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Net Zero: A review of public attitudes & behaviours

For Our 2050 World (commissioned by BSI)

January 2022

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About CAST

Led by Cardiff University, the UK Centre for Climate Change and Social Transformations (CAST) is a collaboration between Cardiff, Bath, Manchester, York, and East Anglia Universities, and the charity Climate Outreach. The Centre aims to be a global hub for understanding the profound changes required to address climate change. Our experts include psychologists, sociologists, political scientists, engineers, and organisational specialists. CAST is funded by the Economic and Social Research Council (ESRC). For further details on CAST see: www.cast.ac.uk.

Executive summary

Introduction

Societal transformation, investment, and behaviour change over the next decade will be required if we are to address the climate and ecological emergency effectively. Yet, to date, the focus of climate policy globally has been far more on technological innovation than on public engagement or behaviour change. This literature review was conducted by researchers at the Centre for Climate Change and Social Transformations (CAST) and the University of Bath for [Our 2050 World](#), commissioned by BSI. Our 2050 World is a collaboration between international organizations and standards bodies to help drive the transformational action required to achieve net zero. This literature review sought to address the following research questions:

1. What are public attitudes and behaviours (including those of indigenous peoples) to climate crisis mitigation; how have these changed; and how are they likely to change?
2. How do attitudes align or vary between different demographic groups (e.g. ethnicity, age, gender, income), countries/cultures, or other factors (such as values, ideology, faith/religion)?
3. What are public attitudes and expectations of governments and businesses on realising net zero?
4. Does the public think it can influence state and non-state actors? Are there groups who feel they have no influence?
5. Are there differences in the views of the public as activists, private consumers, employees, (or other roles)?
6. What are the key challenges to, and drivers of, mobilising the public to influence change?
7. What are the research gaps and further research needs?

International trends in climate concern

Climate concern amongst the public has been rising around the world since the 1980s, and rapidly so since 2018 (Capstick et al, 2015; Ipsos, 2021). Concern globally is likely to further increase as the impacts of climate change become more visible.

Factors influencing climate concern

Although climate concern is high across all demographic groups, variations in concern are linked to demographic factors, beliefs, economic factors, and political affiliation. Young people (16-25 years) are particularly both concerned and anxious about climate change, and, as they grow older, their influence on organisations and governments is likely to grow (Marks et al., 2021). Simpson et al., (2021) in their study of climate change literacy found that education, mobility, and poverty are predictors of climate change literacy. Political ideology also shapes climate concern, particularly in developed countries (Hornsey et al., 2016).

Public expectations for net zero

The public views the government as primarily responsible for addressing climate change. Most members of the public in most countries are prepared to pay economically and socially to support green products and services. The evidence suggests the public is ahead of the government and businesses in calling for more ambitious action against climate change (for example, Reset, 2020). A growing percentage of the public in high income, global north countries supports increased taxes on polluting industries and products, as well as frequent-flier levies for air travellers (Yale Program on Climate Communication, 2020). Policies that are less disruptive, fairer, and more cost-effective are typically the most highly supported by the public. Support for increased prices and carbon taxes is often associated with higher perceived trust in politicians and government (Faure et al., 2022). If companies are perceived to 'greenwash' (i.e. publicise environmental credentials without taking proportionate climate action), this can lead to a breakdown in public trust and perceived legitimacy, and a decrease in support that may be costly to redress (Guo et al, 2018).

Barriers to and drivers of climate action

The role of the richest

Research shows that people with a high socioeconomic status have the most power to effect change within society, as their lifestyles are the most carbon intensive (Nielsen et al, 2021). Analyses indicate that the carbon emissions of high-net-worth individuals (assets over \$1 million), are at least ten times higher than that of the global average, with a report from Oxfam (2015) suggesting that the emissions of the top 1% of earners could be 175 times the amount of the lowest 1% of earners globally. Researchers recommend that interventions should focus on high-earning demographic groups, as they are likely to have the most impact on global carbon emissions (Otto et al., 2019).

Five roles for the general public

The public can act in many ways and in different roles. One report suggests five roles: consumer, investor, citizen, role model, and organisational participant (employee or employer) (Nielsen et al., 2021). The roles are not mutually exclusive and can act in concert to affect climate action. Sustainable investing is on the rise, and consumers may support or boycott firms that do, or do not, take proportionate climate action (Robinson, 2021). The public can also influence organisations through policies and behaviours at their places of work, or by supporting pro-environmental policies at a local and/or national level (Ruepert et al., 2020).

Changing behaviour

As *citizens*, several factors predict public support for net zero policies. Research suggests that the public are more likely to support environmental policies which are perceived to be fair, effective, and not personally too costly – either financially or in terms of behavioural change (Faure et al., 2022). Ptaschunder (2020) argues that to truly effect change more equitable and fair systems must be introduced, with climate action operating within a climate justice framework that incorporates basic wellbeing requirements of humanity as well as environmental limits.

Multiple interventions are usually required to change behaviour, since there are multiple drivers of, and barriers to, behaviour change (Poortinga and Whitaker, 2018; Stern, 1997). Therefore, a combination of informational, economic, and regulatory approaches is likely to be required to achieve net zero behaviour change (Michie et al., 2011). In addition to considering *how* to intervene, it is crucial to plan *when* to intervene to change behaviour. The habit discontinuity hypothesis suggests that change is easier in times of disruption; for example, when moving house, starting a family, or retiring (Kurz et al., 2015; Verplanken and Whitmarsh, 2021).

Future research directions

Based on our review, we would suggest the following priorities for future research:

Evidence based interventions: Robust experimental and qualitative evidence is needed to test out cost-effective and fair packages of interventions to rapidly change public behaviours (in line with net zero).

Elevating underrepresented voices: Much of the climate literature comes from high income global north countries, such as the UK, the US and Australia. In the published literature indigenous voices and those from low- and middle-income countries in the global south are poorly represented (Carbon Brief, 2021).

Other topics identified for further attention include: greenwashing; climate activism; climate anxiety; and climate migration.

