Navigating Food Transition: European Policy Tools for Novel Foods and the Italian Debate on Cultured Meat

Paper first received: 23 April 2024; Accepted: 31 August 2024; Published in final form: 21 June 2025
https://doi.org/10.48416/qyznch63

Rita SALVATORE,[I] Simone BUSETTI,[I] Emilio CHIODO,[I] Maria Angela PERITO[I]

Abstract

The global food system—encompassing production, consumption, and disposal—has been widely recognized as unsustainable, contributing significantly to environmental degradation and social disparities. In response to these challenges, the transition toward more equitable food systems has become imperative. Despite the widely acknowledged need to change Western eating habits, the transition toward more sustainable diets appears as a "false wicked problem" being characterized by intricate trade-offs between economic, ethical, societal, and environmental issues. This paper examines the crucial role of policy interventions in steering the shift and in considering the role that the emergence of novel foods and alternative proteins – such as cultured meat – might play within it. By employing a qualitative methodology, the study maps the policies governing novel foods in Europe, with a specific emphasis on the three tools of regulations, informational campaigns, and incentives. This paper gives particular attention to the cultured meat debate in Italy as a case study for approaching not only the multifaceted nature of food—an interplay of cultural values, economic interests, and political decision-making—but also the staunch resistance that such transition is likely to encounter. The main highlights underscore the need for a comprehensive and balanced approach to integrate regulatory measures, consumer education, and inclusive stakeholder engagement while stressing the importance of evidence-based choices, transparent communication, and the recognition of the socio-cultural dimensions in shaping food policies.

[I] University of Teramo, Italy

Corresponding author: Emilio Chiodo, echiodo@unite.it

Biographical notes

Rita Salvatore is Researcher in Sociology of Environment and territory at the University of Teramo and an Adjunct faculty at the American University of Rome. Her works have been published in leading international scientific journals such as the *Annals of Tourism Research*, *Quality and Quantity* and the *Journal of Rural Studies*. She is the President of Slow Food Abruzzo

Simone Busetti is Associate Professor of Public policy analysis at the University of Teramo. His works have been published in leading journals such as *Policy Sciences, Evaluation, Policy & Politics* and *Public Policy & Administration*. He is the author of *Governing Metropolitan Transport* (Springer, 2015) and *Food Loss and Waste Policy* (edited with Noemi Pace, 2022).

Emilio Chiodo is Associate Professor in Agricultural Economics at the University of Teramo. His works have been published in leading journals such as the *Annals of Tourism Research, Quality and Quantity*, the *Journal of Food Products Marketing* and the *Journal of Environmental Management*. He is the Rector Delegate in the Italian University Network for Sustainable Development.

Maria Angela Perito is an Associate Professor of Agri-food Economics at the University of Teramo. Her research, published in leading international journals, focuses on the agri-food sector, agri-food policies, and consumer preferences in food. In 2019, she served as the head of staff for the Undersecretary of the Italian Ministry of Agricultural Policies.

ACKNOWLEDGEMENTS

This article has been published within the project funded by the European Union – NextGenerationEU, Mission 4, Component 1, under the Italian Ministry of University and Research (MUR) National Innovation Ecosystem grant ECS00000041 – VITALITY – CUP: C43C22000380007.

Introduction

Our global food system—all the activities from production to consumption and disposal of food—is widely recognized to be unsustainable, inequitable and responsible for negative environmental and social impacts (Aiking, 2019; Oliver et al., 2018). The constantly growing demand for food over the past seventy years – and the associated intensification of processes of agricultural production – have had significant repercussions on the integrity and regeneration of environmental resources (Sage, 2022), particularly in relation to meat and dairy production. Since the 1960s, global meat production and consumption have steadily risen by a factor of four, with 360 million tonnes now consumed annually (Roser, 2023). In its reports, the Intergovernmental Panel on Climate Change has recently highlighted that current use of the land for food production, and the related industrialized food systems, contribute significantly to environmental degradation and climate change (IPCC, 2022; Mirzabaev et al., 2023).

In recent years, scientific literature has pointed out how the environmental impact also extends to issues such as water pollution, deforestation and biodiversity loss (Benton et al. 2021) caused by the extensive use of land for livestock and feed production. Livestock raising for meat and dairy cover an estimated half of the world's habitable land; were we to shift towards plant-based diets, our overall agricultural land use would decrease significantly, shrinking from 4.1 billion hectares to just 1 billion hectares – a 75% reduction in land use (Poore and Nemecek, 2018; Ritchie, 2021).

Transitioning toward more sustainable and equitable food systems is essential for addressing these interconnected environmental and social challenges, and a reduction in meat consumption in most western countries is widely recognized by scientists as a way to mitigate climate change (IPCC, 2022). This shift would not only reduce the environmental footprint but also address nutritional and ethical concerns (Springmann et al., 2018) while promoting more sustainable diets (Watts et al., 2021; Willett et al. 2019). Such a transition entails a complex array of changes across the entire food chain, through the agency of governmental and scientific institutions, as well as the private sector. How to effect more sustainable food systems (Spaargaren et al. 2012), therefore, is a complex and multi-faceted debate. Mazac et al. (2022) assert that replacing animal proteins with novel or plant-based foods in European diets would reduce the environmental impact from agriculture by over 80%. If we acknowledge the need to change our eating habits, the question becomes: What should we transition towards? As we reduce our meat consumption, how might we replace it to ensure balanced nutrition?

Environmental, social, and nutritional challenges require us to adapt. Novel foods, technologically advanced alternative proteins and, recently, cultured meat (Rubio et al. 2020) are directly in line with necessary—yet complicated and interconnected—changes. Mazac et al. (2022) assert that by replacing animal proteins with novel or plant-based foods in European diets would reduce environmental impact from agriculture by over 80%.

These new food developments then reflect the need to find more sustainable and ethical solutions in response to environmental, social, and nutritional challenges. These solutions though, are part of important changes that are supposed to happen throughout the global food systems at different levels. In order to analyze the crucial role of policy-making in such a transition, this paper will analyze relevant policy tools (as described in the methodology section).

Food transition as a "false wicked problem"

The introduction of new food technologies and novel foods (Monteiro et al. 2019; Sadler et al. 2021) able to address the need for more sustainable diets would be a crucial evolution of our food systems (European Environment Agency, 2022). Yet, effecting such change poses challenges – as environmental issues, global

consumption demands, human health, economic implications, social as well as cultural factors, and ethical concerns all must be taken into account (Béné and Lundy, 2023).

