Stockholm Environment Institute

A just transition in the meat sector: why, who and how?

A mapping of affected stakeholders in high-income countries, and principles to guide a just transition

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Executive summary

The world's large and growing appetite for meat and other animal products has profound implications for the climate, air and water quality, biodiversity, human health and animal welfare. There is robust evidence that a shift to more plant-based diets is urgently needed in regions with high levels of animal product consumption, along with a shift away from industrial meat production. However, until recently, few governments prioritized the issue, and many governments actively support industrial animal agriculture through subsidies and other measures.

Now, motivated by both environmental and public health concerns, policy-makers in several countries are adopting regulatory and financial measures to scale down meat production and consumption. While these changes are clearly necessary and long overdue, it is crucial that they be planned carefully and inclusively to ensure a just transition.

Meat supply chains support many livelihoods, and meat is an important part of many people's diets and cultural traditions. This means that policies that curtail common production practices, reduce meat output and raise meat prices could have significant impacts across society. A just transition approach can help ensure that both costs and benefits are evenly distributed, and protect the most vulnerable stakeholders. By doing so, it can also help increase public support for the transition.

The concept of just transitions is well established in the energy sector, but is only starting to be recognized in the context of our food systems. This report maps out the key stakeholder groups, focusing on domestic meat markets in high-consuming developed countries, and identifies guiding principles for a just transition away from large-scale meat production and consumption.

Which stakeholders will be most affected?

While awareness of the impacts of the meat sector has grown, **consumers**' demand for meat remains high. In some high-income countries, there is evidence that lower-income groups are particularly dependent on meat, and thus would be disproportionately affected by a rise in prices, especially if they live in "food deserts" where fresh fruit and vegetables are scarce. Cultural preferences and traditions also need to be taken into account. Ensuring a just transition for consumers will require special attention to the affordability and accessibility of alternatives.

Farmers in meat supply chains include animal feed producers, small and mid-size livestock farmers – often family-owned for several generations – and large industrial concerns. The transition may force them to repurpose some or all of their land and facilities and could result in "stranded" farm assets. This could be particularly difficult for farmers who are already indebted and economically vulnerable. Well-designed policies could enable some farmers to benefit from the transition, however – by shifting to new crops, for instance, or seizing opportunities around land conservation and recreation.

Many **workers** in meat supply chains could lose their jobs in the transition. In several European countries and the US, these workers are disproportionately male, poor and from marginalized groups, including immigrants. They already work under precarious conditions and are exposed to a range of health and occupational risks, and they are at high risk of being left behind in the transition. Producers of plant-based foods and other meat alternatives could create many new jobs, but it remains to be seen who will be able to benefit, and what conditions and security they will provide to workers.

Communities where livelihoods and local economies are closely tied to meat supply chains could be negatively affected as well, and see changes in traditional land uses and reduced social cohesion. On the other hand, the transition could reduce these communities' exposure to air and water pollution and other health risks associated with large-scale livestock production

and meat processing facilities. Those impacts often disproportionately affect marginalized socio-economic or ethnic groups. Governments and companies can help these communities diversify their economies.

The global meat market is valued at about US$1 trillion. The **companies** involved range from feed and livestock producers, to meat processors and distributors, to retailers. The largest operators are a handful of meat processors who dominate their respective markets and have to a great extent shaped today's production systems. They could be instrumental in driving the transition, or use their market power to try to block change. Some meat companies have begun to make significant investments in meat alternatives and could capitalize on this expanding industry.

Guiding principles for a just transition

Based on the insights from the stakeholder analysis, we identify five principles to guide policy-makers in promoting a just transition away from high levels of industrial meat production and consumption:

1. **Phase down existing policies, programs and fiscal support that promote industrial meat production and consumption:** A key first step in the transition is to stop actively supporting unsustainable practices. This means phasing out subsidies and other forms of regulatory, financial and policy support to meat production, especially for industrial livestock operations. It also entails the revision of policies, dietary guidelines and publicly funded advertising campaigns that encourage the consumption of meat.

2. **Increase support for alternatives to industrially produced meat, and ensure they safeguard social equity, human health and animal welfare:** Consumers will need affordable, easily accessible new protein sources. Government support can be informational (e.g. through labelling), financial (e.g. through targeted subsidies and investments), and regulatory (e.g. by mandating more sustainable public procurement). However, it is essential to consider the impacts of such measures holistically to avoid unintended negative health, social, environmental, and animal welfare outcomes.

3. **Ensure inclusive and participatory planning processes:** A just transition requires bringing stakeholders to the table and empowering them to co-design solutions that meet their needs. This entails mapping stakeholders across the meat supply chain in each market (as well as meat substitute producers) and convening processes that enable them to shape a shared vision for the transition and identify appropriate mechanisms to support it.

4. **Provide support to stakeholders to help offset impacts of a transition:** A just transition may require substantial investments in affected communities, as well as targeted measures to compensate for higher food prices. Examples of such support include social protection measures for workers and vulnerable consumers, local economic diversification programmes, as well as the creation of specific funding mechanisms.

5. **Address the root causes of injustices in the meat sector:** The stakeholder mapping for this report highlighted the many ways in which poverty and marginalization limit people's access to healthy foods and expose them to economic exploitation and environmental impacts. A just transition requires that we carefully examine existing production systems to identify the root causes of such injustices. This is essential to not only avoid replicating those injustices, but actively begin to correct them when designing and implementing transition measures.

Planning and supporting just transitions is hard work, but it is essential if we are to successfully transform our food systems. Time is short, and there is a great deal at stake – from the climate, to biodiversity, to human health. Prompt action to start planning a just transition away from large-scale meat production and consumption can help ensure a more just and sustainable future for all.

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1. Introduction

Globally, the large – and growing – appetite for animal products has profound implications for the achievement of our sustainable development objectives. The livestock industry is a significant contributor to climate change and a major driver of global biodiversity loss (FAO 2018; Machovina et al. 2015). Industrial production models geared to maximizing outputs at the lowest possible cost can also cause enormous amounts of animal suffering, such as through extreme confinement (Singer 2015; Harari 2015; Poletto and Hötzel 2012).

Large-scale meat consumption poses risks to human health as well. Current practices create conditions that can catalyse the emergence of infectious diseases and antimicrobial resistance (Jones et al. 2013; Talebi Bezmin Abadi et al. 2019). Overconsumption of meat, particularly red and processed meat, is also associated with increased risks of developing heart disease, type II diabetes, and certain cancers (Godfray et al. 2018).

Against this backdrop, there are increasing calls for a shift towards a greater reliance on plant-based diets, particularly in regions that now rely heavily on animal products (FAO and WHO 2019; Shukla et al. 2019; Willett et al. 2019). This would require fundamental changes, as many countries in the Global North and beyond actively support current production practices, large numbers of people work in the industry, and the consumption of animal-based foods is deeply entrenched.

It is thus crucial to plan any such transition carefully to ensure that it is inclusive and just. A well-planned and implemented transition can help minimize disruptions and maximize benefits for affected stakeholders – an important goal in its own right (ITUC 2017; UNFCCC Secretariat 2016), and it can also help build broader societal support (Robins 2020; Sonja and Harald 2018). Moreover, by clearly signalling that a shift is coming, a just transition approach can steer investors away from high-emitting practices (Abram et al. 2022), and thus reduce the risk of either "locking in" unsustainable operations for decades to come, or else creating "stranded" assets that need to be shut down early.

Just transition policy planning and research have gained traction in climate policy in recent years, driven by both ethical and strategic imperatives for realizing a sustainable future, but mainly in the energy sector (Atteridge and Strambo 2020; Green and Gambhir 2019). Research on just transitions in agriculture, including livestock sectors, is relatively nascent, with many knowledge gaps around the opportunities and challenges remaining. These include understanding which stakeholders will be most affected and how, and what policy interventions could best promote a more just and equitable transition (Bastos Lima 2022).

This report helps to fill this gap. We begin with a brief overview of the urgent case for transitioning away from heavy consumption of animal products, with a focus on industrial production system in high-income countries as a starting point (Section 2). We then map the key stakeholders who will be most affected by such a transition (Section 3), drawing on the literature on just transitions in agriculture, energy and industry to identify the factors that most need consideration. Finally, we develop a list of priorities for action that encompass key elements to account for planning and conducting a just transition away from high levels of meat production and consumption (Section 4). While we limit our focus to meat from terrestrial farm animals, some of these lessons are relevant to dairy, egg, and fish production as well.

2. The case for a just transition away from large-scale meat production

There are compelling and urgent environmental reasons to reduce meat consumption in many of the world's regions. Clark et al. (2020) recently showed that even if fossil fuel emissions were eliminated immediately, on current trends, emissions from food systems alone, particularly meat production, would make it impossible to limit warming to 1.5°C and difficult even to realize the 2°C target.

Although humans have long consumed animal-based foods, the scale at which this is occurring today is unprecedented. Global meat production has more than quadrupled since 1961, to an estimated 329 million tonnes per year in 2019–2021, (OECD and FAO 2022).[1] Population growth, urbanization, and more meat-intensive diets associated with rising incomes are all driving up demand. On current trends, daily per capita animal protein consumption is projected to increase by 17% by 2050 from 2012 levels (Henchion et al. 2021), while total meat production is projected to increase more than 60% between 2010 and 2050 (UNEP 2022).

Global food production is a major source of global greenhouse gas (GHG) emissions, and the GHG impact of animal-based foods has been found to be twice that of plant-based foods (Xu et al. 2021). Different studies have estimated the share of global GHG emissions from animal-based food production at 16.5% or more (Twine 2021).

Accordingly, a growing number of experts recognize the significant contribution that reductions in meat consumption can make to achievement of the Paris Agreement (FAO and WHO 2019; Schiermeier 2019; Willett et al. 2019). In many places, they could also play a key role in reducing deforestation, water and air pollution, and other serious environmental impacts (McClelland et al. 2018).

The world is also in the midst of an extinction crisis, and degradation of natural habitats linked with the livestock sector has been found to be an important driver of biodiversity loss (Filazzola et al. 2020). While small-scale or extensive animal husbandry may be more sustainable (Machovina et al. 2015), international supply chains for animal products have been shown to be powerful drivers of habitat and species losses around the world (Pendrill et al. 2022; Green et al. 2019; Nepstad et al. 2006).

Iberian pigs in a factory farm, Salamanca, Spain, © WESTEND61 / GETTY

Conversely, Poore and Nemecek (2018) found that replacing meat consumption with plant-based products could achieve, on average, 76% reductions in land use for food, 19% reductions of scarcity-weighted freshwater withdrawals, and around 50% reductions in CO_2e, acidification and eutrophication.

1 See also Our World in Data historical graph: https://ourworldindata.org/meat-production#global-meat-production.

Although a plant-based diet is generally recognized as the least resource-intensive, a complete shift away from animal protein is not required to achieve meaningful sustainability gains (IPCC 2022). A diet made up of only plant-based food can reduce food-system GHG emissions by half and land use by over 75%, while a "reductarian" or "flexitarian" diet, in which meat and dairy consumption is reduced by 50%, would still achieve over 70% of the GHG reduction and 67% of the land-use reduction associated with a vegan diet (Poore and Nemecek 2018).

A less meat-intensive diet is also desirable from a public health perspective, as regular consumption of meat, particularly red and processed meat, is associated with increased risks of obesity and incidences of cardiovascular disease, type II diabetes, and some cancers especially colorectal (Clark et al. 2019; Godfray et al. 2018; Swinburn et al. 2019). The EAT-Lancet Commission on Food, Planet, Health, a team of 37 top scientists with expertise in both human health and sustainability, examined how best to feed the world within planetary boundaries and developed a "universal healthy reference diet" rich in fruits and vegetables, with protein sourced mainly from plant-based foods (Willett et al. 2019).