Table of contents

INTRODUCTION	7
METHODOLOGY	8
INTERNATIONAL TRENDS IN CLIMATE CONCERN	9
FACTORS INFLUENCING CLIMATE CONCERN	11
PUBLIC EXPECTATIONS FOR NET ZERO	15
BARRIERS TO AND DRIVERS OF CLIMATE ACTION	18
CHANGING BEHAVIOUR	22
FUTURE RESEARCH DIRECTIONS	26
REFERENCES	28

Introduction

Significant international action is required to avert the worst consequences of the climate and ecological emergency. A recent review of climate science papers found over 99.9% of 88,125 scientific papers published since 2012 agree that climate change is anthropogenic (caused by humans) (Lynas et al., 2021). The 2020s are a critical decade for climate action given the need to half global carbon dioxide emissions by 2030 from 2010 levels (IPCC, 2018). The IPCC's (2018) 'Global warming of 1.5 degrees Celsius' report states that "...limiting global warming to 1.5°C would require rapid and far-reaching transitions in land, energy, industry, buildings, transport, and cities" (p.15). Technological change will be essential to reaching net zero; but some technologies such as carbon capture and storage technology are immature or have not been proven to work at the scale required to avert climate catastrophe (Venton, 2016). As such, societal transformation, investment, and behaviour change over the next decade will be required to effectively mitigate climate change risks (IPCC, 2018). This will involve the public (defined as the people within a particular society or country) acting in the various roles they occupy, including as *consumers* of goods and services, *citizens* engaging as political actors (for example, voting or protesting), *professionals*, and members of *communities*.

This literature review was conducted for Our 2050 World (commissioned by BSI). Our 2050 World (www.our2050.world) is a collaboration between international organizations and standards bodies to help drive the transformational action required to achieve net zero. The review also links to related BSI work on consumers and sustainability (BSI, 2021).

Research questions

The following research questions are addressed in the review:

1. What are public attitudes and behaviours (including those of indigenous peoples) to climate crisis mitigation; how have these changed; and how are they likely to change?
2. How do attitudes align or vary between different demographic groups (for example, ethnicity, age, gender, income), countries/cultures, or other factors (such as, values, ideology, faith/religion)?
3. What are public attitudes and expectations of governments and businesses on realising net zero?
4. Does the public think it can influence state and non-state actors? Are there groups who feel they have no influence?
5. Are there differences in the views of the public as activists, private consumers, employees, (or other roles)?
6. What are the key challenges to, and drivers of, mobilising the public to influence change?
7. What are the research gaps and further research needs?

Methodology

A narrative literature review was conducted in October 2021 to address the research questions. Academic sources were identified through Google Scholar, Web of Science and Scopus. White papers were found through Google searches. To ensure the review featured current literature and – as far as was possible – global perspectives, we focused on articles with an international scope published from 2010 onwards, emphasising reviews of the literature, meta-analyses, and representative national surveys. In total, we identified 154 sources for inclusion in the report. All terms used throughout the report are consistent with the language of the papers cited.

Limitations of the review

Whilst every effort was made to include research in the review from the global south and by indigenous communities, it has been shown that climate change research literature is skewed towards white, male perspectives from the global north, and that research from the global south faces a number of barriers (Carbon Brief, 2021). The same report showed that of the most-cited research published between 2016 and 2020, less than 1% of authors in the sample were based in Africa, while almost three-quarters were affiliated with European or North American institutions. China and South Africa were most highly represented in the global south. They also found a gender bias, with only one quarter of research published by female lead authors. As such, the experiences of the global south and women are less represented in the scientific literature on climate change.

Against this backdrop, we would recommend efforts to increase the representation of all minority groups in the climate change literature. We would also encourage readers to consider the bias in the literature when appraising this report.

Further, this review focused specifically on the above research questions identified by Our 2050 World. As such, research outside of this scope was not considered (for this review). The review was completed between October to November 2021 and research published after this date was also not considered.

International trends in climate concern

Widespread public concern for climate change has been growing since the 1980s (Capstick et al., 2015). Since then, concern has been steadily increasing internationally, with a dramatic increase in 2018 following the publication of the IPCC Special Report on 1.5 degrees warming (IPCC, 2018). A global poll of 1.2 million people across 50 countries showed that over two thirds of people surveyed believe that climate change is a global emergency (UNDP, 2021).

Internationally, climate concern varies slightly, with the 'International Public Opinion on Climate Change Report' (Yale Program on Climate Change Communication, 2021a) reporting that almost all in Costa Rica (95%), Brazil and Spain (92%) agreed that climate change is real and a threat. The lowest agreement was found in respondents in Indonesia (78%), Egypt and Saudi Arabia (79%), though the proportion is still the majority of the population in these countries. Where climate concern appears to be lower this may be due to, for example, historic dependence on fossil fuel production and less established green parties or environmental activism (Poortinga et al., 2018).

Reports show that the widespread concern has not been dented in recent years, despite crises such as the COVID-19 pandemic. Evidence shows that climate concern remained high during the pandemic, and there was widespread public support in western nations for pro-environmental measures brought in to aid the pandemic response, such as cycle lanes (CAST, 2020; Reset Initiative, 2020), and for a 'green recovery' (Climate Assembly UK, 2021). Evidence from a 30-country survey conducted by Ipsos MORI in spring 2021 showed that 72% of people believe that if they do not address climate change they will be failing future generations and 68% agreed that businesses who do not act to combat climate change would be failing their employees and customers (Ipsos, 2021).

However, there is a gap in climate action between attitudes and behaviours. While many are concerned about climate change, individuals, organisations, and governments have not yet taken the action required to address the problem effectively. In their review of the climate delay literature, Lamb and colleagues (2020) summarise seven 'discourses of climate delay' that may hinder people's climate action, including redirecting responsibility, pushing non-transformative solutions, surrendering, and emphasising the downsides. Furthermore, there are various barriers to lifestyle change (Whitmarsh et al., 2021). While climate concern is high internationally, more transformative responses from individuals and organisations are required to close the gap between climate concern and climate action (UNEP, 2020).