On one hand, there are those advocating for a "win-all narrative", viewing the shift towards novel foods as a "total fix" (Béné and Lundy, 2023; Guthman and Biltekoff, 2021; Jönsson, 2016; Post 2020). This group includes not only biotechnology researchers, but also vegan consumers and large companies producing technologically processed alternative proteins, which see these innovations as a way to control and monitor environmental impact through technological efficiency (Sexton and Goodman, 2022). Various stakeholders, including institutions, international organizations, and the scientific community, have consistently promoted the adoption of alternative proteins (Béné and Lundy, 2023). These encompass a diverse array of options, ranging from the introduction of novel foods like insects and algae to innovative processing methods for already common proteins, such as plant-based meat alternatives (Lähteenmäki-Uutela et al., 2021). Global alternative meat as well as dairy alternatives are steadily increasing – and are expected to reach a value of $162 billion US dollars by 2030, up from $29.4 billion US dollars in 2020 (FAO, 2022, p.34). According to the Good Food Institute (2023), a total of 156 companies are already developing cultured meat, with an investment of 2.8 billion dollars and 679 unique investors in total. Against this backdrop and within the broader context of European policies towards novel food introduction, cultured meat has also gained attention as a promising solution for meeting the demands of a growing global population while reducing animal suffering and alleviating pressure on planetary resources (Böhm et al., 2018).

On the other hand, the predominantly positive narrative around the multiple benefits of alternative proteins (APs) has encountered significant resistance from 'no-change' proponents, particularly the pro-livestock camp, which includes enthusiastic meat consumers, small and medium-sized breeders, as well as large meat-producing corporations. As clearly highlighted by the Italian case, these groups advocate for preserving traditional livestock production and the conventional meat industry. This opposition is based on concerns that the widespread adoption of alternative proteins and cultured meat would necessitate a major technological overhaul and could trigger substantial economic and social transformations, disrupt the entire meat industry (Treich, 2021), and ultimately distance people even more from the idea of food as coming from nature. Despite the potential for technological innovations to partially solve the environmental and ethical issues of intensive meat production (Hartmann and Siegrist, 2020), such as water usage, pollution, greenhouse gas emissions, land use, animal welfare, and slaughter—and also to mitigate safety concerns like the risk of infectious diseases, pathogen contamination, and antibiotic resistance, challenges still remain. Environmental issues may persist due to high energy demands in large-scale production. Additionally, economic issues include high production costs, industry consolidation, and negative impacts on rural communities and farmers' livelihoods within the food system's value chain (Reigada and De Castro, 2022; Sexton and Goodman, 2022).

As a matter of fact, the biggest world players within the meat processing industry (Cargill, Tyson Foods, PHW Group, Nestlé), along with major food retailers (i.e. Tesco) and Fast food restaurants (i.e. McDonalds', KFC) are either making investments in alternative proteins – including cultured meat –or joint venturing with other specialized big companies such as Beyond Meat and Impossible Foods (Béné and Lundy, 2023; Sexton and Goodman, 2022). Consequently, Sexton and Goodman (2022) assert that "the self-proclaimed fixers are the real ones who significantly contributed to the current social and environmental conditions of food systems". As the polarization surrounding the transition of food systems intensifies, it becomes clear that the binary nature of the discourse may exacerbate the problems it seeks to solve, often by oversimplifying nuanced trade-offs. The antagonism inherent in these debates is not surprising, as the concept of transition itself embodies complex and multifaceted issues. These trade-offs are particularly pronounced when considering the intricate web of social, political, and economic factors that influence food systems transformations. Yet, the situation is not black-and-white; there is significant grey area in which the interests of both camps overlap. In this paper, we aim to delve deeper into the transition process, exploring how changes in food systems can be better managed through targeted policy interventions. By integrating political science with a sociological

lens, a comprehensive perspective on social transition is given focusing on the role of policymaking in steering it. The study employs a qualitative methodology aimed at mapping the policies that govern novel foods in the European context, given the official definition of novel food as "any food that was not used for human consumption to a significant degree within the Union before 15 May 1997, irrespective of the dates of accession of Member States to the Union and that falls under at least one of the categories" mentioned by the art. 3 of the Regulation (EU) 2015/2283. In particular, the research focuses on key policy tools—regulatory tools, informational campaigns, and incentives—to capture the state-of-the-art in the relationship between novel foods, broader food transitions and sustainability.

Given its paradigmatic significance in the field of food transition, a specific focus on the debate surrounding cultured meat has been added for several compelling reasons:

- When compared to traditional meat, cultured meat is one of the most contentious inventions in the food industry because of its uncertain nature – can it even be considered "meat" if it does not originate directly from a slaughtering process, and will it prove to be a panacea to the environmental and ethical challenges posed by excessive consumption of animal proteins?
- It represents the intersection of diverse economic, cultural, and political interests, making it a focal point for broader discussions around food innovation and technology.
- It has raised widespread concerns among a heterogeneous group of stakeholders, including traditional farmers, breeders, farmers' associations, environmentalists, and agroecologists in relation to political economy, environmental and social justice (Dal Gobbo and Bertuzzi, 2024).

Furthermore, the choice to analyze the Italian case has been driven by the intense political debate that unfolded throughout 2023. Largely due to ideological positions, the introduction of cultured meat was banned in Italy while still merely a concept. This highlights the importance of food systems in social transition issues. By placing this specific case within a wider European framework, the analysis provides a more comprehensive understanding of how various policies are interacting within the rapidly evolving domain of novel foods, offering valuable insights into the trajectory of food system transitions.

It is becoming increasingly evident that contemporary eating habits and the industrial methods of food production are no longer seen merely as economic or technological issues. They have emerged as critical social issues that demand necessarily coordinated actions. The challenge lies not only in managing the transition in a way that ensures food safety but also in crafting policies that can mediate the conflicts among various stakeholders—scientists, producers, consumers, and institutions (Morais-da-Silva et al., 2022). Moreover, these policies could guide conscientious consumers towards choices that are safe in terms of mitigating risks and more aligned with both their personal values and nutrition concerns (Dupont and Fiebelkorn, 2020; Lupton and Turner, 2018; Shaw and Mac Con Iomaire, 2019; Tucker, 2018).

As some literature on transition has consistently highlighted (Kemp et al., 2007; Rotmans et al., 2001), although the ultimate objectives of a transition are often shaped by conglomerates of governments, institutions and organizations (macro level), public policies can have a unique role in assisting societal changes in relation to interests, rules and beliefs. Thus, they operate on a *meso level* since they can guide changes in both private and institutional actions. This "intermediation", however, is not without its challenges (Rotmans et al., 2001). While public policies can be instrumental in fostering gradual and systematic change, they also possess the power to impede progress, as seen in the case of Italian regulatory approach to cultured meat.

Methodological notes

By adopting the framework of food transition, a comprehensive map of policies related to novel foods in general and cultured meat in particular has been outlined to offer an in-depth assessment of the current related European landscape. This approach has provided a structured reference for understanding how

different European countries are addressing the challenges of transitioning their food systems towards more sustainable practices. Through the lens of food transition, the analysis identifies some key policy tools, regulatory measures, and strategic initiatives in place across the continent, offering insights into the effectiveness and gaps in the current efforts. Ultimately, this mapping exercise aims to highlight the state-of-the-art policies and practices that are shaping the future of food systems in Europe, while also emphasizing areas where further innovation and policy intervention may be needed to achieve long-term sustainability goals.

