these industries but as participant identification progressed individuals working across multiple departments were contacted. For consumers, individuals who participated in a previous study conducted by the researchers and who had agreed to take part in further research were invited via email. Initially, consumers who reported trying plant-based meat or plant-based dairy in the previous study were randomly selected to participate in the study but as the interviews progressed, purposive sampling was used to recruit consumers who intentionally and frequently consumed plant-based dairy.

2.2. Semi-structured interviews

Semi-structured interviews were conducted between February and August 2022, with interviews focusing on stakeholders' perceptions of: 1) their motivation for producing, selling or consuming plant-based meat and plant-based dairy products; 2) barriers preventing them from producing, selling or consuming these items, and; 3) key changes needed in the industries to promote growth (see Appendix A for topic guide). Interviews were conducted online via 'Zoom', which was

Table 1
Respondents' industry representation, stakeholder group, job role focus, country they were based and consumption of plant-based meat (PBM) and plant-based dairy (PBD; only asked to consumers). Note that N/A means 'not applicable'.

Respondent	Industry	Stakeholder group	Job role focus	Country	Consumed PBD or PBM?
1	Plant-based dairy	Manufacturer	Sustainability	UK	N/A
2	Plant-based dairy	Manufacturer	Product development & sustainability	UK	N/A
3	Plant-based dairy	Manufacturer	Sustainability	Belgium	N/A
4	Plant-based dairy	Consumer	N/A	UK	Frequently
5	Plant-based dairy	Consumer	N/A	UK	Occasionally
6	Plant-based dairy	Consumer	N/A	UK	Occasionally
7	Plant-based meat	Manufacturer	Product development	UK	N/A
8	Plant-based meat	Manufacturer	Sustainability	UK	N/A
9	Plant-based meat	Manufacturer	Product management & sustainability	Netherlands	N/A
10	Plant-based meat	Consumer	N/A	UK	Frequently
11	Plant-based meat	Consumer	N/A	UK	Frequently
12	Plant-based meat	Retailer	Product development	UK	N/A
13	Plant-based dairy & plant-based meat	Retailer	Sustainability	UK	N/A
14	Plant-based dairy & plant-based meat	Retailer	Product development	UK	N/A
15	Plant-based dairy & plant-based meat	Retailer	Product development	UK	N/A

deemed more convenient for participants than in-person methods, both in terms of time and geographic location (Archibald et al., 2019), and interviews lasted 47 min on average. Interviews were audio recorded and transcribed using the software 'Otter.ai', with transcripts manually checked for accuracy. The study received ethical approval from Plymouth Marjon University's Research Ethics Panel (approval code: EP153), and all participants read an information sheet and gave verbal consent to participate in the study prior to interviews being conducted.

2.3. Data analysis

To analyse the data, reflexive thematic analysis was applied whereby codes and themes were systematically developed to identify patterns across the dataset, while critical reflection occurred throughout the process (Braun and Clarke, 2022). To do this, the framework developed by Braun and Clarke (2022) was used as a guide. After becoming familiar with the transcripts, first-level and second-level coding occurred where initial thoughts and potential codes were written on a paper copy of each transcript, and then codes were developed further using NVivo, with codes being refined, combined and/or redeveloped, while duplicate codes were removed. Generation of initial themes then occurred, where codes were organised into categories reflecting 'motivations', 'challenges' and 'changes'. Supporting codes of each theme were checked using NVivo to ensure each theme accurately reflected the codes and that codes supported the themes. After the final themes were determined, data extracts were collated which provided coherent accounts of each theme. Throughout the process, an inductive approach was taken and patterns based on both the surface meaning of information shared by respondents (semantic themes) and the deeper underlying assumptions within this information (latent themes) were explored (Braun and Clarke, 2006).

3. Results

Several themes were identified concerning the motivations driving stakeholder support for the plant-based meat and plant-based dairy industries, challenges inhibiting sector development and key changes needed to increase industry growth. Although coding was initially undertaken separately, most themes covered both industries suggesting that the plant-based meat and plant-based dairy sectors are influenced by similar factors (see Table 2 for an overview of shared themes). Discussion of these themes is provided below, presented under the categories 'drivers of growth', 'barriers to growth' and 'changes needed'. An overview of industry-specific themes is provided in the Supplementary Information.

3.1. Drivers of growth

3.1.1. Supporting a sustainable food transition

Growth of plant-based meat and plant-based dairy is driven by stakeholders who are supportive of innovative commodities that aim to advance production of less environmentally impactful foods and increase plant-based food consumption. As one plant-based dairy manufacturer summarised, supporting these products helps companies show consumers that they can have *"healthy moments of joy without recklessly taxing the planet's resources."* Approaches to supporting such innovations and the tactics used for promoting plant-based eating differ among manufacturers and retailers. Comparatively, manufacturers are more active and pioneering this space. By situating their business model around sustainability, with many achieving B-Corp certification, manufacturers are actualising their commitment to promote plant-based diets into their strategy. This was illustrated by a plant-based dairy manufacturer who emphasised that their company's mission "*has been to look at the better way to feed the world*", while a plant-based meat manufacturer aimed to "*make sustainable foods for the world.*" This contrasted with the passive approach taken by retailers, who perceived their role as providing consumers with sustainable food choices, rather than actively encouraging plant-based eating: "*… it's just making sure that we're making it easier for people to reduce their meat and dairy in whichever way is right for them.*" Retailers believed that this type of action was "*… incrementally going to make a massive difference",* and even though retailers acknowledged being relatively new stakeholders in supporting these industries, they believed their actions benefited society: "*… as a responsible retailer, we will always do the right thing.*" While retailers justified industry support primarily to help sustainably transform the food system, they are also influenced by other benefits that industry support brings, such as expanding customer-base and increasing profits, which may explain their passive approach.

3.1.2. Meeting consumers' needs

Product advancement has accelerated sector growth, with recent improvements in plant-based meat and plant-based dairy products now better meeting consumers' food needs compared to earlier analogues. These improvements are facilitated by technological advancements and increased industry investments, along with consumers' willingness to only purchase high-quality products. For plant-based meat, particular progress has been on taste, with one consumer stating "*… five or ten years ago, um, the plant-based option was always like significantly worse … I wouldn't really choose it because just like I was downgrading the quality of my meal experience."* Replicating the flavour of meat has enhanced taste further, with manufacturers believing that product advancement has been so great in this area that customers are "*pretty much not able to tell the difference."* This makes choosing plant-based meat easier for consumers because their desire for meat-tasting products is not compromised: *"if you give me two hamburgers, for example, and one of those [is] plant-based and one of them is meat, and I couldn't tell the difference, then I would just use the plant-based ones"* (consumer).