In a survey of over 400,000 people in the USA, Bergquist and Warshaw (2019) found that national concern over the climate crisis was modestly predicted by changes in local temperature. Other studies have also shown experiencing extreme weather events can shape climate concern, but more important is whether people *perceive* these events to be linked to anthropogenic climate change (Clayton et al., 2015). Indeed, a meta-analysis of studies across 56 countries found that political ideology and worldview are more

predictive of climate concern than experience of extreme weather events or climate knowledge (Hornsey et al., 2016). Similarly, experimental research has shown that people interpret climate change information in light of their prior beliefs, making it difficult to persuade climate deniers about the reality of the issue (Corner et al., 2012), whereas framing the issue to align with audience values (for example, conservatism) is more likely to engender support for action (Bain et al., 2016; Whitmarsh and Corner, 2017).

Factors influencing climate concern

Climate concern is high globally but varies according to demographic, geographic, and other (e.g., ideological) factors.

Demographic characteristics

Gender

Whilst the UNDP (2021) Climate Choices survey found that, at a global level, men were more likely to be concerned about climate change, the gender difference was only 4% and gender differences differed between countries. On the one hand, women were far more concerned about climate change in Canada (+12 percentage points), the USA (+10) and Australia (+10); on the other, men were far more concerned in Nigeria (+12), Vietnam (+10), Georgia (+9) and India (+9). The authors argue that these differences may have been due to women's access to education and social standing in different societies.

In a review of 80 academic articles, Pearse (2017) suggests that women are more vulnerable to the impacts of climate change yet, on average, emit less carbon emissions (than men) due to their transport, work and consumption patterns. Pearse argued for an intersectional approach to understanding gender differences: *"...gendered vulnerability to climate change must be understood within socioeconomic and cultural contexts. Most researchers in the field describe gender relations as 'intersecting' with race, ethnicity, class, and caste, and increasingly there is recognition of intersecting differences associated with age, sexuality, and disability"* (p.4). All these factors should be considered when understanding and addressing gender differences in climate concern and action.

Young people

Young people globally are inheriting a world greatly influenced by global warming, and climate concern amongst young people is high. The UNDP (2021) report showed that under 18s displayed greater levels of climate concern than all other age groups globally, with 69% believing in the climate emergency (relative to only 58% of those aged 60 years or more). Another recent study examining 10,000 young people (aged 16-25 years) in 10 countries demonstrates that climate anxiety is consistently high among young people (Marks et al., 2021) with 59% 'very' or 'extremely worried' and 84% at least 'moderately worried'. For many young people, this worry negatively impacted their emotional, psychological, and functional wellbeing (i.e. their ability to do the things required of them in their lives). The report asserts that young people surveyed felt 'betrayed by governments', and that action taken thus far was insufficient to address the problem.

This is consistent with other research exploring youth climate movements. Children are increasingly playing a prominent role in climate activism, as exemplified in school strikes and youth movements such as Fridays for Future (Lee et al., 2020). Young people are often excluded from political participation, and express their dissent in different ways, such as through protest and art (O'Brien et al., 2018), or through legal action (Salas et al., 2019). Future generations bills are also being introduced in governments worldwide to counter the 'short-termism' of political leaders (Jones et al., 2018). Evidence indicates that

as young people age, their influence on organisations and governments stands to grow dramatically, and that they are a key demographic to consider in accelerating the transition to net zero.

Indigenous peoples

Indigenous people play a critical role in protecting the environment. The UN reports that there are currently over 476 million indigenous people in over 90 countries (UNEP, 2021), who manage 28% of the global land area, including approximately 40% of formally protected areas and 37% of remaining terrestrial areas with little human interaction (IPBES, 2019). While the IPBES report indicates that land managed by indigenous people has experienced less environmental degradation than other lands, 72% of indicators used by local indigenous people surveyed report environmental degradation in their area. Concern for the environment among indigenous people is high, and many indigenous cultures have a reciprocal relationship with the land (Ford et al., 2016). This is supported by the ICCA Territories of Life Report (ICCA Consortium, 2021), which argued that: *"Indigenous peoples and local communities play an outsized role in the governance, conservation and sustainable use of the world's biodiversity and nature"* (p.10).

Many indigenous peoples are concerned at their lack of influence on governmental decisions, and societal inaction on climate threatens to further deteriorate relations between indigenous peoples and national and local governments (Whyte, 2020). Fossil fuel infrastructure is a key threat: national governments have often laid oil pipelines on indigenous land without consent from the community living there (Nurse-Bray et al., 2019). Indigenous peoples want to be able to govern their land and protect it without interference from national governments or private companies who wish to use the land for their own gain (ICCA Consortium, 2021). Indigenous rights and environmental justice are becoming an increasing concern among the public, with movements such as the '#landback' movement in the US gaining traction in recent years (Fisk et al., 2021).

Small Island Nations

Small island nations will be the most likely to experience the negative effects of global sea level rises in the near future and climate concern amongst small islanders is high (Walshe and Stancioff, 2018), an issue highlighted at international climate meetings such as COP26. Many Pacific Small Island Developing States (PSIDS) argue for an approach emphasising climate adaptation as well as mitigation (Hayward et al., 2020) to ensure the islands which the region comprises are protected from the negative effects of rises in sea levels. Many people believe that countries most responsible for historical carbon emissions (such as, the USA, Russia, and China) should take most responsibility for addressing the modern-day effects of climate change, and help support island states in mitigation measures accordingly (Carbon Brief, 2021).

Education

Educational level is an important predictor of climate concern. In an international survey, researchers (Lee et al., 2015) found that education levels and media communications access are the most important predictors of global climate change awareness and concern – typically, people with a higher educational level are more concerned about

climate change. This finding has been verified in other reports. The UNDP (2021) report, for example, shows that people with a higher educational level are consistent in their climate concern across high- and low-income countries, as well as island states. The report found that people with post-secondary education in sub-Saharan Africa were the most likely of all groups to believe in the climate emergency. Furthermore, a recent review of 160 studies of 'climate literacy' in Africa demonstrates that awareness of climate change and its anthropogenic nature ranges between 23% and 66% of the population across 33 African countries (Simpson et al., 2021). The analysis also suggests that awareness is positively correlated with post-secondary education level, and negatively correlated with poverty. Overall, women were 12.8% less aware in general than men, though this could be linked to poverty levels. As the authors conclude: "*poverty undermines climate change literacy*" (p.940).

