

Crossing the tipping point

Alternative Proteins Case Study



University
of Exeter



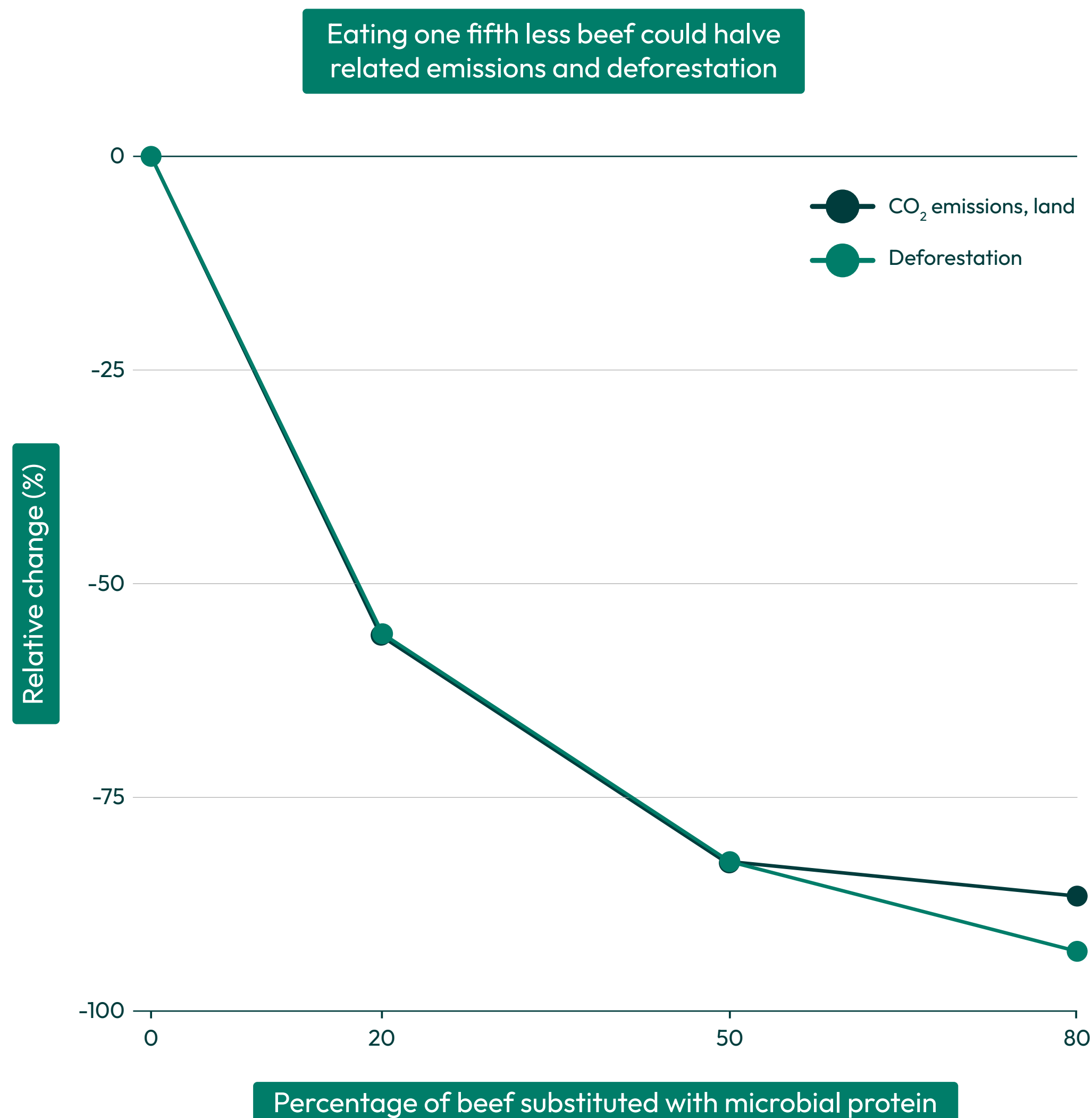
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Plant-based foods and other meat substitutes are critical to cutting emissions