Despite reservations about the affordability and availability of such a diet (Hirvonen et al. 2020), the EAT-Lancet Commission's work shows the gap between current meat intake and consumption levels compatible with an healthy and sustainable diet. It found that only two regions (South Asia and sub-Saharan Africa) currently consume red meat at levels at or below those considered healthy and sustainable, while the United States ate six times too much, and Europe and Central Asia and Latin America and the Caribbean, four times too much (Dunne 2020).

Industrial animal farming and ecosystem degradation associated with meat-intensive diets contribute to the emergence and transmission of infectious diseases (Jones et al. 2013; Roe et al. 2020; Wiebers and Feigin 2020). Increased use of antibiotics for livestock represents another serious threat to human health, through the transmission of anti-microbial resistance (AMR) from livestock to humans. It has been estimated that AMR was responsible for 1.27 million deaths in 2019 (Murray et al. 2022), and may cause the death of 10 million people annually by 2050 (O'Neill 2014).

Animal welfare also offers a compelling rationale for shifting towards more plant-based diets. About 80 billion terrestrial animals – mostly chickens – are slaughtered annually for meat (Ritchie and Roser 2019). It is estimated that nearly 75% of farmed land animals are kept in intensive farming operations or "factory farms" where they live in cramped spaces, rarely see daylight, and are unable to engage in many natural forms of behaviour (Anthis and Reese Anthis 2019). A shift away from high levels of meat consumption and production thus offers enormous potential to alleviate the suffering of billions of sentient beings.

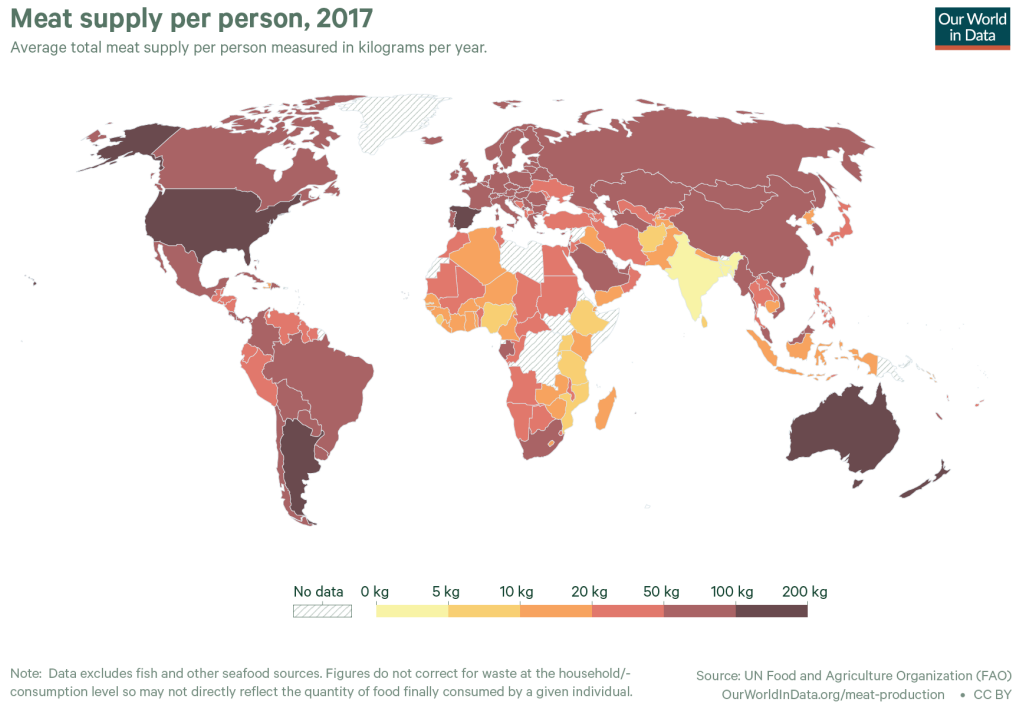
For several of these reasons, some governments have begun to emphasize and recognize the need to shift away from high levels of animal product production and/or consumption. For instance, driven by local environmental concerns related to nitrogen pollution, the Netherlands recently introduced measures to reduce livestock numbers in the country by 30% by 2030 from 2019 levels (see Case Study 1 in Section 3.2). The EU's Farm to Fork strategy highlights increasing the availability and source of alternative proteins as a "key research area" (European Union, 2020, p.16). And countries such as Canada, Denmark, Israel and Singapore are already providing public support towards plant-based or cultivated meat (Danish Government 2021; GFI 2021; Hanson 2020; Singapore Food Agency 2020).

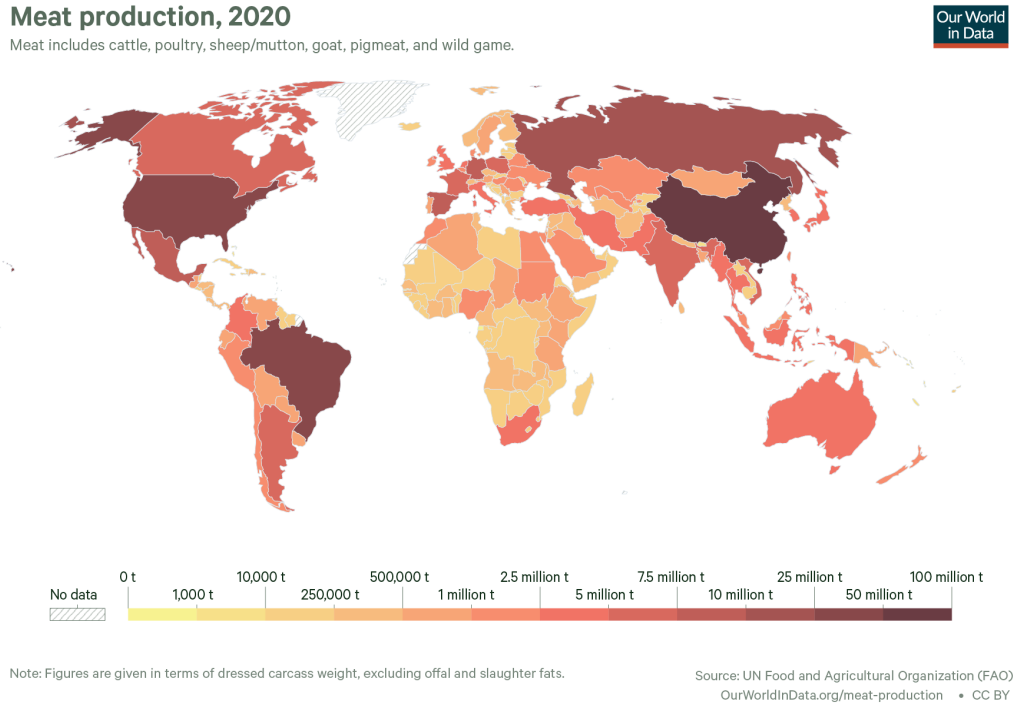
2.1. The Global North as the starting point for a just transition

Globally, the consumption of meat and other animal products is highly unequally distributed. For instance, as shown in Figure 1a, Australia's per capita meat consumption is among the highest in the world, while that of some of its Southeast Asian neighbours is among the lowest. Meat production is also unevenly distributed, and production practices vary considerably. In low-income settings,

particularly in the Global South, industrialized meat production is less common, animal products such as meat and dairy can form an important source of protein and micro-nutrients for many communities, and livestock rearing currently provides much-needed food security, income, and fertilizer for crops (Hlophe-Ginindza and Mpandeli 2020; Kaur 2021; Rufino et al. 2007).

Figure 1a. Meat supply per person, 2017. Figure 1b. Total meat production by country, 2020.





Source: Adapted from Our World in Data, using UN Food and Agriculture Organization data.[2]

2 See https://ourworldindata.org/grapher/meat-supply-per-person and https://ourworldindata.org/grapher/meat-production-tonnes.

Against that background, it is even more vital that higher-consuming and wealthier nations, with lower need and higher capacity (i.e., the Global North), take the lead in supporting a dietary transition away from meat. This is in line with the equity principles embodied in the concept of "common but differentiated responsibilities and respective capabilities" that underpins the Paris Agreement, for instance. As noted above, this is also in these countries' self-interest, as high levels of meat consumption are associated with both public health risks and environmental harm. A growing number of experts have thus called for reductions in meat consumption and/or production in high-income countries in particular (Parlasca and Qaim 2022; Schiermeier 2019).

Our analysis therefore focuses mainly on higher-income countries with high levels of meat production and/or consumption – such as Australia, Canada, New Zealand, the US and many European countries. That said, for sustainability and public health reasons, middle-income countries that are major meat producers and/or consumers should also consider initiating such transitions soon.

The exact size of the suggested drop depends on various assumptions, but are generally significant. For instance, the EAT-Lancet report estimated that red meat consumption should fall 50% globally, with North Americans and Europeans cutting red meat consumption by 84% and 77%, respectively (Willett et al. 2019; Carrington 2019). Researchers at the University of Bonn have suggested that meat consumption in rich countries should fall by at least 75% (Universität Bonn 2022); while a scientific assessment by Greenpeace estimated that meat consumption in the EU should drop by 71% by 2030, and by 81% by 2050 (Reyes et al. 2018).

Since supply chains for meat and other animal products are highly globalized, reductions and changes in diets in one place can impact stakeholders far from the point of consumption (see, e.g., Zhunusova et al. 2022). For an equitable transition, such international effects will be essential to consider and should be the focus of a future analysis. Here, however, we start by exploring the implications of a shift away from large-scale production and consumption of animal-based foods for countries' domestic policies.

2.2. What kind of transition is needed?

While many recognize the need to shift away from their high levels of animal food production and consumption, there are different visions for such a transition, emphasizing different priorities. For instance, from an animal rights perspective, some envisage a complete shift away from animal products (Bruers 2015). Others still foresee room for some consumption of (certain) meat and other animal products in line with environmental boundaries or health guidelines (Willett et al. 2019). Many emphasize the particularly high environmental, health, social and animal welfare costs of industrial animal agriculture, or "factory farming" (50by40 2021; Parlasca and Qaim 2022; FAIRR 2016; Harari 2015), a system that enables overconsumption of animal products due to an emphasis on economic efficiency that hides its true costs.

Views also differ on what alternative food systems we should collectively move to (Garnett 2015). Some encourage a return to greater consumption of legumes, vegetables and traditional meat replacements such as tofu and seitan. Others emphasize the role of technology in creating a different food future, in particular through the fast-evolving "alternative protein" industry (Sexton et al. 2019). Those perspectives reflect contrasting visions for the food system – the latter integrating meat substitutes into industrial food systems, while the former seeks to shift away from heavily processed foods (Hu et al. 2019; Morgan 2021).

The role of livestock in sustainable agri-food systems is a long-standing debate in the literature (see, e.g., Altieri and Toledo 2011; De Schutter 2017). People have kept livestock since ancient times, though in very different ways than is now the norm in industrial systems, and animals can be part of sustainable food systems (IPES-Food & ETC Group 2021). In some places, crop production is not viable, and animals are crucial to local food supplies. Livestock can

also be integrated in mixed farming systems – but at much lower densities than in industrial operations (Fresco et al. 2017).

In this report, we do not specify a particular end state for the transition, given this will be context-specific and best identified through an inclusive process. We do recognize, however, that limited amounts of animal product intake could align with planetary health and boundaries, while also noting the scientific evidence that nearly or completely eliminating animal-sourced foods would achieve even greater climate and broader environmental benefits. Given the high environmental, health, social and animal welfare costs of industrialized animal agriculture, however, we focus here on the need to transition away from it – and from the high levels of meat consumption it supports.

When it comes to the speed of this transition, the urgency of climate change and biodiversity loss call for fast action, but it is clear that such a large change will take time. Success will depend on multiple, combined interventions (Rust et al. 2020). Government policies will play an important role, either accelerating a transition (e.g. by shifting subsidies to promote plant-based food production) or delaying it (by continuing to subsidize industrial meat production and promoting consumption of animal-based foods). At the same time, how and to what extent consumer preferences continue to evolve will affect the pace and nature of this transition.

