The Implications of Behavioural Science for Effective Climate Policy

Output 2: Policy Recommendations

A report by the Centre for Climate Change and Social Transformations (CAST), commissioned by the Climate Change Committee (CCC)

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Centre for **Climate Change** and **Social Transformations**

Executive Summary

The UK is legally bound to reach Net Zero by 2050. Achieving this requires substantial behaviour change by consumers, business leaders, employees, land managers and others across society. Behaviour change is also needed to adapt to the impacts of climate change. The Climate Change Committee (CCC) commissioned the UK Centre for Climate Change and Social Transformations (CAST) to conduct an evidence review on the implications of behavioural science for effective climate policy.

The present report represents Output 2 from the project. The report presents policy recommendations derived from a literature review on the implications of behavioural science for effectively changing behaviours, supplemented by findings from an expert workshop. Together, these offer insights to climate policy design in ways that maximise value for money, effectiveness, and ethical practice.

From the evidence reviewed, it is clear that the scale of behaviour change needed to deliver the UK's climate mitigation and adaptation goals requires government intervention. 'Downstream' approaches that inform the public about ways to tackle climate change are important as part of a wider public engagement strategy on climate change but are ineffective by themselves in changing behaviour, because there remain various economic, social, and structural barriers to taking action. While businesses can help to reduce these barriers via 'midstream' approaches that make low-carbon, climate resilience choices more attractive or available, they also need to be incentivised or enabled to do so by the wider 'upstream' conditions set by government.

This report presents specific recommendations for the eight behavioural areas investigated by the project, as well as general principles for applying behavioural insights in climate policy. These are summarised here:

- *Policy acceptability:* Factors influencing policy acceptability include: perceived effectiveness, fairness, coercion, and personal cost, as well as implementation by trusted institutions. Principles for shaping and communicating effective policies include: co-benefit and urgency framing, connecting individual policies into 'bundles', and using more participatory designs.

- *Diet change:* Changing diets requires: (political) leadership and a coherent vision for the food system; combining upstream and downstream approaches; making plant-based foods more attractive, accessible, and affordable; tailoring interventions to different groups; using consistent messaging; and ensuring fairness for everyone.

- *Reducing end-user consumption:* Changing consumption behaviours requires: upstream interventions to reduce demand and cut waste; rules and regulations for food packaging; food labels and information provision; regulations for repair prices of manufactured goods; increasing personal skills and opportunities for repairing manufactured goods; product category-specific policies for repairing manufactured goods; financial incentives for food waste and recycling; message framing and information provision for manufactured goods; and message framing for food waste.

- *Aviation demand:* Reducing demand for aviation requires: a coordinated approach involving consumers, governments, policymakers, cultural leaders, and the aviation industry; progressive and fair policies; consistent messaging; limiting or banning short-haul flights; and market-based regulations.

- *Adaptation:* Fostering adaptation behaviour change requires: public education and advice; trusted messengers and social networks; removing structural barriers through upstream approaches; using economic and regulatory approaches; and targeting moments of change.

- *Net Zero skills and careers:* Promoting these requires: businesses to provide more Net Zero training opportunities; green skills development for young people; redefining green skills; informational campaigns and education; and social and gamification interventions to encourage training uptake.

- *Business leaders:* Changing business leaders' behaviour requires: market-based regulations; differentiating regulations according to business types/needs; redefining the role of local government; education/training provision; the role of NGOs; and labelling and standards schemes.

- *Land use and farming:* Changing land managers' behaviour to promote tree-planting requires: policies focusing on social influence (e.g. demonstrations); changes to grant scheme applications; working with farmers on designing policies; reducing financial risks; and tailoring policies to farmers' values and abilities.

General principles for using behavioural science in climate policy:

a) *Identifying behavioural targets.* Behaviours to target for intervention can be prioritised according to (a) impact, and (b) feasibility. Impact involves picking behaviours that could have the largest effect in terms of adaptation or mitigation, i.e. those that reduce emissions by the greatest amount, such as less flying and reduced meat consumption, or those that are the most cost-effective. Feasibility, sometimes referred to as behavioural plasticity, encompasses affordability; ease of implementation; equity; side effects and co-benefits; and acceptability.

b) *Identifying and tailoring interventions.* Behavioural interventions represent any interventions aimed to influence behaviour and can include information provision, economic interventions, regulations, and infrastructure change. Different behaviours require different combinations and sequences of interventions. Consistently applying theoretical models (e.g. COM-B; Michie et al., 2011) is crucial for understanding the different constructs influencing behaviour and making sure these are included in intervention design. Different interventions work better for different behaviours. Thus, interventions should be context-specific by recognising the diversity of behaviours people engage in, e.g. private versus professional.

c) *Combining and sequencing interventions*. Downstream interventions, e.g. informational campaigns, together with upstream interventions (i.e. government interventions to change wider systems), are needed to build public support for measures while also removing the barriers to behaviour change. Midstream interventions by businesses and local authorities can also create enabling choice environments by increasing the availability and attractiveness of low-carbon, climate-resilient behaviours.

d) *Tailoring to different populations.* The characteristics of particular audiences is a key factor that needs to be considered during intervention design. Creating fair and effective interventions requires the avoidance of barriers that may differ according to population-specific characteristics, e.g. income levels, minority groups, businesses vs households.

e) *Getting the timing right.* The success of interventions can depend on timing. Targeting key moments, such household renovation or relocation, or farmers making key investment decisions, can increase an intervention's effectiveness.

f) *Engaging the public.* The evidence indicates that public engagement in policy design is very important for developing more effective interventions. This could capture the lived experiences of people who would be affected by the policy; it could also expand the range of perspectives and insights on the policy by engaging with more diverse groups of people. Moreover, since upstream government intervention is needed to deliver sufficient behaviour change to meet the UK's climate goals, communicating the need for (and benefits of) this change – through downstream informational and deliberative engagement approaches – will be essential to achieve public acceptance of behaviour change policies.

g) *Improving the evidence base and evaluating policies*. Our review found little evaluation of real-world interventions. Therefore, more research is required to examine the efficacy and scalability of intervention techniques and approaches. Once implemented, few projects include a budget specifically for evaluations. This makes evaluation inconsistent and variable. Thus, governments need to clarify the oversight, responsibilities, and communication of policy evaluation processes.

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1 Introduction

The UK is legally bound to reach Net Zero greenhouse gas emissions (GHGs) by 2050. To achieve this, substantial emissions reductions will depend on behaviour change from consumers (CCC, 2020a). Changes in behaviour are also needed from business leaders, employees, land managers and others across society (CCC, 2020b). As well as being essential to emissions reductions, behaviour change has an important part to play as the UK adapts to the impacts of climate change (IPCC, 2022).

The Climate Change Committee (CCC) commissioned the UK Centre for Climate Change and Social Transformations (CAST) to conduct an evidence review on the implications of behavioural science for effective climate policy. The project draws from current academic, government, third sector and business reports. In addition, an expert workshop was conducted to explore what types of behavioural interventions effectively change mitigation and adaptation behaviours, as well as key limitations and factors that influence the failure and success of interventions.

The project focuses specifically on high-impact behaviours – those that play a significant role in some of the CCC's modelled pathways for emissions reduction – as well as areas in which evidence of how to promote behaviour change has not yet been synthesised. These behavioural areas are: (1) Policy acceptability (2) Diet change, (3) Reducing end-consumption, (4) Aviation, (5) Adaptation, (6) Net Zero skills and careers, (7) Business leaders, (8) Land use. These sectors were chosen after a first round of literature searches identified that comprehensive literature reviews had previously been conducted on areas such as surface transport, and energy/buildings. Table 1 outlines the behavioural areas discussed in the present report.

Table 1. Behavioural areas addressed in this review

Area	Relevance to Sixth Carbon Budget – Widespread Engagement Scenario	Specific questions for literature review	Policy questions to inform
General/Policy acceptability	Cross-cutting.	How do attitudes, and criteria for policy acceptability, vary between social groups (including minority groups)? What types of framing/communication is likely to promote household actions for adaptation?	What principles should government follow in the design and communication of climate policies (both mitigation and adaptation)? Is targeted messaging needed for certain groups or certain sectors?
Reduction of red meat and dairy / diet change	50% shift away from meat and dairy products by 2050. Behaviour change leads to **10Mt** emissions reduction in 2035.	What are the relevant factors influencing reduction in meat and dairy consumption? What attitudes do the public hold towards policies to encourage a reduction in meat/dairy, and how acceptable are such policies? What is the potential effect size of interventions to change behaviour? How does this vary between social groups?	If the government wanted to introduce measures to reduce meat and dairy consumption significantly, how would this be most effectively designed and delivered? What would be the potential size of the impact?
Reducing end-user consumption (recycling, food waste, reusing/repairing of material goods)	**3Mt** emissions reduction from reducing end-user consumption in 2035. Food waste is halved by 2030 and continues to fall to 70% reduction by 2050.	What has been shown to be most effective to promote households to engage in (i) recycling (ii) reducing food waste (iii) using manufactured goods for longer/buying them second-hand/disposing of them less/sharing items? What does the evidence show in the areas where businesses can have the greatest influence on consumers to reduce end-user consumption?	If the government wanted to promote greater resource efficiency, how would this be most effectively designed and delivered?
Reduction in flying/aviation demand	**16Mt** emissions reductions from demand management in 2035. Demand growth will need to be lower than baseline assumptions, and likely constrained to 25% growth by 2050 from 2018 levels.	What factors influence people's flight purchases? How do people view the idea of reducing emissions from aviation and what factors are important? How does this vary based on social group/income profile?	If the government wanted to introduce measures to reduce aviation demand, how would this be most effectively designed and delivered? What would be the potential size of the impact?

Adaptation behaviours and living with climate change	**Not quantified**.	What influences people's behaviours in homes during heatwaves? What effectively promotes householders to take anticipatory action to make homes flood/heat resilient? What encourages households to avoid behaviours that risk wildfire ignition during droughts? What is effective in promoting changes in agricultural management practices to adapt to the effects of climate change?	What policies should the government put in place to ensure householders are preparing for the increased risk of droughts and heatwaves? How/should government respond to moments of crisis/heightened awareness to encourage these behaviours?
Net Zero skills and careers	**Not quantified** – but key to the transition.	What leads older workers and less skilled workers to be less likely to choose to upskill for net zero? How do 11–19 year-olds decide on careers/how can Net Zero careers appeal to them?	What policies should government put in place to incentivise workers to upskill in areas such as renewable energy, tree planting/peatland restoration and EV manufacture, and to transition away from oil and gas jobs and agriculture?
Business leaders	**Not quantified** – but **2/3** of UK emissions are currently estimated to be scope 1 and 2 business emissions.	What leads people who are leaders or influential in businesses to take action on net zero through their business?	What policies could be most effective in mobilising ambitious UK business action towards net zero?
Land use	Annual afforestation rates reach 50,000 hectares by 2030 and 70,000 from 2035 to 2050. Forestry and peatland restoration lead to **5 and 6Mt** emissions reductions in 2035.	What drives farmers' decisions on how to use their land (in particular whether to switch from livestock to afforestation)? What are the attitudes of farmers towards this shift, and how does it vary by social group?	As government wants to introduce measures to shift land use, what policies most effectively account for farmer preferences/values/ behaviours relating to land use?