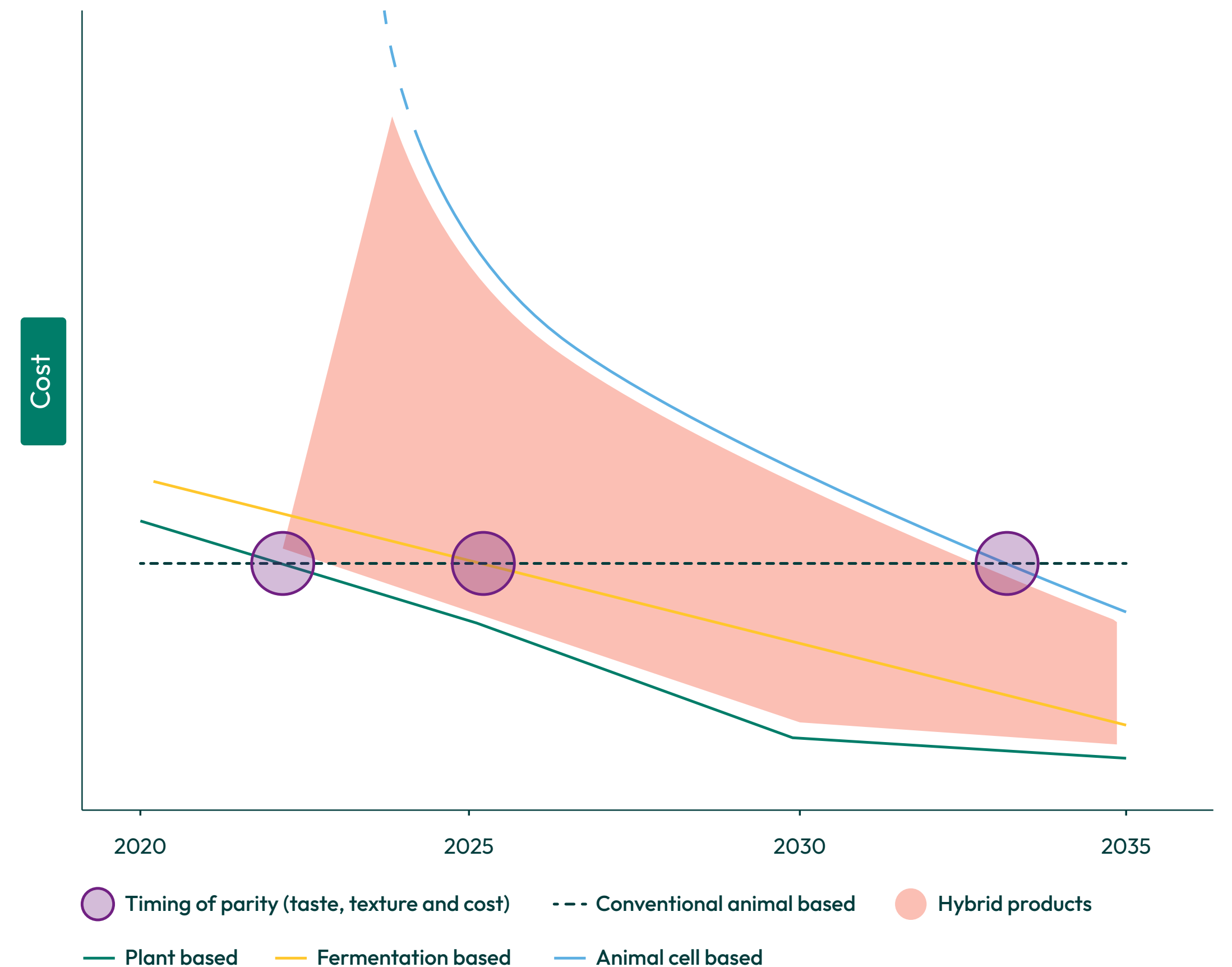
- Shifts towards more plant-based foods and novel animal protein substitutes such as precision fermentation and cultivated meat can strongly reduce greenhouse gas emissions, deforestation, land use, water use, eutrophication, and biodiversity loss [1]. This yields trillions of dollars worth of mitigation and food security benefits [2].
- Rapid reduction of methane emissions is vital to prevent peak warming and reduce climate tipping point risks. Diet shifts and alternative proteins could cut 645 Mt CO₂e/year by 2030 and 1.85 Gt/year by 2050 [2].
- ‘Planetary health’ diets, those rich in plant-based foods, can reduce food-system associated emissions by around 50%, and prevent approximately 11 million deaths per year from diet-related diseases [3].
- Novel plant-based proteins have an environmental impact orders of magnitude smaller than animal equivalents [4]. One plant-based burger creates 89% fewer emissions than its beef-burger equivalent [5].
- Precision fermentation uses yeasts, fungi, mycelium, and other microbial proteins to produce ingredients almost identical at the molecular level to animal proteins [6]. Replacing just 20% of global beef consumption with microbial protein could halve annual deforestation and carbon dioxide emissions, especially methane, associated with it [7].
- Cultivated meat is produced directly from animal cells and is identical to conventional meat at the cellular level. It could use land up to 3 times more efficiently than poultry and 10 times more efficiently than beef [8].



Cost parity can be enabled this decade

- **Despite uncertainty of the speed at which cost parity between alternative and conventional meat proteins will be reached, there is confidence that it can and will be reached**, given cost reductions driven by learning, economies of scale, and increasing investment.
- **Various projections for the EU and US indicate that subject to further action by governments, investors and businesses, cost-parity for selected plant-based, precision-fermented and hybrid meat can be reached between now and 2030**, with cultivated meat products able to reach cost-parity in the early 2030s [1].
- **Individual products in these categories are already beginning to undercut conventional meat options** in countries such as the UK, US, and Germany. Brands such as Beyond Meat and Impossible Foods aim to undercut conventional meat prices as early as 2024. In October 2023, Lidl, a supermarket, announced it would ensure price-parity for all its own-brand plant-based meat alternatives in Germany.
- **A 'planetary health' diet is already cheaper than current (high-meat) diets today.** A 2021 study of 150 countries found planetary health diets to be between 22% and 34% cheaper than current diets in upper-middle-income and high-income countries [2].
- **A major barrier to cost parity for all alternative proteins is created by subsidies and public R&D funding** that are significantly higher for animals and their feed than for plant-based food products and alternative proteins [3].

Projected timing of cost parity for different product types if further actions are taken



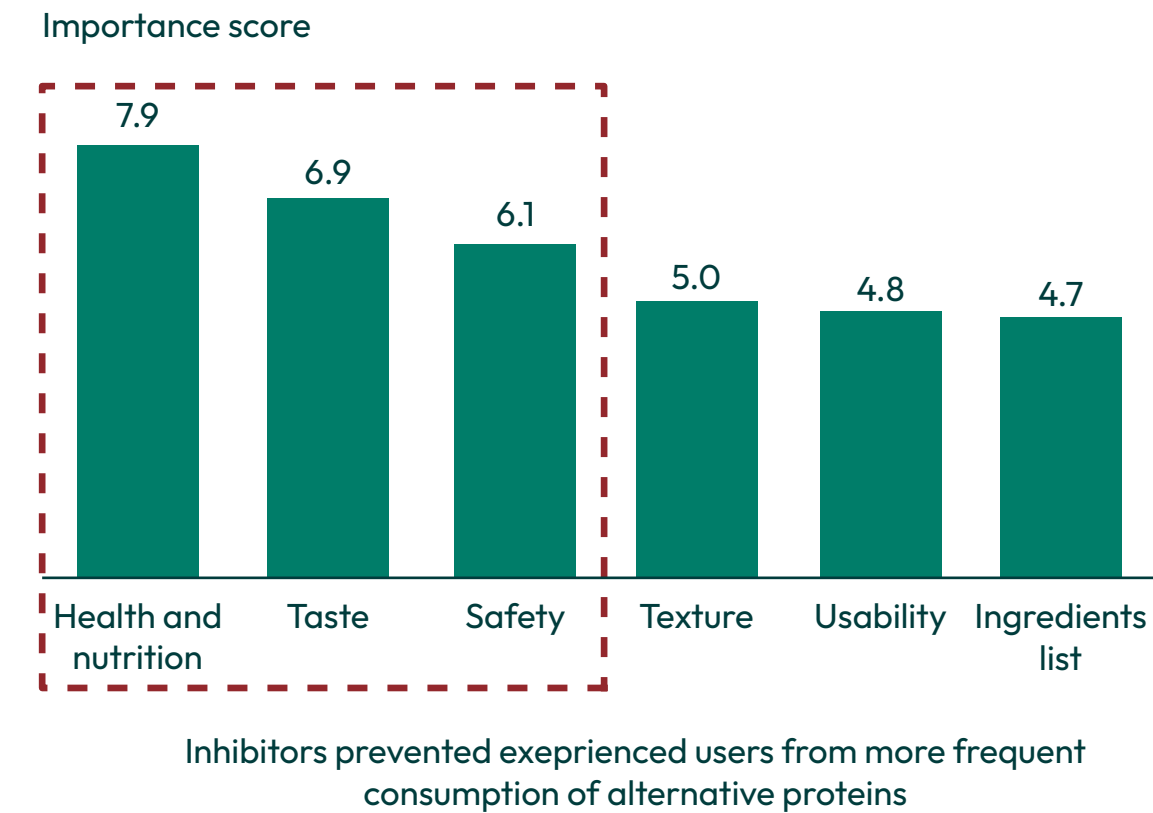
Based on illustrative data for the US and EU