For dairy, product improvements have caused greater product variety and availability. Early development focused on plant-based milk, a product still dominating the sector, but enhanced technology and wider diversity of crop usage (*"… we're now seeing potato milk and things like that"* (retailer)), has caused the plant-based dairy portfolio to expand rapidly, now including cheese, ice cream, yogurt and cream. This journey to expanding the variety of plant-based dairy products was expressed by a manufacturer: "*so, starting with the soya drink, and then looking at more and more ingredients including like the nuts, some cereals, such as oats, etc. And on top of having drinks, looking at having like plant-based alternatives to yogurts, having some dessert, some ice creams ….*" Increased variety has also expanded availability, making products more accessible to consumers, which has been a significant step to gaining consumer support: *"choice is definitely there. And it's not just supermarkets. It's coffee shops and cafes and whatnot, which even five* years *ago, I think was much less common"* (consumer).

3.2. Barriers to growth

3.2.1. Threatened by meat and dairy industries

Despite growing support for plant-based meat and plant-based dairy, the dominant role of meat and dairy pose serious challenges for continued sector expansion. Cultural norms around meat-eating and dairy-drinking are strong in Western societies and has resulted in

Table 2
Shared themes identified on the motivations, challenges and changes needed in the plant-based meat and plant-based dairy industries.

Motivations	Challenges	Changes
Supporting a sustainable food transition	Threatened by meat and dairy industries	Greater industry investment
Meeting consumers' needs	Negative consumer perception	Strengthen consumer support
	High financial risk	

habitual consumption of these products. Consumers illustrated this well, explaining their consumption of dairy instead of plant-based dairy "*because it's what I've always done"* and *"it's a lack of curiosity and the falling back into old habits really."* Food habits were identified as significant barriers to eating plant-based foods:

> *"… I have sort of tried it, you know, sort of many times, made to not eat meat for a while. But inevitably, I've been brought up a meat-eater. So, there's always something that draws you back. You know? Maybe the smell of bacon, or you know, something you really enjoy. Your Mum's chicken Sunday lunch, you know? So, it's hard to kill those habits once they're, once they're in, you know what I mean?"* (consumer)

Support for meat and dairy farmers are also strong. One consumer felt that in the UK this was perpetuated by the government because political campaigns promote *"eat British"* and *"support the local farmers."* Such campaigns strengthen industry support among consumers, causing the promotion of plant-based meat and plant-based dairy as sustainable alternatives to conflict with their ideology of the meat and dairy industry: "*… people have been brought up with farms, and they like to go and see the lambs in spring … And they don't want to see anything that's going to negatively impact our cultural heritage like that"* (consumer). This can make consumers wary of plant-based alternatives. One consumer who was particularly supportive of the dairy industry expressed dislike of plant-based replications of dairy products, saying *"if it ain't broke, why fix it, you know?"* Preference for meat and dairy inhibits growth of plant-based alternatives because it prevents manufacturer and retailer support. This is especially problematic for plant-based meat; when discussing the lower plant-based meat offerings in some food outlets compared to meat products, a retailer emphasised that plant-based meat "*… doesn't drive the same volume*."

The plant-based meat and plant-based dairy sectors are further threatened by the meat and dairy industries' size and power. While the lobbying actions of meat stakeholders were less discussed, attempts by the dairy industry to sabotage plant-based dairy was. The European dairy industry frequently lobby governments to restrict plant-based dairy activities, with one manufacturer describing the dairy industry as "*… absolutely relentless. Huge, vested interests. And they're big."* Lobbying efforts have included perpetuating stories that plant-based milk is ultra-processed and have successfully led to legislation restricting labelling of plant-based dairy in the European Union. This makes increasing sector support through advertising problematic: "*… it's not easy to put a name and to explain to our customers that actually these products are really similar to dairy by the taste, without saying that they [are]"* (manufacturer). While not all manufacturers felt these restrictions detrimentally affected sales (*"people are already calling it milk …. we're doing a pretty good job without even, without having the word 'milk' on it"*), the dairy industry's lobbying efforts has caused plant-based dairy manufacturers to retaliate, with two manufacturers discussing their antagonistic public campaigns to counteract actions and shift consumer support away from dairy. One campaign pushed back on the dairy industry's proposal of Amendment 171, which aimed to further restrict plant-based dairy labelling and packaging in Europe. One manufacturer was particularly concerned about the amendment's suggestion that plant-based milk should no longer be packaged in cartons or containers that look similar to those used for dairy milk. Describing the proposal as "*an insult to the average person",* they emphasised that *"we should be focusing our legislative efforts elsewhere*." This retaliative action was not supported by one manufacturer, whose *"… brand positioning states that we don't demonise dairy."* However, they did acknowledge the harm Amendment 171 could have had on plant-based dairy production if implemented: "*that would have caused a massive issue because all the factories are set-up to produce as they are … nobody's going to be able to overnight change to a new packaging format … you'd have, you know, 100 defunct factories … you would have put multiple businesses under, um, overnight."*

3.2.2. Negative consumer perception

Negative perceptions of plant-based meat and plant-based dairy prevent consumers purchasing products, with consumers believing that products taste poor and have bad texture. As illustrated with plant-based cheese, a consumer said, *"there's always a sort of underlying taste or sensation when eating them, it's just not quite right"* and described products as being *"more melted plastic than the, you know, cheese texture."* A retailer agreed that taste quality was still an issue, saying *"I think there are compromises on eating quality",* and these negative experiences can stop consumers trying new and improved products ("*picked up a couple of things [plant-based meat products], not been that nice, haven't rushed back to buy them"* (consumer)). Consumers also believed that products are expensive, describing plant-based meat as being *"twice as expensive as the meat alternative."* High product price is a concern for retailers, but prices are not likely to decrease while product development is occurring. As one retailer said "*fundamental research that is still going on, that is expensive",* while a plant-based meat manufacturer stated, "*this is not an established market, there is decades of development to go to get to nutritionally balanced, great texture, wonderful tasting products … they're expensive to consider, expensive to create … we're learning, it's not established."*