2 Project objectives

The project had the following objectives:

1. To produce a **systematic literature review** on the scale of the potential impact of behavioural interventions for climate policy.
2. To identify key factors that lead to **success or failure** in behavioural interventions.
3. To identify **evidence gaps** and make **recommendations** for further empirical work.
4. To produce a summary of the **high-level implications** of behavioural science for climate policy informed by engagement with policy experts and the literature review.

To achieve these objectives, three outputs were produced:

1. **Output 1** is a **background report** that summarises findings from the literature review, assesses their robustness and relevance, and highlights evidence gaps.
2. **Output 2** is a summary of the **high-level recommendations** of behavioural science for climate policy. It is informed by engagement with policy experts and the background report.
3. **Output 3** is an **excel workbook**, where we list the reviewed evidence that informed our work, such as academic papers and grey literature reports.

The current report represents Output 2.

3 Methods

Output 1, i.e. the first phase of the project, consisted of using Scopus to conduct a literature review to identify relevant academic papers. A call for evidence was also issued to identify additional academic and grey literature sources. In total, we identified 398 sources. Full details on the methodology of the literature review are contained in Output 1.

A workshop with expert stakeholders was then conducted to discuss the main findings of the literature review (Output 1), together with draft policy suggestions and principles for applying behavioural insights to climate policy design in order to maximise value for money, effectiveness, and ethical practice. The workshop attendees included behavioural experts from academic, policy and business sectors together with representatives from the CCC. The workshop took place online on 13 March 2023 and was attended by 22 participants and five members of the CAST research team.

The project team synthesised recommendations from the literature review and workshop. Where possible, we assessed the importance of the recommended principles for behaviour change and policy acceptability, classifying them as **moderately important** or **very important**. Factors considered 'not important' to behaviour change or policy acceptability are not outlined in this report since they should not inform policy recommendations. Therefore, no interventions are labelled not important. The ranking of importance is based on (1) the relative contribution to behaviour change or policy support, compared to other factors, and (2) the strength of the evidence base for the intervention.

4 Policy recommendations

4.1 Cross-domain recommendations

Before discussing each topic individually, we present overarching policy implications and suggestions that could be applied across climate change domains where behaviour change is needed.

Communication and engagement. Across sectors, despite most of the public being supportive of Net Zero action, there remains a lack of public understanding of the transformations required to reach net zero and adapt to climate change, and the role individuals will need to play. Knowledge gaps remain about which behaviour changes are most effective and how to change them. For example, there remains consistent over-estimation of the contribution that recycling and waste reduction makes to emissions reductions, and low awareness of how to adapt to climate risks, including amongst households and land managers.

More broadly, there is a need for a cross-sectoral public engagement strategy as a framework to tie together the various behavioural interventions into a compelling climate transition narrative. For example, the health and environmental co-benefits of climate policies could be communicated to boost public support. A public engagement strategy would set out processes for more active involvement of the public in shaping a Net Zero, climate resilient future and communicate the scale of lifestyle changes needed to deliver on climate targets. People tend to underestimate both the climate action being taken by Government *and* the level of widespread public support for climate action. A public engagement strategy could raise awareness of both, helping to foster a sense of collective effort on climate change. By highlighting the effectiveness of climate policies, such a strategy could also increase policy acceptability (Reynolds et al., 2020). Processes of public engagement (e.g. deliberative methods, co-production) are particularly important for effective behaviour change programmes to both foster acceptance and address contextual factors or behavioural barriers, such as cost or inconvenience, within policy design (Demski, 2021; Howarth et al., 2021).

More education provision is also needed to increase employers' Net Zero skills and resilience to climate change. Policies aimed at including climate change courses in school and university curricula could also be vital for young people's career choices and skills development in the green sector. Carbon labelling of products (e.g. food) may only have small effects on consumers' behaviour, but could be more effective in driving producers to cut emissions through 'deshrouding' markets (i.e. being transparent about products' environmental impacts; Behavioural Insights Team, 2023).

Moving upstream. While communication is necessary for a Net Zero, climate resilient transition, 'downstream' interventions – those that target individuals' decision-making (e.g. information provision) – by themselves are not enough to change behaviour. There is a need also for 'midstream' and 'upstream' measures – those that change choice environments and the wider system – to remove the barriers to behaviour change and create enabling environments for low-carbon, climate resilient behaviour. Consistent evidence shows interventions must be combined to effectively change behaviour and address the multiple drivers of and barriers to behaviour change (Whitmarsh et al., 2021).

This requires governments to work with businesses to incentivise and change citizens' behaviour (e.g. making low-carbon choices the default) as well as working with media and other communicators to create social norms that support low-carbon, resilient choices. Importantly, for these policies to be publicly acceptable, they need to be seen as fair, effective, and not overly restrictive of personal freedoms.

Getting the timing right. Timing matters. Across sectors, we have found that interventions are likely to work better during key decision-points or 'moments of change' when habits are more malleable. For example, interventions to promote low-carbon travel choices or domestic energy efficiency or adaptation measures could focus on targeting house-movers or the transition from school to higher education or work. For professional decision-makers (business leaders, land managers, etc.), climate action may be best promoted at times when strategic or long-term investment decisions are being made to lock in climate benefits.

In addition, our review identified that exogenous moments of change such as extreme weather events (droughts, floods, etc.) can trigger climate action. For instance, in agriculture, such events might encourage farmers to implement both climate mitigation and climate adaptation strategies. Other exogenous events, such as energy crises, might similarly trigger energy efficiency action by businesses and householders.

Leadership and ambition. Finally, given the importance of leadership and social norms in shaping public willingness to act, the UK government should send clear, consistent signals that climate change is a priority across the whole economy and that there is a need to change behaviour and lifestyles to mitigate and adapt to climate change. As noted in the House of Lords (2022) inquiry on behaviour change for climate and environmental goals, this leadership is not yet happening.

A substantial amount of behaviour change will require interventions from the government that restrict some behaviours and incentivise others. The government's hesitation to manage demand and their climate goals is perhaps most stark for aviation, where emissions will grow substantially if demand is not curtailed and where a small section of the population is responsible for the bulk of emissions. Diet change similarly is an area where the government has been reluctant to intervene, despite a need to cut emissions from food consumption. Grappling with these areas will be a key political challenge for the government, and one for which it should have an honest conversation with the public. This conversation could form part of its public engagement strategy, and involve deliberative engagement as exemplified by the UK Climate Assembly (2020). For example, following a citizens' assembly on climate change France banned short-haul domestic flights in 2022 (Dobruszkes et al., 2022).

4.2 Policy acceptability

As noted in the CCC's Sixth Carbon Budget report (2020) and subsequent annual reports, the scale of behavioural and social change needed to reach the UK's climate goals requires public buy-in and policy support. Public concern about climate change is widespread, with 43% of the public stating they were extremely or very worried about climate change in 2022 (Whitmarsh et al., 2022). Despite this, public opposition to climate policies is a key reason for policy failure, withdrawal, or redesign (Howarth et al., 2020). Accordingly, to design and implement inclusive, fair, and well-accepted climate policies, the diverse viewpoints of multiple societal groups must be considered. Below, the main findings and implications from our literature review are outlined.

Key findings & implications

Factors that influence climate policy acceptability

- Perceptions of how fair a policy is across all societal groups is one of the most important determinants of acceptability (Bergquist et al., 2022). Generally, the public favour policies that distribute the costs based on needs and responsibility (Hammar & Jagers, 2007; Bechtel & Scheve, 2013), protect the disadvantaged, and fairly redistribute revenue into environmental initiatives, such as renewable energy development (Rotaris, 2017), and public transportation initiatives (Bristow et al., 2010).
- Perceived policy effectiveness is amongst the most important determinants of acceptability (Bergquist et al., 2022), and this can increase once a policy has been implemented (when benefits are directly experienced, rather than only imagined prior to implementation (Santos, 2004).
- Communicating the efficacy and urgency of an adaptation response may increase policy acceptability (Lim et al., 2022).
- Policies are favoured when sufficient information about a policy is provided (Holmes & Clark, 2008), and decision-making processes are 'procedurally just', i.e. open, transparent and fair (Jagers et al., 2017).
- Policies are favoured if they are not perceived as coercive or infringing on one's personal freedom, and have some societal benefit (Drews & van den Bergh, 2016). For adaptation policies, autonomy in decision-making is vital to support (Dessai & Sims, 2011).

- Climate concern is more related to adaptation policy acceptability than to mitigation policy acceptability (Hagen et al., 2016). For mitigation, heightened perceptions of climate risk and seriousness are moderately linked to higher policy support, and increased knowledge is weakly linked to higher acceptance. Adaptation policy acceptability is influenced by climate change belief, concern, experience, risk perception, and psychological distance from impacts (de Jalón et al., 2013).
- Policies may be better accepted when implemented by trusted leaders and organisations (Bergquist et al., 2022), and by trusted sources for adaptation policies (Hagen et al., 2016).
- Socio-demographic factors do not reliably predict acceptability alone, but there are differences in acceptance between social groups.
- Framing policies around health, environmental and moral co-benefits may boost support (Rossa-Roccor et al., 2021; Behavioural Insights Team, 2022), especially if multiple (Wolstenholme et al., 2020) or tailored (Jennings et al., 2020) co-benefits are communicated.
- Showing how individual policies are connected (in 'policy bundles') may bolster public support (Bergquist et al., 2020).
- Including the public in policy design through participatory and deliberative processes can result in more effective and accepted mitigation and adaptation policies (Lancaster University, 2022).

4.2.1 Factors influencing policy acceptability

Our literature review highlighted several factors that are particularly important to designing and implementing climate policies to maximise their public acceptability. Informed by our literature review, we outline some policy-specific attributes that increase the acceptability of climate policies, with indications of how important the attribute is to policy support.

Effective – very important. The Government should ensure that climate policies are not only effective but also perceived to be effective in reaching their goals, especially for regulation-based (compared to price-based) policies. The perceived effectiveness of the Government's Net Zero plan and specific proposed policies are thus very important. For adaptation policies specifically, policymakers should communicate the policy's ability to reduce risks and achieve its desired consequences. Implementing policies for a trial period can help assess efficacy but also overcome status quo bias (i.e. resistance to change).

Fair for all – very important. The Government should seek to develop climate policies that are perceived as fair for all societal groups, and do not disproportionately impact marginalised groups (e.g. low-income households). This should include drawing on needs-based principles, in which those who are required to reduce their emissions the most are the ones who are most able to, and 'polluter-pays' principles, in which those most responsible for emissions are most impacted by the policy. The Government should seek to fairly redistribute policy-generated revenue, since this increases perceptions of fairness. Reinvesting revenue into environmental initiatives (e.g. renewable energy development) and funding public transportation are the most favoured strategies. Perceptions of fairness can be increased if people have access to a viable alternative.

Fair and transparent decision-making processes – moderately important. Sufficient information about a policy should be communicated to the public before its implementation, to increase transparency. When designing policies, policymakers should ensure that decision-making processes are open, fair, and just.