Quality parity is feasible

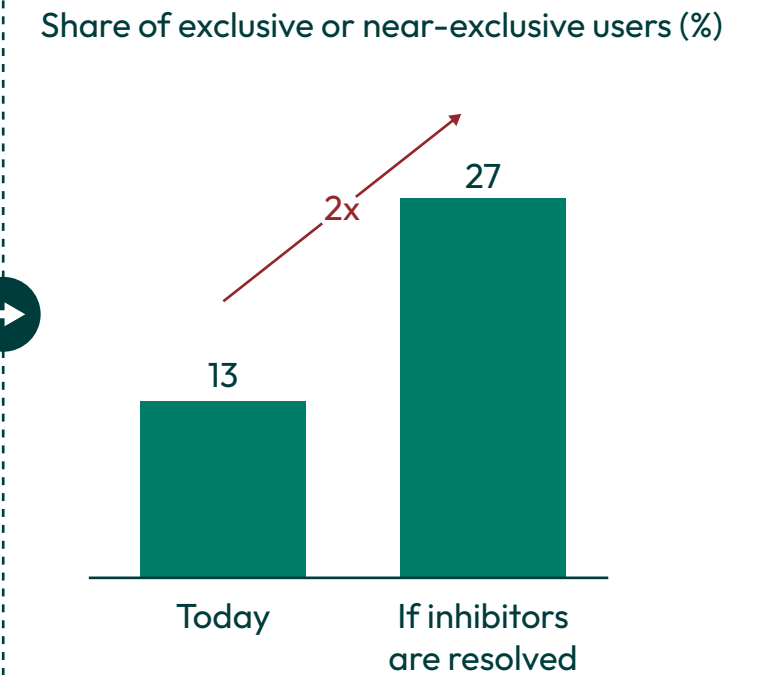
- **Quality is key to consumer shifts** to meat alternatives. Once alternative proteins are as good as animal proteins in taste, texture, nutritional value and safety, and well as in price, rapid consumer uptake is likely [1]. Policy, investment, and innovation can make this happen.
- **Quality parity is within reach, with some projections estimating that combined price, taste and texture parity will be feasible for different alternative proteins by 2035** [2]. It is most likely to be achieved first for ground meat (used for mince-meat) and later for tissues (such as steak).
- **In precision fermentation, quality improvement is being supported by advances** and cost declines in technologies such as computing, data storage and genome sequencing. These technologies are enabling food scientists to more cost-effectively engineer food for quality, nutrition, taste and structure [3].
- **Hybrid forms of alternative proteins are likely to reach both quality and price parity the earliest**, by combining the texture created by plant-based processing innovations, with the taste and micro-nutrients from precision-fermentation processes, and the fat from cultivated meat processes [4].
- **Public funding for open-access R&D can accelerate learning and product improvement.**

Customer willingness to consume alternative proteins if barriers are overcome

Q. Please select the most important aspect that prevents you from consuming products based on alternative proteins more frequently