Although there are many ways to approach the analysis of policy making, an instrument-based approach (Capano and Howlett, 2020) can be very useful to better understand the policy dynamics, and to reveal where policymakers need to take action in order to achieve their goals in transforming the global food system (Capano et al., 2020; Hood, 1983). Accordingly, this section explains and provides a definition of the categories that have guided this explorative research, i.e. the extraction of policy tools, and their subsequent classification. The map has been outlined looking at the following typology of policy tools:
Regulatory tools: namely, regulations, laws and standards meant as the primary tools for the formulation, implementation and subsequent monitoring of the respective policies (Neuwirth, 2014: 15). Regulatory tools concern governments' coercive power, and how it is used to influence and direct the behaviour of receivers, in accordance with what is ordered in such rules and directives (Bemelmans-Videc et al., 2011). Drawing from the literature, we broadly define regulations as the application of public authority to foster the "public interest" (Eisner et al., 2020).

Information tools: there are different ways in which governments (or other actors in the policy field) use data, facts and information to support the behaviour of policy targets. Referring to the meso level of any transition, this has to do with the so-called nodality, i.e. the property of being in the middle of a social network, which provides governments with a range of information for a panoramic overview (Hood, 1983). Policymakers may give out information directly or require others to disseminate certain types of communication. For the purpose of this paper, we consider these tools as means for governments to leverage available knowledge and data to guide both consumers' and producers' behaviour in a way that aligns with wider goals and objectives (Howlett, 2009).

Incentives and economic measures: generally referred to as "carrots" or "treasure", this category of tools includes measures aimed at incentivising a specific trend of actions or behaviour of the policy targets, which is deemed necessary to fulfil the policy goals. Economic measures can take the form of rewards and benefits, including grants, tax exemptions, and facilitative measures (Bemelmans-Videc et al., 2011). Consistent with the literature, we describe incentives in the sector as instruments to try to influence the world outside and then to set 'money-moving' in a wider context (Hood, 1983).

The above-mentioned tools were identified through desk research, including a comprehensive analysis of the existing literature and an exploration of grey literature. These two approaches should not be seen as sequential but as parallel and complementary. For the analysis of the literature, data sets on Google Scholar were examined using keywords related to the food and social transition (food transition, social transition), novel food sector (novel food, new food, cultured meat, cell meat), and to policy tools (policy, regulation, legislation, instrument, framework, incentive, information, education, investment, service). In relation to the grey literature, in the need of performing exploratory research covering existing policies on novel foods, pertinent documents were selected concerning policy tools such as regulations, strategic papers, information and incentives. The research was conducted on FAOLEX, EFSA Journal and FAO websites (mainly on regulatory and information tools within the domains of 'food and nutrition', 'agricultural and rural development' and 'new foods'); CORDIS EU database, NOP "Innovation and Research" website, and EU CAP Network database were explored to examine incentives as well as financing on novel food and innovative food production programs. Given the current nature of its development, the analysis of the Italian case history has predominantly relied on a diverse range of grey literature sources in relation to the different policy tools. These sources have

included position papers from civil society organizations, official documents related to legislative debates at both the national and EU levels, as well as press releases and news articles. This approach allows for a comprehensive understanding of the evolving dynamics in Italy, drawing insights from key actors involved in the debate. By incorporating multiple non-academic sources, this methodology ensures a nuanced analysis that captures both formal and informal perspectives, reflecting the complexity of food transition discussions within the Italian context.

Discussion: policy tools for novel foods within the European context

Based on the policy tools framework and the research methodology described above, the following discussion will analyze the application of regulatory, informational, and economic instruments within the European context of novel foods before moving on to specifically examine the Italian case.

Regulatory tools

Referring to the regulatory tools of policy making, in recent years, EU authorities have implemented a legislative framework under the Novel Food Regulation (Regulation EU 2015/2283) to address the emergence of innovative food products. The EU's authorization process requires that products receive safety clearance, overseen by the European Food Safety Authority (EFSA), when an application to legally process and sell the food product is submitted to the Commission.

Despite this, the debate around cultured meat remains theoretical, as it has not reached the market yet (Southey, 2022). However, after the recent initiatives taken by EFSA (EFSA, 2023), the first application was presented by a French company in July 2024 under the Novel Food regulation, whose evaluation process will require a period of at least 18 months (Eunews, 2024). A recent report by the FAO and WHO (FAO and WHO, 2023) highlights safety considerations for cell-based meat, stressing the need for enhanced data generation and sharing to guide international regulatory actions. The EU has acknowledged the importance of thoroughly assessing the environmental and sustainability impacts of novel foods alongside safety considerations. However, safety clearance alone is not sufficient, as novel foods must also gain public acceptance before becoming a part of mainstream diets (Frewer, 1998; Palmieri et al., 2020). Thus, the potential and hypothetical benefits and challenges of cultured meat continue to be actively debated, not only at the procedural and scientific levels but also within the public sphere. Through regulations, policymakers face the dual challenge of protecting public health from potential risks associated with novel foods while simultaneously fostering the societal shifts necessary for systemic change in the food sector (European Environment Agency 2022).

Because food practices and diets are deeply intertwined with national and cultural identities, specific and strategic food policies will be crucial in changing perceptions and – ultimately – persuading consumers to choose alternative proteins. Intricate factors come into play when examining the connection between social change and the transition to more sustainable diets. These issues—while encompassing human and animal well-being alongside the preservation of planetary resources—reveal a complex web of interconnected elements, including market dynamics, economic considerations, cultural values, ethics, philosophy, geopolitics, and societal structures (Mason and Lang, 2017).

Drawing from Mary Douglas' cultural theory, Tansey and Rayner (2020) emphasize that any societal change, particularly when involving exposure to risks, requires both individual awareness and institutional support. While little prevents individuals from behaving in ways that may at times be considered inappropriate by other individuals or simply driven by a highly personal interest, institutions remain constantly responsive to change according to a wider system of rules/norms that have defined their framework of actions collectively. In the field of environmental policy-making, these issues have been addressed in the forms of policy dialogues, face-to-face deliberations, stakeholders' engagement in problem-solving processes and consensus-building

(Beierle, 2002). An interesting case of participatory policymaking related to food transition comes from the development of the Novel Foods Regulation in the Netherlands as an example of approaches that address uncertainty about new foods and new technology (biotechnology-produced foods in this case) by prescribing the interaction of consumer organizations, food industry and regulators (Hillers and Löwick, 1998). One outcome was the Advisory Report on Biotechnology, which the Dutch Government requested from the Food and Nutrition Council (i.e., the scientific advisory board to governmental bodies). This report highlighted the need to develop transparent regulations, informational and educational programs and activities to foster consumers' informed decisions. The procedure for authorizing new foods required a prior safety assessment conducted by businesses applying for authorization and then evaluation by Dutch scientists. If the scientists provided positive feedback, a committee including representatives of industry and trade, consumer and environmental organizations, and scientists was to be consulted to address societal aspects of the potential authorization.