Education can foster a sense of self-efficacy (Muroi and Bertone, 2019). Self-efficacy – one's belief in their ability to do something successfully – is an important predictor of climate concern and climate action. Research from Spain shows that self-efficacy increases intrinsic motivation, which improves recycling behaviours (Taberero and Hernández, 2011). Evidence from Australia shows that self-efficacy influences behavioural spillover from easier to more difficult forms of climate action (Lauren et al., 2016). A study from the USA shows that self-efficacy predicts climate action even when political ideology and beliefs about climate change are controlled for (Bostrom et al., 2019). This finding has been replicated in many countries, including coastal Cambodia (Ung et al., 2015).

For climate action, beliefs about whether the government or a social group can take effective action to address the climate crisis is also important. Feeling a lack of self-efficacy or disempowerment leads to an increase in climate anxiety and distress, particularly among young people (Marks et al., 2021). Similarly, those on lowest incomes may be least supportive of climate policies if they do not trust government, feel disenfranchised, or because the costs will be harder to bear (CAST, 2021).

Beliefs

Religious affiliation

There is evidence of the role of religion in climate concern. Research has shown how messaging from spiritual leaders has an impact on religious people's climate concern in the global north (Myers et al., 2017). A recent review by Koehersen (2021) outlined the current literature on Islam and climate change, suggesting there are different interpretations and levels of concern between different Muslim denominations. Research has also suggested that faith-based actors play important roles in climate negotiations at an international level (Glaab, 2017) and that Buddhists are often strongly engaged with climate change and environmental causes (Morrison et al., 2015).

However, Haluza De-Lay (2014) argued that the relationship between religion and climate attitudes varies vastly according to religious doctrine as well as culture, and more study is required into specific religious denominations in different countries (to determine the impact). As a review by Jenkins et al. (2018) states: "*There is not yet a substantial body of quantitative research about the relationship between religious identity and climate*

change opinions outside of North America and Northern Europe” (p.88) highlighting a need for further research to establish the relationship between religion and climate action worldwide.

Attitudinal segmentation

Various segmentation models have been developed to identify sub-groups within the public according to their climate change attitudes (e.g. Climate Outreach, 2020). The Yale Program on Climate Change Communication (2021) categorised the US public into six segments according to their level of climate concern (see Figure 1).

Figure 1: US Climate Concern Segments (Yale Program on Climate Change Communication, 2021)

SEGMENT	INCIDENCE
Alarmed	26%
Concerned	29%
Cautious	19%
Disengaged	6%
Doubtful	12%
Dismissive	8%

The ‘Alarmed’ are those most motivated to act on climate change, believing that the climate crisis is a threat and, typically, strongly support climate policies. By comparison, the ‘Dismissive’ believe that climate change is either not real or a threat. Research has shown that the climate action of the ‘Alarmed’ group is driven by social norms and feelings of self-efficacy (Doherty and Webler, 2016). The segments have been verified in other samples internationally (Metag et al., 2017), and have been used by governments, educators, media and climate advocates.

Political affiliation

Political orientation has also been shown to be a strong predictor of climate concern. A representative survey conducted in the USA, Germany and China, Ziegler (2017) demonstrated that political orientation was a predictor of climate change beliefs and attitudes and was more likely to be so in politically polarised countries, such as the USA, than in Germany or in China. However, in the same study, Ziegler argued that individual environmental values were *more* predictive of climate concern than overall political orientation. That said, Marquart-Payatt et al (2014) and Hornsey et al (2016) found that political orientation was the largest predictor of environmental attitudes in the US (and over and above personal experience or subjective climate knowledge).

Political orientation has been shown to also influence responses to climate information. Ogunbode et al. (2020) found that in a sample of the Norwegian public, exposure to the IPCC Special Report on 1.5 degrees warming was associated with greater perceived threat from climate change and greater concern. However, this effect was moderated by political orientation: there was a weaker relationship between reading the report and climate threat among right-wing participants (compared to left-wing participants). Political leaders also have an important role in shaping the climate discussion amongst the public since trusted information sources and ‘elite’ cues help shape climate concern and motivation to act (Clayton et al., 2015).

Public expectations for net zero

Many consumers want government and business to do more about climate change (Ipsos, 2021). For example, Yale Climate Communication's survey on Politics and Global Warming (2021) showed recently that 73% of the US public believe government and corporations should do more to combat climate change.

Policy preferences

Since 2019, the 'Green New Deal' (a suite of policies designed to meet the urgency of climate change through economic reform, societal transition, and job growth) has grown in popularity around the world (Klein, 2020). Whilst initially there was strong bipartisan support for the policy package in the US, as the policy has grown in prominence so has political polarisation, with right-wing voters less likely to support it than left-wing voters (Gustafson et al., 2019).

That said, amongst the public in the UK and USA, there is widespread support for individual policies that foreground jobs in clean and renewable energy, such as wind, hydroelectric and solar (Carlock et al., 2018; Reset Initiative, 2020). Organisations have also argued that creating jobs should be a key focus of a net zero transition, with the International Labour Organisation (2021) reporting that implementing the Paris Agreement has the potential to create a net gain of 18 million jobs globally. After the global pandemic lockdowns in Spring 2020/21, many organisations emphasised a 'Green Recovery', stressing the need for clean jobs to restart the economy (Khan and Robinson, 2020).

An experimental study by Faure et al (2022) across Italy, Poland, Sweden, and the UK concluded that *"...households prefer effective policies, dislike personal costs, and prefer non-coercive to coercive instruments; further, trust in government helps make coercive policies such as taxes more acceptable, whereas environmental identity makes consumption limits more acceptable"* (p.1). Other research has shown how public support for policies is predicted by personal cost, perceived fairness, and effectiveness (CAST, 2021). Analysis of European Social Survey data from 23 countries (Umit and Schaffer, 2020) found support for carbon taxes was lowest amongst groups with high energy dependence, while support increased with political trust and feelings of self-efficacy.