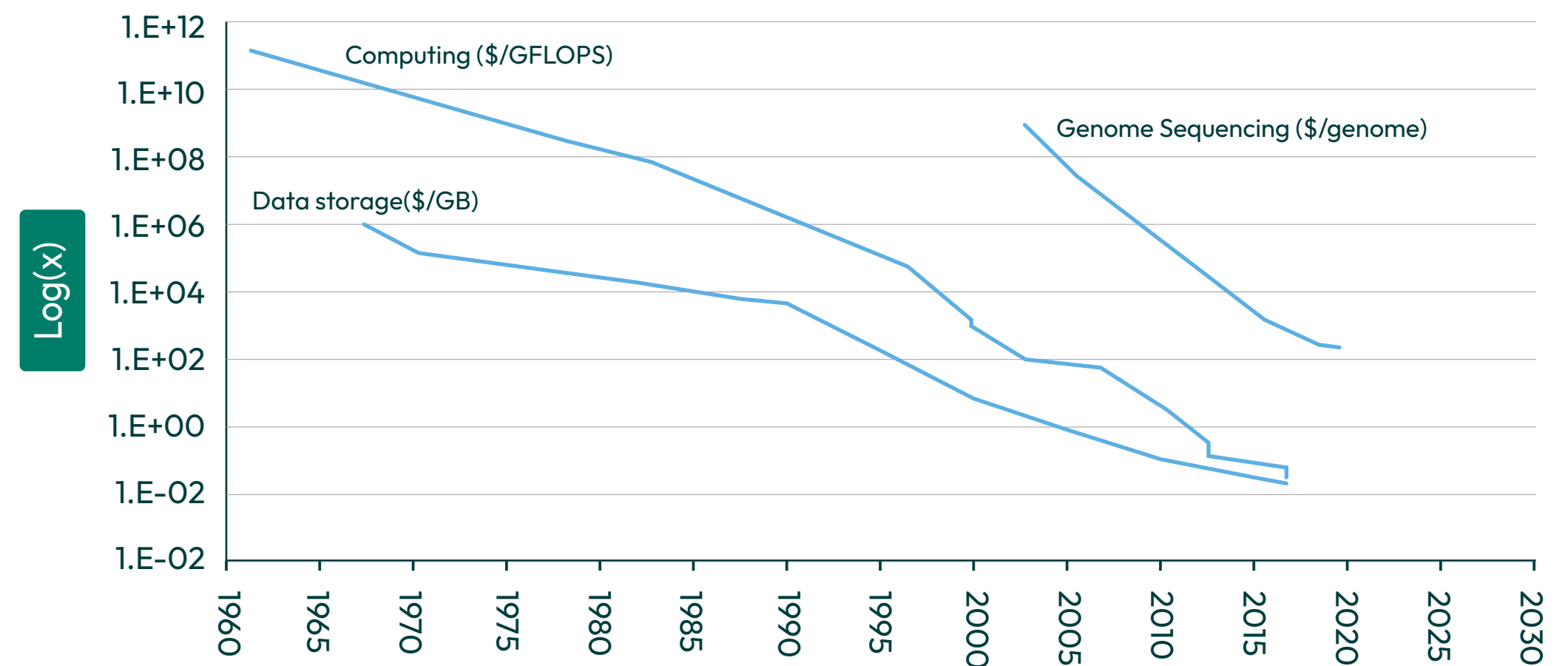


Q. If the inhibitors are resolved, how would you change how much products, based on alternative proteins, you consume?



Source: Blue Horizon & BCG Customer Survey (Feb-April 2022) in [Morach et al. \(2022\)](#)

Cost of key underlying technologies falling exponentially

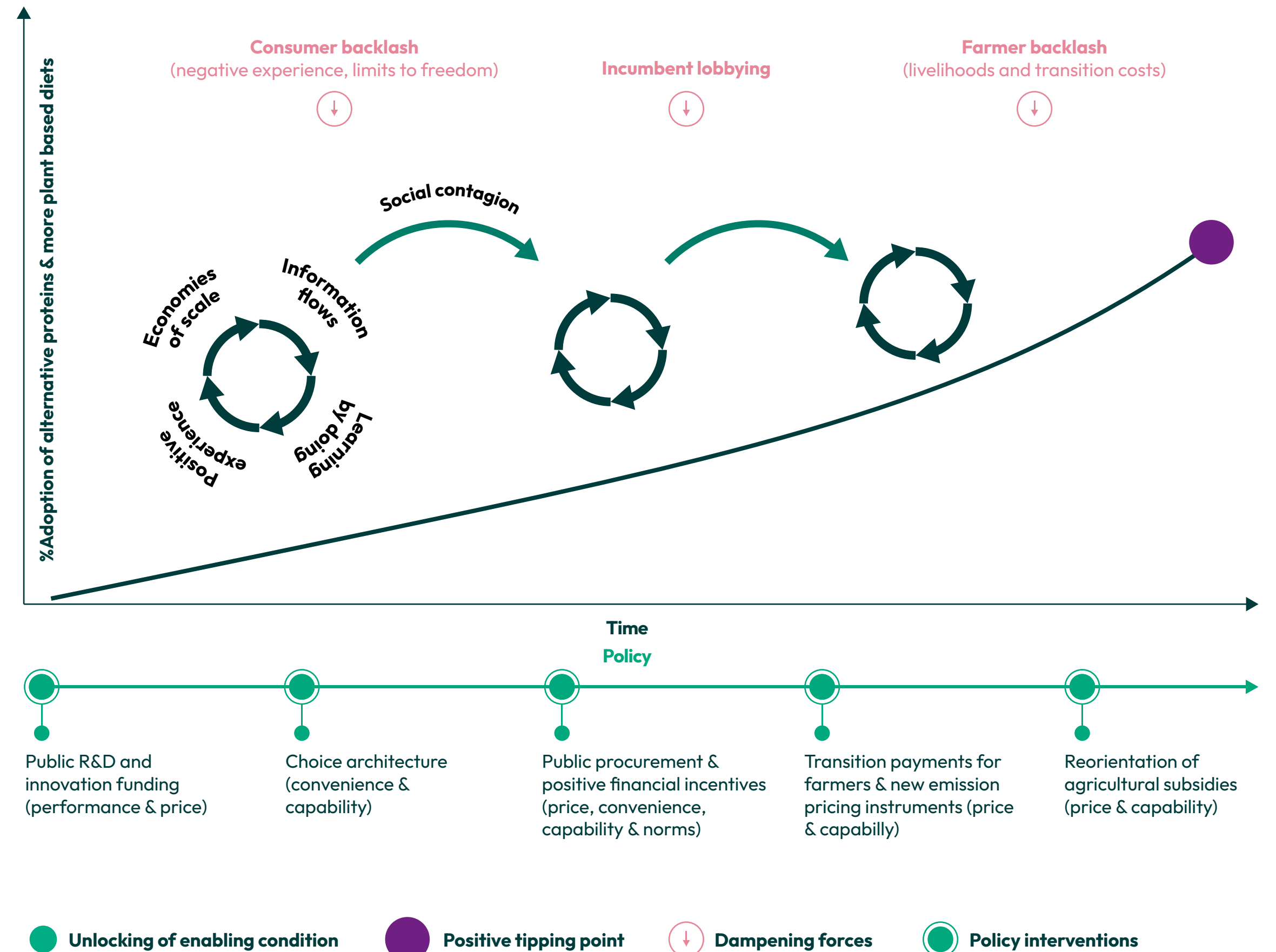


The right policies at the right times can bring forward tipping points

Policies can create feedback loops that accelerate progress and build social support [1]. A positive feedback can operate between increasing production, falling costs, product improvements, positive consumer experiences, and increasing awareness and demand.