Not coercive – moderately important. Although some infringement on perceived personal freedom may be needed to achieve effective emission reductions, costs to the individual (e.g. direct monetary costs, adverse employment outcomes) should be minimised as far as possible.

Personally beneficial – moderately important. Policies should be designed to clearly communicate the benefits to the individual as well as society. For example, a policy could be made more attractive by using incentives.

Implemented by a trusted institution and leader – moderately important. The Government and local councils should seek to create a trusting relationship with the public, through being responsive, reliable, honest, fair, and transparent, in order to increase policy support. Policymakers should carefully consider who communicates with the public about new or developing policies. When communicating adaptation policies, trusted information sources should be used to foster acceptance.

Tailored to policy type – moderately important. When designing mitigation policies, policymakers should understand that climate change concern in itself is not generally sufficient for policy support. For adaptation policies, however, policymakers may seek to instil some level of public concern about climate change, since this may better foster policy support. In addition, the seriousness and risks associated with climate change should be communicated.

4.2.2 Principles for shaping and communicating climate policies to improve acceptability

Co-benefit framing. To boost policy support, policymakers may consider communicating certain information about the co-benefits of a policy. Policymakers should keep in mind that people's preferences for co-benefits will depend on their individual priorities (e.g. health, environment). If possible, policies should therefore either tailor co-benefit framing to the population they are addressing, or communicate multiple co-benefits. It is worth noting that the evidence base on co-benefit framing is not sufficiently strong to definitively conclude which type of framing will result in heightened policy support.

Health framing. Policymakers should consider the use of positive, health-related messages as they are thought to make climate change appear more local, near-term and personal. In particular, framing policies around co-benefits to the National Health Service (NHS) and other healthcare benefits is generally effective.

Environmental framing. Policymakers may also consider communicating environmental co-benefits to bolster policy support. Policies may be more effective if this is paired with moral messaging, in which the moral imperative of climate policies to prevent harm is communicated.

Urgency framing. For adaptation policies, policymakers should seek to frame policies as happening here, now (i.e. in the present or very near future), and as affecting similar people to the target population. For mitigation policies however, urgency framing is generally not effective.

Policy bundling. Policymakers should consider using policy bundles, in which climate policies are deployed alongside other social and economic policies, to increase public support. A recent example of this is the Inflation Reduction Act (2022) in the US. Alongside climate policies, policymakers may consider implementing social (e.g. affordable housing) or economic policies (e.g. job guarantee). Social reforms in particular (e.g. health insurance and free education) should be considered to bolster support amongst low-income and ethnic minority groups. If tailored bundles are not possible, social commitments such as affordable housing and improved minimum wages should be considered, owing to their more consistent increase in support across social groups.

Participatory design. Policymakers should seek to engage with the public at the early stages of policy planning and design. Key mechanisms to achieve this include citizens assemblies, citizens juries, and deliberative polling. For both mitigation and adaptation policies, policymakers should seek to involve the public on the local level to increase feelings of policy ownership, fairness in decision making and effectiveness.

4.2.3 Research gaps

Research exploring adaptation policy acceptability is generally lacking. Across both mitigation and adaptation policies, there is little understanding of how different interventions (e.g. different message frames, incentives, or structural changes) differentially influence climate policy acceptability. This has resulted in difficulties comparing the effectiveness of different methods to enhance policy support. In addition, existing work has not considered which progress indicators should be used to monitor changes in acceptability over time, and between social groups. Finally, previous research has neglected to consider if different social groups (e.g. low income or disabled groups) may be more likely to support a policy depending on how it is communicated, as well as differences in individual, household, and business support.

4.3 Diet change

Food production and consumption have considerable implications for climate change. The CCC's Pathway Scenarios show that there needs to be a 20% to 50% shift away from meat and dairy products

to plant-based diets by 2050 as this will result in 10Mt emissions reduction in 2035 and help meet UK climate targets (CCC, 2020b).

Key findings & implications

Factors that influence consumption

- There has been an increase in adoption of plant-based foods, and the public largely support a reduction of meat and dairy consumption in diets.
- The food ***environment*** strongly influences dietary choices including meat and dairy consumption, so measures that target this environment tend to be effective (Taufik et al., 2019; Marteau et al., 2022). These include for example, taxing high-carbon foods, labelling, subsidising meat-free options, and increasing the relative availability of plant-based food.
- Access to healthy and sustainable foods are strongly influenced by geographical inequalities, whereby limited retail and transport opportunities and low socioeconomic status can result in so-called "food deserts" (see Newing et al., 2022).
- Using communication and goal-setting approaches to target ***psychological factors*** that influence food choice can be relatively effective for some groups, but may also increase inequalities (Taufik et al., 2019). These psychological factors include, for example, individual identity, goals, emotions, and attitudes, which can be used to effectively frame messaging and target different populations.
- Making plant-based foods more appealing and connecting them to indulgent language and positive emotions supports diet change towards higher plant-based food consumption (Behavioural Insights Team, 2020). Changing the names of vegetarian options can lead to an increase in choosing these meals by meat eaters (Vennard et al., 2019)
- Using co-benefits and combining message framing (e.g. health, animal welfare, environment) and supporting skill development can be important components of successful interventions.
- The removal of cigarette adverts resulted in reduced smoking rates (e.g. Saffer & Chaloupka, 2000), suggesting similar techniques might also be useful for changing meat and dairy consumption. For example, restrictions on the advertising of high fat, salt, and sugar products across the Transport for London network resulted in positive changes of household food purchases (Yau et al., 2021).
- Informational approaches play an important role in consumer choices, but work best in combination with other intervention approaches (e.g. pricing, increased availability). Information provision alone is not effective.
- Targeting ***interpersonal factors,*** for example through social norm messaging about others' dietary choices***,*** can be somewhat effective in changing behaviour (Taufik et al., 2019).
- Convenience factors (e.g. saving time on food preparation) and taste are additional factors to consider when designing interventions.
- Interventions are more likely to succeed when making use of ***windows of opportunity*** to break habits.

Considerations for scaling up interventions

- Achieving a 'balanced' diet has wider appeal than vegan or vegetarian diets. Many people are already reducing their meat and dairy consumption and are willing to reduce it further. To scale up any intervention, potential adoption rates need to be considered and support mechanisms for the already willing need to be put in place. Sustainable labels may only have small effects on consumers' behaviour, but could help shift manufacturer practices by revealing a product's environmental impact (Behavioural Insights Team, 2023).
- Field-studies are needed that are co-designed with stakeholders in order to design a coherent and effective intervention portfolio. Currently, real-world trials and insights on how to engage with different groups are limited.
- The UK needs a coherent vision of what its future food system might look like. More political leadership is required to facilitate and communicate Net Zero compatible diets.

4.3.1 Policy recommendations

Below we list our policy recommendations for applying behavioural science to diet change.

(Political) leadership and coherent vision – very important. The government should engage in more political leadership by creating a vision for achieving a low-carbon, climate-resilient food system. Given that people have already started changing their meat consumption behaviours to reduce ruminant meat consumption, government policies can help people to achieve their goals to have lower-carbon diets. Policies need to be integrated across the food system (e.g. through a national food framework) and support access to a healthy and low-carbon diet.

Combine upstream and downstream approaches – very important. Removing structural barriers through, for example, low-carbon labelling, tax, and advertisement regulations for (red) meat and dairy creates an environment in which low-carbon diet choices are made easier. However, a scale-up programme needs to be developed that draws on real-world trials co-designed with stakeholders. Evidence shows that information-based interventions alone have limited efficacy in changing consumer behaviour, hence combining approaches is crucial.

Make plant-based foods attractive, accessible and affordable – very important. Policymakers need to ensure that plant-based and lower-emission foods are cheaper and more easily accessible. However, more action is also needed to increase the availability of such foods and make them more attractive through using different framing and marketing techniques. Normalising and making plant-based food more available (e.g. through public provisioning) would increase adoption even further. Introducing a carbon version of the sugar levy might also lead to a switch to more sustainable diets by way of producers reformulating recipes or production processes to reduce emissions.

Tailored interventions and consistent messaging – very important. Informational approaches are more effective when tailored to people's values, motivations, and identities. With this in mind, the government should design campaigns targeting certain populations. For example, more affluent people are more likely to be able to afford to make choices in line with their sustainability principles, so the environmental benefits of plant-based foods could be emphasised. At the same time, there needs to be a unified system of a single and trusted eco-label as this would help reduce greenwashing and reveal products' environmental impacts. Going further, regulating meat/dairy advertising could also be considered.

Fair for everyone – moderately important. There need to be policies in place that support a diet shift for everyone. Since low-income and rural households tend to have limited access to affordable fruit and vegetables, policies should support access to low-carbon food for example through community food projects that provide deprived communities with produce direct from farmers. Similarly, policies need to be in place to support food producers, especially small businesses and farmers, to adapt food production to facilitate a shift in people's diets.

4.3.2. Research gaps

There are large evidence gaps in the literature particularly related to field studies in the area of diet change. Developing field studies in collaboration with stakeholders is necessary in order to design coherent and effective intervention portfolios.

Further research on the combination of several intervention techniques and engaging with different groups is required to scale up diet change interventions.

More precise techniques for measuring food consumption should also be applied. Currently, self-report measures lead to imperfect evidence because people have shifted towards out-of-home consumption (i.e. more snacking) making for larger errors in self-report data.

4.4 Reducing end-user consumption

Recycling, avoiding food waste, and reducing end-user consumption (re-using/repairing items and buying second-hand goods) are very important for tackling climate change. According to The CCC's 'Widespread Engagement Pathway' (2020) there could be a reduction of 3Mt of emissions from end-user consumption of new resources in 2035. For example, this could come from less disposal of clothes and textiles, using electronic appliances and furniture for longer, sharing, and repairing. The Widespread Engagement Pathway sees a halving of food waste by 2035 and a reduction of 60% by 2050.

Key findings & implications

Factors that influence end-user consumption

- Socio-demographic factors such as income, age, and having children affect end-user consumption. Older people, those with children, and those with higher incomes consume and waste more.
- Values, attitudes, and social norms could be key for engaging in recycling, and reducing food waste and material consumption (Punzo, 2019).
- Skills, more time, access to equipment, and knowledge of legal rights are key for increasing people's engagement with repairing items (Fischer et al., 2008; Armstrong et al., 2015) as only 54% of people in the UK would prefer to repair rather than replace a piece of technology when it breaks (YouGov, 2021).
- Repairing electronics might be dependent on the product category, for instance surveys show that 80% of people are likely to try to repair white appliances compared to 49% for smartphones or tablets, and only 14% for small household items such as kettles, toasters, etc. (Consumer Reports, 2022).
- People with higher incomes and those who identify as White or Asian appear to be more likely to replace their electronics instead of repairing them (Consumer Reports, 2022).
- Financial incentives have delivered mixed results in reducing food waste and increasing recycling (Tian et al., 2022; Xia et al., 2023), while more research is needed to inform their application in the domain of material consumption.
- Food labels alone might not reduce food waste, but they could be more effective when combined with additional information (WRAP, 2022).
- Information provision related to reducing material consumption has been successfully applied in lab settings (Ölander & Thøgersen, 2014). Less is known on its real-world application.
- Nudge-type interventions such as prompts might reduce food waste (Shearer et al., 2017) especially when these are combined with additional information (Tiefenback, 2017).