Plant-based meat and plant-based dairy are also perceived as being overprocessed and unhealthy. One consumer described plant-based meat as *"just another type of processed food"*, adding *"I'm not entirely convinced they're any good for you either."* These concerns were shared by manufacturers and retailers, with a retailer identifying consumers' perceptions around the health credential of products as among the biggest challenges to selling them. This is particularly problematic for advancing the taste and texture of plant-based cream and cheeses, which often have *"one natural ingredient and four or five additives"* (retailer). While consumers questioned the health credentials of plant-based meat and plant-based dairy (*"people slap plant-based on it and you think, "oh, that's healthy", it doesn't mean that at all really. You look at the ingredients, you don't even understand half of them")*, manufacturers and retailers believed that the public often perceive items as being healthier than they are, with a retailer stating "*I think the consumer continues to believe in the perception that these things are healthy"* while a plant-based meat manufacturer said *"if you look at the nutritional content of things, it probably isn't."* Improving products' health credentials is a key focus for retailers and manufacturer (except for plant-based milk, which respondents agreed was as nutritious as dairy). However, lack of benchmark on what constitutes a healthy product is inhibiting progress, with a plant-based meat manufacturer stating *"is the benchmark the meat … or is the benchmark me as a human? Is my weight the benchmark? Is my blood pressure the benchmark? … What is the objective measure of health?"*

3.2.3. High financial risk

As evidenced by the challenges outlined above, supporting these industries is financially risky for businesses. Industry expansion is reliant on consumer demand, yet demand is still being established, making industry growth uncertain. Manufacturers are particularly affected by unknown consumer demand, with those in the plant-based meat industry concerned that recent increases in demand is a short-term trend, while those producing plant-based dairy are worried about not getting a financial return on their investment: "*ultimately, if the category, the inherent category is going backwards, if there was a scare or if there was a, an issue within plant protein, then, of course, every brand operating in that space would suffer as a result"* (plant-based meat manufacturer). As these sectors are still being established, some manufacturers are investing more money in plant-based food products than other food categories, leaving them financially vulnerable if demand decreases. This is a bigger risk for plant-based meat, which is still developing but has experienced rapid technological advancements. As said by one retailer, "*there are products that we launched today that in six months' time we will do differently because new technology comes to bear … it is so nascent and fast-moving. It's not like a proper food industry, more like a tech company."*

The investment needed to continue growing these industries also poses a risk to manufacturers and retailers. For example, the limited number of UK factories which process plant-based foods increase costs and restricts sector innovation, with a plant-based meat retailer stating *"we do not have many established food manufacturers who are really ready to take the volume of a big retailer like us, which is inherently a challenge because then that limits your scope of innovation. It does limit the scope of selling products, because the costs are higher from small suppliers."* It also increases reliance on using factories abroad, "*we would love to produce our milks in the UK, but there simply isn't a factory that could even do what we require. It doesn't exist"* (plant-based dairy manufacturer). These issues make these sectors challenging for new brands to enter, resulting in larger companies spearheading the market while smaller brands struggle to stay in business: *"… our president in the US talks about, um, 20 new brands a month going into the US in meat alts, um, and vanishing really quickly because not many people are making money out [laughs] of it at the moment. They're all backed by private equity and investment funds, um, but burning through cash"* (plant-based meat manufacturer).

3.3. Changes needed

3.3.1. Greater industry investment

To increase growth, greater industry investment is needed. A significant challenge inhibiting growth which investment could address is the small number of European factories capable of producing plant-based meat and plant-based dairy. As expressed by one plant-based meat manufacturer, *"… there aren't enough manufacturing facilities available for making the vegetarian and the vegan products … you literally struggle to get enough space in those places to go because they're very busy."* Currently, meat and dairy factories are being adapted and used, but their limited number, restricted capacity and time needed for clean-downs make them inefficient at large scale production. Instead, plant-based factories are needed: *"… how can you make plant-based products in factories that make non-plant-based products? That's just kind of bizarre when you think about it … we need to have a whole new set of plant-based factories. Surely, isn't that the way to go?"* (plant-based meat manufacturer). Retailers were quick to place the responsibility of building factories on manufacturers, stating *"… we need some of the bigger food manufacturers to come to this party in a big way. They need to invest and make the production at scale."* Although manufacturers were keen to make this possible, one plant-based meat manufacturer acknowledged that *"… trying to get money for five new factories is quite tough."* Lack of investment in new factories was believed to be influenced by concerns that plant-based eating is a short-term trend; to address this, manufacturers and retailers stressed the importance of reassuring businesses that plant-based food consumption is a long-term lifestyle choice.

For the plant-based meat industry, financial investment is also needed to advance technological innovation. While technology has advanced rapidly in this sector, manufacturers and retailers acknowledged that improvements are still needed. This was particularly relevant to the processing of mycoprotein or different plant-based substrates (an area discussed as the next step in expanding plant-based meat), but which is currently restricted by limited technology: *"… the world is transitioning from kind of soy into pea. But actually, what about oat? What about fava bean? … Now, those are challenging questions. But they're the right questions to be asking and trying to find solutions to, in my view"* (retailer). While financial support is needed to make this happen, one manufacturer felt universities should train students on these technologies: *"… you would expect that the next generation that are coming through are much better informed than I am, um, about the substrates, about how you grow them, and how you do that more effectively than we've done."* Supporting students in advancing plant-based meat technology would help drive the industry forward.

For the plant-based dairy sector, governmental investment is needed, with consumers and manufacturers wanting European governments to promote plant-based diets and remove higher-rate Value-Added Tax on plant-based dairy to reduce costs. However, a bigger issue is the food subsidy system, with manufacturers and consumers believing that subsidies should support sustainable practices and not dairy. As one manufacturer said, *"we need to be the same price as dairy milk … we've got to shift the subsidies away from dairy."* Although not all stakeholders were knowledgeable on the subsidy system and able to comment, those who did believed that a fairer subsidy system would incentivise farming of the sustainable commodities used in plant-based dairy products, thus increase sector support. One consumer identified Brexit "*as an opportunity [in the UK] now to actually have a rethink about where all the money's going."* However, government support for reforming the subsidy system was perceived to be low: "*there is a huge culture of resistance in Westminster around all of this, because, you know, we've got a lot of rural MPs, and it's all about protecting the farmer … it's about protecting dairy and livestock farmers"* (plant-based dairy manufacturer). Despite this resistance, redirecting subsidies to sustainable food would support plant-based dairy growth by incentivising production, reducing costs and making product prices comparable to dairy.