- Public funding for R&D, open-access research, and scaling up infrastructure** (e.g. manufacturing facilities) can accelerate product improvement, de-risk private investments and foster emergence of new business models.
- Changes in how choices are presented to consumers in supermarkets, restaurants, and cafeterias are also vital to shift consumer demand**, by making it easier, cheaper and more enjoyable to buy and consume plant-based foods.
- Public procurement & positive financial incentives can grow the market for plant-based foods and animal protein substitutes, incentivising further private investment.**
- Targeted transition payments that make it easier for farmers to shift towards plant-based food production can help build social support for the transition.** New emission pricing schemes can encourage the production and consumption of more sustainable alternatives.
- Reorienting agricultural subsidies and R&D funding away from animals and towards plant-based foods and alternative proteins could be particularly powerful.** The political feasibility of this can be increased by each of the policy measures outlined above [2].

Strategic policy sequencing can accelerate momentum

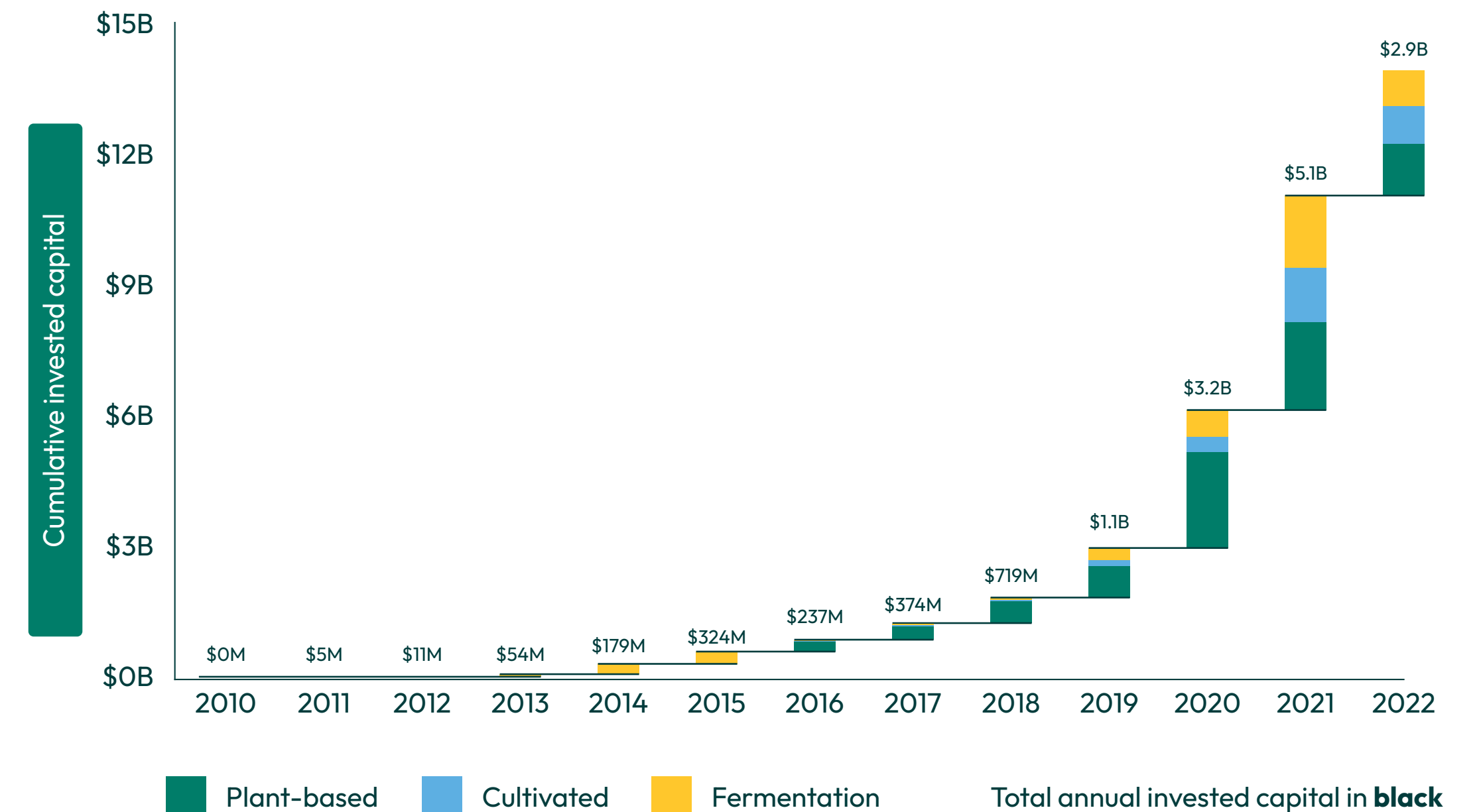


Source: adapted from FOLU (2021)

It's time for public funding to catch up with private investments in alternative proteins

- **Private investment in alternative proteins is growing strongly**, especially in fermentation- and culture-based production [1]. The amount invested in 2021 was a thousand times as much as the amount invested in 2011.
- **Public investment can help businesses scale up.** Globally, around \$4.4 billion/year public spending on R&D and \$5.7/year billion on commercialization is needed [2]. Denmark's Fund and Action Plan for Plant-based food uses innovation funds, subsidies, support for processing equipment, advice for start-ups and initiatives to attract investment in plant-based foods throughout the value chain. This de-risks expensive infrastructure investments, improves price and quality, and supports market growth.