Considerations for scaling up interventions

- Real-world trials in end-user consumption, more specifically material use, are very limited due to the difficulty and cost of designing such trials.
- Moments of change could be key for behaviour change relating to end-user consumption (Verplanken & Roy, 2016).
- Changes to recycling infrastructure around the UK should be considered in order to create a more unified system.
- Ease of implementation should be considered when designing interventions, incorporating consultations with people who engage in the proposed behaviours.

4.4.1 Policy recommendations

Below we list our policy recommendations for applying behavioural science for reducing end-user consumption.

Upstream interventions for end-user consumption – very important. Some of our workshop-specific recommendations include a significant shift in incentives. Current upstream (i.e. government-led) incentives for businesses encourage consumption and thereby result in more waste. This points to the need for significant shifts in upstream incentives, including moving towards a circular economy. For example, proportionate pricing and the removal of price promotions could reduce excessive purchasing.

Rules and regulations for food packaging – very important. Policymakers could introduce improved rules for selling food with less packaging, e.g. loose fruit and vegetables. When packaging is required, this should be done under the Extended Producer Responsibility regulation intended to incentivise business to use less/better packaging.

Food labels and information provision – very important. The government should prioritise better, more informative food labelling on packaging. Research shows that combining food labels with explanatory information may represent best practice to reduce food waste, whereas food labels alone may not result in significant behavioural shifts.

Rules and regulations for repair prices of manufactured goods – very important. Legislation should mandate a 'reasonable price for repair', i.e. all common repairs must be substantially cheaper than buying a replacement. Otherwise, manufacturers can disincentivise repairs by charging a premium for spare parts.

Increasing personal skills and opportunities for repairing manufactured goods – moderately important. The Government recently introduced the 'right to repair' regulation for electronics, however, it has proved difficult to access and the public seems to lack the required technical skills. Encouraging skills acquisition therefore presents an opportunity for government. For instance, skills such as knitting and sewing could tap into the upward trend of these activities amongst younger generations. Repair services, specifically those connected with clothing repairs, tend to be focused around women, indicating more broadly that policies are necessary to engage the whole community in repairing activities.

Product category-specific policies for repairing manufactured goods – moderately important. The government should identify certain product categories for which repairability might be more attractive. For example, personal devices such as phones, laptops, and tablets tend to be replaced more often to keep up with the latest technologies. For other products such as white appliances repairability might be more attractive. Thus, tailoring policies for these categories may lead to more engagement with repair activities.

Financial incentives for food waste and recycling – moderately important. The government could develop financial incentive schemes to promote circular economy actions – e.g. deposit return schemes (DRS). It should be noted, however, that while DRS schemes have proved effective in Europe, other financial incentives (e.g. lottery ticket rewards) seem to deliver mixed results. More research on identifying which financial incentives are best suited for reducing end-user consumption would be valuable.

Message framing and information provision for manufactured goods- moderately important. Policymakers should aim to make buying second-hand items more appealing to the public. Findings have emerged that barriers differ according to the product category. People tend to avoid purchasing second-hand electronics because they believe these would be out of date and lack a suitable warranty. Buying second-hand furniture may seem less convenient due to the need to arrange delivery from private sellers. Some people might be reluctant to purchase second-hand clothing because they have concerns related to cleanliness, although the vintage and second-hand clothing market has grown in recent years. Campaigns aimed at removing these perceived and actual barriers might be crucial to encourage the reuse of manufactured goods.

Message framing for food waste – moderately important. There is a close connection between self-transcendence and biospheric values (defined as a concern for the welfare of others and the environment) and food waste/waste management. People with higher levels of self-transcendence values tend to engage more in recycling, and they waste less. Waste is an intuitive concept that people tend to view negatively, meaning they can often aspire to avoid waste. This provides an opportunity for government to use messages of waste avoidance, and put in place suitable provisions to help people achieve this goal.

4.4.2 Research gaps

We identified several evidence gaps in the literature on end-user consumption. As with diet change, field studies are not common. Interventions do not tend to focus on long-term effects, and assessments rely predominantly on self-report measures. There is also a lack of research that encompasses diverse groups. Distinctions between the changes in consumption levels of low-income cohorts vs high income cohorts vs businesses are necessary to inform more precise interventions for wider segments of the population. Finally, the design of interventions relating to household consumption should include engagement with the target audience to increase the likelihood of success.

4.5 Aviation demand

Emissions reductions in line with the Paris Agreement will likely require significant behaviour change in the aviation sector. Current policies will not deliver the required emissions reductions (Larsson et al., 2019), so new policies are required. Aviation produces 7% of the UK's total emissions. It has high mitigation potential from demand reduction, but there are considerable challenges in achieving this (Dobruszkes et al., 2022). The CCC's Balanced Pathway Scenario estimates that if demand is constrained to 25% growth by 2050 compared to 2018 levels, there could be 12Mt emissions reductions from aviation demand in 2035 (CCC, 2020c). Aviation demand is very unevenly distributed amongst the population, and alternatives to flying can be expensive or impractical.

Key findings & implications

- Behaviour change can involve *avoidance and substitution* where people choose to fly less; *greener choices,* which include such behaviours as travelling in seats that require less space (for instance economy rather than business or first class); and choosing to buy *carbon offsets* (Gössling & Dolnicar, 2023).
- There is a reluctance among many air travellers to fly less (Gössling & Dolnicar, 2023).
- People tend to place responsibility on governments and industry to reduce emissions from aviation (Gössling & Dolnicar, 2023).
- Concern about climate change often does not correspond with behaviour change when it comes to flying (Alcock et al., 2017).
- Flying behaviour is often closely associated with pleasure, success, identity, aspiration, social capital, freedom, progress, economic growth. This makes it a particularly challenging area for behaviour change to occur (Gössling & Dolnicar, 2023).
- Flying is heavily promoted and incentivised by industry, governments, and through cultural signals such as the celebration of celebrity lifestyles, compounding the intransigence of behaviour change (Gössling 2019; Cohen et al., 2022).
- Behaviour change by individuals alone is unlikely to lead to substantial reductions in aviation emissions unless it is accompanied and incentivised by multilateral international agreements and national legislation (Higham et al., 2019; Logan et al, 2022; Gössling & Dolnicar, 2023).
- Perceived fairness of policies to reduce aviation demand is a key consideration for acceptability (UK Climate Assembly, 2020).
- A Frequent Flyer Levy or a Frequent Air Miles Tax have the potential to be effective in reducing aviation demand and to be perceived as fair by the public (UK Climate Assembly, 2020; Ipsos CAST, 2022; Büchs and Mattioli, 2022).
- Social norms around flying may be changing, and this process has more potential as moral considerations come to the fore (Wormbs & Wolrath Söderberg, 2021; Gössling et al., 2020).
- Improving the information available to customers could lead them to choose more efficient airlines, planes and routes (Baumeister, 2020).
- A jet fuel tax has been found to be effective in Japan, apparently suppressing demand for jet fuel by 10% (González & Hosoda, 2016).
- The effect of Air Passenger Duties at current levels on UK flight demand have been found to be "marginal" (Larsson et al., 2019).
- Uptake of offsets by customers is low, at 1–3% of passengers, and depends on: attitudes, values, identity, social norms, perceived efficacy, guilt avoidance, and the choice architecture during ticket purchase – for instance "opt in" or "opt out" (Gössling & Dolnicar, 2023). Behavioural 'nudges' that suggest a default purchase option can promote the uptake of offsets (Berger et al., 2022).
- Short haul flights have been banned in France, and this is under consideration in other countries, with the potential to drive modal shift and signal the importance of avoiding flights (Dobruszkes et al., 2022).
- There is a lack of evidence on the effectiveness of interventions to reduce aviation demand, and on the scale of changes that may be possible (Wynes et al., 2018).

Considerations for scaling up interventions

- If behaviour change is to make a significant contribution to emissions reductions from aviation, it is likely to require the alignment of action from multiple parties: consumers, governments, policymakers, cultural leaders, and the aviation industry (Gössling & Dolnicar, 2023).

4.5.1 Policy recommendations

Below we list our policy recommendations for applying behavioural science to aviation demand.

A coordinated approach – ***very important***. Achieving substantial demand reductions in aviation, or limiting its growth, is likely to require the alignment of action from multiple parties: government,

consumers, policymakers, cultural leaders, and the aviation industry. Government will need to take the lead via policies aimed at consumers and industry, alongside consistent messaging.

Progressive and fair policies – very important. Policies that are believed to be progressive and fair have the best chance of receiving public support. This is particularly the case with aviation because flying activity is very unevenly distributed among the population, and policies that can be portrayed as "stopping families from taking their one holiday a year" encounter backlash. Research shows that a Frequent Flyer Levy or Frequent Airmiles Tax can be both progressive and fair, and be popular with the public, although the framing and messaging around such policies are likely to be crucial.

Consistent messaging – very important. Contradictory messages from government and industry actors that promote flying activity while also suggesting consumers should make greener choices is likely to inhibit behaviour change and undermine public confidence that the Net Zero transition is a coherent societal project. If demand reduction is the goal, government should therefore avoid its current message of "guilt free flying", and consider restrictions on the advertising of flying along with clear communications about why reducing demand is necessary to meet climate goals. There is scope for raising the moral considerations around flying as a means of encouraging a shift in social norms, and behavioural leadership can play a role in this.

Limiting or banning short-haul flights – very important. A ban on short-haul flights within the country's airspace should be considered. This has been implemented in France, and is being explored elsewhere. It should also be accompanied by policies aimed at making alternative transport cheaper and more appealing. While such a ban would have a limited effect on emissions, as the bulk of emissions come from long-haul flights, it would send an important signal about the importance of behaviour-related emissions reductions to tackle climate change (see "Consistent messaging", above).

Market-based regulations – moderately important. Market-based regulations such as jet fuel taxes and Air Passenger Duty can be effective if set at the right level. However, they are less progressive than other tax-based interventions such as a Frequent Flyer Levy (see above), and so may be perceived as unfair and encounter more resistance. They should be considered, however, as part of a coordinated approach.

4.5.2 Research gaps

There is a general lack of evidence on the efficacy of interventions to encourage demand reduction in aviation (Wynes et al., 2018). Given the need for a coordinated approach to this, research would be valuable to explore combinations of measures that would be effective and publicly acceptable, perhaps building on the multi-policy explorations conducted during the UK Climate Assembly (UK Climate Assembly, 2020). More specifically, given the potential for a Frequent Flyer Levy or Frequent Airmiles Tax to be effective, fair, and publicly acceptable, further research could be carried out into its feasibility. Furthermore, considering how a relatively small section of the population is responsible for the bulk of aviation emissions, government could investigate how personal carbon allowances (PCAs) may affect demand for flying, and how publicly acceptable they are (Fuso Nerini et al., 2021).