Information tools

Given the above-mentioned intertwined dynamics, a key area for public intervention is the use of information tools (b), which would benefit from a more participatory and inclusive approach, also in connection with the regulatory framework. Instead of relying on one-way transfers of expert information to citizens, which have proven relatively ineffective (Pidgeon et al., 2005), engaging citizens in more collaborative policymaking processes through specific information tools would better address societal concerns, values, and expectations. Multi-stakeholder engagement and participation are usually enough to reduce disinformation and construct an open-minded attitude to innovation as well as a more conscious critique. As suggested in literature (Frewer, 2004; Frewer et al., 2003; Wynne, 2006), such inclusive processes may facilitate the development of information and communication strategies, eventually reaching wider groups of individuals. Including different perspectives, concerns, and preferences will help ensure that novel foods are developed and introduced in a manner that aligns with societal values and addresses the needs of different socio-economic actors.

Together with public policy-making processes, the social acceptability of cultured meat may also be tackled through the provision of broad public outreach. Institutions are thus called into action to create adequate education policies (Amato et al., 2023) with the aim of conveying more complete sets of information. When in front of a novel food, people need to be particularly reassured about their selection; they may want to know more about its concrete attributes, such as nutritional value and more generally all "label information". Barrena and Sàchez's findings (2013), for example, show that the more reticent people are towards new foods, the higher their interest is in product information. Similarly, Siddiqui et al. (2022b) emphasized in their literature review that individuals with extensive food knowledge may exhibit lower levels of neophobia compared to those with less information and less commitment to public debate about food.

Our desk research into policy tools, particularly information tools at the European level, has highlighted a critical issue. Although the widespread adoption of novel foods depends heavily on consumer acceptance and approval, there remains a significant gap in available information specifically tailored to address consumers' needs. This gap reveals that consumer education and awareness are not currently prioritized as central objectives within European policy frameworks. Moreover, the lack of focus on knowledge dissemination seems to suggest that these areas have not been effectively integrated into the strategic goals of policymakers. In the specific case of cultured meat, its correct labelling becomes a key element in consumer acceptance (Camilleri et al. 2019). As reported by the FAO and WHO (2023), there are several possible nomenclatures for cultured meat, as there is no internationally harmonized terminology to indicate this type of product. This has created the potential for confusion (Bryant and Barnett, 2019). For this reason, FAO calls for national authorities to use terminology regarding cultured meat that is more transparent and informative for food labelling, clearly communicating that the products produced through the new technology are different from the conventional ones.

Another terminological matter concerns the use of the word meat in itself. While general EU regulations govern food product marketing (Reg. (EU) 1169/2011), there is a gap within the existing European framework concerning cultured and plant-based meat alternatives (Lähteenmäki-Uutela et al., 2021). In the present absence of a European legal status, member State legislations and customary names come into force, leading to potential case-by-case judicial decisions and causing uncertainty for companies operating in the common market. The French government addressed this gap by proposing in 2022—initially in a generic way—the prohibition of labelling plant-based products with the term "meat". The decision was suspended by the French government, and then reintroduced by decree in September 2023. Italy has followed this path, even though the French law applies only to products made and sold in France, with the indication of a positive list of twenty-one meat names exclusively for use in meat products.

Incentives and economic measures

Another way for governments to guide change is through specific incentives and economic measures (c) that align with sustainability goals. For example, the cultured meat industry is gaining traction in public investment policies at an international level, as seen in the US, Singapore, and Israel. Although only two companies with patents (out of the top ten globally) are based in Europe—Mosa Meat in the Netherlands and Biotech Foods in Spain—several European countries are allocating substantial funding for research in this emerging field. The Netherlands, the European country most engaged in cultured meat development, recently announced a €60 million investment to support the creation of a national cellular agriculture system (Morrison, 2023).

However, within the European framework, there are significant barriers to advancing food technology innovation, with political commitments facing resistance from livestock breeders and agricultural operators. It is important to note that 50% of breeders' revenue comes from EU subsidies. A major shift towards novel food production, moving away from conventional animal farming, could lead to significant job losses for those currently employed in livestock breeding (Bryant, 2020). Technological innovation raises crucial concerns about the social reproduction of labour forces, which could be disrupted or replaced. Given that one of the key challenges identified by the OECD (2022) is to support farmers' livelihoods throughout the food supply chain, policymakers must carefully consider these social and economic issues when determining economic support for technological innovation.

Several factors have thus far impeded funding and incentives to researching alternative options to traditional meat. These challenges include current livestock farming practices, deep-rooted food traditions, and the interests of various stakeholders (Moritz et al., 2023), including those who advocate for an agroecological transformation of food systems. Agroecology, which emphasizes sustainable farming practices working in harmony with nature, seeks to promote biodiversity, regenerate soil health, and reduce the environmental impact of agricultural activities. Proponents of this approach argue that, rather than focusing on technological innovations such as cultured meat, incentives should centre on improving traditional farming systems through organic practices, polycultures, and local food sovereignty (Martins et al. 2024). This approach represents yet another vision for the future of food production, one that prioritizes maintaining rural livelihoods, enhancing ecosystems, and supporting small-scale farmers. This perspective actually conflicts with the push for high-tech food alternatives, such as cultured meat, which mostly rely on scientific advancements and industrialized processes. For many, the idea of replacing livestock farming with lab-grown alternatives seems incompatible with the goals of agroecology – which values community-driven approaches to food production while prioritizing ecological integrity and cultural traditions. Navigating these competing visions will require careful consideration of the social, economic, and environmental impacts of each approach, ensuring that solutions to the food system's challenges are both equitable and inclusive.

Food policies and cultured meat: the Italian case

In order to concretely illustrate the dynamics and challenges related to the adoption of novel foods within

the European context, the following section will analyze the Italian case, characterized by an intense debate and specific policy initiatives that reflect some of the tensions also present at the Communitarian level.

The concept of food transition as a "false wicked problem" (Béné and Lundy, 2023) is particularly fitting for the Italian context, given Italy's internationally recognized role in promoting food culture (e.g., the Mediterranean Diet and its numerous renowned designations of origin). Italy also stands out due to the positions held by influential civil society actors, such as the Slow Food movement, farmers' unions, and environmental organizations, alongside Italian governmental institutions. The Italian case raises important questions about various aspects of policy making, particularly by challenging the political and decision-making processes at the national level and examining the relationships between Member States and the European Union. This occurs within a framework where regulatory tools are governed by a multilevel European system. Additionally, the analysis brings to light the tension between ensuring accurate public information through specific information tools and the dynamics related to political consensus-building.

The discussion focuses on the recent stance taken by the Italian government regarding the prohibition of cell-based foods and feeds, both in terms of production and market placement. However, the core of the debate centres on defending the existing meat production system, with its supporting policies shaped by political, economic, and cultural factors. Three main positions have emerged in the debate: *(1)* defenders of the current meat production system, which is regarded as highly valuable by certain groups (including farmers' unions, political parties in power, and some designation of origin consortia); *(2)* critics of both the current system and the cultured meat alternative who mostly advocate for an implementation of agroecology perspective (such as Slow Food, environmental organizations, and organic producers); and *(3)* advocates for cultured meat, who are also critical of the current system (including animal welfare groups, certain environmental associations, and the Green Party).