Social costs

Some people are willing to adopt pro-environmental behaviours at substantial social costs, including where those practices are currently uncommon. Take-up of veganism for example, (the practice of abstaining from meat and animal products in one's diet and lifestyle) has grown significantly around the world, and despite its minority status in many societies (Judge et al., 2022). In societies where meat eating is the norm, research has shown that vegans and vegetarians may be socially derogated for not eating meat and may also experience cultural or family difficulties for doing so (Earle and Hodson, 2017; Greenebaum, 2018; Markowski and Roxburgh, 2019; Tobias-Mamina and Maziriri, 2021). Other research demonstrates that 'early adopters' of sustainable innovations may be less

worried about the costs of a product and more about the social signal they are sending (Noppers et al., 2015). This evidence suggests that some members of the public in the global north may be willing to pay more for environmentally innovative products despite the cost, given their motivation to signal their technological innovativeness or by a moral feeling of 'the right thing to do' for society and the environment, and such individuals can inspire others (Bolderdijk et al., 2018).

Are people willing to pay and act?

A large body of literature exists around the world on how much consumers are willing to 'pay' to achieve net zero emissions, with varying results. However, most of the literature has been conducted in the global north. Such studies have found a strong relationship between acceptance of climate costs (for example, via taxes) and political trust.

A 2016 survey on 42,401 individuals across 23 European countries suggested that while most (78%) Europeans believe in anthropogenic (human-caused) climate change and its dangers, only a third (33%) support increased taxes on fossil fuels (Fairbrother et al., 2019). The study also demonstrated a relationship between political trust and willingness to endorse carbon taxes; specifically, the countries most supportive of carbon taxes also had the highest levels of political trust. The authors argued that: *"...perhaps counter-intuitively, efforts to increase popular support for carbon taxes may need to focus most on generating overall confidence in the political system and its actors"* (p.9).

Quality of government (defined as the capacity of the state to perform its activities in an efficient, fair, and impartial manner without corruption) was also found to predict support for carbon taxes in a survey of 39,486 people across 23 European countries (Davidovic et al., 2020). A follow-up study using data from the European Social Survey (ESS) demonstrated that quality of government and generalized trust (defined as a willingness to trust their fellow citizens and actors to comply with policies) are positively linked to support for taxes, but not for subsidies and bans (Davidovic and Haring, 2020). Other ESS analysis (Pohjolainen et al., 2021) found national affluence (measured using GDP per capita) and democracy (defined according to the electoral democracy index) are positively connected to perceived climate responsibility, and that people in more affluent countries are also more likely to support higher taxation of fossil fuels.

Recent evidence from the UK and USA suggests an increase in support for carbon taxes and fuel levies (CAST, 2021). The Climate Consensus report (Demos, 2021) also found in a survey of the UK public support for new measures to reduce climate change. The most popular were: carbon taxes on polluting manufacturing and construction businesses (supported by 94% of people), better integrated local public transport (93%), a UK-wide electric vehicle charging network by 2028 (91%), and raising flying costs, particularly on frequent fliers (89%). Yale Climate Change Communication (2021) recently reported that a majority of the US American public supports initiatives including: providing tax incentives or rebates to make existing buildings more energy efficient (86%), funding research into renewable energy sources (81%), and tax rebates to people who purchase energy-efficient vehicles or solar panels (81%).

There is some evidence of consumer preferences for more sustainable materials. In a discrete choice experiment with 6,033 participants in Germany, India, Japan, Sweden, the UK and the USA, Potoglou et al (2020) found that: *"...respondents from all countries except the US placed a significantly positive value on cars made of ethically-sourced, organic materials with marginal willingness to pay values ranging from a minimum of €1,951 in Germany up to a maximum of £4,524 in the UK"* (p.1). That said, consumer choices were predicted more strongly by purchase and running costs than environmental concerns, suggesting that the co-benefits of interventions and products (such as reduced long-term running costs) should be stressed to the public alongside any environmental benefits.

Barriers to and drivers of climate action

While there is widespread concern about climate change and broad support for climate action, the evidence indicates that responsibility for taking action differs between and within countries. Wealthier countries have higher carbon emissions, so need to make greater reductions to reach global carbon targets (IPCC, 2018). As we now discuss, though, there is also considerable disparity *within* countries in per capita carbon emissions. There are also various types of climate action that individuals can take, and different factors that shape or inhibit this.

The role of the richest

Nielsen et al. (2021) argue that there are groups which bear greater responsibility to effect change in carbon emissions, particularly the 10% of people globally with highest socioeconomic status (SES) (i.e., incomes over GBP 28,000pa). The review argues that people with higher SES worldwide are disproportionately responsible for greenhouse gas emissions and, further, are typically the least likely to be vulnerable to the effects of climate change. Such a view is supported by a report by Oxfam (2015), which suggests a strong correlation between income and carbon emissions, particularly consumption emissions. The report estimates that the emissions share from the top 10% of income earners is around 36-49% of the global total. By comparison, the lowest 50% of income earners account for only 7-15% of all emissions.

Another review by Otto et al. (2019) suggests that climate interventions should focus on those with the highest incomes – the ‘super rich’ – instead of the poorest who often have little responsibility for, or control over, global carbon emissions. Their analyses suggest that the carbon emissions of high-net-worth individuals (defined as those with assets over USD 1 million), have carbon emissions at least ten times that of the global average footprint, with Oxfam (2015) also proposing that the emissions of the top 1% of earners could be 175 times the amount of the lowest 1% of earners globally. Wealthy people also tend to have higher consumption carbon footprints than poorer people. Otto et al (2019) argue that the super-rich (defined as the top 0.5% of the population) may be responsible for 13.6% of all lifestyle-related carbon emissions, compared to less than 10% of emissions caused by the bottom 50% of the population.

The wealthiest in society also possess more political power and influence, and are often able to lobby politicians and organisations against climate reform that would significantly affect their lifestyles (Westlake, 2017). From a climate justice perspective, Ptaschunder (2020) argues that any carbon reduction initiative must take the power imbalance between the richest and the poorest into account, to ensure that the cost of addressing climate change is shared fairly and proportionately according to individual and country-level income.