3.3.2. Strengthen consumer support

Industry growth also requires improved efforts among stakeholders to increase sector support, particularly in relation to strengthening their consumer-base. To achieve this, the multitude of barriers described above needs addressing (i.e., greater industry investment, development of healthier and tastier products, and cleaner labels by using more recognisable ingredients among consumers). However, an area respondents felt could be improved was consumer education, with consumers, manufacturers and retailers believing that better education on plant-based diets would empower consumers to make better food choices and encourage plant-eating: *"… we need to do a better job of explaining those things, the benefits, the environmental impacts, the nutritional stuff. So, all those great stories that are around it. I don't think people know"* (plant-based meat manufacturer). Manufacturers and retailers believed that educational efforts should teach consumers how to cook plant-based products and emphasise the low environmental impacts of plant-based products. Consumers supported this, believing it would encourage them to consume plant-based meat and plant-based dairy: *"well obviously, I am interested in our environment, um, and if I could really be shown that, um, that what I consume is making a significant difference, that would influence me."* While there was agreement that the public needed to be better informed on products, consumers were unsure how this information should be conveyed, with many feeling that previous campaigns promoting environmental action were ineffective. Despite this uncertainty, future industry efforts should show compassion and not lecture people. As one consumer said *"… it's a really, really fine balance of not lecturing people but also making the situation clear, the pitfalls clear and how they are personally affecting them*", while another said *"… the way you're going to change people's minds is through compassion and understanding and trying to understand their point of view, rather than just trying to put your own agenda on them."*

4. Discussion

This study illustrates the range of factors that influence stakeholder support of plant-based meat and plant-based dairy, and demonstrates that sector growth is dependent on continued industry development. The factors identified have previously been poorly understood due to limited research on the plant-based meat and plant-based dairy industries, with research predominantly focusing on one stakeholder group in a single industry (Gravely and Fraser, 2018; Koch, 2020; Laila et al., 2021; Trewern et al., 2021); this is one of the first studies to examine the two industries in tandem and to take a multi-stakeholder approach to understand them. To help understand the implication of these findings further, we now draw explicitly on the multi-level perspective (MLP) as an analytical framework (Geels, 2019; Geels et al., 2023a).

The MLP suggests that sustainable transitions occur through the interplay of processes at the niche, regime and landscape levels (Geels, 2011; Geels et al., 2023a). Applying a multi-level perspective to these findings is useful because it examines influential factors affecting plant-based meat and plant-based dairy growth across different levels of the food system, providing a more holistic perspective on these sectors' status. The findings suggest that the two industries are still largely operating as niche sectors and are yet to fully emerge into the mainstream food sector. Niche industries are important drivers of system transitions because they instigate systemic change, yet growing niche innovations and affecting change to existing systems can be challenging, especially in respect to a global system as large and intricate as the food system (Geels, 2012). One way that niche industries can gain traction is when landscape changes occur which make these systems unstable, creating a window of opportunity for emerging innovations (Geels, 2019). This seems to be the case for the plant-based meat and plant-based dairy industries, whereby changing societal attitudes towards environmental sustainability and the increased adoption of plant-based eating in Western countries has created this opportune time for change in our food system. This has likely increased public and industry support for meat and dairy alternatives and is helping accelerate their transition from being niche products to mainstream food items.

However, there are still issues at the niche level inhibiting growth. Although support for plant-based meat and plant-based dairy is growing (Good Food Institute, 2025), these sectors are still partially operating at the experimental phase of development and are learning as they go; these are key traits of niche industries (Smith et al., 2010). A critical area in need of advancing is product development (Begho and Zhu, 2025). While improvements to taste and quality have significantly increased consumer support, they still need to reduce the processed nature of products and increase their health credentials. This is vital for overcoming consumers' negative perception of products. Increasing consumer demand is integral to sector growth (Koch, 2020; Tziva et al., 2020), with consumers being powerful stakeholders in the food industry who can influence what foods are manufactured and how they are produced (Franzo and Davis, 2021). However, product improvements rely on technological advancements, a costly part of innovation. To continue developing during the experimental stage, niche industries need a high level of resources and financial support. However, obtaining this is challenging, and unstable access to resources can restrict the plant-based meat and plant-based dairy's potential to strengthen and grow.

Alongside niche level challenges, changes at the regime level are slow and occur incrementally, making it difficult for these sectors to become dominant players in the food system. This is evident by how the meat and dairy industries dominate the food system in terms of production, consumption and stakeholder support (Good Food Institute, 2024; Trefis Team, 2022), and how the infrastructure for manufacturing products in Europe is not designed for plant-based alternatives. There is also a lack of plant-based manufacturers in general across the region (Schulp et al., 2024). The regime level constitutes the 'status quo', a dominant stable configuration which can result in failure for niche innovations (Smith et al., 2010). Nonetheless, it seems that the plant-based meat and plant-based dairy industries have successfully started to enter the mainstream food market because they are positioned as an 'add on' to the existing food system, rather than a competitive food category aiming to replace meat and dairy. This is demonstrated by retailers and food manufacturers simultaneously producing and selling plant-based meat and plant-based dairy alongside their meat and dairy counterparts. This positioning can help niche industries breakthrough into the current regime (Geels and Schot, 2007) and has likely given the plant-based meat and plant-based dairy industries the opportunity to gain traction in selective food market niches, increasing their customer-base and creating a stable income of resources which has helped them grow (Geels, 2019). However, this positioning inhibits the industries' ability to become dominant players in the food system, and their long-term success in helping sustainably transition the food system depends on them becoming repositioned as dominant players in the food market.

Cultural norms around meat and dairy consumption make it challenging for the plant-based meat and plant-based dairy industries to disrupt the current system and continue growing, and their ability to exist long-term is largely dependent on the redistribution of power away from meat and dairy. These changes can only occur at the regime level (Grin et al., 2010; Smith et al., 2010). Furthermore, some actors operating at the regime level perceive growth of these industries as a threat to the current working of the food system (including livestock farmers and policymakers invested in the meat and dairy sectors), and they create resistance for these industries. Collectively, this opposition protects the meat and dairy industries, while developing barriers for companies promoting plant-based alternatives (Grin et al., 2010). This is illustrated through livestock subsidies, which make meat and dairy cheaper than plant-based alternatives, and dairy labelling regulations to restrict labelling of plant-based dairy. While the present study shows plant-based meat and plant-based dairy manufacturers attempting to instigate change by adapting factories developed for meat and dairy production and revolting against policy proposals for tighter plant-based food regulations, disrupting a complex system of this magnitude at the regime level, which has existed for decades, is challenging (Geels, 2011). The food system is supported by multiple deep-set interrelated factors, including consumption behaviour, cultural meanings, business values, public policies, and technological progression (Köhler et al., 2019), making it difficult to promote change across the spectrum of influencing factors. It is not surprising that a key challenge of supporting plant-based meat and plant-based dairy is the risk that stakeholders experience.