Another key driver will be continued innovation in alternatives to meat and other animal products. A recent analysis projected that the plant-based food market would grow more than fivefold in this decade alone (Bloomberg Intelligence 2021), but incumbent actors are also fighting to protect their interests. Among them are some of the world's largest corporations, which wield significant financial, political and lobbying power, as evidenced by persistent disputes over the labelling of vegan meat and dairy alternatives, and the recent ban of vegan cheese alternatives in Turkey (Ettinger 2022).

While we recognize just transitions in the meat sector will look different in distinct contexts, we do make two normative assumptions. The first is that transitions in the meat sector must be comprehensive and fast enough to meet climate and other sustainability targets; continued delays would be fundamentally unjust, as unsustainable practices continue to take a major toll. The second is that given the significant changes that it would entail and the risks to individuals and communities, a just transition approach is vital. It will require inclusive planning to promote equitable outcomes, avoid creating new injustices, and help address existing ones.

2.3 What does it mean to have a 'just transition'?

The concept of just transition emphasizes that large socio-economic shifts in response to climate change should be planned and implemented in a way that is socially fair. The initial conceptualization of the term, developed by US trade unions in the 1970s, focused on protecting the rights of workers and communities that would lose jobs and economic opportunities in the face of new environmental regulations (Stevis et al. 2020).

More recently, the concept has become an important pillar of climate policy agendas, highlighting the different economic and social equity dimensions associated with transitioning away from fossil fuels to renewable energy sources (Wang and Lo 2021). In this context, the meaning of just transition has also been widened to consider not just job losses, but also impacts on a much wider range of stakeholders whose prior entitlements or expectations are put at risk by climate change policy. That broader group might include, for instance, households and communities who still lack basic energy access, people who depend on their cars for mobility, industry-dependent regions, and those who have been adversely affected by an industry (McCauley and Heffron 2018).

It is only recently that the need for just transitions in agriculture, including the livestock sector, has become more widely acknowledged (UNFSS 2021; Blattner 2020; Anderson 2019; 50by40 2021). As discussed above, there are compelling reasons to move swiftly away from

large-scale meat production and consumption. Nevertheless, achieving a just transition will pose significant challenges.

First, the transition will affect food supply and diets, which are essential to human well-being. Diets come with strong personal and cultural ties that may incur significant resistance to changes. Without deliberate just transition policies, approaches that increase prices or otherwise change food access and availability could adversely affect low-income and food-insecure households.

Second, many millions of people globally are economically dependent on the meat industry. These include groups that already face significant socio-economic challenges, such as many farmers and rural communities, as well as other workers in the meat supply chain, who often face exploitation, discrimination and precarious working conditions, and whose interests risk being overlooked if their industry declines.

Third, the global meat market is worth about US$1 trillion and continues to grow rapidly,[3] while the alternative protein industry is expanding even faster, with one recent analysis projecting it could jump from US$4 billion in 2020 to US$28 billion in 2025 and US$74 billion in 2030 (Bloomberg Intelligence 2021). Significant economic and political interests are thus vying to shape the future food system.

A key point in a just transition is that it is important to find solutions that are not just environmentally sustainable and economically viable, but also socially just. It is important to recognize upfront that the process of just transition is a political and contested one. There are no “one-size fits all” solutions, and just transition policies should be tailored to different circumstances with the participation of affected stakeholders. These decisions are inherently political, including questions of whose voice is heard. Being aware of the potentially affected stakeholders and principles that can help to promote a more just process is an important prerequisite for following these aims. With that in mind, the next section maps the key groups of stakeholders in the transition away from large-scale production and consumption of meat in wealthy countries.

Turkeys being raised on a farm in the US. © U.S. DEPARTMENT OF AGRICULTURE

3 Recent estimates include US$897.5 billion in 2021 (MMR 2022), US$1.33 trillion in 2021 (IMARC Group 2022), and about US$1.30 trillion, including fish, in 2020 (Bloomberg Intelligence 2021). All three analyses project robust growth; Bloomberg Intelligence projects the market for animal protein will reach US$1.5 trillion in 2030.

3. Mapping key stakeholders for a just transition

To our knowledge, this is one of the first papers to systematically map the key stakeholders who would be affected by a transition away from high levels of meat consumption and production in the Global North. We do so by building on Green and Gambhir's (2019) assessment of stakeholders affected by a low-carbon transition in the energy sector. We have adapted that analytical framework for the industrial meat sector by adding a separate category for farmers. As explained in Section 2, unlike Green and Gambhir, we do not discuss the role of different countries as stakeholders of global trade in meat, although we recognize the importance of such an analysis to securing a transition that is not only just and equitable within countries, but also among them.

The key categories we identified are consumers, farmers and other producers, workers, communities and companies. This section discusses each category in turn (for a summary, see Figure 2).

Grilling meat is a cherished part of many cultures.
© STEPHANIE MCCABE / UNSPLASH

3.1. Consumers

Meat can be an important source of protein and nutrients (Bohrer 2017). What is more, many people derive considerable enjoyment from consuming meat; from holiday roasts, to backyard barbecues, meat products often play a central role in cultural and social lives as well as personal and group identities (Zaraska 2016).

An increasing but still small percentage of the populations of high-income countries are following flexitarian/reductarian (having a substantially reduced meat intake, but not eliminating it entirely), vegetarian (no meat) or vegan (no meat or animal products) diets, due to concern for animal welfare, climate concerns, crises in meat supply chains and shifting dietary advice from health experts (Kopplin and Rausch 2021; Sanchez-Sabate and Sabaté 2019). While vegans remain a small minority, many people now routinely consume plant-based alternatives to meat and dairy (Ho 2020a), with vegan milks enjoying by far the greatest global market share – 10% in 2020 (Bloomberg Intelligence 2021).

The 2019–2021 average consumption in developed countries[4] was 68 kg per capita per year – an approximate doubling over the preceding 50 years (OECD and FAO 2022; Ritchie and Roser 2017). This trend hides significant differences in the types and amounts of meat consumed across countries and demographic groups, reflecting cultural preferences, religious beliefs, and concerns about health, the environment and animal welfare.

For instance, while globally, there is a strong correlation between rising incomes and increased meat consumption, within high-income countries, meat consumption patterns are complex (see, e.g., Zeng et al. 2019; Frank et al. 2021), and poorer people sometimes have meat-heavier diets. In France, higher-income groups tend to consume less meat than the rest of the population, while low-income groups consume the most (Tavoularis and Sauvage 2018). Similarly, in Germany, lower socio-economic status groups consume more meat and meat products than their wealthier counterparts (Heuer et al. 2015), and in the UK, the lowest-earning households consume more red and processed meat than the highest-earning households (Maguire and Monsivais 2015).

While there may be several reasons for these income-based differences, they are often linked to disparities in access to a broad range of nutritious foods, especially fruit and vegetables. Many lower-income households, even within highly developed nations, can more easily find – and afford

4 The FAO categorizes "developed countries" to include Canada, the US, all of Europe, Japan, Israel, South Africa, Australia, and New Zealand, and countries of the Commonwealth of Independent States (Azerbaijan, Armenia, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Uzbekistan and Ukraine).

Figure 2. An overview of key stakeholders in the transition away from industrialized meat production and consumption.

Farmers and other producers

Animal farming has undergone significant transformation in the past decades, and in many high-income regions the vast majority of livestock is raised in industrial conditions. Still, livestock farmers and animal feed producers are a diverse group, and some are economically vulnerable.

Challenges

- Producers face potentially large reductions to their incomes and job losses. Farm assets could be stranded.
- Tenant farmers may lack flexibility in how they use their land. Many farmers may be locked into vertically integrated systems with large outstanding loans and few affordable alternatives.
- Older farmers, farmers with pre-existing debt, and small farmers with limited government support may face additional transition barriers.
- Strong cultural and emotional ties to existing practices and livelihoods may make farmers strongly resistant to (government-mandated) change.

Opportunities

- Farmers with arable land may benefit from new market opportunities, particularly if they receive support to unlock themselves from animal feed production.
- There is potential for new uses of landscapes, including through new ecosystem markets (e.g., recreation, crops providing renewable energy or activities benefiting biodiversity). Some may benefit from increased land prices with the development of new markets such as carbon sequestration.

Workers in meat supply chains

Workers in this sector are often disproportionately male, migrant, and/or from disadvantaged or marginalized groups.

Challenges

- Workers may face significant job losses. Discrimination, exploitation and precarious and dangerous employment conditions experienced by meat supply chain workers all create a high risk of an unjust transition.

Opportunities

- Jobs in plant-based or novel alternatives sectors are projected to grow significantly; however, these will not necessarily benefit the same workers who stand to lose jobs in the meat sectors. Attention will also need to be paid to the quality of new jobs.

Companies

Large companies are involved across many aspects of the meat supply chain, including in meat processing, distribution and retail, and shape industry practices to a great extent.

Challenges

- Meat producers could be forced to change their practices in fundamental ways, and could also see their profits sharply reduced.
- Other actors across the supply chain will have to adapt, and not all will do so successfully.
- Livestock industry lobby groups have significant political and economic influence, and some are seeking to delay any transition.

Opportunities

- Rising demand for plant-based foods, including meat alternatives, is a major business opportunity. As the same time, the rise of the alternative protein industry raises new just transition questions, e.g., related to societal impacts.
- Across the supply chain, some companies will be better positioned than others to capitalise on dietary shifts. New market leaders are likely to emerge.

Communities

The identities and economies of some communities, particularly in rural areas, are closely tied to animal farming and/or meat processing. These communities may include a high density of low-income groups and ethnic minorities.

Challenges

- Some communities may have few, if any, alternative employment options available.
- Altering land uses may impact the cultural life and social fabric of communities.

Opportunities

- Potential to sharply reduce air and water pollution and other health hazards associated with livestock operations and meat processing plants.

Consumers

While awareness of meat's impacts is growing, per capita meat consumption remains high in high-income countries. Consumption levels vary with factors such as age, gender, culture, religion, and socio-economic status.

Challenges

- Higher meat prices could disproportionately affect low-income households and those with limited access to affordable plant-based foods.
- Strong cultural and personal attachments to meat among many consumers, with potential risks of "culture wars" due to sensitive nature of diets.

Opportunities

- A growing array of meat substitutes can provide alternative sources of protein and replace popular meat products (e.g. vegan "burgers" and "bacon").
- Repurposing subsidies to expand access to healthy foods could improve nutrition, particularly among vulnerable populations, and could reduce (non-communicable) disease burdens.

SEI

– highly processed foods and meat than fresh produce (Annie E. Casey Foundation 2021). Indeed, "food deserts" – areas characterized by high poverty rates and limited access to healthy food – have been documented in the UK, Germany, Slovakia, Australia and the US, among others (Krizan et al. 2014; Neumeier and Kokorsch 2021; Needham et al. 2022).

Aside from wealth, there are a host of other factors that help explain differences observed in levels of meat consumption. These include gender differences – on average, men consume more meat (particularly more red and processed meat) than women, resulting in a higher dietary environmental footprint (Rippin et al. 2021; Meier and Christen 2013). Age differences are likely important, too, though findings are mixed: young people in the US and UK are purchasing more animal-based products than older-age groups, but favouring poultry over red meat (Attwood et al. 2021). Yet younger generations in the US and UK have also been found to be likelier to see meatless diets as healthier (Dsouza 2022), and appear to be leading alternative protein consumption (Ho 2020b).

Although the patterns are not clear-cut and will vary by region, what is apparent is that the impacts of any transition away from industrialized meat consumption will vary across consumer groups, reflecting pre-existing differences in their eating habits and in the alternatives available to them.

A shift towards reduced meat consumption can follow different paths. If it aligns with a shift away from industrial livestock production and the economic efficiencies that this offers, then consumers are likely to experience price increases, akin to those often associated with sustainability criteria, such as organic labelling (Staudigel and Trubnikov 2022; Schulz 2020). This could be particularly difficult for low-income households to manage.