1. Farmers' organizations strongly oppose the introduction of cultured meat into the market, firmly defending the existing production system. Italy's largest and most influential producers' organization, namely Coldiretti, launched a public campaign against cultured meat in 2022, gaining widespread support from citizens and local public administrations. In response to this growing opposition, and in line with other producers' organizations, the Italian government introduced a draft law in March 2023, effectively blocking any attempts to produce or sell cultured meat. The scope of this law goes beyond cultured meat, aiming to protect Italy's agricultural and food heritage—particularly meat production—due to its strategic importance for national interests. An endorsement from the Grana Padano Cheese Consortium, which represents one of Italy's most economically significant PDO products, further underscores the motivations behind this law. In its statement, the consortium emphasized that "the draft law represents a serious protection for Italian consumers and producers at a time when Italian food and its application to the UNESCO World Heritage List is under attack" (press release, La Repubblica, March 2023).
2. Not all parties of Italian agriculture are united in defending the traditional livestock industry. A broad coalition called "Cambiamo Agricoltura" ("Let's Change Farming") —which includes various environmental and consumer associations, as well as national representatives of organic and biodynamic farming—advocates for a transition in farming practices towards agroecology. The coalition also calls for a comprehensive revision of the European Common Agricultural Policy. Cultural aspects and a shift in the food paradigm are central to the position paper recently published by Slow Food Italia (2023)—a globally recognized association advocating for "good, clean, and fair" food since the 1980s. While acknowledging the unsustainability of the current meat production model, both in terms of productive processes and consumption habits, they argue that "food is, first and foremost, a cultural expression, a language". As an integral part of people's identity, shaped by the exchange of knowledge and traditions, food, according to Slow Food, cannot be reduced to a laboratory product. From this perspective, cultured meat would lose its essential value as food—its connection to the land and local communities. Slow Food Italia contends that shifting from intensive farming to lab-based production does not address the core issues of

a food system increasingly dominated by multinational corporations. Instead, the organization advocates for a radical cultural shift in meat consumption, promoting what they term a "protein transition". This transition emphasizes the importance of plant-based diets while also recognizing the vital role of legumes, particularly for small-scale farmers in mountainous regions (Slow Food Italia, 2023). Other environmental associations have also highlighted the socio-economic costs and environmental impacts associated with current agricultural practices. In response to the challenges posed by intensive livestock farming, a coalition of environmental organizations, led by the Italian branch of the World Wide Fund for Nature (WWF), presented a legislative proposal in March 2024. The proposal calls for the temporary prohibition of new intensive livestock farms and a cap on increasing the number of animals—excluding small-scale farms. Additionally, it advocates for the agroecological transformation of the Italian livestock sector through a National Plan for reconversion (Act of the Deputy Chamber n°1760, March 6, 2024).

3. While all environmental associations agree on the need for a paradigm shift in livestock farming, opinions diverge when it comes to the introduction of cultured meat. Animal welfare organizations and WWF are in favour of exploring the potential of cultured meat, whereas other grassroots movements—such as consumer organizations, certain Catholic community groups, and many national-level environmental associations (including Federparchi and Italia Nostra)—remain more critical (Raimo, 2024). The left-wing parties, currently in opposition in Parliament, are similarly divided over the issue. Some members are reluctant to cede leadership on agricultural matters to the current right-wing government, contributing to the ongoing debate over cultured meat. Researchers in biological and biotechnological sectors have expressed a strong opposition to the law. They highlighted, in the official documents produced during the legislative process, the ineffectiveness of a prohibition based on the precautionary principle, given that robust safety assurance procedures are already in place at the European level under the Novel Food Regulation. They argue that such a ban could have detrimental consequences for Italian research, including reduced funding, the creation of an environment unfavourable to research-driven industries, and the risk of brain drain among researchers in the sector. Ultimately, these factors could lead to Italy's marginalization in a rapidly developing and promising field (Biotecnologi Italiani, 2023; Conti et al., 2023).

Despite the ongoing debate, the law was swiftly and definitively approved by the Italian Parliament in November 2023 (Italian Law 1st December 2023, n.172) with a significant majority, sparking further political controversy and widespread media coverage.

The regulatory process

From a regulatory perspective, the rationale behind the law is based on the precautionary principle (Regulation (EC) No. 178/2002) and includes a ban on producing and marketing foods and feeds derived from cell cultures or tissues of vertebrate animals. Additionally, it prohibits the use of the term 'meat' for processed products containing only plant proteins, with the stated goal of protecting both the national livestock industry and ensuring consumers' right to accurate information. This law represents a "rushed approach" —not only in relation to the public debate, but also from a regulatory standpoint. It seeks to preemptively ban a product that has yet to reach the market, in a domain largely governed at the EU level, where both market regulation and safety clearance are already subject to broader oversight. Various non-profit organizations focused on animal welfare, groups promoting cultured meat, certain political parties, and researchers in the field have expressed strong opposition to the law. The main criticalities can be summarized as follows:

- The redundancy of the law, given that the existing European safety evaluation process, which is already built upon the precautionary principle, is sufficiently robust.
- Potential conflicts with the European common market regulations, particularly if cultured meat products are approved by EU authorities.
- A lack of transparency in the parliamentary decision-making process, as not all relevant stakeholders were given the opportunity to present and discuss their positions.
- The negative impact on Italy's research and industrial sectors, as the law hinders the development of this promising technology—potentially stifling innovation and competitiveness.

Information tools

As part of the current Italian government's broader effort to preserve national identity the approved law emphasizes protection of the domestic livestock sector, which is regarded as having "significant cultural, socio-economic, and environmental value" (Art. 3). In terms of information, the introduced restrictions on the use of the term 'meat' for the production and marketing of plant-based protein products expanded the scope of the law—yet seems to have remained in the background, hidden in the debate by the stronger discussion on cultured meat. Terms traditionally associated with meat products, as well as specific terminologies used in butchery, charcuterie, and fisheries, are prohibited for products made solely from alternative proteins.
The terminology used in the law to describe cultured meat was "products based on cell cultures" (referred to as "synthetic foods" in the draft law). The debate over the naming of the product highlights how terminological choices are ideologically based and meant to negatively impact consumer perception, given the technical complexity of the topic and the general lack of clarity in informed communication and in public opinion making. A recent survey of Italian citizens revealed that the acceptability of cultured meat is influenced by respondents' political and ideological affiliations—with higher levels of opposition among government supporters. Additionally, a potential priming effect has been hypothesized which suggests that opposition to cultured meat among government supporters may have increased following the government's decision (Dotti Sani et al., 2024).

Incentives and economic measures

Regarding incentives and economic tools, while the law does not explicitly ban research on cultured meat, it is expected to have an indirectly negative impact on research funding from both public and private sources. In particular, the potential decrease in public research funding raises concerns for several reasons. Firstly, the existing uncertainties regarding the safety of cultured meat necessitate further study and evidence. Secondly, the actual contribution of industrial cultured meat production towards a more sustainable food system remains to be demonstrated (see Dal Gobbo and Bertuzzi, 2024). The FAO and WHO report (2023) emphasizes the importance of continued investment in research and development to fully assess whether the claimed benefits in terms of sustainability can be achieved.