Risk is an inevitable part of business (Sadgrove, 2016), yet supporting the plant-based meat and plant-based dairy industries seems particularly financially risky. Despite industry growth (Good Food Institute, 2025), stakeholder risk is heightened by these industries still experimenting with product development and refinement. This process is costly, and it is not surprising that retailers and manufacturers are investing more money in these industries than other food categories. This risk is increased by the challenges of growing these industries, with both sectors constrained by limited investment and capacity to grow. This was highlighted by suggestions that the plant-based meat industry operated like a tech company and needed financial support to innovate, as well as plant-based dairy experiencing restricted factory capacity. These barriers to growth create uncertainty for stakeholders, and while no business can predict the future when anticipating required resources (Bohan et al., 2024), uncertainty in these industries increases pressure to learn fast and base critical decisions on poorly supported estimates (Garvin and Levesque, 2006). Furthermore, supporting niche industries requires stakeholders to be innovative and test new ideas, adding to the financial threat that they face (Hellström, 2003), while potentially leading to issues not experienced in established markets, such as labelling legislation (Alcorta et al., 2021). All these risks are amplified by industry success being dependent on consumer growth, since these markets currently have a fraction of the customers of meat and dairy (Good Food Institute, 2023; Trefis Team, 2022). Understanding the risks, and the influence that consumer growth has on them, is vital to increase stakeholder support for these industries.

4.1. Study strengths and limitations

Our study possesses many strengths, including: i) examining the plant-based meat and plant-dairy industries in tandem to identify common factors influencing these sustainable food industries; ii) applying a multi-stakeholder perspective as a conceptual lens for understanding the factors influencing industry growth and the ways in which niche innovations interact with regime structures and landscape pressures in socio-technical transitions; and iii) implementing a qualitative approach to gain in-depth insights on the challenges experienced

by these industries and to identify changes needed to support sector growth, which is currently limited in the literature. These strengths have increased understanding of the factors influencing stakeholder support of plant-based meat and plant-based dairy and provides implications on how to continue growing these sustainable food industries.

However, there are several limitations worth noting. First, industries were examined in the Global North context, particularly Europe. Although this was intentional because plant-based meat and plant-based dairy is primarily growing in this region (Grand View Research, 2024, 2025), excluding stakeholder groups in the Global South is an ongoing issue in sustainable food transformation discussions (Davis et al., 2022). By not incorporating these perceptions, it weakens the ability to transfer study findings to stakeholders outside of the targeted region. Therefore, research incorporating stakeholders' views from the Global South is needed to develop a global picture of these industries. Second, most stakeholders were UK-based. Although the manufacturers interviewed worked across Europe and discussed the industries from this wider perspective, retailers and consumers discussed sectors from a UK context. Therefore, incorporating retailers' and consumers' viewpoints from other Western regions would have strengthened the applicability of findings to a Global North context. Third, the inclusion of additional stakeholder groups would have provided deeper insights. Some voices missing were farmers, who contribute significantly to the food system (Ricciardi et al., 2018), and healthcare professionals who advise on nutritional content of food, and would have shed further light on the themes explored in this study. While their exclusion does not detract from the findings, it does limit the generalisability to other stakeholder groups across the supply chain. Future research incorporating farmers' perspectives, alongside other missing stakeholder groups, is needed. Lastly, respondents representing manufacturers and retailers were mostly responsible for managing their company's sustainability work, meaning that information shared by respondents may not reflect wider industry practice, and perceptions from other stakeholders are missing, such as product developers, finance staff and marketing personnel. Since many respondents represented well-known companies, individuals may have framed their responses more positively and withheld information that they did not want the public or their competitors to know. Withholding information is not unusual during interviews, and although it does not undermine the information shared by respondents (Nunkoosing, 2005), it can affect the accuracy of research findings. Despite these limitations, this innovative study provides valuable insights on an underexplored area, shedding light on the systemic challenges faced by stakeholders involved in developing and supporting these niche industries.

5. Conclusion

The present study applied a multi-stakeholder perspective to examine factors influencing growth of the plant-based meat and plant-based dairy industries. Stakeholders are motivated to support these industries because of their desire to promote a sustainable food transition and the belief that products now better meet consumers' needs, yet they experience structural barriers hindering support and scaling up. This includes aggressive competition from the meat and dairy industries, consumers' negative perceptions of products, and the high perceived financial risk associated with supporting these emerging sectors. Overcoming these barriers is important for strengthening stakeholder support and subsequent industry growth, with two changes identified as being key to helping achieve this: greater industry investment and stronger consumer support. Transitioning sustainable food industries into the mainstream food market is a complex and challenging process (Geels et al., 2023b). The findings of this study illustrate this complexity well, demonstrating the numerous drivers and barriers of growing the plant-based meat and plant-based dairy industries, and illuminating the interconnectedness of these factors. By applying the multi-level perspective, it is evident that the plant-based meat and plant-based dairy industries are still operating as niche industries and that changes need to occur at the niche and regime levels. By bringing together insights from multiple stakeholders, we hope that this research will advance understanding of these industries and help stakeholders overcome significant challenges preventing sector growth. Ultimately, we hope this will help grow the plant-based meat and plant-based dairy industries and support their role in helping promote a sustainable transition in the food system by encouraging plant-based eating.

CRediT authorship contribution statement

Katie Major-Smith: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Gregory Borne:** Writing – review & editing, Supervision, Conceptualization. **Laura Wallis:** Writing – review & editing, Supervision, Conceptualization. **Debby Cotton:** Writing – review & editing, Supervision, Conceptualization.

Data statement

Due to the sensitive nature of the data, pseudonymised transcripts are available upon request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We thank the respondents who took the time to participate in this study and share interesting insights on the plant-based meat and plant-based dairy industries. KM-S gratefully acknowledges the support of the Marjon 180 PhD Studentship from Plymouth Marjon University.

Appendix A

Topic guide.

Tell me about your role at [organisation]? *[Non-consumers only]*

Tell me about your diet and how eating plant-based meat/plant-based dairy fits into it? *[Consumers only]*

- Prompt: Why did you start eating plant-based meat/plant-based dairy?
- Prompt: How often do you eat it?
- Prompt: If you don't eat it, why not?

What role do you feel that [organisation] plays in the plant-based meat/plant-based dairy industry? *[Non-consumers only]*

- Prompt: What caused [organisation] to start producing/selling plant-based meat/plant-based dairy?
- Prompt: Do you feel that [organisation] thinking around plant-based meat/plant-based dairy has changed in recent years? If so, how?
- Prompt: Can you briefly talk me through [organisation] commitments to plant-based meat/plant-based dairy?