4.6 Adaptation

Analysis undertaken as part of the UK CCRA (Power et al., 2020) found 86 unique climate adaptation behaviours that can be taken by the public to reduce vulnerability and increase preparedness to risks such as heatwaves, floods, droughts, and other natural disasters. Behaviours in this domain include those undertaken by businesses and households, and cover a range of actions including civic engagement, consumption, coping, property protection, learning, lifestyle changes, migration, and self-protection.

Key findings & implications

- Adaptation behaviours are not widespread, and awareness of adaptation is lower amongst the public than about mitigation (Power et al., 2020).
- Households are less likely than land managers to undertake permanent protective measures (e.g. modifications to their property) in preparation for climate events (Power et al., 2020).
- Factors known to shape behavioural adaptation responses include individual, economic, physical, cultural, and institutional factors (IPCC, 2022; McLoughlin et al, 2023). Power et al.'s (2020) UK review of adaptation behaviours found age, direct experience, and social norms were the most common factors driving behavioural change among households; income was also a barrier or enabler of adaptation.

- Experiencing extreme weather, such as drought, can encourage adaptation (or maladaptation) behaviours, suggesting such events could create windows of opportunity for effective adaptation (e.g. water-saving) policy initiatives (Liu et al., 2022).
- The way in which the media frames climate risks (e.g. extreme heat as health risk versus 'fun in the sun'; O'Neill et al., 2022) is likely to shape public adaptation responses and acceptability of resilience policies.
- There is little evidence of effective adaptation behaviour change interventions, and most of what does exist is methodologically weak, so the scale of behaviour change cannot be quantified (McLoughlin et al., 2023).
- Most interventions so far focus on information provision (which can exacerbate inequalities); although some financial interventions (e.g. loans) have been tested, particularly amongst farmers (e.g. Power et al., 2020).
- Effective risk communication is tailored to specific risks, provides clear behavioural advice, is framed to audience needs/values, applies visuals and demonstrations, and uses trusted communicators (McLoughlin et al., 2023; Seebauer & Babcicky, 2017).
- Information and advice on effective adaptation measures are needed, along with upstream interventions (e.g. regulations, incentives) to remove behavioural barriers.
- There are evidence gaps relating to types of risks, with flood risks more researched within the UK context than other climate risks (Power et al., 2020).

4.6.1 Policy recommendations

Below we list our policy recommendations for applying behavioural science to climate change adaptation.

***Public education and advice** – very important*. Given the low levels of awareness of effective adaptation, government should focus on applying effective communication techniques to promote adaptation behaviour change. This includes providing clear and consistent behavioural advice, targeted to specific risks (e.g. flood, drought, heat stress). Framing messages to the specific needs and values of the target population is likely to increase their efficacy. For example, this could mean avoiding using a 'climate' framing for segments who are dismissive of climate change (instead focussing on health or financial benefits); or in the agricultural sector, focusing on the (co-)benefits of climate adaptation behaviours for productivity. Effective communication should also employ use of visuals. The government should also work with media and health agencies to support provision of consistent behavioural advice and help shape social norms in relation to climate risk (e.g. highlighting health risks associated with hot weather).

***Trusted messengers and social networks** – very important.* Adaptation behaviours are more likely to be adopted if communicated by trusted communicators and diffused through social networks. This includes farming communities for whom early adopters can help demonstrate adaptation innovations, and their benefits, to peers.

***Removing structural barriers through upstream approaches** – very important.* By themselves, downstream measures such as risk advisories or peer demonstrations, are unlikely to be effective in promoting adaptation behaviour change unless structural barriers are removed through more upstream measures. Such barriers include home or land tenancy, for which there are 'split incentives' for adopting resilience measures between tenants and owners. This is likely to be a particular problem for adaptation in agriculture, since around 25% of farmers are tenants so may not benefit from investment in the way landowners do, or may be restricted in taking adaptation measures due to specific terms and length of their lease. Adaptation policies to promote long-term resilience should therefore target landowners and homeowners. This could include working with insurers to incentivise owners to implement resilience measures.

***Using economic and regulatory approaches** – very important.* Other barriers to adaptation behaviour change may be financial (e.g. upfront costs) and addressed through upstream or midstream economic interventions. These might be addressed through interest-free loans, for example. Building and planning regulations could help build resilience into homes and communities (e.g. nature-based solutions, water-efficient homes), and therefore reduce the need for ongoing behavioural modification to cope with climate risks. Local governments can help support implementation of adaptation measures (e.g. passive cooling) amongst communities.

Target moments of change – moderately important. The timing of interventions can affect their success. Since extreme weather events can trigger maladaptation action (e.g. installing air conditioning) that locks in carbon-intensive adaptation, it is important for low-carbon resilience measures to be implemented sooner rather than later. Common Agricultural Policy (CAP) reform in the agricultural sector could also offer a window of opportunity to embed adaptation action in policy and provide a way in which farmers can be actively engaged in adaptation uptake along with considering regulatory agricultural reform.

4.6.2 Research gaps

More research is needed on the impact of adaptation interventions in the UK as most of the work comes from non-UK contexts. Further, compared to mitigation behaviours, research on adaptation behaviours is lacking especially on how to apply behavioural interventions in this domain. More research is needed to test upstream and combined (downstream and upstream) approaches to adaptation behaviour change.

4.7 Net Zero skills and careers

One of the most important factors for a successful switch to a green economy is the development of workers' green skills. These are defined as the practical application of knowledge and abilities to reduce the impact of human activities on the environment and environmental degradation. These could be especially useful in green jobs, and the Green Jobs Task Force recognised that, to an extent, every job will need to be a 'green job'.

Key findings & implications

- Environmental awareness, i.e. the conscious perception of how an organisation is harming the environment, together with knowledge about climate change or position-specific technical knowledge (e.g. in the energy or manufacturing domain), and positive attitudes for the preservation and utilisation of natural resources are key for workers' initial engagement with Net Zero skills training opportunities (Cabral & Dahr, 2020).
- The farming community tends to be older; 70% are over the age of 59 (Gitting, 2019), and may not prioritise climate change (Hyland et al., 2015). Self-training or informal training is common in agriculture.
- In comparison to other developed nations, the UK is underperforming both in regard to investment in training and measures of skills (UK 2070 Commission, 2020). Thus, more innovative training and skills regimes are needed.
- Information provision is key for young people choosing a green career (Plan International, 2022).
- Better definitions for the terms 'Net Zero skills' and 'Net Zero careers' are needed to provide clarity for policymakers, researchers, and the labour market.
- Young people believe their employers should do a lot to tackle climate change and want to feel proud of their employer (Heath & Yarick, 2021).
- There is a lack of diversity in the green careers sector (e.g. landscape design) as 97% identify as 'White British' and only 1 in 10 are women (Groundwork, 2022).
- Lifelong learning is key to adapting to technological advances.
- Transferable skills are important for engaging in upskilling. Lack of information on green careers could hinder young people's choices (White et al., 2021).
- Those living in rural or remote areas could be more primed towards green careers due to close relationship between green jobs and nature protection or agriculture (Sulich et al., 2020).

Considerations for scaling up interventions

- Gamification (e.g. badges, leader boards, earning points) could be key in engaging employees with training activities, however, studies have only focused on general training opportunities rather than green ones (Meister, 2013; Stanculescu et al., 2016).
- Engaging a whole organisation is important for successful upskilling initiatives (Ramsarup & Ward, 2017).
- Education at school on Net Zero careers could increase their uptake (White et al., 2021).

- Limited evidence on behaviour change interventions exists in relation to green skills and careers.

4.7.1 Policy recommendations

Below we list our policy recommendations for applying behavioural science to the development of green skills and careers.

The role of government in Net Zero upskilling – very important. The government should develop clear and consistent long-term policies related to access of training and re-training of employees by ensuring the longevity of jobs requiring Net Zero skills. This would give businesses the confidence to invest in skills training.

The roles of businesses in providing training opportunities – very important. Government should create policies that encourage businesses to provide more training opportunities for their staff. This could involve identifying large companies in different sectors that can afford to offer and develop courses related to Net Zero skills. In addition, more support will be needed for implementing these new skills. Recently manufacturers have been incentivised to create solutions related to heating practices, e.g. by offering heat pumps, however, a lack of skilled installers might be slowing down or even preventing household uptake. This demonstrates the importance of persuading companies to invest in employee skills and infrastructure.

Green skills development for young people – very important. The government should design policies aimed at green skills development for young people, e.g. opportunities for placements at green businesses while they are still at school. First-hand experiences could be an efficient way to raise interest in green careers. This could be achieved by targeting big companies that have the resources to invest in apprenticeships.

Re-defining green skills – very important. Discussions during our workshop revealed that policymakers should consider remedying the lack of a clear and unified definition of 'green skills'. Creating a set of skill standards should also be considered, while trying to avoid the creation of new qualifications. This might make it easier for employees to choose more unified pathway qualifications and pivot between jobs.

Informational campaigns and education – very important. A stronger focus on green careers can be achieved by designing more informational campaigns and embedding green skills into educational curriculums at school and university. This is crucial for harnessing young people's desire to pursue a green career. It is especially important for people considering degrees in the sectors of energy and agriculture. Thus, adding this additional layer and integrating it within the existing educational system should be a priority for governmental bodies.

Social interventions – moderately important. In addition to offering more training, policymakers should address generational disparities as these could serve as a barrier to acquiring green skills. Older age groups seem to be less concerned about climate change. For instance, farmers are usually self or informally trained, and so may lack the necessary skills to engage in green agriculture. Interactive approaches such as mentorship schemes, which include a social element popular with farmers, might be a successful route to upskilling.

Gamification – moderately important. Finally, behavioural interventions employing gamification techniques (e.g. leader boards, badges, competitions, etc.) have proven to be successful in driving employees' engagement with skills training. Government could therefore consider competitions between companies working in similar sectors as a way to develop green skills. However, the focus in the research literature has so far been on training sessions for general skillsets rather than sustainability skills, indicating that more evidence in this area is needed.

4.7.2 Research gaps

Overall, the subject of Net Zero skills and careers is not well developed in the behavioural science literature. Research seems to be limited to agriculture and energy, limiting the scope for general conclusions. Furthermore, while there is a wealth of research on the young people's general career choice, evidence is lacking on their green career choices.

4.8 Business leaders

Businesses and their leaders will be crucial players in achieving Net Zero targets, with the CCC estimating that business operations account for two-thirds of the UK's emissions. This highlights the importance of understanding the factors driving corporate eco-innovation and greener business models.

Key findings & implications

Factors that influence the transition to a green economy

- Governmental regulations and cost-saving practices are driving factors for businesses to become more sustainable (Horbach et al., 2022).
- Managerial awareness of climate change and its impacts is key for transitioning to a more sustainable business model (Gadenne et al., 2019).
- Competitors' actions might also drive change; however, more evidence is needed as findings are mixed. Li et al. (2014) found competition to be a driving force, while Tsendsuren et al. (2021) found that when competition becomes too strong, there could be a reduction in environmental efforts.
- Customer demand for eco-friendly practices could also influence business' decisions, but concrete data is lacking.
- Non-governmental organisations (NGOs) could help push businesses to become more sustainable through helping organisations comply with environmental standards (Berrone et al., 2013).
- Family-owned or family-run businesses might be more likely to become green but have fewer resources to invest in eco-practices (Bammens & Hünermund, 2020).
- Social norms and the company's legitimacy in the eyes of the consumer might also push businesses into sustainability.
- Extreme weather events could be crucial in managers' decisions related to climate change Horbach et al. (2022).
- Policies aimed at marked-based regulations could be more successful in making businesses more sustainable compared to command-and-control regulations.