However, research on the affordability of healthy and sustainable diets is inconclusive. A recent analysis found that, compared with current diets, healthy and sustainable dietary patterns would cost up to 22–34% less, on average, in upper-middle-income and high-income countries, but at least 18–29% more in lower-middle-income and low-income countries (Springmann et al. 2021). An earlier meta-analysis of 27 studies from 10 high-income countries that included price data for individual foods found that the healthiest diets were US$1.50 more expensive per day than the least healthy diets (Rao et al. 2013).

It is worth bearing in mind that most meat is artificially cheap, due to extensive subsidies on livestock and animal feed production (Rust et al. 2020). Prices also do not reflect health, environmental or animal welfare impacts (Funke et al. 2021). Consumers may instead pay for such impacts in other ways – through taxes or individual healthcare costs. However, with the deepening cost-of-living crisis that is affecting even the highest-income countries, it is critical to consider affordability and accessibility in realizing a just transition away from high-meat diets.

Beyond economics, many other factors may drive resistance to change, including deeply ingrained cultural and familial traditions associated with meat; scepticism about the need to reduce meat consumption; a distaste for the flavour, texture and other qualities of substitutes; a lack of skills and knowledge preparing meals without meat; health concerns; and a desire to maintain control and agency regarding food choices (Collier et al. 2021).

Some of these concerns may be addressed through the already broad and fast-growing array of plant-based foods available in stores, including many meat replacements. As noted above, the global plant-based food market is growing rapidly. This means that consumers are likely to have access to many different plant-based protein sources.

Still, the rise of meat alternatives also poses new transition challenges and questions (see also Case Study 2 in Section 3.5). For instance, alternative proteins are still generally more expensive than meat products (Good Food Institute 2022). Moreover, products designed to imitate meat, such as plant-based sausages and burgers, can be highly processed and contain high levels of sodium and saturated fats, so we need a better understanding of their potential health impacts (Santo et al. 2020; Hu et al. 2019).

In politically polarized times, meat consumption can also become a subject of "culture wars". In France, for instance, a decision by the Green mayor of Lyon to temporarily serve vegetarian meals at schools to speed up food serving and facilitate social distancing during the pandemic led to public protests (Henley 2021). In the US, false claims that President Biden's climate plan demanded cuts in meat consumption sparked significant public outrage (Contois 2021).

These experiences highlight the delicate balance that policy-makers must strike: on the one hand, ambitious policies are needed to transform food systems; on the other hand, policies that are perceived as heavy-handed may activate political and social identities around meat-eating and lead to public outcry and pushback (Zaraska 2021). Thoughtful and just policies will be necessary to navigate this dynamic.

3.2. Farmers and other producers

The effects of reducing meat production and consumption will be felt strongly by farmers – those raising livestock as well as those producing feed for the animals. The transition will compound challenges in a sector that has already faced significant changes and challenges in the past decades. OECD countries are undergoing long-term structural changes in farming, characterized by a steady increase in average farm sizes and a concentration of production on fewer and larger farms:

- Australia: Since the 1980s, the total number of farms has been halved, while average farm size has increased alongside major shifts towards corporate ownership (Sheng et al. 2017; Skilbeck n.d.).

- Canada: Farm consolidation is observed in Canada as well, where the total number of farms has dropped (Government of Canada 2022).

- EU: The number of farms in the EU declined between 2003 and 2016 from about 15 to 10 million (-32%), with the decline strongest among small farms (<5 ha) while the number of large farms (>50 ha) has increased (Lecarte and Negre 2022).

- US: Farm numbers are slowly, but steadily declining, while farm size is growing; in 2021, there were around 200,000 fewer farms than in 2007, with average farm size up by about 5 acres, or 2 ha (USDA 2022); the 2017 Census of Agriculture found that about 60% of all cows were on farms with at least 100 cattle, and over 18% were on farms with at least 1,000 cattle (USDA 2019).

In many regions, the livestock sector has seen a significant shift from small, independently owned operations towards the emergence of a much smaller number of large operations, called "concentrated animal feeding operations" (CAFOs).[5] In the US, this began in earnest with poultry in the 1950s and cattle and pigs in the 1970s and 1980s, with a shift from small, independently owned operations towards a much smaller number of large operations (Macdonald and McBride 2009), and by the mid-2000s, CAFOs dominated livestock and poultry production. Similarly, in the EU, almost three-quarters of farmed animals were reared on very large farms (defined as having an output of >€100,000) in 2013 (Eurostat 2018), while small and medium livestock farms have been disappearing rapidly in the past 15 years (Harvey 2021).

Despite these trends, the data make it clear that livestock farmers are a very heterogenous group, in terms of farm size, types of animals raised, and the conditions in which animals are kept. They are also socio-economically diverse: in the Netherlands, a third of farmers earn less than minimum

5 The US Environmental Protection Agency defines an "animal feeding operation" as a lot or facility where animals are kept and fed for a total of 45 days or more in any 12-month period, and crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility. Within that category, there are medium and large CAFOs; a medium CAFO has 300–999 cattle, for example, whereas a large CAFO has 1,000 or more; for pigs weighing over 55 pounds each, the corresponding limits are 750–2,499 and over 2,500, respectively; for chickens (other than laying hens), a medium CAFO is 37,500–124,999, and a large CAFO is 125,000 or more (US EPA 2021).

wage, but one in five millionaires in the country is a farmer (Bohlmeijer 2022). Understanding these nuances will be crucial; nevertheless, some general observations can be made.

Farmers in the industrial livestock industry face a range of significant challenges in transitioning partially or fully away from meat production, since many might have to repurpose some (or even all) of their land and facilities. Many chicken and pig farmers are locked into vertically integrated systems (integration from the primary producer to the processing companies) with large outstanding loan repayments for specialized buildings and may have land that allows for few affordable alternatives for conversion to alternative products (Newton and Blaustein-Rejto 2021). Some may no longer be able to make a living from their historical form of production and could find themselves with stranded assets due to the transition, such as large climate-controlled animal rearing barns (Caldecott et al. 2013).

Older farmers and those with small and/or remote farms may face particularly large challenges, as could those already in debt to suppliers and meat companies and those with poor access to information (Baldock and Buckwell 2021). Limited government support for the transition and lack of access to attractive incentive schemes or private markets would exacerbate those difficulties.

Another possible barrier to transition for tenant farmers will relate to land ownership and governance. Landlord tenancy law and percentage of tenanted farms vary between countries substantially but in certain jurisdictions tenant farmers may have less flexibility to change land use and require permission from their landlord to diversify (Harris 2021; Ranjan et al. 2019).

Farmers already suffer from higher-than-average suicide rates, including in the EU, US and Australia, which has been linked to stresses associated with fluctuating markets, small profit margins, debts, exposure to pesticides, social isolation and increasingly unpredictable weather patterns (Weingarten 2018). Additional stressors for farmers may include asymmetrical power relationships vis-à-vis meat processing companies and increasing burdens of government regulations (Murphy et al. 2022). Work and finance flows may be disrupted with changes in land-use and farm activities with concomitant increase in stress and mental health problems for farmers and their workers.

Smaller-scale meat production or a shift to different activities may be economically attractive to some farmers, particularly if they can find ways to diversify their income – for instance, through agritourism, recreation and hospitality activities.[6] Farmers may be able to seize new opportunities through targeted national or regional support for the transition (e.g. in the EU), through policy measures and the establishment of new ecosystem markets, such as for bioenergy crops, forestry or activities benefiting biodiversity. Some may benefit from increased land prices with the development of private or public markets in environmental services such as carbon sequestration (Baldock and Buckwell 2021). Nevertheless, it is important to recognize that not all farmers will have these options, nor will all welcome them, as they may feel strong personal ties to their current activities.

Animal feed producers may also benefit from new market opportunities if they receive government support to find new markets or shift to other crops (Newton and Blaustein-Rejto 2021). Some of the most cultivated crops today, such as soy, wheat and maize, are used in large quantities for animal feed; soy in particular could instead be used to produce plant-based meat. Increased demand for other plant proteins, such as peas, nuts, mushrooms and lentils (if compatible with soils and local climate), could allow farmers to diversify and increase their income (see also Santo et al. 2020).

A handful of government initiatives have begun to pave the way for the transition as a result of livestock emissions. For example, the government of Flanders (Belgium) is planning to close its most polluting livestock farms by 2025 (Steffens 2022), and in 2021 the new Dutch government announced a €25 billion initiative that included plans for livestock farmers to cease farming, providing assistance

6 A prime example is the US state of Vermont, which has developed a robust culture of small-scale farms, farm-to-table restaurants and farmstands, backed by supportive state policies and programmes: https://agriculture.vermont.gov/development/agritourism.

for others to transition to more extensive farming methods (Levitt 2021). These measures have faced steep resistance from some in the Dutch farming community, demonstrating the significant challenges for individuals, communities and governments (Case Study 1). Farmers in Spain, Ireland and New Zealand have also protested environmental reforms in recent years (Nugent 2022).

Indeed, as important as economics – perhaps even more – farming identity is a key factor that will need to be considered in any transition of the sector. One of the discourses fuelling farmer protests in the Netherlands is the notion that farmers are underappreciated and have been side-lined in Dutch society (Mijnlieff and Tielbeke 2021). Similarly, in interviews conducted with beef farmers in Ireland, identity emerged as an important theme, with farming connecting farmers to their culture, community, and families, and in how they relate and connect with others (Murphy et al. 2022).

Policy-makers will also need to consider and grapple with are the power dynamics within the farming sector, and whose discourses they fuel. For instance, while farmers are the figureheads of the large-scale protests in the Netherlands, these have been financially supported by large feed and meat processing corporations, who also stand to be financially affected by the proposed policy measures (Leiten and Boogaard 2022). As Case Study 1 highlights, engaging proactively with a broad cross-section of farmers will be crucial to a successful and just transition.

CASE STUDY 1: A BELATED EFFORT TO REDUCE FARM ANIMAL STOCKS IN THE NETHERLANDS

The Netherlands has one of the highest livestock densities in the world – more than 4.5 times the EU average in 2016 (Eurostat 2019) – and is a leader in the production and export of meat, dairy and other animal products. The country exported 3.6 billion kg of meat in 2020, of which 85% was domestically produced, generating 98,000 full time jobs (CBS 2021).

The sector has raised environmental concerns since the 1970s, however, due to the overflow of nutrients – particularly nitrogen – into surrounding areas (Bobbink et al. 1998; Post et al. 2020). Cattle and pigs are the main drivers of ammonia emissions (one of the targeted nitrogen-based compounds): 49% and 15% respectively in 2017. This is primarily caused by excess manure produced in intensive and highly specialized farms (TNO 2019).

In May 2019, the Council of State (the highest Dutch administrative court) ruled that nitrogen depositions in protected natural areas part of the EU's Natura 2000 network were too high (RIVM 2019), and that the ongoing national emission permit strategy for managing and reducing these emissions was not compliant with the EU Habitat Directive that established Natura 2000 (EU DG Environment 2015). After expert consultations (Remkes et al. 2019), the Dutch government announced in 2021 the unprecedented plan to cut the number of animals in farms by 30% by 2030 (from 2019 levels) in an attempt to halve nitrogen emissions (NOS 2022). The new livestock strategy contains several just transition measures aiming at minimizing and addressing the unavoidable impacts of such a rapid transition, including a €25 billion fund for the extensification, conversion, relocation, and innovation in the sector. Provinces are responsible for the implementation of the plan with flexibility to adapt to the local needs (VVD et al. 2021).

The Dutch farming community responded with some of the biggest protests in the country's recent history. Many farmers felt betrayed by the government's sudden change of discourse after decades of promoting intensive livestock farming, and excluded from key decision processes despite consultations with traditional farmer unions (NOS 2019; Schaart 2019).