Do you think that the demand for plant-based meat/plant-based dairy has changed in recent years?

- Prompt: What do you believe is causing that change?
- Prompt: How has this impacted [organisation]?

What motivates the [organisation/consumer]/or would motivate [consumer] to produce/sell/buy plant-based meat/plant-based dairy?

- Prompt: Why is this a key driver for your organisation?
- Prompt: Has this motivation changed over recent years? If so, how?
- Prompt: What about when purchasing a product? E.g., price, availability, labelling?
- Prompt: Do family/friends have any influence? Or social perceptions of plant-based meat/plant-based dairy and plant-based diets?

What are the key challenges [organisation/consumer] faces producing/selling/buying plant-based meat/plant-based dairy?

- Prompt: How do they affect you producing/selling/buying plant-based meat/plant-based dairy?
- Prompt: Is [organisation] trying to overcome them? If so, how?
- Prompt: Do you think other stakeholders in the industry face the same challenges?
- Prompt: What can be done to overcome these challenges?

What key changes do you feel need to happen in the plant-based meat/plant-based dairy industry to increase the production and consumption of plant-based meat/plant-based dairy?

- Prompt: Why do you think this?
- Prompt: Do you feel these changes can be made? Do you think they will?
- Prompt: Who is responsible for making these changes?

Do you think there are any key changes that need to be made in the retailer/manufacturer/consumer sector to increase the production and consumption of plant-based meat/plant-based dairy? If so, what changes?

- Prompt: Why do you think this?
- Prompt: Do you think these changes will be made?
- Prompt: Is [organisation] working on making these changes?

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clfs.2026.100021.

Data availability

Data will be made available on request.

References

Alcorta, A., Porta, A., Tárrega, A., Alvarez, M.D., Vaquero, M.P., 2021. Foods for plant-based diets: challenges and innovations. Foods 10 (2), 293. https://doi.org/10.3390/foods10020293.

Aleksandrowicz, L., Green, R., Joy, E.J.M., Smith, P., Haines, A., 2016. The impacts of dietary change on greenhouse gas emissions, land use, water use, and health: a systematic review. PLoS One 11 (11), e0165797. https://doi.org/10.1371/journal.pone.0165797.

Archibald, M.M., Ambagtsheer, R.C., Casey, M.G., Lawless, M., 2019. Using zoom videoconferencing for qualitative data collection: perceptions and experiences of researchers and rarticipants. Int. J. Qual. Methods 18, 1–8. https://doi.org/10.1177/1609406919874596.

Barona, E., Ramankutty, N., Hyman, G., Coomes, O.T., 2010. The role of pasture and soybean in deforestation of the Brazilian Amazon. Environ. Res. Lett. 5 (2), 024002. https://doi.org/10.1088/1748-9326/5/2/024002.

Begho, T., Zhu, Y., 2025. Where are we now with meat alternatives? Global insights and strategic lessons for UK's net-zero goals through agri-food system transition. Cleaner Food Systems 1, 100001. https://doi.org/10.1016/j.clfs.2025.100001.

Bocken, N., Morales, L.S., Lehner, M., 2020. Sufficiency business strategies in the food industry—The case of Oatly. Sustainability 12 (3), 824. https://doi.org/10.3390/su12030824.

Bohan, S., Tippmann, E., Levie, J., Igoe, J., Bowers, B., 2024. What is scaling? J. Bus. Ventur. 39 (1), 106355. https://doi.org/10.1016/j.jbusvent.2023.106355.

Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qual. Res. Psychol. 3 (2), 77–101. https://doi.org/10.1191/1478088706qp063oa.

Braun, V., Clarke, V., 2022. Thematic Analysis. A Practical Guide. Sage Publications.

Carlsson-Kanyama, A., Hedin, B., Katzeff, C., 2021. Differences in environmental impact between plant-based alternatives to dairy and dairy products: a systematic literature review. Sustainability 13 (22). https://doi.org/10.3390/su132212599, 12599.

Choudhury, D., Singh, S., Seah, J.S.H., Yeo, D.C.L., Tan, L.P., 2020. Commercialization of plant-based meat alternatives. Trends Plant Sci. 25 (11), 1055–1058. https://doi.org/10.1016/j.tplants.2020.08.006.

Davis, B., Lipper, L., Winters, P., 2022. Do not transform food systems on the backs of the rural poor. Food Secur. 14 (3), 729–740. https://doi.org/10.1007/s12571-021-01214-3.

FAIRR, 2021. Appetite for disruption. The last serving. https://www.fairr.org/resources/reports/appetite-for-disruption-the-last-serving.

FAO, 2025. Gateway to dairy production and products. Food and Agriculture Organization of the United Nations. https://www.fao.org/dairy-production-products/production/en.

FAO, UNDP, UNEP, 2021. A multi-billion-dollar Opportunity. Repurposing Agricultural Support to Transform Food Systems. FAO, Rome. UNDP, UNEP. http://www.fao.org/3/cb6562en/cb6562en.pdf.

Franzo, J., Davis, C., 2021. Global Food Systems, Diets, and Nutrition: Linking Science, Economics, and Policy. Palgrave Macmillan.

Gambert, I., 2019. Got mylk? the disruptive possibilities of plant milk. Brooklyn Law Rev. 84 (3). https://brooklynworks.brooklaw.edu/blr/vol84/iss3/3.

Garvin, D.A., Levesque, L.C., 2006. Meeting the challenge of corporate entrepreneurship. Harv. Bus. Rev. 84 (10), 102–112.

Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Research Policy, 31 (8–9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8.

Geels, F.W., 2011. The multi-level perspective on sustainability transitions: responses to seven criticisms. Environ. Innov. Soc. Transit. 1 (1), 24–40. https://doi.org/10.1016/j.eist.2011.02.002.

Geels, F.W., 2012. A socio-technical analysis of low-carbon transitions: introducing the multi-level perspective into transport studies. Journal of Transport Geography, Special Section on Theoretical Perspectives on Climate Change Mitigation in Transport 24, 471–482. https://doi.org/10.1016/j.jtrangeo.2012.01.021.

Geels, F.W., 2019. Socio-technical transitions to sustainability: a review of criticisms and elaborations of the Multi-Level Perspective. Curr. Opin. Environ. Sustain. 39, 187–201. https://doi.org/10.1016/j.cosust.2019.06.009. Open Issue 2019.