In January 2024, the European Commission rejected the notification of the law (Notification: 2023/675/IT) since it violates the Article 6 of EU Directive 2015/1535, which requires submitting to the member states for review, through the TRIS procedure, any bill that is potentially not in line with the European single market – a step that Italy did not fully comply with. Given this procedural fault, no judgement of value has been given and, therefore, the law can be judged unenforceable by the national courts (Cappellini, 2024).

At the same time, on January 23, 2024, a communication titled "The CAP's Role in Safeguarding High-Quality and Primary Farm-Based Food Production" (Information n° 5469/1/24 rev1) was presented to the European Council Agriculture and Fisheries (Agrifish) by the Austrian, French, and Italian delegations, with support from the Czech, Cypriot, Greek, Hungarian, Luxembourgish, Maltese, Polish, Romanian, Slovakian, and Spanish delegations. The communication argued that "new laboratory-cultivated food production raises numerous questions that require thorough discussion among Member States, the Commission, stakeholders, and the general public." These questions span ethical, economic, sustainability, social, public health, transparency, and legal concerns. Consequently, the communication calls for a "transparent, science-based, and comprehensive approach" that adheres to dedicated EFSA guidelines, similar to those applied to new pharmaceutical products. It also requests a "comprehensive impact assessment by the Commission, considering all relevant issues, including the views of EU consumers and citizens" before any authorization for sale and consumption is granted. The position expressed in the communication is highly critical of this innovation. However, it marks a shift toward a more institutionalized approach to the debate, advocating for further research, public consultation, and participatory decision-making—political steps that the Italian law had previously bypassed entirely.

Conclusions

The transition towards more sustainable food systems is a pressing issue that necessitates careful balancing between environmental sustainability, economic viability, and social equity. While the rise of novel foods and alternative proteins, such as cultured meat, may present promising solutions to some of the challenges posed by traditional livestock production, it also introduces complex trade-offs. Some of the challenges include concerns about the high energy demands of new technologies, potential economic disruption, and the socio-cultural implications of changing food systems. Because of these complexities, the management of transition in food systems requires a comprehensive approach that integrates different policy tools (regulation, information and incentives) into a wider framework along with consumer education and inclusive stakeholder engagement. Public food policies play a crucial role in driving societal changes in food consumption patterns and promoting the adoption of novel foods. By adopting and developing more inclusive processes of change, governments could incentivize industries aligned with sustainability goals, regulate food technologies, ensure transparency in communication, all while addressing social values, cultural norms, and economic implications (Ares et al., 2023; Graça et al., 2022). Public awareness campaigns, education initiatives, and transparent communication are essential for shaping consumer perceptions and fostering trust in novel food technologies (Rombach et al., 2022; Siddiqui et al., 2022a).

The Italian case highlights the complexity of such transitions, where political decisions can either facilitate or hinder progress. In 2023, Italy enacted a law banning the production and sale of cultured meat, citing precaution and concerns about food safety as well as consumer information accuracy. This decision, supported by farmers' unions and cultural organizations like Slow Food, reflects broader resistance to lab-grown alternatives in favour of traditional livestock or plant-based protein sources. However, this move has sparked debate and criticism from various stakeholders – including animal welfare groups, cultured meat advocates, and researchers. The European Commission's rejection of the Italian law in 2024 due to violations of EU directives underscores the need for harmonized regulatory frameworks within the EU.

As seen in Italy, the absence of a unified European position on cultured meat and alternative protein labelling creates uncertainty for companies and researchers operating within the common market. A balanced approach, combining evidence-based policymaking with grassroots engagement, is needed to navigate these challenges. Clarity in food labelling, transparent communication, and inclusive decision-making processes are crucial for building consumer trust and promoting informed decision-making. Continued investment in research and development is essential for closing knowledge gaps, evaluating safety, and assessing the potential benefits of cultured meat in achieving a sustainable food system. Ultimately, consumer acceptance and behavioural change will require innovative policies driven by bottom-up engagement involving key stakeholders—consumers, scientists, and producers. These policies must bridge the information gap surrounding new food technologies while recognizing that food extends beyond its nutritional or commodity value. Therefore, an effective management of the food transition requires an integrated approach that consistently utilizes regulatory, informational, and economic tools, also taking into account contextual specificities like the Italian case has been underscoring.

Through a nuanced approach that accounts for the unique social, cultural, and economic contexts of each situation, policy makers could finally realize that "one size does not fit all" and design more tailored policy frameworks that hold the promise of greater sustainability for the years to come.

References

Aiking H (2019) Environmental degradation—An undesirable output of the food system. In: Sabaté J (ed) *Environmental Nutrition*. Academic Press, pp. 123-138.

Amato M, Riverso R, Palmieri R, Verneau F and La Barbera F (2023) Stakeholder Beliefs about Alternative Proteins: A Systematic Review. *Nutrients* 15, 837. https://doi.org/10.3390/nu15040837

ANBI (Associazione Nazionale dei Biotecnologi Italiani) (2023) *Contributo al DDL n. 651 concernente "Alimenti e mangimi sintetici"*, Atto Senato n. 651, https://www.senato.it/leg/19/BGT/Schede/Ddliter/documenti/56933_documenti.htm (accessed 2 October 2024).

Ares G, De Rosso S, Mueller C, Philippe K, Pickard A, Nicklaus S and Varela P (2023) Development of food literacy in children and adolescents: Implications for the design of strategies to promote healthier and more sustainable diets. *Nutrition Reviews* 82(4): 536-552.

Barrena R and Sánchez M (2013) Neophobia, personal consumer values and novel food acceptance. *Food quality and preference* 27(1): 72-84.

Beierle TC (2002) *Democracy in Practice: Public Participation in Environmental Decisions* (1st ed.). Routledge. https://doi.org/10.4324/9781936331017

Bemelmans-Videc ML, Rist RC and Vedung EO (2011) *Carrots, Sticks, and Sermons: Policy Instruments and Their Evaluation*. Transaction Publishers.

Béné C and Lundy M (2023) Political economy of protein transition: Battles of power, framings and narratives around a false wicked problem. *Frontiers in Sustainability* 4, 1098011.

Benton TG, Bieg C, Harwatt H, Pudasaini R and Wellesley L (2021) *Food system impacts on biodiversity loss. Three levers for food system transformation in support of nature.* London: Chatham House.

Böhm I, Ferrari A and Woll S (2018) Visions of In Vitro Meat among Experts and Stakeholders. *Nanoethics* 12: 211–224. https://doi.org/10.1007/s11569-018-0330-0

Bryant C (2020) Culture, meat, and cultured meat. *Journal of Animal Science* 98(8): 1-7.

Bryant C and Barnett JC (2019) What's in a name? Consumer perceptions of in vitro meat under different names. *Appetite* 137: 104-113.