Dutch Farmers on their way to a protest in The Hague, October 2019 © KEES TORN / WIKIMEDIA

The Dutch government is now back at the negotiating table to find a transition pathway agreed with all stakeholders, including farmers (NOS 2022). But experts fear that the dialogue will result in a weakened plan that undermines the government's original objectives (Olff and de Vries 2022).

The Dutch case is one of an abrupt transition after decades of delay. As early as 1974, the Dutch Ministry of Agriculture warned against the significant environmental effects of intensive livestock farming (De Minister van Landbouw en Visserij 1974). However, the various attempts to cap and reduce nitrogen emissions contained many loopholes, with successive governments prioritizing the expansion of a demand-driven, intensive and techno-centred farming sector over environmental concerns (van der Ploeg 2020). This approach was backed by the influential Dutch agrobusiness lobby, supported by the Dutch farmer unions and the EU Common Agricultural Policy (Frouws 1994; van der Ploeg 2020).

This example illustrates the risks of delaying necessary transition steps, as well as the challenges of inclusivity in a rushed process, where the victims of the transition may become its strongest opponents. Going forward, clear, predictable policies can reduce uncertainty for impacted stakeholders and enable a less disruptive transition.

Lessons from the Dutch nitrogen crisis may be relevant for other European countries, not only because Belgium, Denmark and Germany, for example, also face nitrogen problems (Bombaerts 2022; Eurostat 2019; TNO 2019), but also to meet recent methane reduction pledges (Van der Veen et al. 2022). The Netherlands case is also a reminder that European countries cannot effectively tackle their livestock emissions without an alignment of EU level policies, such as the CAP, and without coordination within European countries as Dutch farmers increasingly relocate to other neighbouring countries with less stringent environmental regulations (Schaart 2021).

3.3 Workers in meat supply chains

The livestock industry is a significant employer of both formal and informal workers along the supply chain, from farm production to meat processing and packing, transport, wholesale and retail trade. Besides animal husbandry and meat processing and/or packing, workers also contribute to the livestock sector as providers of animal feed and veterinary support.

Reliable and comparable global data on livestock sector employment are not readily available, although estimates in selected high-income countries and regions (see Table 1) suggest that in each country, tens of thousands of farm and meat processing workers have the potential to be impacted by a reduction in meat consumption and production.

Table 1. Employment in the meat industry in selected high-income countries

Country/region	Measure	Number of workers	Source
Australia	Direct employment across the meat industry	195,800 (2019–2020), including 131,500 in production, 30,900 in processing, rest in sales	Meat & Livestock Australia (MLA 2021)
Canada	Meat, Beef & Poultry Processing	71,905 (2022)	IBISWorld (2022)
EU	Meat industry	1,000,000 (2019)	EFFAT (2020b), using Eurostat data
Germany	Slaughtering and meat processing	151,500 (2021)	Statistisches Bundesamt (Destatis 2022)
New Zealand	Direct employment in the red meat sector	35,700 (2020)	Beef+Lamb New Zealand and Meat Industry Association (B+LNZ and MIA 2020)
UK	Meat processing jobs	97,000 (no date given, presented as current)	British Meat Processors Association (BMPA n.d.)
US	Meat and poultry industry	520,000 (2021)	US Bureau of Labor Statistics (BLS 2021)

Understanding the socio-economic profile of workers and analysing employment trends in the global livestock industry is challenging given the different modes and realities of employment. Nevertheless, similar patterns can be identified across the countries and regions which dominate meat production.

Meat factory workers in Europe and the US are disproportionately male, and migrant and/or from a marginalized or disadvantaged ethnic group (Fremstad et al. 2020; Hansen 2018). In the US, nearly 60% of those employed in the animal slaughtering industry are Black or Latinx (Stuesse and Dollar 2020), and in some regions meat processing and packaging workers are disproportionately undocumented workers and refugees (Hausermann et al. 2021).

Europe's meat industry is also reliant on migrant labour (EFFAT 2020a). For example, it is estimated that 90% of workers in the Netherlands' meat sector are migrants; about a third of workers in Spain's meat sector are migrants, mostly from North Africa and Eastern Europe; and in Italy more than 50% of the workforce are migrants, mostly from Eastern Europe, the Balkans, North and Central Africa, and East Asia (McSweeney and Young 2021).

Workers are exposed to a range of health issues – from respiratory and water-borne diseases, antimicrobial resistance, bacterial and viral infections, to effects of exposure to dangerous equipment and hazardous chemicals (Hu et al. 2017; Martin et al. 2015; Walker et al. 2005). The COVID-19 pandemic demonstrated these issues, when many meat processing and packing facilities became hotspots for COVID-19 transmission. In the US, for instance, it was found that livestock workers and their families/networks faced over 50% higher COVID-19 infection rates and

Workers at a meat factory in Switzerland © JAI79 / PIXABAY

up to 50% more deaths compared to the general population (Taylor et al. 2020). This impact is attributed to crowded workplaces, worker accommodation and transport, a lack of sick leave and healthcare benefits, language barriers; and poor company record-keeping to track the outbreak (McSweeney and Young 2021; Reuters 2020; Zee et al. 2020).

For slaughterers and meat packers – particularly hazardous occupations (Wasley et al. 2018) – health and safety concerns have been raised and physical injuries tend to lead to high turnover rates (EFFAT 2020a; GAO 2016; Kendall 2020). Mental health and well-being impacts are less well-documented but are likely to be a significant concern, given the physical conditions and general stress associated with the issues outlined. In addition, slaughterhouse workers have been found to experience adverse mental health impacts from killing animals, including trauma, shock, anxiety, guilt, shame and depression (Slade and Alleyne 2021).

The discrimination and exploitation experienced by a significant proportion of the livestock industry workforce, in addition to the low wages and precarious nature of employment for many, means there is high risk of an unjust transition for workers (Mouat et al., 2019; Stephens et al., 2018). Proactive, equitable measures to support workers must be included in transition planning, and new opportunities must benefit these workers.

Findings from socio-economic modelling analysis of the French food system suggest that a just transition involving a systematic, policy-led recomposition of the food system that prioritizes climate health and biodiversity could maintain and generate more jobs across the European agri-food sector[7] without loss of income than the business-as-usual scenario, while offering more diversified foods and despite reductions in total production (Aubert et al., 2021a ; Aubert et al., 2021b).

Another study from the Climateworks Foundation and the UK Foreign, Commonwealth and Development Office found that the alternative protein market could create more than 8 million jobs globally by 2040 (ClimateWorks Foundation and UK Foreign, Commonwealth and Development Office 2022). Elsewhere, analysis of Latin America and the Caribbean estimates a shift from animal-based to plant-based diets could generate 19 million new jobs by 2030, compared with 4.3 million lost from livestock herding, poultry, dairy and fishing (Saget et al. 2020).

7 At the farm level and processing-industry level.

At the same time, further research is needed to understand what economic and fiscal adjustments would be required to make this possible. The impact and opportunities associated with such a transition will depend on a range of factors, including the scale of the transition, the labour intensity of jobs created compared to the jobs lost, the transferability of jobs and skills, job quality and security, and the desirability of new jobs given existing social and cultural ties. As transition jobs are lost and created, decision-makers and planners need to consider who will lose and benefit from these jobs, including considerations of the working conditions of new sectors and possible disparities between "science/tech-based jobs" and "production jobs" in the plant-based industry (ClimateWorks Foundation and UK Foreign, Commonwealth and Development Office 2022).

3.4 Communities

A transition away from industrial meat production will have strong repercussions for communities where large numbers of people derive their livelihoods from meat supply chains, and where local economies may depend heavily on the meat sector and the income it provides. Of particular concern are isolated rural communities and those in deeply impoverished areas. At the same time, local communities are disproportionately exposed to the negative impacts of meat production, so they could also benefit from a transition to more sustainable activities.

Job losses and reductions in small-business income would certainly take a toll on communities. Context-specific analyses are necessary to understand both direct and indirect economic impacts for local communities, including local businesses whose income depends on farmers and other workers in the meat industry. In the US, for instance, the expansion of the meat industry in some regions (e.g. North Carolina, Kansas and Texas) has been a source of jobs, income and tax revenues (Horowitz 2006) although its positive spill-over effects on employment in other sectors or on wage growth are debatable (Artz et al. 2007).

Beyond economic impacts, a whole host of other factors will need to be considered. For instance, regional industries, including animal farming, can be an important part of the social fabric of communities. Place attachment – or the bond between people and the place they live – can have significant value for individuals and communities, and changes to places, or a need to move away from them, understandably threatens individual and communal identity

Cattle awaiting slaughter in a feedlot in West Texas. Large-scale livestock operations often produce strong odors and air and water pollution that affect surrounding communities. © DHUGHES9 / GETTY

(Della Bosca and Gillespie 2018). The closure of farms could also exacerbate demographic changes in rural communities, which in many places are already being depopulated with an aging farmer population and through consolidation of farms (Newton and Blaustein-Rejto 2021). Farming communities may have intergenerational dimensions, with relatives living close to one another.

A shift away from meat-intensive diets may also alter traditional land uses that are part of the cultural life of communities. Examples of such practices may include sheep-grazed uplands in the UK, which contribute to a distinct aesthetic, support local breeds, retain heritage of traditional sheep farming, and support tourism along with providing economic opportunities for local and rural communities (Clark and Scanlon 2019; DEFRA 2013). Similarly, extensive pig farming in the oak forests of the Iberian peninsula contributes cultural and biological value to the region (Gandini and Villa 2003), and in Ireland, cattle farming has been associated with the preservation of archaeological and historical sites (Murphy et al. 2022). However, such local benefits tend to be limited when it comes to more industrialized farming methods.

Indeed, a transition away from industrial meat production could increase quality of life and reduce documented environmental risks, health risks and accidents in communities resulting from the proximity of intensive livestock farming and meat processing activities (Barrett 2006; Wing and Wolf 2000). For example, communities exposed to intensive livestock production often face disproportionately high impacts to their physical and mental health due to noxious odours, volatile organic compounds, microbes, antibiotics and hormones that can be associated with the faecal or manure "lagoons" associated with large farms – particularly with CAFOs (APHA 2019; McElroy 2010). These operations tend to disproportionately affect low-income and otherwise disadvantaged communities, and racial and ethnic minorities (American Public Health Association 2019).

Meat production can also contaminate freshwater supplies, mainly through nutrient use in growing feed crops, as well as manure management in CAFOs, farmyards, and other intensive facilities (Rust et al. 2020). In Europe, the livestock sector contributes significantly to agriculture's overall environmental impact, including an estimated 78% of terrestrial biodiversity loss, 80% of soil acidification and air pollution, and 73% of water pollution (Leip et al. 2015). Living near animal farms in Europe has been linked to health impacts such as reduced lung function associated with exposure to high concentrations of ammonia, higher risk of pneumonia and more likelihood to be carrying the MRSA bacterium (Maassen et al. 2016; Pushkarev 2021).

While some communities could capitalize on the rise of plant-based and cultivated meat production with new uses of farm buildings and conversion of land to alternative crops, this would need to be planned. Otherwise, production and processing might move closer to urban areas, which would likely worsen rural economies. To mitigate this, governments and regional decision-makers can actively plan for and support policies and programmes that support just transitions for farmers and rural communities, and companies could be incentivised to establish production facilities in historically marginalized or disadvantaged communities (Newton and Blaustein-Rejto 2021). For such interventions to succeed, it will be important to develop more granular and stratified understandings of the diverse way that different communities are impacted by the meat sector in different contexts, and the needs of the individuals within them.

3.5 Companies

The industralized meat supply chain encompasses many types of activities, from agrichemical and other inputs, to livestock feed production, pharmaceutical inputs, slaughtering, transportation, processing and retail. Given the wide range of activities they span, companies across this supply chain will be affected by a reduction in meat production and consumption in very different ways.