Geels, F.W., Kern, F., Clark, W.C., 2023a. Sustainability transitions in consumption-production systems. PNAS 120 (47), e2310070120. https://doi.org/10.1073/pnas.2310070120.

Geels, F.W., Kern, F., Clark, W.C., 2023b. System transitions research and sustainable development: challenges, progress, and prospects. Proc. Natl. Acad. Sci. USA 120 (47), e2206230120. https://doi.org/10.1073/pnas.2206230120.

Geels, F.W., Schot, J., 2007. Typology of sociotechnical transition pathways. Res. Pol. 36 (3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003.

Good Food Institute, 2022. 2021 State of the Industry Report. Plant-based Meat, Seafood, Eggs, and Dairy. Good Food Institute. https://gfi.org/wp-content/uploads/2022/04/2021-Plant-Based-State-of-the-Industry-Report-1.pdf.

Good Food Institute, 2023. Europe Plant-based Food Retail Market Insights 2020-2022. https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Europe-retail-market-insights_updated-1.pdf.

Good Food Institute, 2024. 2023 State of the Industry Report: Plant-Based Meat, Seafood, Eggs, and Dairy. Good Food Institute.

Good Food Institute, 2025. 2024 State of the Industry: Plant-Based Meat, Seafood, Eggs, Dairy, and Ingredients. Good Food Institute. https://gfi.org/resource/plant-based-meat-eggs-and-dairy-state-of-the-industry/.

Grand View Research, 2024. Plant-based meat market size, share & growth report, 2030. https://www.grandviewresearch.com/industry-analysis/plant-based-meat-market.

Grand View Research, 2025. Dairy alternatives market size, share, industry report, 2030. https://www.grandviewresearch.com/industry-analysis/dairy-alternatives-market.

Gravely, E., Fraser, E., 2018. Transitions on the shopping floor: investigating the role of Canadian supermarkets in alternative protein consumption. Appetite 130, 146–156. https://doi.org/10.1016/j.appet.2018.08.018.

Grin, J., Rotmans, J., Schot, J., 2010. Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change. Routledge.

Hargreaves, S.M., Rosenfeld, D.L., Moreira, A.V.B., Zandonadi, R.P., 2023. Plant-based and vegetarian diets: an overview and definition of these dietary patterns. Eur. J. Nutr. 62 (3), 1109–1121. https://doi.org/10.1007/s00394-023-03086-z.

He, J., Evans, N.M., Liu, H., Shao, S., 2020. A review of research on plant-based meat alternatives: driving forces, history, manufacturing, and consumer attitudes. Compr. Rev. Food Sci. Food Saf. 19 (5), 2639–2656. https://doi.org/10.1111/1541-4337.12610.

Hellström, T., 2003. Systemic innovation and risk: technology assessment and the challenge of responsible innovation. Technol. Soc. 25 (3), 369–384. https://doi.org/10.1016/S0160-791X(03)00041-1.

Henry, R.C., Alexander, P., Rabin, S., Anthoni, P., Rounsevell, M.D.A., Arneth, A., 2019. The role of global dietary transitions for safeguarding biodiversity. Glob. Environ. Change 58, 101956. https://doi.org/10.1016/j.gloenvcha.2019.101956.

Kim, B.F., Santo, R.E., Scatterday, A.P., Fry, J.P., Synk, C.M., Cebron, S.R., Mekonnen, M. M., Hoekstra, A.Y., de Pee, S., Bloem, M.W., Neff, R.A., Nachman, K.E., 2020. Country-specific dietary shifts to mitigate climate and water crises. Glob. Environ. Change 62, 101926. https://doi.org/10.1016/j.gloenvcha.2019.05.010.

Koch, C.H., 2020. Brands as activists: the Oatly case. J. Brand Manag. 27 (5), 593–606. https://doi.org/10.1057/s41262-020-00199-2.

Köhler, J., Geels, F.W., Kern, F., Markard, J., Onsongo, E., Wieczorek, A., Alkemade, F., Avelino, F., Bergek, A., Boons, F., Fünfschilling, L., Hess, D., Holtz, G., Hyysalo, S., Jenkins, K., Kivimaa, P., Martiskainen, M., McMeekin, A., Mühlemeier, M.S., et al.,