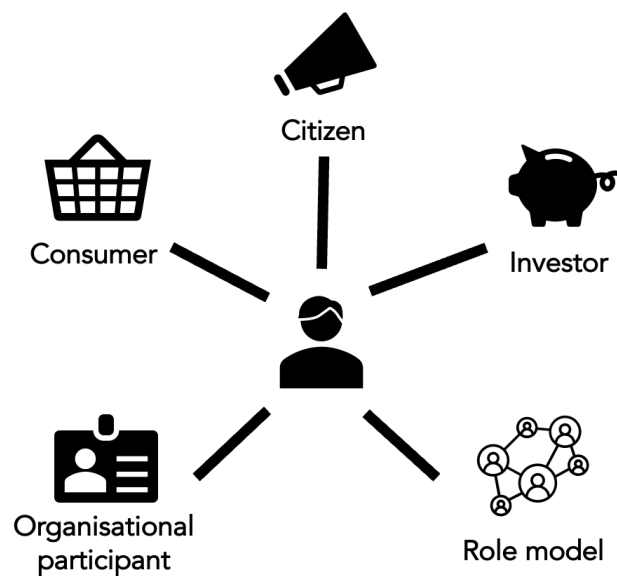
According to the UN Emissions Gap Report (2020), approaches to climate mitigation and interventions should focus on the emissions of the wealthy. The report argues that to not do so would be ineffective and unjust. It suggests that high impact ‘luxury’ behaviours

should be reduced among consumers, and in order of reduction potential, including, reducing frequency of medium/long-haul flights; reducing car use; increasing public and active (walking, cycling) transport; buying more fuel-efficient vehicles; buying electric vehicles. The report shows how these changes can be fostered at multiple levels, through policy, legal frameworks, purchasing behaviour, increased taxes, behaviour change, protest, and social influence.

Roles of the public

Nielsen et al. (2021) argue that there are five roles that the public – and particularly people of high SES who tend to have more influence – can play in influencing business, governments, and society as a whole to reduce global greenhouse gas emissions. As depicted in Figure 2, these roles are that of consumer, investor, citizen, organisational participant, and role model.

Figure 2. Five roles through which the public can act to reduce greenhouse gas emissions (adapted from Nielsen et al., 2021)



a) *Consumer*

As *consumers*, people can influence organisations and markets through their purchasing behaviour. Many pro-environmental products are increasing in market share, including meat and dairy replacements, and there is growing market support in the investment and purchasing of new environmental food innovations, such as cultured meat (Aschemann-Witzel et al., 2020; Bryant and Barnett, 2020). Consumers may also boycott companies they feel do not meet environmental or social standards, or invest in companies they feel reflect their values (Hoffmann et al., 2018). An example of a high-profile environmental product boycott is palm oil, which was shown to lead to deforestation and habitat destruction, resulting in public and industry rejection of the product (Teng et al., 2020).

Consumers may also become distrustful of companies who 'greenwash' their products; specifically, the practice of emphasising environmentalism as a sales tactic

without taking proportionate climate action (Aji and Sutikno, 2015; Chen and Chang, 2013). Research demonstrates that greenwashing leads to a breakdown in trust among consumers, which is often costly for firms to repair (Guo et al., 2018). More generally, there is a need for trusted and clear information on the carbon impacts of companies and products (Consumers International, 2021). Indeed, carbon disclosure has been identified as a critical lever for wider social action on net zero because it provides information to support consumer decision-making, but also leads to business innovation for net zero by increasing shareholder pressure and firm competitiveness (Otto et al., 2020).

b) *Investor*

The climate crisis is also becoming an increasing concern amongst *investors*, and 'sustainable investing' is on the increase, with 'socially-responsible' investment accounts growing in popularity, alongside specific environmental investment organisations (Robinson, 2021). Many individuals and organisations are choosing to 'divest' from fossil fuels and other environmentally damaging products (Ayling and Gunningham, 2017).

c) *Citizen*

As *citizens*, the public can campaign for action on climate change through political participation, voting, protesting, and lobbying. Initial studies of climate protests indicate they can be effective in both pushing leaders to take action and raising public awareness of climate change (Bugden, 2020). Howarth et al (2020) asserts that politicians can no longer claim they lack the political mandate for bold climate action because of growing climate activism, lobbying by constituents, and results of polls and climate assemblies showing strong public support for climate policies. Analysis of online climate search behaviour in 46 countries by Sisco et al. (2021) found that activism can also increase public concern for climate change. They suggest that climate activist events and news coverage were strong predictors of climate search behaviour amongst the public, although they also found that activity returned to pre-event levels within a few days. Further, little research exists that currently explores the longitudinal impact of protest events on participants and observers.

d) *Organisational participant*

As *organisational participants*, individuals can encourage pro-environmental policies and practices at their workplaces (Unsworth et al., 2021). Individuals can express dissent with a company or organisation through striking, or activism designed to disrupt or change the organisation's work and profit focus (Temminck et al., 2015). It is important to remember that, while businesses have a large role to play in addressing the climate crisis, these businesses are run and organised by individuals, and thus are susceptible to social and political interest as well as direct action from within.

e) *Role model*

Role models have a powerful impact on climate action worldwide. A study by Sweetman and Whitmarsh (2015) suggests that role-modelling by high-status or well-respected individuals within their communities can have an important impact on pro-environmental action. Celebrities are often high in income and social influence

potential, so behaviour change from these groups to bring their lifestyles in line with climate concerns may have potential for behaviour change among the general public (Doyle et al., 2017; Gössling, 2019). Local leaders (e.g. politicians, councillors, etc.) can also act as role models within their communities and signal new social norms through their behaviour (Westlake, 2017). However, evidence from Kantar Public (2021) shows that people underestimate how willing other people are to address the climate crisis. In a survey of 10 countries (including the USA, UK, France, and Germany), 36% of those surveyed rated themselves “highly committed” to preserving the planet, yet only 21% felt the same was true of the media and 19% of local government. A minority felt their local community was equally committed (18%), with national governments (17%) and big corporations (13%) seen as even less engaged. These results suggest there is much work to do to convince the public that other societal actors are willing to commit to addressing the climate crisis.