Fresh chicken on a supermarket shelf. Industrialized production is a core part of meat companies' business models. © U.S. DEPARTMENT OF AGRICULTURE

The production of feed for farmed animals requires a range of inputs and activities, such as machinery, seeds, fertilizers and agrichemicals. Since a reduction in meat production and consumption will still require inputs to grow crops, it appears likely that some of the activities that currently support feed production could over time be directed towards the production of alternatives, such as crops for direct human consumption and/or energy. Nevertheless, this may still entail significant disruptions and changes for businesses. Inputs for feed for farmed animals currently come from a highly consolidated global industry with a few key players (Gerhardt et al. 2019), which may help to facilitate the adaptation to new market realities, allowing for upfront investments needed to shift economic activities towards alternative goods.

A handful of companies now dominate the global meat market (slaughtering, processing, packaging and distribution), including JBS (Brazil), Tyson Foods (US), Cargill (US), and WH Group (a US firm with Chinese ownership) (Heinrich Böll Stiftung et al. 2021; Hendrickson 2020). In the US, just four conglomerates control 55–85% of the market for pork, beef and poultry (Deese et al. 2021). The actions of such companies are likely to play an important role in shaping future food systems, given the enormous resources they can mobilize to try to block a transition, or to drive a transformation.

Indeed, the development of alternatives to conventional animal products also creates new economic opportunities. Between 2018 and 2020, sales of plant-based meat and milk replacements in US grocery retailers grew three times faster than conventional animal products (GFI 2021). It is therefore possible that meat producers and processors will find attractive opportunities in the meat substitute market. Major companies such as JBS and Tyson are already making significant investments in meat alternatives, and buying up companies in this area. In 2021, Tyson introduced its first vegan burger, and JBS invested US$100 million to buy the cultured meat company BioTech Food and create a research centre on cultured meat in Brazil (Reuters 2021).

However, it is not obvious that such opportunities around plant-based alternatives or cultured meat will necessarily benefit incumbent conventional meat companies. For instance, activities such as precision fermentation and other biotech-derived meat alternatives may take place at smaller scales, will require different facilities, and need different expertise than conventional meat production and processing. Similarly, the production of cultivated meat is a highly technological process, requiring expertise in areas such as chemistry, engineering and microbiology. As

such, the emergence of such industries may also be a risk for incumbent meat companies, some of which wield considerable power individually and through their industry bodies (Heinrich Böll Stiftung et al. 2021).

There is evidence that certain agricultural and meat lobby groups are actively working undermine a transition to a food system with reduced meat production and consumption. In the US, their activities have included spending millions of dollars lobbying against climate policies and funding research that tries to blur the links between animal agriculture and climate change (Lazarus et al. 2021), while meat and other animal product lobbies in different parts of the world are seeking to prevent progress in the labelling of alternative proteins in different parts of the world (Bromwich and Yar 2019; Carrington 2020).

Further down the supply chain, companies that sell end products (e.g. fast-moving consumer goods companies and retailers such as supermarkets and restaurants) will generally more easily adapt to changing consumption patterns and less affected by a shift away from meat, given that adapting to shifting consumer demand is part of their business model.

Some of the largest companies are already diversifying their product range towards alternative products, including McDonald's (the McPlant, in partnership with Beyond Meat), Burger King (the Impossible Whopper) and KFC (Beyond Fried Chicken), and supermarkets have been similarly expanding their product range to include a wider range of meat alternatives.

Specialized stores for the retail sale of meat and meat products such as butchers are already on a decline in many high-income countries, including as a result of financial pressures due to rising rents and competition from supermarkets, a trend that could further accelerate under scenarios of significantly lower meat intake, although in some higher income communities, stores specialized in "upscale" and "artisanal" meat products may again be on the rise (Tapper 2019; Fieldsteel 2015; Ocejo 2014). Some places have also seen an emergence of "vegetarian butcher shops" that specialize in vegetarian and vegan alternatives to meat (Kendrick 2018; Lowbridge 2021): it remains to be seen whether this business model can thrive beyond a niche market.

CASE STUDY 2: THE POTENTIAL ROLE OF CULTIVATED MEATS IN A JUST TRANSITION

Cultivated meat, also called "cultured", lab-grown or cell-based meat, is an animal meat alternative produced by taking stem cells from a living animal to grow in bioreactors sufficient numbers of cells to produce muscle tissue (Post 2014). Since a first public appearance in 2013, interest and investment in cultivated meat has accelerated its technical development, driven in part by increased public awareness of the many harmful impacts of conventional meat production. Unlike plant-based meat alternatives, cultivated meat could act as an identical analogue of animal meat, which could appeal to consumers who are otherwise unlikely to choose plant-based substitutes for taste or cultural reasons.

While cultivated meats are not yet widely available, and the potential for them to replace animal meat products as scale remains uncertain, several countries have taken steps to bring these products to market. In 2020, Singapore became the first nation to approve the sale of cultivated chicken meat, based on its regulatory framework on novel foods (Huling 2020), while various other countries are working on approvals (Derbes 2021; FSIS 2022). China's latest five-year agricultural plan, released in early 2022, features cultivated meat as a component of national food security – raising expectations of accelerated growth in research, investment, and ultimately regulatory approval of cultivated meats for sale in China and for global export (Baker 2022).

The growth of alternatives to conventional animal products, including cultivated meats, may raise a range of new just transition questions. Given the infancy of the sector, there are uncertainties around the potential scale, affordability and consumer impact, as well as the relative environmental impacts of cultivated meat production (Mancini and Antonioli 2022). There are questions about the potential impact of industrialized meat substitute production on food sovereignty and the inclusivity of global food markets. Large corporations, backed by intellectual property protections and ample financial resources, could reinforce centralized and monopolized food system dynamics, while marginalizing smaller-scale producers and deepening the divide between rural and urban economies (Treich 2021; Howard 2022; Lorenzo 2022).

That said, several companies at the forefront of the cultivated meat space have been vocal and proactive about their intention to support an inclusive transition towards a sustainable and resilient meat sector (see, e.g., Vegconomist 2021). With adequate regulatory support and investment, there are opportunities for such companies to collaborate with local, regional and global partners to help generate inclusive protein supply chains. Multi-stakeholder collaboration would not only increase the chances of buy-in, but would also foster a culture of transparency that could encourage companies to pursue a 'race to mission' rather than the race to market for cultivated meats (Holmes et al. 2022). A race to mission would see the prioritization of ethical practice, sustainability and open science principles.

Decentralized production processes may be feasible in some cases, including community-owned labs that offer shared space, equipment, and mentorship for cultured meat production (Soice and Johnston 2021). These production models have several expected benefits, such as lowering the economic barriers to produce cultured meat, supporting foods with more regional utility (producers can craft products that are appropriate for nutritional and cultural needs of their local communities), creating shorter supply chains, and supporting regional food sovereignty.

The viability of a decentralized approach or other equitable production models can be improved with government support – for instance, through grants that incentivize cultured meat companies to share technologies with rural communities; funding for research and utilization of renewable local energy sources, immortal cell lines and locally-derived inputs; and partnerships with NGOs to provide training in how to grow and sustain communal facilities (Soice and Johnston 2021).

A meat specimen in the laboratory. Alternatives to conventional animal protein can improve the sustainability of our diets, but may also raise new just transition questions. © LJUBAPHOTO / GETTY

4. Guiding principles for a just transition

The concept of just transition emphasizes that large socio-economic shifts should be planned and implemented in a way that is both environmentally effective and socially fair. As discussed in Section 2.3, the concept has been broadened over time, from a primary focus on job losses, to a broader conception of who stands to be affected and how to justly address their concerns.

As highlighted in Section 3, reducing large-scale meat consumption and production will have significant impacts on several groups of stakeholders. However, even in countries where policy-makers already want to initiate such a transition, little has been done to ensure the transition is just. Experiences in the energy and industrial sectors highlight the importance of planning ahead of the decline of a sector to minimize disruptions (Atteridge and Strambo 2021b).

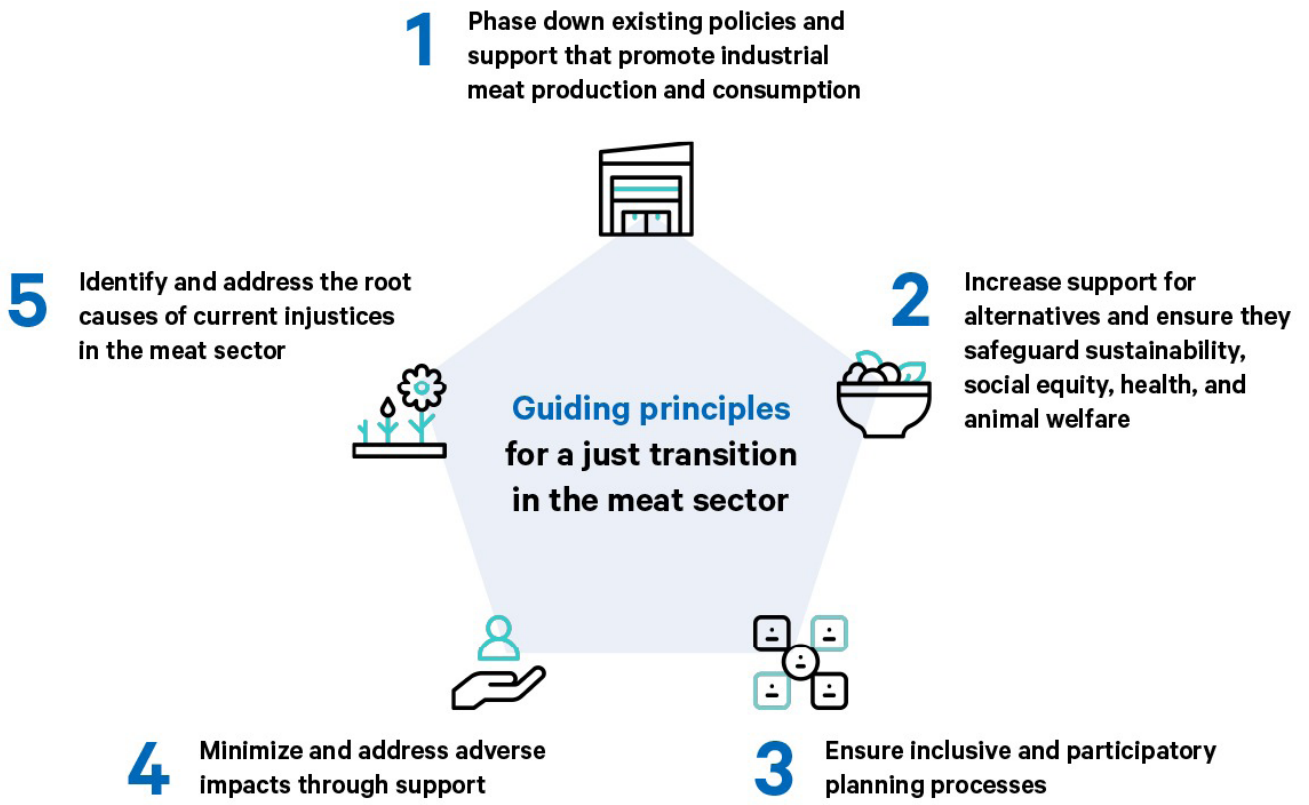
Plant-based cuisine is flourishing, with a growing array of options available. © VICTORIA SHES / UNSPLASH

What makes a transition just? Some focus on maintaining the socio-economic status quo – ensuring that no one is left worse off. Increasingly, however, just transition efforts are aiming higher, for transformative change, seeking to move beyond systems that are incompatible with sustainable development and social equity (JTRC 2018). Whatever the desired level of change, there is broad agreement that measures need to be tailored to the specific geographical and sectoral context (Galgóczi 2018; Healy and Barry 2017; ILO 2015).

The academic and policy literature provides valuable insights on guiding principles for a just transition (see, e.g., Newell and Mulvaney 2013; UNFCCC Secretariat 2016). Most of the work to date has focused on two dimensions: distributional justice (ensuring that benefits and burdens are fairly distributed) and procedural justice (a fair and inclusive decision-making process). A third dimension is now drawing attention: restorative justice – the need to provide support to people who were harmed by the activities that are being phased out (e.g. a community whose water was polluted by a mine that is now being shut down) and repair the damage done (Bastos Lima 2022; Robinson and Carlson 2021; Climate Investment Funds 2020; Greenberg 2018).