4.8.1 Policy recommendations

Below we list our policy recommendations for applying behavioural science to businesses.

Market-based regulations – very important. Policymakers should prioritise market-based regulations such as tax breaks over command-and-control measures. This is mainly because the former has a greater focus on productivity growth, which then drives the desire for change. This is similar to the 'Investment Tax Credit (ITC)' and 'Production Tax Credit (PTC)' introduced by the US with 'The Inflation Reduction Act' in 2022. However, additional research might be necessary to establish at what level of cost parity businesses need to feel they can invest in low-carbon alternatives, i.e. is it full cost parity or are levels around parity still acceptable?

Differences in regulations according to business types/needs – very important. Governmental policies should be able to differentiate between small and large businesses as the processes of transitioning to sustainability could be different. In addition, there should be different recommendations for firms depending on whether they operate on a business-to-business or business-to-customer basis. Differences might also emerge between businesses that have to decarbonise by themselves and those receiving support from the government. The drivers, barriers, and incentives experienced by such businesses could be very diverse.

Redefining the role of local government – very important. The role of local governments should be more clearly defined as they could play a substantive role in businesses' sustainability processes. Facilitating connections between local businesses could, for example, allow for the repurposing of one businesses' waste to be the main source material for another. Thus, policies that redefine local government's involvement in the Net Zero transition may be crucial.

Education/Training provision – very important. One of the biggest factors driving eco-innovation is managerial awareness of climate change. Therefore, policies aimed at educating managers and CEOs about the impact of climate change are urgently needed. For example, carbon literacy trainings could be implemented at the workplace, and best practice highlighted, such as the recommendations from the Task Force on Climate-Related Financial Disclosures (TCFD), which advocates for financial risks and opportunities related to climate change to become integrated into companies' risk management and strategic planning processes. A successful transition to a green business model also requires the engagement of the whole organisation. Therefore, while managerial buy-in is crucial, behaviour change should be facilitated across the whole company.

Role of NGOs – moderately important. Businesses working with non-governmental organisations could also drive eco-innovation as NGOs could act as a convener between governmental bodies and firms by helping companies to better implement green policies in their operations. As just one example, organisations such as WRAP UK could perform this role in the area of food waste and recycling.

Labelling and standards schemes – moderately important. The efficacy of customer-friendly labelling and transparency to harness customer pressure could benefit from further investigation by governmental bodies as the current evidence shows mixed results. Similarly, standards and schemes that provide comparisons with competitors should be further investigated.

4.8.2 Research gaps

Behavioural science has not been widely applied in this sector. While changes in business models have been identified after the application of governmental regulations, most of the analyses have not been based on behavioural principles. Thus, more work is needed to further identify how behavioural science can inform the transition to greener business models and eco-innovation.

4.9 Land use and farming

Agriculture is responsible for around 10% of UK emissions (DEFRA, 2019). The CCC's 'Balanced Pathway Scenario' calls for at least 30,000 hectares of annual afforestation across the UK by 2025 and 50,000 hectares annually after 2030. Restoring forestry and peatland could reduce emissions by up to 6Mt by 2035. Meeting these climate targets will require behaviour change from farmers, landowners, and farmworkers.

Key findings & implications

Factors that influence the transition to sustainable agriculture

- Family-owned businesses, especially farms, could be more open to sustainability initiatives.
- Extreme weather events are important in farm owners' decisions to invest in climate change mitigation and adaptation.
- Older farmers might be less likely to change behaviours (Staddon et al., 2021).
- Attitudes, worldviews, values and beliefs, and age are important factors to consider.
- Financial incentives and subsidies are important, however, grant applications are seen as complex and bureaucratic by farmers, which reduces their willingness to apply (Confor, 2020).
- Classifying land as something other than 'agricultural' could hinder afforestation due to farmers' identity being connected to agriculture. Research shows that the word 'agroforestry' could elicit negative responses from the farming community even if there is support for tree planting (Irwin et al., 2022).
- Risk-aversion could hinder the adoption of new and sustainable practices (Dessart et al., 2019).
- Perceived loss of control over land when using grants could also be a problem for farmers, thus working together with farmers is key (Westaway et al., 2023).
- The identity of farmers has also been linked to their engagement with sustainable agriculture. For example, a productivist identity, defined by short-term profits and maximizing outputs, has been linked to lower engagement. A conservationist identity considers the long-term values of the land and seeks to improve soil health, and is connected with higher likelihood of engaging with sustainable farming practices (Dixon et al., 2021)

Considerations for scaling up interventions

- Social and descriptive norms (for example through demonstrations by innovative farmers) could be relevant for achieving behaviour change related to the process of afforestation.
- Incentives in the form of grants should emphasise that there will be no loss of control over land, while the grant application process should be made clearer and simpler. This could be beneficial for increasing engagement and subsequent behaviour change.

- Information campaigns and training are vital, especially when focusing on profitability and engaging larger portions of the farming community.

4.9.1 Policy recommendations

Below we list our policy recommendations for applying behavioural science in relation to land use and farming.

Policies focusing on social influence – very important. Government should employ policies that use social norms techniques such as peer-to-peer learning or demonstrations. Given that working alone is very common in the farming sector, socially-based interventions might be very influential in shaping farmers' perceptions of appropriate changes to land use.

Financial incentives and grant schemes – very important. The availability of financial incentives is fundamental for promoting Net Zero farming and helping farmers to make the transition to sustainable agriculture. However, policymakers also need to work on simplifying grant schemes. The current application process is seen as too complex and involving too much bureaucracy by those working in agriculture. Further assurances in grant applications are also needed to allay fears about losing control and land ownership. Strong evidence points to the need for changes in the design of grant applications.

Working with farmers on designing policies – very important. Government should organise transparent consultations with members of the agricultural community. This will help to ensure that farmers' opinions are considered during policy design, rather than after policies have been put in place.

Reducing financial risks – moderately important. Better measures should be implemented to reduce the financial risks of taking land out of production. For example, refining the 'Income foregone' scheme by framing the ideas of afforestation in a way that could elicit positive responses from the community.

Tailoring policies to farmers' values and abilities – moderately important. Government should consider landowners' and farmers' differing worldviews, cultural values, and beliefs, as those working in the sector tend not to see climate change as a priority either personally or professionally. Therefore, aligning climate policies with farmers' economic priorities and social values is essential. For example, policy communications should highlight the financial, personal, and environmental benefits of engaging with afforestation. Similarly, policies need to recognise that the ability of farmers to implement change varies widely – particularly that tenant farmers have less capacity to implement long-term or costly measures than landowners.

4.9.2 Research gaps

Research that tests the effectiveness of different information framing techniques is lacking in this sector. In addition, research on modelling or demonstration techniques would be valuable as there is currently little evidence on this subject. Finally, research on the effect of subjective norms (e.g. planting trees being seen as beneficial by the local community) should be prioritised as this could prove influential, especially in smaller communities.

5 Conclusion & general principles

From the evidence reviewed, it is clear that the scale of behaviour change needed to deliver the UK's climate mitigation and adaptation goals requires government intervention. Downstream approaches that inform the public about ways to tackle climate change are important as part of a wider public engagement strategy on climate change but are ineffective by themselves in changing behaviour, because there remain various economic, social, and structural barriers to taking action.

While businesses can help reduce these barriers via 'midstream' approaches that make low-carbon, climate resilience choices more attractive or available (Behavioural Insights Team, 2023), they also need to be incentivised or enabled to do so by the wider 'upstream' conditions. This points to the key role of government. Indeed, a recent systematic review of the evidence on how to decarbonise societies confirms that government action is essential (Moore et al., 2020).

The recent House of Lords (2022) inquiry into pro-environmental behaviour change similarly concluded that government intervention is essential to enable and motivate behaviour change; yet found the UK government's approach to date to be 'seriously inadequate' and risks failing to meet the UK's climate targets.

Based on our evidence, we propose the following overarching principles for using behavioural science in climate policy.

a) *Identifying behavioural targets.* Behaviours to target for intervention can be prioritised according to (a) impact, and (b) feasibility. Impact involves picking behaviours that could have the largest effect in terms of adaptation or mitigation, i.e. those that reduce emissions by the greatest amount, such as less flying and reduced meat consumption, or those that are the most cost-effective. Feasibility, sometimes referred to as behavioural plasticity, encompasses affordability; ease of implementation; equity; side effects and co-benefits; and acceptability.

b) *Identifying and tailoring interventions.* Behavioural interventions represent any interventions aimed to influence behaviour and can include information provision, economic interventions, regulations, and infrastructure change. Different behaviours require different combinations and sequences of interventions. Consistently applying theoretical models (e.g. COM-B; Michie et al., 2011) is crucial for understanding the different constructs influencing behaviour and making sure these are included in intervention design. Different interventions work better for different behaviours. Thus, interventions should be context-specific by recognising the diversity of behaviours people engage in, e.g. private versus professional.

c) *Combining and sequencing interventions*. Downstream interventions, e.g. informational campaigns, together with upstream interventions (i.e. government interventions to change wider systems), are needed to build public support for measures while also removing the barriers to behaviour change. Midstream interventions by businesses and local authorities can also create enabling choice environments by increasing the availability and attractiveness of low-carbon, climate-resilient behaviours.

d) *Tailoring to different populations.* The characteristics of particular audiences is a key factor that needs to be considered during intervention design. Creating fair and effective interventions requires the avoidance of barriers that may differ according to population specific characteristics, e.g. income levels, minority groups, business vs household.

e) *Getting the timing right.* The success of interventions can depend on timing. Targeting key moments, such household renovation or relocation; or farmers making key investment decisions, can increase an intervention's effectiveness.

f) *Engaging the public.* The evidence indicates that public engagement in policy design is very important for developing more effective interventions. This could capture the lived experiences of people who would be affected by the policy; it could also expand the range of perspectives and insights on the policy by engaging with more diverse groups of people. Moreover, since upstream government intervention is needed to deliver sufficient behaviour change to meet the UK's climate goals, communicating the need for (and benefits of) this change – through downstream informational and deliberative engagement approaches – will be essential to achieve public acceptance of behaviour change policies.

g) *Improving the evidence base and evaluating policies*. Our review found little evaluation of real-world interventions. Therefore, more research is required to examine the efficacy and scalability of intervention techniques and approaches. Once implemented, few projects include a budget specifically for evaluations (NAO, 2021). This makes evaluation inconsistent and variable. Thus, governments need to clarify the oversight, responsibilities, and communication of policy evaluation processes.