Looking across these roles, the evidence reviewed in this section shows they can affect wider social change. This social change in turn can support individual behaviour change. The UN Emissions Gap Report (2020) points out that behaviour can be changed through a number of pathways, including: economic policies, legal frameworks, social norms and movements, interpersonal influence, habit disruption, improving infrastructure, information-based policies, standards, and supply chains. These pathways are said to be influenced by individuals in different ways with: *“...system change and behaviour change two sides of the same coin. When communicating about lifestyle change, it is important to recognize the constant interplay between the lifestyles of individuals and the social, cultural, political and economic systems in which they live and which they help shape”* (p.75).

Changing behaviour

The various roles individuals can play can be shaped by different interventions, which can help narrow the gap between climate concern and climate action.

Motivating policy support

In terms of people's roles as *citizens*, there are a number of factors which predict their support for net zero policies. As noted, the public are more likely to support pro-environmental policies if they are perceived to be fair, effective, and not personally too costly – in either financial or behavioural terms (Faure et al., 2022). That is, people appear to factor in both personal and societal benefits (or costs) of policies when evaluating them. Ptaschunder (2020) argues that the climate crisis is borne out of worldwide inequality, and to truly effect change more equitable and fair systems must be introduced. It is thus important that any climate action taken operates within a climate justice framework, and that environmental limits do not preclude the basic wellbeing requirements of humanity or serve to disadvantage those who are already impoverished (Ptaschunder, 2020)

To help conceptualise such an approach, leading UK economist Kate Raworth proposed a 'donut' approach to economics (Raworth, 2017), where countries and organisations should aim to keep within the donut: specifically, beyond the social foundation of essentials for a good quality of life (e.g. food, water, peace), but within the ecological ceiling of environmental feedback loops identified by Rockström et al. (2009). 'Doughnut economics' has become a popular approach, with several cities and regions in the global north adopting this approach to guide their climate action, including Portland, Philadelphia, Amsterdam, and Cornwall.

Motivating consumer action

Consumer action on climate change is predicted by how easy, attractive, and socially 'normal' net zero choices are (Whitmarsh et al., 2021; BIT, 2014). Much less influential on people's consumption behaviours are environmental values, climate concern or knowledge. A meta-analysis found willingness to take low-carbon action was only weakly influenced by climate beliefs (Hornsey et al., 2016), while the environmental 'knowledge-behaviour' gap has long been observed (Kollmuss and Agyeman, 2010; Whitmarsh, 2009; Whitmarsh and O'Neill, 2010). This is because behaviour is a product of a multitude of factors, including attitudes, skills, social influence, incentives, and physical opportunities (Ajzen, 1991; Michie et al., 2011). Knowing about a problem – or even how to address it – is rarely enough alone to motivate or remove barriers to action (Whitmarsh, 2009).

Consequently, *informational* approaches (such as product labels) tend only to be about 2-3% effective in changing behaviour (Nisa et al., 2019) whereas *structural* ones are more effective. For example, making renewable energy the default tariff for consumers increased consumer adoption from 3% (when fossil energy was the default) to around 90%, even though the renewable tariff was higher (Liebe et al., 2021). Other research has shown how increasing the proportion of plant-based options on canteen menus (from one

in four to two in four) increased purchases of such meals by up to 80% (Garnett et al., 2021). This is because *convenience* and *availability* are key factors in shaping behaviour. To further illustrate, making physical changes to infrastructure, such as reallocating road space from cars to pedestrians and cyclists, has been shown to be up to 100% effective in changing behaviour (Cairns et al., 2002), because active travel becomes more attractive – given greater convenience – than driving. *Economic* measures can similarly shift incentives in favour of low-carbon options; for example, congestion charging has been shown to significantly reduce car use (TfL, 2006) and shift demand towards public transport (Agarwal and Koo, 2016) and lower-emission vehicles (Percoco, 2014).

Social processes also play an important role in changing behaviours. Social norms (what is perceived to be normal or the ‘right thing to do’) are a strong influence on behaviour, and new behaviours can spread via ‘social contagion’ and peer influence (Wolske et al., 2020). For example, when one household installs solar panels, neighbours are more likely to follow suit (Graziano and Gillingham, 2015); similarly, the growth in electric bikes and scooters is partly a result of initial adopters discussing their use and encouraging others to try them (Seebauer, 2015).

Where *informational* approaches are more effective, they: target messages to the time and place that people are making decisions (e.g., on product labels, stickers on light switches, energy monitors); frame messages around audience values (e.g. health benefits of plant-based food, cost savings from avoiding driving, Unsworth et al., 2013; Wolstenholme et al., 2020); utilise trusted messengers and role models, such as friends, colleagues, celebrities, or independent organisations (for example consumer groups; Consumers International, 2021; Westlake, 2017); and foster a sense of agency or self-efficacy (i.e. show that their actions make a difference, Climate Outreach, 2019).

Given widespread misunderstanding amongst the public about what actions are most effective, there is also a need for informational interventions to channel good environmental intentions into behaviours which are more impactful (for example, changing travel habits rather than increasing recycling behaviours, Wynes and Nicholas, 2017). That said, research has shown that *multiple* interventions are usually required to change behaviour, since there are multiple drivers of, and barriers to, behaviour change (Poortinga and Whitaker, 2018; Stern, 1997). Therefore, a combination of informational, economic, and regulatory approaches will be required to achieve net zero behaviour change (Michie et al., 2011). This is supported by recent survey evidence from ten countries (Kantar, 2021) which found people prioritised behaviours that were already habitual or easy to complete in addressing the climate crisis. About 57%, for example, said that reducing waste and increasing recycling was “very important”. The public also prioritised behaviours they had little personal responsibility over, for example reversing deforestation (54%), protecting endangered animal species (52%), building energy-efficient buildings (47%), and replacing fossil fuels with renewable energy (45%). These findings suggest that a mixture of structural changes and support to help people change their habits would be more effective than individualised interventions (e.g., information campaigns).