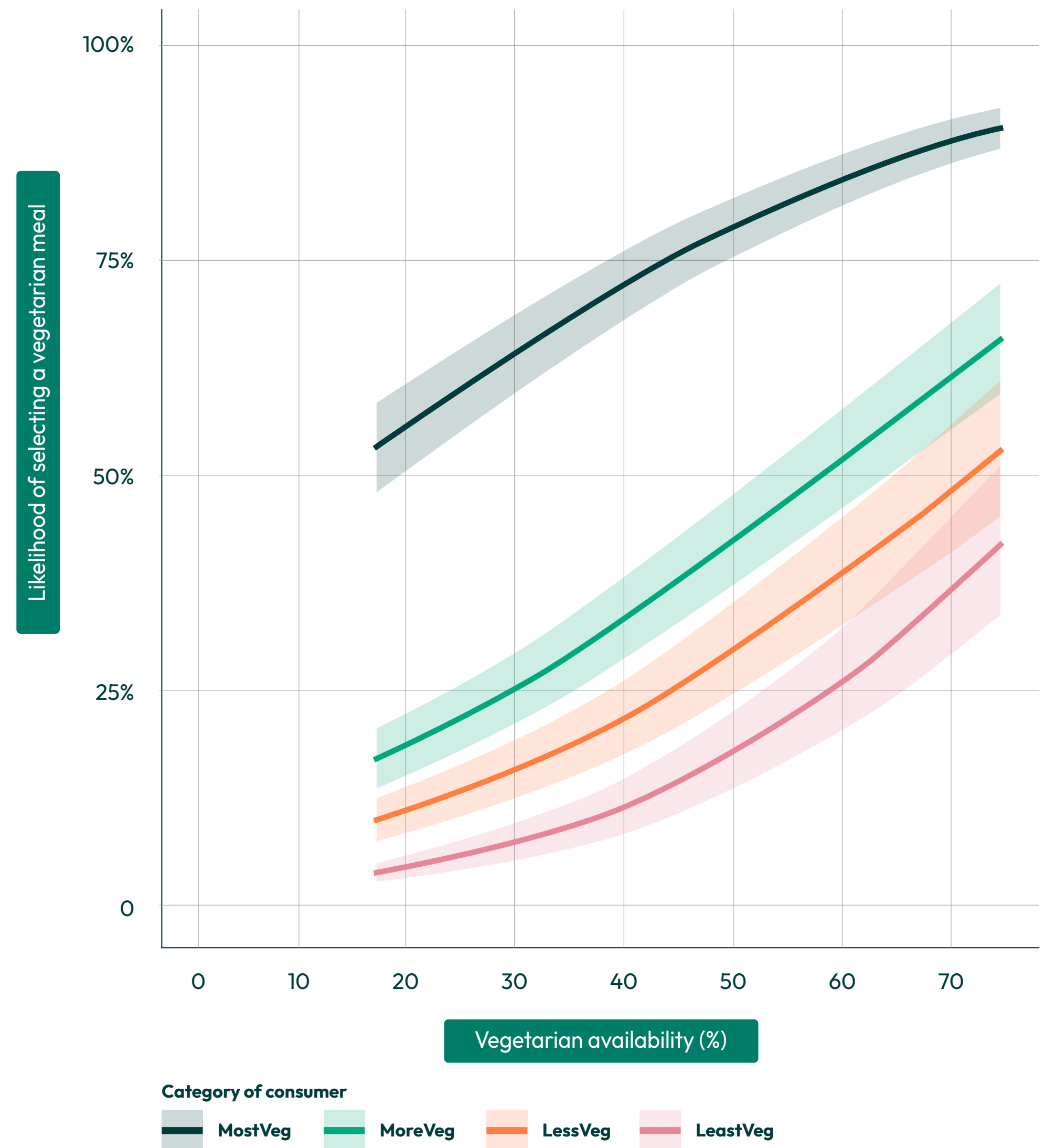
Alternative protein investment is increasing exponentially



Enable sustainable choices: Alternative proteins are chosen more when visible and accessible

- **Changes in the consumer choice architecture in public cafeterias, restaurants and supermarkets can enable rapid dietary changes, especially among heavy meat eaters.** Governments can fund behavioural insights teams that support changes in consumer choice architectures. Simple measures like changing the position and increasing the availability and share of plant-based foods are among the most effective ways to change choices.
- **In an experimental study of UK cafeterias,** doubling the plant-based meals offered (e.g., from 1 in 4 to 2 in 4 options) led to an increase in sales between approx. 40% and 80% within weeks, with the largest behaviour change among the highest meat-eaters [1].
- **Increasing consumer experience with plant-based meats and animal protein substitutes can trigger positive societal and political feedbacks.** Good experiences increase demand, leading to greater investment, improving quality, and reducing costs. Increasing consumer experience is one of the strongest predictors of dietary change and support for policies to promote more sustainable food [2].

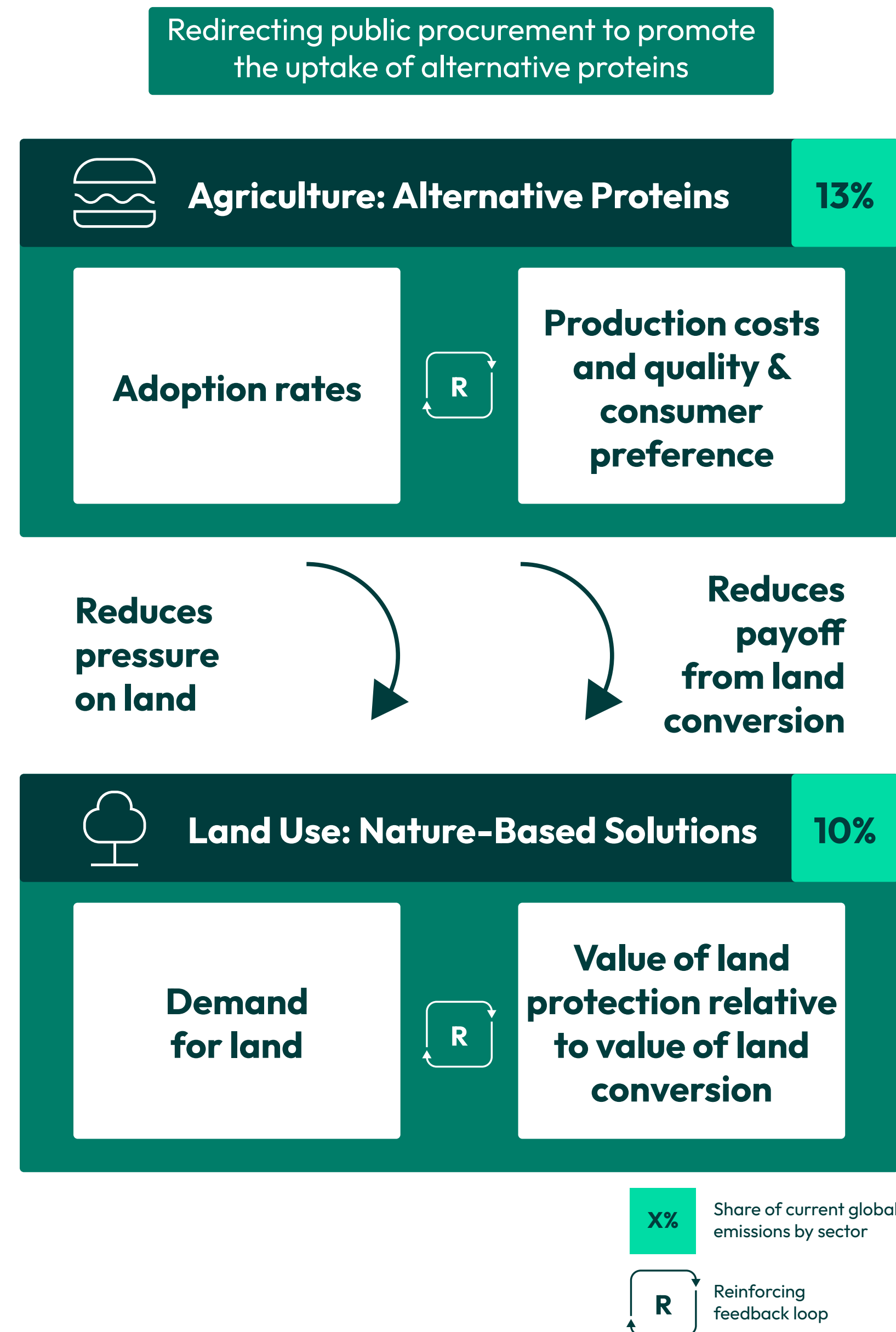
More plant-based options increased uptake in public cafeterias