Camilleri AR, Larrick RP, Hossain S and Patino-Echeverri D (2019) Consumers underestimate the emissions associated with food but are aided by labels. *Nature Climate Change* 9(1): 53–58.

Capano G and Howlett M (2020) The knowns and unknowns of policy instrument analysis: Policy tools and the current research agenda on policy mixes. *Sage Open* 10(1), 2158244019900568. https://doi.org/10.1177/2158244019900568

Capano G, Pritoni A and Vicentini G (2020) Do policy instruments matter? Governments' choice of policy mix and higher education performance in Western Europe. *Journal of Public Policy* 40(3), 375–401. https://doi.org/10.1017/S0143814X19000047

Cappellini M (2024) Carne coltivata, tutta la storia di una legge a ostacoli e l'ultimo rebus della pronuncia Ue. *Il Sole XXIV Ore,* 3 February. Available at: https://www.ilsole24ore.com/art/carne-coltivata-tutta-storia-una-legge-ostacoli-e-l-ultimo-rebus-pronuncia-ue-AFF245ZC (accessed 7 April 2024).

Conti L, Biressi S, Gargioli C, Massai D (2023) *Contributo al DDL n. 651 concernente "Alimenti e mangimi sintetici",* Atto Senato n. 651, https://www.senato.it/leg/19/BGT/Schede/Ddliter/documenti/56933_documenti.htm (accessed 2 October 2024).

Dal Gobbo A and Bertuzzi N (2024) Cultured meat as «food for the future»? Contentious perspectives between science and publics in the Anthropocene. *Rassegna Italiana di Sociologia* 65(4), 735-770.

Dotti Sani G, Maggini N, Moroni M and Vezzoni C (2024) Cosa pensano gli italiani della carne coltivata. *lavoce.info,* 1st January. Available at: https://lavoce.info/archives/103215/cosa-pensano-gli-italiani-della-carne-coltivata/ (accessed 7 April 2024).

Dupont J and Fiebelkorn F (2020) Attitudes and acceptance of young people toward the consumption of insects and cultured meat in Germany. *Food Quality and Preference* 85, 103983.

EFSA (2023) The safety of cell culture-derived food – ready for scientific evaluation. Available at: https://www.efsa.europa.eu/en/news/safety-cell-culture-derived-food-ready-scientific-evaluation (accessed on 7 April 2024).

Eisner MA, Worsham J and Ringquist EJ (2000) *Contemporary Regulatory Policy*. Lynne Rienner Publishers.

Eunews (2024) A French company has filed the first application to sell cultivated meat in Europe. Available at: https://www.eunews.it/en/2024/07/26/french-sell-cultivated-meat-europe/ (accessed on 11 January 2025).

European Environment Agency (2022) Reimagining the food system through social innovations. Available at: https://www.eea.europa.eu/publications/reimagining-the-food-system-the (accessed on 20 January 2024).

FAO (2022) *Thinking about the future of food safety – A foresight report*. Rome. https://doi.org/10.4060/cb8667en

FAO and WHO (2023) *Food safety aspects of cell-based food*. Rome. https://doi.org/10.4060/cc4855en

Frewer L (1998) Consumer perceptions and novel food acceptance. *Outlook on Agriculture* 27(3): 153-156.

Frewer L (2004) The public and effective risk communication. *Toxicology letters* 149(1-3): 391-397.

Frewer L, Scholderer J and Lambert N (2003) Consumer acceptance of functional foods: issues for the future. *British Food Journal* 105(10): 714-731.

Good Food Institute (2023) 2022 State of the Industry Report: Cultivated meat and seafood. Available at: https://gfi.org/cultivated-meat-and-seafood-state-of-the-industry-report-pdf/ (accessed 22 May 2023).

Graça J, Roque L, Guedes D, Campos L, Truninger M, Godinho C and Vinnari M (2022) Enabling sustainable food transitions in schools: a systemic approach. *British Food Journal* 124(13): 322-339.

Guthman J and Biltekoff C (2021) Magical disruption? Alternative protein and the promise of de-materialization. *Environment and Planning E: Nature and Space* 4(4), 1583-1600.

Hartmann C and Siegrist M (2020) Our daily meat: Justification, moral evaluation and willingness to substitute. *Food Quality and Preference* 80, 103799.

Hillers VN and Löwik MRH (1998) Incorporation of Consumer Interests in Regulation of Novel Foods Produced with Biotechnology: What Can Be Learned from The Netherlands? *Journal of Nutrition Education* 30(1): 2–7. https://doi.org/10.1016/S0022-3182(98)70268-7

Hood CC (1983) Government as a Tool-Kit. In Hood CC (ed), *The Tools of Government*. Macmillan Education UK, pp. 115–131. https://doi.org/10.1007/978-1-349-17169-9_7

Howlett M (2009) Government Communication as a Policy Tool: A Framework for Analysis. *Canadian Political Science Review* 3(2), 23–37. https://doi.org/10.24124/c677/2009134

IPCC (2022) Summary for Policymakers. In: Climate Change and Land: IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems. Cambridge: Cambridge University Press, pp. 1–36.

Jönsson E (2016) Benevolent technotopias and hitherto unimaginable meats: Tracing the promises of in vitro meat. *Social Studies of Science* 46(5), 725-748.

Kemp R, Loorbach D and Rotmans J (2007) Transition management as a model for managing processes of co-evo-

lution towards sustainable development. *The International Journal of Sustainable Development & World Ecology* 14(1), 78-91.

Lähteenmäki-Uutela A, Rahikainen M, Lonkila A and Yang B (2021) Alternative proteins and EU food law. *Food Control* 130, 108336. https://doi.org/10.1016/j.foodcont.2021.108336

Long N (2001) *Development Sociology. Actor Perspective*. London-New York: Routledge.

Lupton D and Turner B (2018) Food of the future? Consumer responses to the idea of 3D-printed meat and insect-based foods. *Food and Foodways* 26(4): 269-289.

Martins IR, de Oliveira Pereira F, Coelho RDFR, da Paixão Sousa R, da Silva Martins LH and Joele, MRSP (2024) Agroecology: A Promising Path Towards the Sustainable Transition of Food Systems. *Revista de Gestão Social e Ambiental* 18(8), e06066-e06066.

Mason P and Lang T (2017) *Sustainable diets: how ecological nutrition can transform consumption and the food system*. London: Routledge.

Mazac R, Meinilä J., Korkalo L., Järviö N, Jalava M, and Tuomisto HL (2022) Incorporation of novel foods in European diets can reduce global warming potential, water use and land use by over 80%. *Nature Food* 3, 286–293 https://doi.org/10.1038/s43016-022-00489-9

Mirzabaev A, Olsson L, Kerr RB, Pradhan P, Ferre MGR and Lotze-Campen H (2023) Climate change and food systems. *Science and Innovations for Food Systems Transformation* 511.

Monteiro CA, Cannon G, Levy RB, Moubarac JC, Louzada ML, Raube, F, ... and Jaime PC (2019) Ultra-processed foods: what they are and how to identify them. *Public health nutrition* 22(5), 936-941.