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Appendix. Full list of recommendations

Cross-domain recommendations
Communication and engagement. Across sectors, despite most of the public being supportive of Net Zero action, there remains a lack of public understanding of the transformations required to reach Net Zero and adapt to climate change, and the role individuals will need to play. Knowledge gaps remain about which behaviour changes are most effective and how to change them. For example, there remains consistent over-estimation of the contribution that recycling and waste reduction makes to emissions reductions, and low awareness of how to adapt to climate risks, including amongst households and land managers. More broadly, there is a need for a cross-sectoral public engagement strategy as a framework to tie together the various behavioural interventions into a compelling climate transition narrative. For example, the health and environmental co-benefits of climate policies could be communicated to boost public support. A public engagement strategy would set out processes for more active involvement of the public in shaping a Net Zero, climate resilient future and communicate the scale of lifestyle changes needed to deliver on climate targets. People tend to underestimate both the climate action being taken by Government *and* the level of widespread public support for climate action. A public engagement strategy could raise awareness of both, helping to foster a sense of collective effort on climate change. By highlighting the effectiveness of climate policies, such a strategy could also increase policy acceptability (Reynolds et al., 2020). Processes of public engagement (e.g. deliberative methods, co-production) are particularly important for effective behaviour change programmes to both foster acceptance and address contextual factors or behavioural barriers, such as cost or inconvenience, within policy design (Demski, 2021; Howarth et al., 2021). More education provision is also needed to increase employers' Net Zero skills and resilience to climate change. Policies aimed at including climate change courses in school and university curricula could also be vital for young people's career choices and skills development in the green sector. Carbon labelling of products (e.g. food) may only have small effects on consumers' behaviour, but could be more effective in driving producers to cut emissions through 'deshrouding' markets (i.e. being transparent about products' environmental impacts; Behavioural Insights Team, 2023). ***Moving upstream.*** While communication is necessary for a Net Zero, climate resilient transition, 'downstream' interventions – those that target individuals' decision-making (e.g. information provision) – by themselves are not enough to change behaviour. There is a need also for 'midstream' and 'upstream' measures – those that change choice environments and the wider system – to remove the barriers to behaviour change and create enabling environments for low-carbon, climate resilient behaviour. Consistent evidence shows interventions must be combined to effectively change behaviour and address the multiple drivers of and barriers to behaviour change (Whitmarsh et al., 2021). This requires governments to work with businesses to incentivise and change citizens' behaviour (e.g. making low-carbon choices the default) as well as working with media and other communicators to create social norms that support low-carbon, resilient choices. Importantly, for these policies to be publicly acceptable, they need to be seen as fair, effective, and not overly restrictive of personal freedoms. ***Getting the timing right.*** Timing matters. Across sectors, we have found that interventions are likely to work better during key decision-points or 'moments of change' when habits are more malleable. For example, interventions to promote low-carbon travel choices or domestic energy efficiency or adaptation measures could focus on targeting house-movers or the transition from school to higher education or work. For professional decision-makers (business leaders, land managers, etc.), climate action may be best promoted at times when strategic or long-term investment decisions are being made to lock in climate benefits. In addition, our review identified that exogenous moments of change such as extreme weather events (droughts, floods, etc.) can trigger climate action. For instance, in agriculture, such events might encourage farmers to implement both climate mitigation and climate adaptation strategies. Other exogenous events, such as energy crises, might similarly trigger energy efficiency action by businesses and householders. ***Leadership and ambition.*** Finally, given the importance of leadership and social norms in shaping public willingness to act, the UK government should send clear, consistent signals that climate change is a priority across the whole economy and that there is a need to change behaviour and lifestyles to

mitigate and adapt to climate change. As noted in the House of Lords (2022) inquiry on behaviour change for climate and environmental goals, this leadership is not yet happening.

A substantial amount of behaviour change will require interventions from the government that restrict some behaviours and incentivise others. The government's hesitation to manage demand and their climate goals is perhaps most stark for aviation, where emissions will grow substantially if demand is not curtailed and where a small section of the population is responsible for the bulk of emissions. Diet change similarly is an area where the government has been reluctant to intervene, despite a need to cut emissions from food consumption. Grappling with these areas will be a key political challenge for the government, and one for which it should have an honest conversation with the public. This conversation could form part of its public engagement strategy, and involve deliberative engagement as exemplified by the UK Climate Assembly (2020). For example, following a citizens' assembly on climate change France banned short-haul domestic flights in 2022 (Dobruszkes et al., 2022).

Policy acceptability

Co-benefit framing. To boost policy support, policymakers may consider communicating certain information about the co-benefits of a policy. Policymakers should keep in mind that people's preferences for co-benefits will depend on their individual priorities (e.g. health, environment). If possible, policies should therefore either tailor co-benefit framing to the population they are addressing, or communicate multiple co-benefits. It is worth noting that the evidence base on co-benefit framing is not sufficiently strong to definitively conclude which type of framing will result in heightened policy support.

Health framing. Policymakers should consider the use of positive, health-related messages as they are thought to make climate change appear more local, near-term and personal. In particular, framing policies around co-benefits to the National Health Service (NHS) and other healthcare benefits is generally effective.

Environmental framing. Policymakers may also consider communicating environmental co-benefits to bolster policy support. Policies may be more effective if this is paired with moral messaging, in which the moral imperative of climate policies to prevent harm is communicated.

Urgency framing. For adaptation policies, policymakers should seek to frame policies as happening here, now (i.e. in the present or very near future), and as affecting similar people to the target population. For mitigation policies however, urgency framing is generally not effective.

Policy bundling. Policymakers should consider using policy bundles, in which climate policies are deployed alongside other social and economic policies, to increase public support. A recent example of this is the Inflation Reduction Act (2022) in the US. Alongside climate policies, policymakers may consider implementing social (e.g. affordable housing) or economic policies (e.g. job guarantee). Social reforms in particular (e.g. health insurance and free education) should be considered to bolster support amongst low-income and ethnic minority groups. If tailored bundles are not possible, social commitments such as affordable housing and improved minimum wages should be considered, owing to their more consistent increase in support across social groups.

Participatory design. Policymakers should seek to engage with the public at the early stages of policy planning and design. Key mechanisms to achieve this include citizens assemblies, citizens juries, and deliberative polling. For both mitigation and adaptation policies, policymakers should seek to involve the public on the local level to increase feelings of policy ownership, fairness in decision making and effectiveness.

Diet change

***(Political) leadership and coherent vision*.** The government should engage in more political leadership by creating a vision for achieving a low-carbon, climate-resilient food system. Given that people have already started changing their meat consumption behaviours to reduce ruminant meat consumption, government policies can help people to achieve their goals to have lower-carbon diets. Policies need to be integrated across the food system (e.g. through a national food framework) and support access to a healthy and low-carbon diet.	*Very important*

Combine upstream and downstream approaches. Removing structural barriers through, for example, low-carbon labelling, tax, and advertisement regulations for (red) meat and dairy creates an environment in which low-carbon diet choices are made easier. However, a scale-up programme needs to be developed that draws on real-world trials co-designed with stakeholders. Evidence shows that information-based interventions alone have limited efficacy in changing consumer behaviour, hence combining approaches is crucial. ***Make plant-based foods attractive, accessible and affordable.*** Policymakers need to ensure that plant-based and lower-emission foods are cheaper and more easily accessible. However, more action is also needed to increase the availability of such foods and make them more attractive through using different framing and marketing techniques. Normalising and making plant-based food more available (e.g. through public provisioning) would increase adoption even further. Introducing a carbon version of the sugar levy might also lead to a switch to more sustainable diets by way of producers reformulating recipes or production processes to reduce emissions. ***Tailored interventions and consistent messaging.*** Informational approaches are more effective when tailored to people's values, motivations, and identities. With this in mind, the government should design campaigns targeting certain populations. For example, more affluent people are more likely to be able to afford to make choices in line with their sustainability principles, so the environmental benefits of plant-based foods could be emphasised. At the same time, there needs to be a unified system of a single and trusted eco-label as this would help reduce greenwashing and reveal products' environmental impacts. Going further, regulating meat/dairy advertising could also be considered.	
Fair for everyone. There need to be policies in place that support a diet shift for everyone. Since low-income and rural households tend to have limited access to affordable fruit and vegetables, policies should support access to low-carbon food for example through community food projects that provide deprived communities with produce direct from farmers. Similarly, policies need to be in place to support food producers, especially small businesses and farmers, to adapt food production to facilitate a shift in people's diets.	*Moderately important*
Reducing end-user consumption	
Upstream interventions for end-user consumption. Some of our workshop-specific recommendations include a significant shift in incentives. Current upstream (i.e. government-led) incentives for businesses encourage consumption and thereby result in more waste. This points to the need for significant shifts in upstream incentives, including moving towards a circular economy. For example, proportionate pricing and the removal of price promotions could reduce excessive purchasing. ***Rules and regulations for food packaging.*** Policymakers could introduce improved rules for selling food with less packaging, e.g. loose fruit and vegetables. When packaging is required, this should be done under the Extended Producer Responsibility regulation intended to incentivise business to use less/better packaging. ***Food labels and information provision.*** The government should prioritise better, more informative food labelling on packaging. Research shows that combining food labels with explanatory information may represent best practice to reduce food waste, whereas food labels alone may not result in significant behavioural shifts. ***Rules and regulations for repair prices of manufactured goods.*** Legislation should mandate a 'reasonable price for repair', i.e. all common repairs must be substantially cheaper than buying a replacement. Otherwise, manufacturers can disincentivise repairs by charging a premium for spare parts.	*Very important*
Increasing personal skills and opportunities for repairing manufactured goods. The Government recently introduced the 'right to repair' regulation for electronics, however, it has proved difficult to access and the public seems to lack the required technical skills. Encouraging skills acquisition therefore presents an opportunity for government. For instance, skills such as knitting and sewing could tap into the upward trend of these activities amongst younger generations. Repair services, specifically those connected	*Moderately important*