2019. An agenda for sustainability transitions research: state of the art and future directions. Environ. Innov. Soc. Transit. 31, 1–32. https://doi.org/10.1016/j.eist.2019.01.004.
Krampe, C., Fridman, A., 2022. Oatly, a serious 'problem' for the dairy industry? A case study 25 (1), 157–172. https://doi.org/10.22434/IFAMR2021.0058.
Kustar, A., Patino-Echeverri, D., 2021. A review of environmental life cycle assessments of diets: plant-based solutions are truly sustainable, even in the form of fast foods. Sustainability 13 (17). https://doi.org/10.3390/su13179926, 9926.
Lachman, D.A., 2013. A survey and review of approaches to study transitions. Energy Policy 58, 269–276. https://doi.org/10.1016/j.enpol.2013.03.013.
Laila, A., Topakas, N., Farr, E., Haines, J., Ma, D.W.L., Newton, G., Buchholz, A.C., 2021. Barriers and facilitators of household provision of dairy and plant-based dairy alternatives in families with preschool-age children. Public Health Nutr. 24 (17), 5673–5685. https://doi.org/10.1017/S136898002100080X.
Loken, B., DeClerck, F., 2020. Diets for a better future: rebooting and reimagining healthy and sustainable food systems in the G20. https://eatforum.org/content/uploads/2020/07/Diets-for-a-Better-Future_G20_National-Dietary-Guidelines.pdf.
Malterud, K., Siersma, V.D., Guassora, A.D., 2016. Sample size in qualitative interview studies: guided by information power. Qual. Health Res. 26 (13), 1753–1760. https://doi.org/10.1177/1049732315617444.
Markard, J., Raven, R., Truffer, B., 2012. Sustainability transitions: an emerging field of research and its prospects. Research Policy 41 (6), 955–967. https://doi.org/10.1016/j.respol.2012.02.013.
Messina, M., Duncan, A.M., Glenn, A.J., Mariotti, F., 2023. Perspective: Plant-based meat alternatives can help facilitate and maintain a lower animal to plant protein intake ratio. Adv. Nutr. 14 (3), 392–405. https://doi.org/10.1016/j.advnut.2023.03.003.
Michalk, D.L., Kemp, D.R., Badgery, W.B., Wu, J., Zhang, Y., Thomassin, P.J., 2019. Sustainability and future food security—A global perspective for livestock production. Land Degrad. Dev. 30 (5), 561–573. https://doi.org/10.1002/ldr.3217.
Mylan, J., Morris, C., Beech, E., Geels, F.W., 2019. Rage against the regime: Niche-regime interactions in the societal embedding of plant-based milk. Environ. Innov. Soc. Transit. 31, 233–247. https://doi.org/10.1016/j.eist.2018.11.001.
Nunkoosing, K., 2005. The problems with interviews. Qual. Health Res. 15 (5), 698–706. https://doi.org/10.1177/1049732304273903.
OECD, FAO, 2024. OECD-FAO agricultural outlook 2023-2032. https://www.oecd.org/en/publications/oecd-fao-agricultural-outlook-2023-2032_08801ab7-en.html.
Poore, J., Nemecek, T., 2018. Reducing food's environmental impacts through producers and consumers. Science 360 (6392), 987–992. https://doi.org/10.1126/science.aaq0216.
Reed, M.S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C.H., Stringer, L.C., 2009. Who's in and why? A typology of stakeholder analysis methods for natural resource management. J. Environ. Manag. 90 (5), 1933–1949. https://doi.org/10.1016/j.jenvman.2009.01.001.
Ricciardi, V., Ramankutty, N., Mehrabi, Z., Jarvis, L., Chookolingo, B., 2018. How much of the world's food do smallholders produce? Global Food Secur. 17, 64–72. https://doi.org/10.1016/j.gfs.2018.05.002.
Ritchie, H., Rosado, P., Roser, M., 2023. Meat and dairy production. Our World in Data. https://ourworldindata.org/meat-production.
Ritchie, H., Roser, M., 2024. Half of the world's habitable land is used for agriculture. Our World in Data. https://ourworldindata.org/global-land-for-agriculture.
Saari, U.A., Herstatt, C., Tiwari, R., Dedehayir, O., Mäkinen, S.J., 2021. The vegan trend and the microfoundations of institutional change: a commentary on food producers' sustainable innovation journeys in Europe. Trends Food Sci. Technol. 107, 161–167. https://doi.org/10.1016/j.tifs.2020.10.003.
Sadgrove, K., 2016. The Complete Guide to Business Risk Management. Routledge.
Santo, R.E., Kim, B.F., Goldman, S.E., Dutkiewicz, J., Biehl, E.M.B., Bloem, M.W., Neff, R. A., Nachman, K.E., 2020. Considering plant-based meat substitutes and cell-based meats: a public health and food systems perspective. Front. Sustain. Food Syst. 4. https://doi.org/10.3389/fsufs.2020.00134.
Scarborough, P., Appleby, P.N., Mizdrak, A., Briggs, A.D.M., Travis, R.C., Bradbury, K.E., Key, T.J., 2014. Dietary greenhouse gas emissions of meat-eaters, fish-eaters, vegetarians and vegans in the UK. Clim. Change 125 (2), 179–192. https://doi.org/10.1007/s10584-014-1169-1.
Scarborough, P., Clark, M., Cobiac, L., Papier, K., Knuppel, A., Lynch, J., Harrington, R., Key, T., Springmann, M., 2023. Vegans, vegetarians, fish-eaters and meat-eaters in the UK show discrepant environmental impacts. Nat. Food 4 (7), 565–574. https://doi.org/10.1038/s43016-023-00795-w.
Schulp, C.J.E., Ulug, C., Elise Stratton, A., Williams, T.G., Verburg, P.H., 2024. Linking production, processing, and consumption of plant-based protein alternatives in Europe. Glob. Environ. Change 89, 102940. https://doi.org/10.1016/j.gloenvcha.2024.102940.
Smetana, S., Profeta, A., Voigt, R., Kircher, C., Heinz, V., 2021. Meat substitution in burgers: nutritional scoring, sensorial testing, and Life Cycle Assessment. Future Foods 4, 100042. https://doi.org/10.1016/j.fufo.2021.100042.
Smith, A., Voß, J.-P., Grin, J., 2010. Innovation studies and sustainability transitions: the allure of the multi-level perspective and its challenges. Research Policy, Special Section on Innovation and Sustainability Transitions 39 (4), 435–448. https://doi.org/10.1016/j.respol.2010.01.023.
Tilman, D., Clark, M., Williams, D.R., Kimmel, K., Polasky, S., Packer, C., 2017. Future threats to biodiversity and pathways to their prevention. Nature 546 (7656), 73–81. https://doi.org/10.1038/nature22900.
Trefis Team, 2022. Why mock meat stocks are outperforming this year. Forbes. https://www.forbes.com/sites/greatspeculations/2022/02/17/why-mock-meat-stocks-are-outperforming-this-year/?sh=59cbef4936e0.
Trewern, J., Chenoweth, J., Christie, I., Keller, E., Halevy, S., 2021. Are UK retailers well placed to deliver 'less and better' meat and dairy to consumers? Sustain. Prod. Consum. 28, 154–163. https://doi.org/10.1016/j.spc.2021.03.037.
Tubiello, F.N., Rosenzweig, C., Conchedda, G., Karl, K., Gütschow, J., Xueyao, P., Obli-Laryea, G., Wanner, N., Qiu, S.Y., Barros, J.D., Flammini, A., Mencos-Contreras, E., Souza, L., Quadrelli, R., Heiðarsdóttir, H.H., Benoit, P., Hayek, M., Sandalow, D., 2021. Greenhouse gas emissions from food systems: building the evidence base. Environ. Res. Lett. 16 (6), 065007. https://doi.org/10.1088/1748-9326/ac018e.
Twine, R., 2021. Emissions from animal Agriculture—16.5% is the new minimum figure. Sustainability 13 (11). https://doi.org/10.3390/su13116276, 6276.
Tziva, M., Negro, S.O., Kalfagianni, A., Hekkert, M.P., 2020. Understanding the protein transition: the rise of plant-based meat substitutes. Environ. Innov. Soc. Transit. 35, 217–231. https://doi.org/10.1016/j.eist.2019.09.004.
UNFCCC, 2016. The Paris agreement. https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf.
Van Mierlo, K., Rohmer, S., Gerdessen, J.C., 2017. A model for composing meat replacers: Reducing the environmental impact of our food consumption pattern while retaining its nutritional value. J. Clean. Prod. 165, 930–950. https://doi.org/10.1016/j.jclepro.2017.07.098.
Walker, G., King, D., 2008. The Hot Topic: How to Tackle Global Warming and Still Keep the Lights on. Bloomsbury Publishing.