Public procurement & financial incentives can grow the alternative protein market

- The use of public procurement to increase demand for alternative proteins, and help producers achieve economies of scale and lower costs, offers one of the most powerful policy levers for accelerating the tipping point [1].
- Public procurement can meaningfully increase the market share of plant-based products and alternative proteins, because it often accounts for significant food sales (5-6% in the EU and the UK). Its use also exposes more people to alternative protein products, improving accessibility and shifting social norms [1].
- It is a particularly powerful lever as it does not require significant additional government expenditure – instead, existing budgets can be redirected from animal proteins [1].
- There is a precedent of using public procurement to shift dietary habits: green public procurement criteria are already used in France, Sweden, Denmark, Italy, Norway and Brazil (e.g. demanding a minimum percentage of produce be organic or local) [2].
- Enabling alternative proteins to reach 20% market share by 2035 would free up an estimated 7-15% total agricultural land, and reduce the value of converting land relative to the value of protecting it [1]. The combination of its cost-effectiveness and cascading impact across agriculture and land use make it a critical policy lever.

Sources: [1] Systemiq (2023) [2] EC (2018), GPF (2013)

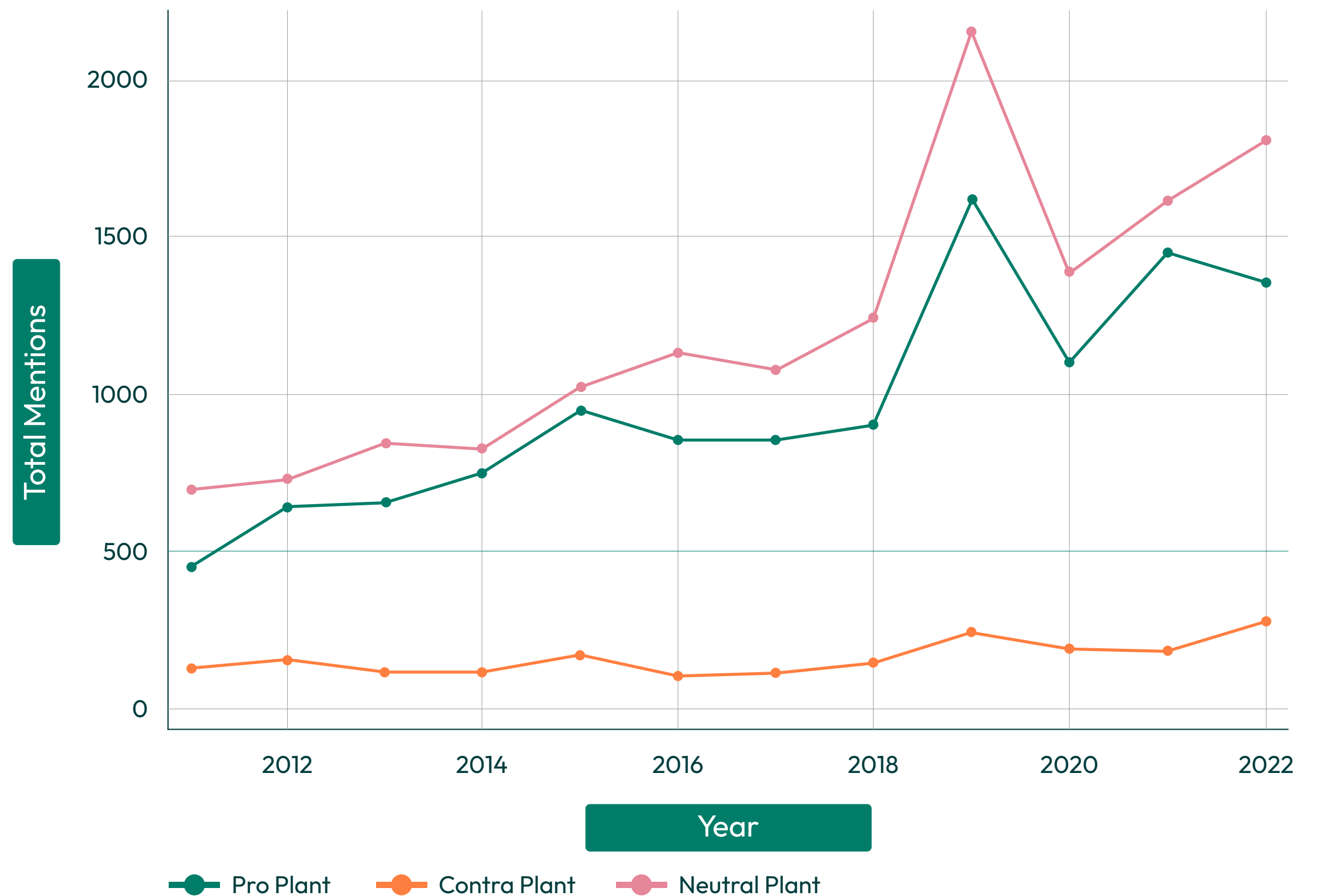


Source: Systemiq (2023)