Drawing on the literature, we have identified five guiding principles of just transitions in the livestock sector and developed suggestions for their practical implementation, with a focus on distributional and procedural justice. The five principles touch on different, yet essential, aspects of just transitions, and are to be pursued collectively. Figure 3 provides a summary; the remainder of this section examines each in more detail.

Figure 3. Guiding principles for a just transition in the meat sector. (Icon source Freepik - Flaticon)



4.1. Phase down existing policies, programs, and fiscal support that promote industrial meat production and consumption

The first step towards a just transition in livestock production is to acknowledge the problem and its root causes. Policy-makers need to recognize that current meat production and consumption patterns are incompatible with the objectives of the Paris Agreement and the Sustainable Development Goals (SDGs), and include commitments to change those patterns in their updated nationally determined contributions (NDCs) (Bruun 2021). International recognition of this challenge could help build global momentum and set the stage for international cooperation in this area.

The Netherlands' plan to reduce livestock production by 30% within 10 years, discussed in Case Study 1, is a step in that direction (Netherlands Environmental Assessment Agency 2021). The government of Flanders, in Belgium, meanwhile, has a plan to close the most polluting livestock farms by 2025 (Steffens 2022). Moreover, in September 2022, Switzerland held a vote on an initiative to ban factory farming. While the proposal was rejected by 63% of the votes (Swiss Federal Council 2022a ; 2022b); it is an example of the bold type of action that can be taken towards a more sustainable and healthy food system.

Indeed, a key starting point for countries is to phase down support to industrialized meat production, which raises the most serious sustainability, animal welfare and health concerns (Section 2). Governments today support the sector in numerous ways, including through subsidies and advantageous laws and regulations (Blattner and Ammann 2020; FAO et al. 2021; Rust et al. 2020). A recent UN report found that poultry, pork, mutton and beef are among the food products that benefit most from government support, and a majority of subsidies go to industrial production (FAO et al. 2021). The report also found that most global agricultural subsidies also distort food prices.

Policy-makers can accelerate a just transition and improve policy coherence by adopting policies to remove subsidies to industrial animal farming and internalize the negative externalities of livestock production. Forced by a fiscal crisis in the 1980s, New Zealand sharply reduced farm subsidies that had propped up inefficient sheep farms (Vitalis 2007; Smith 2020). Most recently, New Zealand has proposed a scheme to require farmers to pay for their agricultural GHGs, including methane and nitrous oxide (Corlett 2022). Denmark introduced a tax on saturated fat, including from meat and dairy, in 2011, but it was repealed after a year (Wright 2022).

Subsidies for industrial meat production can be repurposed to support sustainable and resilient agricultural practices that create viable alternatives, as discussed further below. The UN has recommended repurposing subsidies to reduce poverty and hunger, improve nutrition, reduce GHG emissions, adapt to climate extremes, restore nature and improve animal welfare (FAO et al. 2021).

Governments also support the meat industry through promotional campaigns and protective policies. For example, the EU spends tens of millions of euros a year on ads to encourage meat consumption (Boffey 2020). In Australia, the government provides matching funding for marketing and research and development projects by Meat and Livestock Australia, a company that regulates standards for and promote the development of the meat and livestock sector (MLA 2021). Several US states have passed laws that criminalize undercover investigations of industrial food animal production facilities to expose animal cruelty or environmental or health risks (ASPCA 2021). In contrast, the municipality of Haarlem, the Netherlands, has introduced a ban on advertising of most meat products in public spaces (Wright 2022).

Beyond ending existing support for harmful animal agriculture practices, governments can accelerate the transition through proactive policy-making. For example, they can update regulatory guidelines to discourage high levels of meat consumption. Guidelines recommending limited meat intake are already in place in several countries, including China, France, the UK, Denmark and the US (Ministry of Food, Agriculture and Fisheries of Denmark 2021; NHS 2018; Santi 2017; Xiaodong 2016; USDA and HHS 2020). They are not always strongly promoted, however.

Governments can also use labelling to raise awareness of the environmental impacts and/or health risks of high-meat diets; an example is Denmark's climate labelling system on food, part of a plan to achieve carbon neutrality by 2050 (Donnellan 2019). Public procurement and educational campaigns are important options as well. For example, schools in Ghent, Belgium, have "vegetarian days"; Helsinki, Finland, requires school canteens to provide at least one meatless meal per week, and so does a French law (De Keyzer et al. 2012; Lombardini and Lankoski 2013; Ministère de l'agriculture et de l'alimentation 2019).

Table 4. Illustrative policies that can support shifts away from meat-heavy diets

Policy		Example
Information and Education	Update dietary guidelines to reflect health and environmental costs of high levels of meat consumption	Dietary guidelines supporting limiting meat intake in China, France, the UK, Denmark, and other countries (Ministry of Food, Agriculture and Fisheries of Denmark 2021; NHS 2018; Santi 2017; Xiaodong 2016)
	Use labelling to raise awareness about environmental impacts and/or health risks of high-meat diets	Denmark's climate labelling system on food as part of plan to achieve carbon neutrality by 2050 (Donnellan 2019)
	Implement programs and campaigns to promote plant-based diets	"Vegetarian days" in schools in Ghent (Belgium); Helsinki (Finland), as well as France's EGalim law requiring school canteens to provide at least one meatless meal per week (De Keyzer et al. 2012; Lombardini and Lankoski 2013; Ministère de l'agriculture et de l'alimentation 2019)
Financial	Remove subsidies for the industrial livestock industry	Removal of agricultural subsidies in New Zealand (Vitalis 2007)
	Direct support to sustainable alternatives	USD 100 million investment from Canada's federal government to a plant producing plant-based proteins (Global News 2020) Denmark's USD 195 million investment to advance plant-based foods (Danish Government 2021) USD 108 million Singapore Food Story R&D program to support food-related research, including cultured meat (The Business Times 2019) The Netherlands has allocated €60 million to Cellular Agriculture Netherlands (Buxton 2022) USD 18 million grant from Israel Innovation Authority to cultivated meat consortium led by the Good Food Institute (GFI) (Ben-David 2022) China's 14th Five-Year Plan identifies cultivated meat and other novel technologies as areas for R&D investment (Ellis 2022)
	Increase taxes for industrial meat products and/or farming to better reflect their societal and environmental costs	New Zealand has proposed a scheme that will require farmers to pay for their agricultural GHGs, including methane and nitrous oxide (Corlett 2022) Denmark introduced a tax on saturated fat including meat and dairy in 2011; however, this was repealed after a year (Wright 2022)
	Lower costs of healthier and more sustainable alternatives	Plans in the Netherlands to set VAT for fruit and vegetables at 0% (ProVegInternational, 2022)
	Offer payouts to farmers and other stakeholders to support their transition	The Netherlands is offering payouts for livestock farmers to voluntarily leave the industry (Levitt 2021)
Regulatory	Adopt more sustainable public procurement strategies to increase the share of sustainable alternatives	The City of Malmö in Sweden set a goal to reduce its GHG emissions relating to food procurement by 40% by 2020 (from 2002 levels), including through more vegetarian meals served in schools (Klammeus 2021)
	Set clear and ambitious targets and plans to reduce livestock- and diet-related emissions	The Netherlands' plan to reduce livestock production by 30% within 10 years (Netherlands Environmental Assessment Agency 2021)
	Limit production, importation, or export of (certain types of) meat (e.g. through bans and quotas)	The government of Flanders' plan to close the most polluting livestock farms by 2025 (Steffens 2022) In September 2022, Switzerland held a vote on an initiative to ban factory farming (Swiss Federal Council 2022a). It was rejected by 63% of voters (Swiss Federal Council 2022b).
	Introduce marketing regulations to limit advertisement of meat-based products	The municipality of Haarlem (the Netherlands) has introduced a ban on advertising of most meat products in public spaces (Wright 2022)

4.2 Increase support for alternatives and ensure they safeguard sustainability, social equity, human health and animal welfare

As governments encourage more plant-based diets and end subsidies that artificially reduce the price of meat, it is important to ensure that healthy and sustainable alternatives are readily available and affordable. This might entail repurposing meat industry subsidies to support the production of fruit, vegetables, nuts, seeds and legumes (Springmann and Freund 2022); bringing more fresh foods to "food deserts"; or investing in nutrition programmes to ensure they can offer healthier and more sustainable foods.

Several governments are already actively supporting the development of meat substitutes. Canada's government is investing US$100 million in a facility producing plant-based proteins (Global News 2020). Denmark has invested US$195 million to advance plant-based foods (Danish Government 2021). Singapore has a US$108 million programme to support food-related research, including cultured meat (The Business Times 2019). The Netherlands has allocated €60 million to Cellular Agriculture Netherlands (Buxton 2022). The Israel Innovation Authority awarded US$18 million to a cultivated meat consortium (Ben-David 2022). And China's 14th Five-Year Plan identifies cultivated meat and other novel technologies as areas for R&D investment (Ellis 2022).

In this context, it is important that they consider the socio-economic implications of the transition away from meat. For instance, while showing significant promise with regard to environmental impacts, the emerging plant-based meat substitutes and cultivated meat industries raise important questions about the extent to which they might reinforce inequalities or create new ones, both between and across countries (Case Study 2).

Policies to promote a shift from large-scale meat consumption to more plant-based foods should be based on a systematic assessment of the potential impacts on human health, the environment, socio-economic conditions, and animal welfare. For example, a tax on meat could have significant negative impacts on animal welfare, since it might shift consumption from larger animals, such as cows and pigs, to lower-cost, smaller animals, such as chickens or fish, requiring many more animals to be raised and slaughtered to produce the same amount of meat (Springlea 2022). This example also further highlights the need for policy mixes, rather than one single approach.

As the transition gathers pace, it will also be essential to ensure that increased demand for and production of plant-based foods does not exacerbate the environmental or socio-economic problems linked to conventional, input-intensive monocultures, such as deforestation (in places such as South America or Southeast Asia), excessive freshwater use, or agrochemical contamination (HLPE 2017; IPES-Food & ETC Group 2021). For example, there are some concerns about the water intensity of nuts (Vanham et al. 2020). This is particularly important in this time of globalization, when rising demand for land-based resources in some regions increasingly generates social, economic and environmental impacts elsewhere on the globe (Friis and Nielsen 2019).

A transition away from high levels of industrial meat production and consumption needs to be carefully planned out to ensure it does not undermine food security and human rights (Davis et al. 2022). Investments can instead be made in more sustainable agri-food systems that are also resilient and better cushioned from future climate impacts. The High-Level Panel of Experts of the World Committee on Food Security, for example, highlights the crucial importance of decoupling food production from deforestation and other environmental impacts, promoting efficient and inclusive mixed-farming systems (HLPE 2017).

4.3 Make transition planning processes inclusive and transparent

A just transition is built on truly inclusive, transparent processes that enable stakeholders to participate meaningfully and produce plans that reflect and account for their concerns and needs (Bergquist et al. 2022; Bruun 2021). Achieving such procedural justice first requires systematically mapping stakeholders – as Section 3 began to do – and engaging relevant government agencies and civil society organizations at all levels (Anderson 2019; Bruun 2021; Mombauer and Sood 2021). Together, participants can develop a collective vision, supported by mechanisms designed and implemented with buy-in from all stakeholder groups.

Given the history of systemic marginalization and discrimination within the livestock sector, as discussed in Section 3, and across societies more broadly, it is particularly important to ensure the meaningful participation and political empowerment of marginalized groups. These include smallholder ranchers, workers from ethnic minorities, migrant and female workers, and informal and seasonal workers. Intergenerational justice – accounting for transition impacts on future generations – should be addressed by ensuring youth participation in planning processes and dedicated consultations with different age groups (Bidadnure 2016; Pernice-Warnke 2019; Piggot et al. 2019).