with clothing repairs, tend to be focused around women, indicating more broadly that policies are necessary to engage the whole community in repairing activities. ***Product category-specific policies for repairing manufactured goods.*** The government should identify certain product categories for which repairability might be more attractive. For example, personal devices such as phones, laptops, and tablets tend to be replaced more often to keep up with the latest technologies. For other products such as white appliances repairability might be more attractive. Thus, tailoring policies for these categories may lead to more engagement with repair activities. ***Financial incentives for food waste and recycling.*** The government could develop financial incentive schemes to promote circular economy actions – e.g. deposit return schemes (DRS). It should be noted, however, that while DRS schemes have proved effective in Europe, other financial incentives (e.g. lottery ticket rewards) seem to deliver mixed results. More research on identifying which financial incentives are best suited for reducing end-user consumption would be valuable. ***Message framing and information provision for manufactured goods.*** Policymakers should aim to make buying second-hand items more appealing to the public. Findings have emerged that barriers differ according to the product category. People tend to avoid purchasing second-hand electronics because they believe these would be out of date and lack a suitable warranty. Buying second-hand furniture may seem less convenient due to the need to arrange delivery from private sellers. Some people might be reluctant to purchase second-hand clothing because they have concerns related to cleanliness, although the vintage and second-hand clothing market has grown in recent years. Campaigns aimed at removing these perceived and actual barriers might be crucial to encourage the reuse of manufactured goods. ***Message framing for food waste.*** There is a close connection between self-transcendence and biospheric values (defined as a concern for the welfare of others and the environment) and food waste/waste management. People with higher levels of self-transcendence values tend to engage more in recycling, and they waste less. Waste is an intuitive concept that people tend to view negatively, meaning they can often aspire to avoid waste. This provides an opportunity for government to use messages of waste avoidance, and put in place suitable provisions to help people achieve this goal.	
Aviation demand	
A coordinated approach. Achieving substantial demand reductions in aviation, or limiting its growth, is likely to require the alignment of action from multiple parties: government, consumers, policymakers, cultural leaders, and the aviation industry. Government will need to take the lead via policies aimed at consumers and industry, alongside consistent messaging. ***Progressive and fair policies.*** Policies that are believed to be progressive and fair have the best chance of receiving public support. This is particularly the case with aviation because flying activity is very unevenly distributed among the population, and policies that can be portrayed as "stopping families from taking their one holiday a year" encounter backlash. Research shows that a Frequent Flyer Levy or Frequent Airmiles Tax can be both progressive and fair, and be popular with the public, although the framing and messaging around such policies are likely to be crucial. ***Consistent messaging.*** Contradictory messages from government and industry actors that promote flying activity while also suggesting consumers should make greener choices is likely to inhibit behaviour change and undermine public confidence that the Net Zero transition is a coherent societal project. If demand reduction is the goal, government should therefore avoid its current message of "guilt free flying", and consider restrictions on the advertising of flying along with clear communications about why reducing demand is necessary to meet climate goals. There is scope for raising the moral considerations around flying as a means of encouraging a shift in social norms, and behavioural leadership can play a role in this. ***Limiting or banning short-haul flights.*** A ban on short-haul flights within the country's airspace should be considered. This has been implemented in France, and is being explored elsewhere. It should also be accompanied by policies aimed at making	*Very important*

alternative transport cheaper and more appealing. While such a ban would have a limited effect on emissions, as the bulk of emissions come from long-haul flights, it would send an important signal about the importance of behaviour-related emissions reductions to tackle climate change (see "Consistent messaging", above).	
Market-based regulations. Market-based regulations such as jet fuel taxes and Air Passenger Duty can be effective if set at the right level. However, they are less progressive than other tax-based interventions such as a Frequent Flyer Levy (see above), and so may be perceived as unfair and encounter more resistance. They should be considered, however, as part of a coordinated approach.	*Moderately important*
Adaptation	
Public education and advice. Given the low levels of awareness of effective adaptation, government should focus on applying effective communication techniques to promote adaptation behaviour change. This includes providing clear and consistent behavioural advice, targeted to specific risks (e.g. flood, drought, heat stress). Framing messages to the specific needs and values of the target population is likely to increase their efficacy. For example, this could mean avoiding using a 'climate' framing for segments who are dismissive of climate change (instead focussing on health or financial benefits); or in the agricultural sector, focusing on the (co-)benefits of climate adaptation behaviours for productivity. Effective communication should also employ use of visuals. The government should also work with media and health agencies to support provision of consistent behavioural advice and help shape social norms in relation to climate risk (e.g. highlighting health risks associated with hot weather). ***Trusted messengers and social networks.*** Adaptation behaviours are more likely to be adopted if communicated by trusted communicators and diffused through social networks. This includes farming communities for whom early adopters can help demonstrate adaptation innovations, and their benefits, to peers. ***Removing structural barriers through upstream approaches.*** By themselves, downstream measures such as risk advisories or peer demonstrations, are unlikely to be effective in promoting adaptation behaviour change unless structural barriers are removed through more upstream measures. Such barriers include home or land tenancy, for which there are 'split incentives' for adopting resilience measures between tenants and owners. This is likely to be a particular problem for adaptation in agriculture, since around 25% of farmers are tenants so may not benefit from investment in the way landowners do, or may be restricted in taking adaptation measures due to specific terms and length of their lease. Adaptation policies to promote long-term resilience should therefore target landowners and homeowners. This could include working with insurers to incentivise owners to implement resilience measures. ***Using economic and regulatory approaches.*** Other barriers to adaptation behaviour change may be financial (e.g. upfront costs) and addressed through upstream or midstream economic interventions. These might be addressed through interest-free loans, for example. Building and planning regulations could help build resilience into homes and communities (e.g. nature-based solutions, water-efficient homes), and therefore reduce the need for ongoing behavioural modification to cope with climate risks. Local governments can help support implementation of adaptation measures (e.g. passive cooling) amongst communities.	*Very important*
Target moments of change. The timing of interventions can affect their success. Since extreme weather events can trigger maladaptation action (e.g. installing air conditioning) that locks in carbon-intensive adaptation, it is important for low-carbon resilience measures to be implemented sooner rather than later. Common Agricultural Policy (CAP) reform in the agricultural sector could also offer a window of opportunity to embed adaptation action in policy and provide a way for farmers to be actively engaged in adaptation uptake along with considering regulatory agricultural reform.	*Moderately important*
Net Zero skills and careers	
The role of government in Net Zero upskilling. The government should develop clear and consistent long-term policies related to access of training and re-training of employees by ensuring the longevity of jobs requiring Net Zero skills. This would give businesses the confidence to invest in skills training.	*Very important*

The roles of businesses in providing training opportunities. Government should create policies that encourage businesses to provide more training opportunities for their staff. This could involve identifying large companies in different sectors that can afford to offer and develop courses related to Net Zero skills. In addition, more support will be needed for implementing these new skills. Recently manufacturers have been incentivised to create solutions related to heating practices, e.g. by offering heat pumps, however, a lack of skilled installers might be slowing down or even preventing household uptake. This demonstrates the importance of persuading companies to invest in employee skills and infrastructure. ***Green skills development for young people*.** The government should design policies aimed at green skills development for young people, e.g. opportunities for placements at green businesses while they are still at school. First-hand experiences could be an efficient way to raise interest in green careers. This could be achieved by targeting big companies that have the resources to invest in apprenticeships. ***Re-defining green skills.*** Discussions during our workshop revealed that policymakers should consider remedying the lack of a clear and unified definition of 'green skills'. Creating a set of skill standards should also be considered, while trying to avoid the creation of new qualifications. This might make it easier for employees to choose more unified pathway qualifications and pivot between jobs. ***Informational campaigns and education.*** A stronger focus on green careers can be achieved by designing more informational campaigns and embedding green skills into educational curriculums at school and university. This is crucial for harnessing young people's desire to pursue a green career. It is especially important for people considering degrees in the sectors of energy and agriculture. Thus, adding this additional layer and integrating it within the existing educational system should be a priority for governmental bodies.	
***Social interventions*.** In addition to offering more training, policymakers should address generational disparities as these could serve as a barrier to acquiring green skills. Older age groups seem to be less concerned about climate change. For instance, farmers are usually self or informally trained, and so may lack the necessary skills to engage in green agriculture. Interactive approaches such as mentorship schemes, which include a social element popular with farmers, might be a successful route to upskilling. ***Gamification*.** Finally, behavioural interventions employing gamification techniques (e.g. leader boards, badges, competitions, etc.) have proven to be successful in driving employees' engagement with skills training. Government could therefore consider competitions between companies working in similar sectors as a way to develop green skills. However, the focus in the research literature has so far been on training sessions for general skillsets rather than sustainability skills, indicating that more evidence in this area is needed.	*Moderately important*
Business leaders	
Market-based regulations. Policymakers should prioritise market-based regulations such as tax breaks over command-and-control measures. This is mainly because the former has a greater focus on productivity growth, which then drives the desire for change. This is similar to the 'Investment Tax Credit (ITC)' and 'Production Tax Credit (PTC)' introduced by the US with the 'The Inflation Reduction Act' in 2022. However, additional research might be necessary to establish at what level of cost parity businesses need to feel they can invest in low-carbon alternatives, i.e. is it full cost parity or are levels around parity still acceptable? ***Differences in regulations according to business types/needs.*** Governmental policies should be able to differentiate between small and large businesses as the processes of transitioning to sustainability could be different. In addition, there should be different recommendations for firms depending on whether they operate on business-to-business or business-to-customer levels. Differences might also emerge between businesses that have to decarbonise by themselves and those receiving support from the government. The drivers, barriers, and incentives experienced by such businesses could be very diverse.	*Very important*

Redefining the role of local government. The role of local governments should be more clearly defined as they could play a substantive role in businesses' sustainability processes. Facilitating connections between local businesses could, for example, allow for the repurposing of one businesses' waste to be the main source material for another. Thus, policies that redefine local government's involvement in the Net Zero transition may be crucial. ***Education/Training provision.*** One of the biggest factors driving eco-innovation is managerial awareness of climate change. Therefore, policies aimed at educating managers and CEOs about the impact of climate change are urgently needed. For example, carbon literacy trainings could be implemented at the workplace, and best practice highlighted, such as the recommendations from the Task Force on Climate-Related Financial Disclosures (TCFD), which advocates for financial risks and opportunities related to climate change to become integrated into companies' risk management and strategic planning processes. A successful transition to a green business model also requires the engagement of the whole organisation. Therefore, while managerial buy-in is crucial, behaviour change should be facilitated across the whole company.	
Role of NGOs. Businesses working with non-governmental organisations could also drive eco-innovation as NGOs could act as a convener between governmental bodies and firms by helping companies to better implement green policies in their operations. As just one example, organisations such as WRAP UK could perform this role in the area of food waste and recycling. ***Labelling and standards schemes.*** The efficacy of customer-friendly labelling and transparency to harness customer pressure could benefit from further investigation by governmental bodies as the current evidence shows mixed results. Similarly, standards and schemes that provide comparisons with competitors should be further investigated.	*Moderately important*
Land use and farming	
Policies focusing on social influence. Government should employ policies that use social norms techniques such as peer-to-peer learning or demonstrations. Given that working alone is very common in the farming sector, socially-based interventions might be very influential in shaping farmers' perceptions of appropriate changes to land use. ***Financial incentives and grant schemes.*** The availability of financial incentives is fundamental for promoting Net Zero farming and helping farmers to make the transition to sustainable agriculture. However, policymakers also need to work on simplifying grant schemes. The current application process is seen as too complex and involving too much bureaucracy by those working in agriculture. Further assurances in grant applications are also needed to allay fears about losing control and land ownership. Strong evidence points to the need for changes in the design of grant applications. ***Working with farmers on designing policies.*** Government should organise transparent consultations with members of the agricultural community. This will help to ensure that farmers' opinions are considered during policy design, rather than after policies have been put in place.	*Very important*
Reducing financial risks. Better measures should be implemented to reduce the financial risks of taking land out of production. For example, refining the 'Income foregone' scheme by framing the ideas of afforestation in a way that could elicit positive responses from the community. ***Tailoring policies to farmers' values and abilities.*** Government should consider landowners' and farmers' differing worldviews, cultural values, and beliefs, as those working in the sector tend not to see climate change as a priority either personally or professionally. Therefore, aligning climate policies with farmers' economic priorities and social values is essential. For example, policy communications should highlight the financial, personal, and environmental benefits of engaging with afforestation. Similarly, policies need to recognise that the ability of farmers to implement change varies widely – particularly that tenant farmers have less capacity to implement long-term or costly measures than landowners.	*Moderately important*