Social support for the transition is growing. Get farmers on board with transition payments

- In leading markets around the world, public discourse, public opinion, and social norms are shifting in favour of more plant-based diets and animal protein alternatives, driven by availability and positive experience [1].
- Transitioning towards alternative proteins and more plant-based foods can lower food prices, reduce food security concerns, and create 83 million jobs globally by 2050 [2].
- Even costly policies like new animal welfare levies or emission pricing of food are supported by a majority of citizens when bundled together with higher producer standards, tax revenue recycling to lower income households, and reduced prices for plant-based food [3]. Reducing VAT and sales tax rates for plant-based products can shift demand and also reduce costs for low-income households.
- Moving to more plant-based food consumption overall has positive income effects for farmers [4], but the transition will be most difficult for producers of animal meat and animal feed [5]. Governments can support farmers by providing transition payments, as Denmark does, and by supporting the development of new business models such as agriculture combined with renewable energy production and carbon markets. Support for the transition can also be provided at regional level.

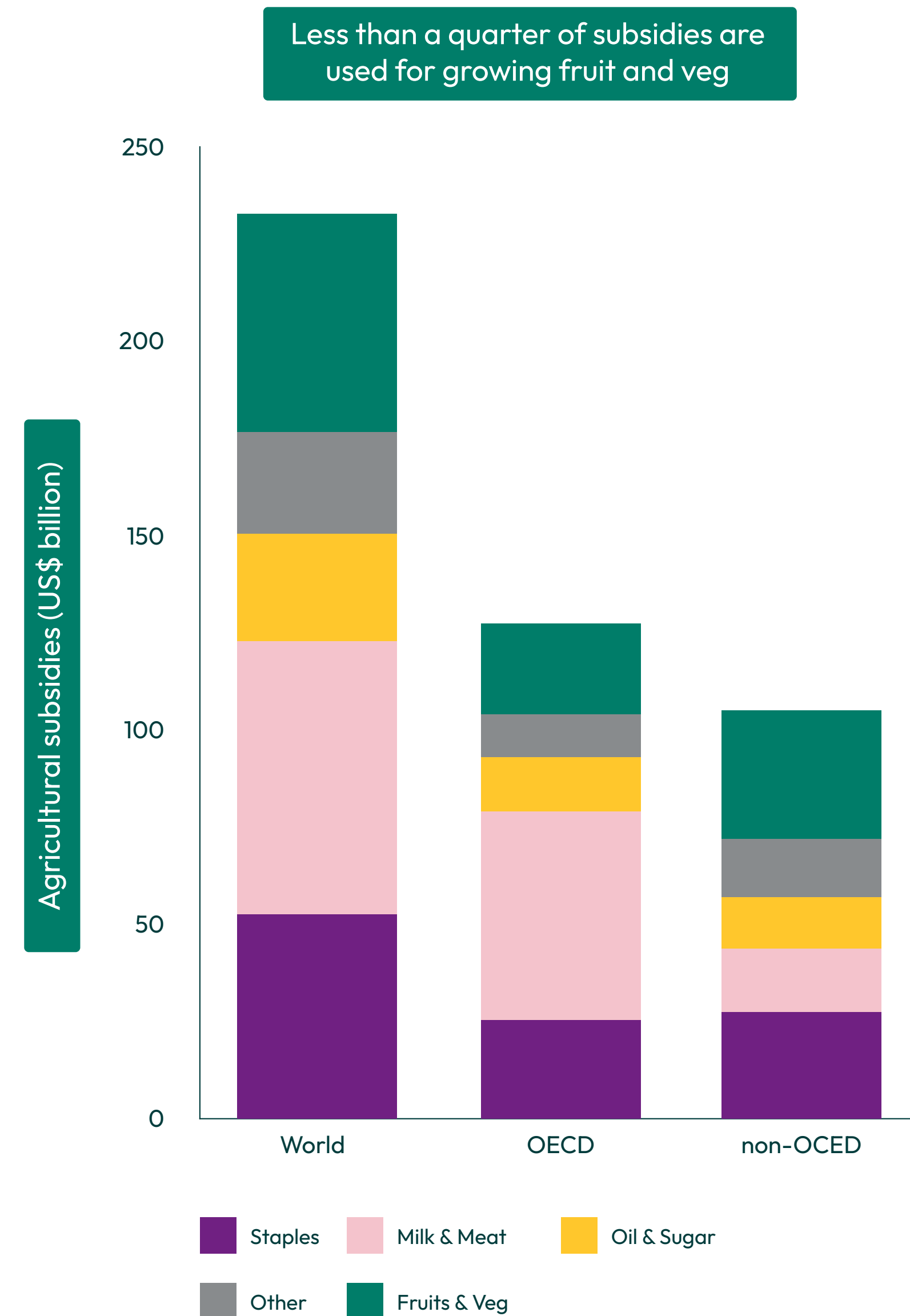
Media statements increasingly favour plant-based foods



Based on a natural language processing analysis of over 500'000 media reports from the two most populated countries per continent, the graph shows the share of media statements in favour (pro), neutral, and against (con) plant-based food.

A reorientation of agricultural subsidies becomes possible through the measures above

- Less than a quarter of global agricultural subsidies are used for growing fruit, vegetables, legumes and nuts [1].
- Reorienting agricultural subsidies and R&D funding away from animals and towards plant-based foods and alternative proteins could be particularly powerful [2]. This can be done by making a part of the subsidies conditional on growing plant-based foods and alternative proteins.
- The political feasibility of this will increase as new industry coalitions grow and strengthen [3].



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