Morais-da-Silva RL, Reis GG, Sanctorum H, and Molento CFM (2022) The social impacts of a transition from conventional to cultivated and plant-based meats: evidence from Brazil. *Food Policy* 111, 102337.

Moritz J, McPartlin M, Tuomisto HL and Ryynänen T (2023) A multi-level perspective of potential transition pathways towards cultured meat: Finnish and German political stakeholder perceptions. *Research Policy* 52(9), 104866.

Morrison O (2023) Europe 'lagging' in lab-grown meat investments. *FoodNavigator,* 30 January. Available at: https://www.foodnavigator.com/Article/2023/01/30/europe-lagging-in-lab-grown-meat-investments#:~:text=A%20new%20report%20reveals%20the,on%20profitable%20and%20sustainable%20opportunity (accessed 7 April 2024).

Neuwirth RJ (2014) "'Novel food' for thought" on law and policymaking in the global creative economy. *European Journal of Law and Economics* 37(1), 13–50. https://doi.org/10.1007/s10657-013-9415-y

OECD (2022) Meat Protein Alternatives: Opportunities and Challenges for Food Systems' Transformation. OECD food, agriculture and fishery Papers, 182, September.

Oliver TH, Boyd E, Balcombe K, Benton TG, Bullock JM, Donovan D and Zaum D (2018) Overcoming undesirable resilience in the global food system. *Global Sustainability* 1, e9.

Palmieri N, Perito MA and Lupi C (2020) Consumer acceptance of cultured meat: Some hints from Italy. *British Food Journal* 123(1): 109-123.

Pidgeon NF, Poortinga W, Rowe G, Horlick-Jones T, Walls J and O'Riordan T (2005) Using Surveys in Public Participation Processes for Risk Decision Making: The Case of the 2003 British GM Nation? Public Debate. *Risk Analysis: An International Journal* 25(2), 467-479.

Poore J and Nemecek J (2018) Reducing food's environmental impacts through producers and consumers. *Science* 360, 987-992. DOI: 10.1126/science.aaq0216

Post M, Levenberg S, Kaplan D, Genovese N, Fu J, Bryant C, Negowetti N, Verzijden K and Moutsatsou, P (2020) Scientific, sustainability and regulatory challenges of cultured meat, *Nature Food* 1(7): 403-415. https://doi.

org/10.1038/s43016-020-0112-z

Raimo A (2024) Tormenti green sulla carne coltivata. Gli ambientalisti si dividono a tavola. *HaffPost*, 5 December. Available at: https://www.huffingtonpost.it/politica/2023/12/05/news/verdi_carne_sintetica-14425112/ (accessed 7 April 2024).

Reigada A and De Castro C (2022) Agricultural labour in the global food system. In Sage C (ed.) *A Research Agenda for Food Systems*. Cheltenham: Edward Elgar Publishing, pp. 89–110.

Ritchie H (2021) If the world adopted a plant-based diet, we would reduce global agricultural land use from 4 to 1 billion hectares. *OurWorldInData.org*, 4 March. Available at: https://ourworldindata.org/land-use-diets (accessed 10 March 2024).

Rombach M, Dean D, Vriesekoop F, De Koning W, Aguiar LK., Anderson M and Boereboom A (2022) Is cultured meat a promising consumer alternative? Exploring key factors determining consumer's willingness to try, buy and pay a premium for cultured meat. *Appetite* 179, 106307.

Roser M (2023) How many animals get slaughtered every day? *OurWorldInData.org*, 26 September. Available at: https://ourworldindata.org/how-many-animals-get-slaughtered-every-day (accessed 10 March 2024).

Rotmans J, Kemp R and Van Asselt M (2001) More evolution than revolution: transition management in public policy. *Foresight* 3(1), 15-31.

Rubio N, Xiang N and Kaplan D (2020) Plant-based and cell-based approaches to meat production. *Nature Communications* 11, 6276. https://doi.org/10.1038/s41467-020-20061-y

Sadler CR, Grassby T, Hart K, Raats M, Sokolović M and Timotijevic L (2021) Processed food classification: Conceptualisation and challenges. *Trends in Food Science & Technology* 112: 149-162.

Sage H (2022) *A Research Agenda for Food Systems*. Cheltenham: Edward Elgar Publishing.

Sexton AE and Goodman MK (2022) Of fake meat and an anxious Anthropocene: towards a cultural political economy of alternative proteins and their implications for future food systems. In: Sage C (ed) *A research agenda for food systems*. London: Edward Elgar Publishing, pp. 175-197.

Shaw E and Mac Con Iomaire M (2019) A comparative analysis of the attitudes of rural and urban consumers towards cultured meat. *British Food Journal* 121(8): 1782-1800.

Siddiqui SA, Khan S, Farooqi MQU, Singh P, Fernando I and Nagdalian A (2022a) Consumer behavior towards cultured meat: A review since 2014. *Appetite* 106314.

Siddiqui SA, Zannou O, Karim I, Kasmiati, Awad NMH, Gołaszewski J, Heinz V and Smetana S (2022b) Avoiding food neophobia and increasing consumer acceptance of new food trends—A decade of research. *Sustainability* 14(16), 10391.

Slow Food Italia (2023) Slow Food sulla carne (anche quella coltivata). In: slowfood.it. Available at: https://www.slowfood.it/slow-meat-2/sf-carne-coltivata/ (accessed 7 April 2024).

Southey F (2022) Why is EFSA yet to receive a novel food dossier on cell-based meat? *FoodNavigator,* 31 October. Available at: https://www.foodnavigator.com/Article/2022/10/31/Why-is-EFSA-yet-to-receive-a-novel-food-dossier-on-cell-based-meat (accessed 10 March 2024).

Spaargaren G, Oosterveer P, Loeber A (2012) (eds) *Food Practices in Transition. Changing Food Consumption, Retail and Production in the Age of Reflexive Modernity*. London-New York: Routledge.

Springmann M, Clark M, Mason-D'Croz D, Wiebe K, Bodirsky BL, Lassaletta L and Willett W (2018) Options for keeping the food system within environmental limits. *Nature* 562(7728): 519-525.

Tansey J and Rayner S (2020) Cultural theory and risk. In: Heath RL and Dan O'Hair H (eds) *Handbook of risk and crisis communication*. Routledge, pp. 53-79.

Treich N (2021) Cultured meat: Promises and challenges. *Environmental and Resource Economics* 79: 33-61.

Tucker C (2018) Using environmental imperatives to reduce meat consumption: Perspectives from New Zealand. Kō tuitui: *New Zealand Journal of Social Sciences Online* 13(1): 99-110.

Watts N, Amann M, Arnell N, Ayeb-Karlsson S, Beagley J, Belesova K and Costello A (2021) The 2020 report of The Lancet Countdown on health and climate change: responding to converging crises. *The Lancet* 397(10269): 129-170.

Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, … and Murray CJ (2019) Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet* 393(10170): 447-492.

Wynne B (2006) Public engagement as a means of restoring public trust in science–hitting the notes, but missing the music? *Public Health Genomics* 9(3): 211-220.