Lessons from transitions in the coal and industry sectors suggest that transitions with strong local ownership can deliver better outcomes than approaches managed at the national level (Atteridge and Strambo 2020; Weller 2019). For example, when steelworks closed in Newcastle, Australia, local leaders gathered stakeholders to create a "common purpose" and vision for the region, and on this basis, developed local socio-economic development plans that directed public and private investments and contributed to the growth of higher-skilled, value-adding industries (Atteridge and Strambo 2021a). By contrast, the transition away from coal in Colombia has been hindered by the national government's strong focus on maintaining public income from coal production while overlooking more local-level concerns, such as ensuring employment and environmental rehabilitation after the departure of one of the main coal producing companies in 2022 (Yanguas Parra et al. 2021).

Inclusion, meaningful participation and transparency are key to building trust and buy-in across diverse stakeholders and social groups. The transformative changes associated with shifting to more sustainable food production are likely to be met with uncertainty and, for some, justifiable scepticism and resistance. One way to address these concerns is to listen to and work with stakeholders from the outset, and for governments and companies to clearly identify and communicate the intentions, outcomes, opportunities and challenges associated with pursuing transitions in the meat sector (Anderson 2019; Bruun 2021).

Nevertheless, as planning and policy-making in the sector are typically affected by power and privilege (see Section 2.3.), which may affect, for instance, certain groups' abilities to engage in government processes, or may be affected by imbalances of information. Just transition processes will therefore likely require changes in institutional settings and decision-making procedures. This requires a better understanding of the blockages and inertia in governance for each context, as well as innovations in governance.

4.4 Provide support to stakeholders to help offset adverse impacts

It is a common practice in the context of just transitions to provide direct support to stakeholders, such as through social safety nets and compensation for the disruptions caused (Pollin and Callaci 2018). Specific funding mechanisms to assist the people and territories affected by the transition can be established, similar to the EU Just Transition Fund for energy transitions (Bruun 2021).

Taking a more long-term view, policy-makers can also invest in local economic diversification to create new economic opportunities and compensate for revenue losses through investments in low-emission, job-rich sectors with existing local assets, including, when

possible, resilient agriculture (Blattner 2020; Carley, Evans and Konisky 2018). In addition, production facilities for alternatives to conventional meat (e.g. plant-based or cultivated) could be established in rural areas to be closer to crops, revitalize rural areas, and help offset any revenue and job losses associated with the reduction in conventional meat production (Newton and Blaustein-Rejto 2021).

The decline of the coal and other minerals extraction in various countries has also shown the potential negative financial implications for local governments and, therefore, for the provision of public services (Atteridge and Strambo 2021b; Harrahill and Douglas 2019). Similar challenges can be expected in regions that are highly dependent on the meat sector. There is thus a need to diversify local public income, restructure local public debt, and allocate additional national financial resources to affected regions and municipalities. Financial and economic support can be delivered as part of broader support to meat sector workers to develop new knowledge and skills to shift to plant-based agriculture or other sectors, through retraining and reskilling, and through early retirement schemes (Cha 2017; Mayer 2018; Newton and Blaustein-Rejto 2021).

Effective and equitable support can also go beyond socio-economic losses to address the physical and mental impacts associated with the breakdown of social networks, cultural practices and traditions, and attachments to place (Green and Gambhir 2019). For example, cattle ranching and pastoralism can be core parts of a community's culture, heritage and identity, just as coal production is for some mining communities (Sanz-Hernández 2020; Della Bosca and Gillespie 2018; Starrs 2000). Acknowledging the importance of these non-financial losses and addressing those through non-financial responses is important to receiving broad support and acceptance for transitions (Green and Gambhir 2019).

Transition support must also extend to meat consumers, particularly those who may struggle to adapt to changes in food access and cost as new policies reduce meat production and drive up prices. Specific taxes and subsidies that influence consumers' food choices can sometimes have negative effects on health and social inequality (WHO Regional Office for Europe 2015; Seyfang and Paavola 2008), although more evidence on the consumption impacts of climate change policies is needed to better understand the meat sector transition (Dawkins et al. Forthcoming). As discussed in Section 4.2, governments can help ensure a just transition for consumers through proactive policies that help make plant-based foods and sustainable meat substitutes affordable and easily accessible to all.

Comprehensive assessments of both potential and realized socio-economic impacts can help inform policy-makers as to how, and to whom, support can best be directed (Blattner 2020; ILO 2015), with consideration of how and why the transition affects stakeholder and social groups differently (Carley, Evans, Graff, et al. 2018). Equitable assessments can inform decisions on how support and compensation can be provided in just and equitable ways.

In coal transition contexts, Sartor (2018) has argued that owners of carbon-intensive assets should "generally be required to bear losses where it was possible to sufficiently anticipate risks, even regulatory ones" (p. 25). Similar principles of the distribution of impacts and support may be considered in the meat sector transition – that is, tackling the question of whether asset owners aware of transition risks that failed to adapt should be entitled to compensation for losses.

4.5 Address the root causes of injustices in the meat sector

With inclusive planning, design and investment, a just transition in the meat sector has the potential to not only address the injustices experienced by farmers and meat sector workers, as discussed in Section 3, but also help to address the root causes of inequalities (re-)produced by our food systems more broadly. Transformations that emphasize alternatives to meat can be opportunities to provide jobs to marginalized groups, promote healthier diets, and design fairer models of land ownership (50by40 2021; Newton and Blaustein-Rejto 2021).

Shifting away from industrialized meat production, which prioritizes quantity over quality, is an opportunity to invest in a better food system that rewards sustainability, provides decent and safe jobs, and promotes animal welfare. However, cases of industrial transition in the United States and South Africa have shown that, in the absence of adequate social safety nets and redeployment programmes, the groups that are already most vulnerable are also less likely to find replacement jobs and are more exposed to human and worker rights abuses (Atteridge and Strambo 2021b; Sesele et al. 2021).

For a just livestock transition, a valuable step can be to identify existing inequalities and flaws embedded in the meat sector, to avoid transferring or exacerbating those through transition planning processes (Anderson 2019). Indeed, support measures can seek to proactively address existing inequalities, and not only to avoid worsening them or creating new ones. And, as many inequalities are deeply embedded in the broader socio-economic paradigm that prevails globally, addressing them will require the involvement of stakeholders beyond the meat sector itself.

Examples of such inequality include the prevalence of migrant workers and workers from marginalized ethnic groups in the meat sector in the Global North (see Section 3.3), and women's restricted opportunities and participation in the sector. In the context of coal transitions in South Africa, for example, it has become clear that a just transition implies recognizing the inequalities inherited by the history of colonization and apartheid, by taking an affirmative approach to local ownership and economic empowerment of those affected by race- and gender-based discrimination (Climate Investment Funds 2020).

An autumn equinox dinner at Soil Born Farm in California, which combines organic farming with educational programmes to reconnect people to the land.

A survey of 60 companies with a combined total of over 50,000 employees in the UK, Ireland, the United States, Australia and New Zealand found that women in the meat industry represent 36% of the workforce, and only 5% of chief executive positions (Meat Business Women 2021). In Latin America, it is estimated that more than 80% of new jobs created in a future net-zero emissions economy will be in currently male-dominated occupations, including agriculture (ILO and IDB 2020). This draws attention to the need to challenge structural drivers of occupational segregation as part of just transition processes and to the need for targeting transition support to historically disadvantaged social groups.

Finally, there may be a need to provide support and repair the harm done to victims of damages. This approach has received attention in the energy sector, in the context of fossil fuel companies' responsibilities for damages caused (Greenberg 2018; Pollin and Callaci 2018). In the meat sector, policy-makers could, for instance, strengthen regulatory requirements for companies to compensate for environmental damage they have caused, including deforestation and local pollution.

Table 3 provides an overview of the five guiding principles.

Table 3. Five guiding principles for just transitions in the meat sector

Principle	Key elements
1. Phase down existing policies, programs, and fiscal support that promote industrial meat production and consumption	• Acknowledge that large-scale production and consumption of animal-based foods is inconsistent with Sustainable Development Goals and climate commitments, and set national targets to reduce it. • Phase out subsidies to meat production and consumption, particularly for industrial livestock operations, as well as supporting policies and programmes. • Revise any policies, dietary guidelines or publicly funded promotional campaigns that encourage large amounts of meat consumption.
2. Increase support for alternatives and ensure they safeguard sustainability, social equity, human health and animal welfare	• Support the production of plant-based foods and sustainable and healthy meat substitutes, financially and through policy, to help ensure these options are available and affordable to all. • Invest in agricultural systems that are less carbon-intensive, more efficient, more biodiversity compatible and resilient to future climate impacts. • Consider impacts of new policies holistically to avoid unintended negative health, social, environmental, and animal welfare outcomes.
3. Make transition planning processes inclusive and transparent	• Map stakeholders across agri-food supply chains and engage them in processes that enable them to shape a shared vision for the transition and identify appropriate mechanisms to support it. • Prioritize the meaningful participation of marginalized groups who are already harmed by injustices and discrimination within existing systems, and ensure that their needs and concerns are addressed. • Guarantee intergenerational participation by including youth quotas and/or consulting with bodies representing different age groups. • Identify and communicate outcomes, challenges, and disruptions that will arise from these transitions in order to protect procedural justice.
4. Provide support to stakeholders to help offset impacts	• Conduct early assessments of the social, economic and employment impacts of the transition and plan for adequate, equitable and context-specific assistance for those affected. • Help workers cope with the transition through social protection measures, such as early retirement schemes or the development of knowledge and skills required to shift to plant-based agriculture or other sectors. • Invest in local economic diversification to create new opportunities and buffer revenue losses (e.g. through investments in low-emission, job-rich sectors). • Extend appropriate support to meat consumers, particular those most likely to struggle to adapt to changes in food access and cost. • Establish specific just transition funding mechanisms to support the people and territories affected.
5. Address the root causes of injustices in the meat sector	• Carefully examine existing production systems to identify injustices in existing production systems (farmer and worker exploitation, various forms of discrimination, environmental harm) and their root causes. • Design transition measures and new food systems with care to not only avoid replicating those injustices, but actively begin to correct them.

5. Looking ahead

With the climate emergency escalating alongside a global crisis of biodiversity loss and environmental degradation, and numerous social, health and ethical concerns around current meat consumption and production systems, inaction should no longer be an option. The science is clear: We need to move away from industrialized meat production and consumption.

Food production will be on the agenda at COP27 in multiple ways: from the first-ever Food Systems Pavilion, to discussions about raising ambition – where the large GHG emissions of our current food systems cannot be ignored. In some places, transitions away from unsustainable meat production and consumption are already happening, because the environmental impacts of current practices have become untenable, and a growing array of alternatives are available.

Without deliberate policy action, however, the needed transitions are likely to be delayed, making future changes more costly and disruptive. This is why it is vital to start planning now to ensure a just transition for all. This report has sought to contribute to those efforts by mapping the key groups of stakeholders whose needs and concerns need to be addressed, and by laying out five guiding principles drawn from the literature on just transitions and on food systems.

Further research is needed to examine stakeholders at a more granular, stratified and context-specific level, in order to deepen our understanding of those affected and ensure their voices are heard throughout the transition process. It is also important to take a holistic approach, in order to avoid perpetuating injustices in current systems, or creating new ones.

On that note, it is important to bear in mind a key difference between this transition and those in the energy or industry sectors: animals are sentient beings. Farm animals will be directly affected by the policies that governments adopt to transform the meat sector, and some proposed climate mitigation strategies – such as increased intensification – could be harmful for animal welfare (Shields and Orme-Evans 2015). The solutions chosen should reduce suffering, never increase it.

Planning and supporting just transitions is hard work, but it is essential. Through proactive, inclusive approaches, we can ensure a just transition away from large-scale meat production and consumption and build a more just and sustainable food future for all.

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