As well as considering *how* to intervene to change behaviour, it is critical to consider *when* to do so. The habit discontinuity hypothesis suggests that change is easier in times of disruption, for example, when moving house, starting a family, or retiring (Kurz et al., 2015; Verplanken and Whitmarsh, 2021). This is because much high-impact environmental behaviour (for example, transportation and energy usage) is habitual (Kurz et al., 2015), and interventions should strive to take advantage of times when habits are disrupted. Research in the UK and Germany has shown that where a free bus pass was provided to those who had recently moved house, it increased bus travel (Bamberg, 2006; Verplanken and Roy, 2016). Societal disruption and crisis also accelerate innovation and can reconfigure patterns of behaviour for the longer-term (Marsden et al., 2020). For example, the COVID-19 pandemic has been shown to increase virtual working practices amongst office workers (CAST, 2020) and to create more support for climate policies (Reset, 2020).

Critically though, behaviour change interventions are most effective when they build on engagement with the target audience (for example, employees, citizens) and take into account their values and specific needs or constraints (Geller, 2002). As Ghosh and Sharmeen (2021) argue, interventions should: “...be adaptive to the local socio-cultural context, inviting policy-makers and users to act in coordination with one another in shaping smart and sustainable [...] futures” (p.1). This is important across the global south where involving marginalised groups in policy development can support social justice outcomes and improve decision quality (Dawson et al., 2021), but also in the global north where participatory policy development has been found to lead to fairer and more acceptable policies (National Research Council, 2008; UNEP, 2020).

Motivating organisational action

Consistent with the literature on consumer behaviour, organisational research shows pro-environmental action within the workplace is predicted by various psychological, social, institutional, and physical factors (Whitmarsh et al., 2018; Young et al., 2015). Studies of workplace low-carbon or green action show factors shaping employee behaviour include *leadership behaviours*, that is, exemplary behaviour of managers, as well as managerial commitment to a green agenda (Epstein et al., 2008). For example, one study found behaviours of line managers served to influence employees’ motivation to conduct green behaviours (Rayner and Morgan, 2018). Similarly, employees’ *organisational commitment* has also been found to be positively related to environmental behaviours in the workplace (Temminck et al., 2015).

Psychological and *social* factors are also relevant. For instance, in terms of psychological factors, people with stronger pro-environmental values and sense of moral obligation to protect the environment report taking more green actions at work (Ruepert et al., 2016; Tezel and Giritli, 2019). A sense of self-efficacy or perceived ability to act can also shape employees’ green behaviour, as can strong positive social norms (Banwo and Du, 2019). Indeed, social factors are particularly important where people work in teams (Blok et al., 2015). That said, the most common barriers to workplace environmental behaviour change are more often *structural* than *motivational* (for example, lack of recycling facilities and not lack of motivation to recycle) (Gainforth et al., 2016). Taken together, this research highlights that physical factors (such as infrastructure) are at least as important as

organisational or psychological factors (such as motivation) in shaping climate action at work.

Consistent with the wider behaviour change evidence base, changing workplace behaviours is most effective where a combination of physical and social interventions is used (Gregory-Smith et al., 2015; Holland et al., 2006; Nilsson et al., 2015). For example, reductions in energy use of up to 50% have been achieved through a range of measures that included technological measures (such as automation), provision of supporting facilities, and social approaches, such as eco-champions (Staddon et al., 2016).

Education can help change behaviour, where it creates new work cultures and motivates staff to act, as well as rectifying knowledge gaps (Yun et al., 2014). For example, a recent evaluation of carbon literacy training found it changed behaviours and reduced emissions in the workplace and at home (Büchs and Payling, 2020). For organisational contexts like the workplace, social and institutional factors are critical elements in shaping behaviours (Handgraaf et al., 2013). One study found that providing team-based feedback on the amount of printing and its environmental impact reduced printing on average by 28% (Hasan et al., 2013). Changing the physical and institutional context is also very important, such as through the implementation of telecommuting policies (allowing or requiring employees to work from home or a local hub; Henderson and Mokhtarian, 1996).

Interventions tend to be more effective when employees identify with, and share, the values of their employer, and perceive them to be committed to environmental action, since this motivates employees to support collective action (Gregory-Smith et al., 2015; Nilsson et al., 2004). As with interventions with households, behaviour change is most likely when the new behaviour is easier and more attractive than the old one. As examples, this might entail climate action being included in promotion criteria, prioritising low-carbon suppliers on procurement lists, or making workplaces more comfortable as well as lower-carbon (such as via office retrofits) (Grubb et al., 2020; Unsworth et al., 2013).

Future research directions

Our review has revealed a bias in the literature in favour of studies conducted in the global north, with far less evidence available on consumer engagement with net zero in the global south (see also Whitmarsh et al., 2021). Similarly, relatively few studies provide any cross-cultural evidence of engagement across countries, making comparative analysis challenging. Future research is needed which moves beyond single country studies to provide detailed international studies, particularly to shed light on consumer engagement within low- and lower-middle-income countries.

In addition, we have uncovered several specific areas which, we would argue, merit further research.

Greenwashing

The rising public concern about climate change (as evidenced in our review) has been accompanied by a shift in corporate organisations acknowledging the climate crisis and a growth in net zero claims. Given evidence that public information on the environment has tended to mislead the public about which actions are most effective (Wynes and Nicholas, 2017), there is a risk that corporate environmental claims may similarly be misunderstood, or even perceived as greenwashing (Consumers International, 2021). Research is needed to explore how the changing informational context may shape consumer attitudes and decisions, including exploring how carbon disclosure by corporate organisations, along with reporting and advertising standards, can support informed consumer decision-making (Otto et al., 2020).

Climate anxiety

Researchers have raised concerns that growing public awareness of climate change is impacting negatively on mental health, particularly amongst young people (Hickman et al., 2021); yet, to date, only a handful of studies have assessed climate anxiety, and there is currently no longitudinal evidence to show whether rates are rising or changing over time. This is a burgeoning research area that stands to grow more in the coming years.

Activism

There remains a focus in the literature on the public as consumers and on behaviours which individuals can take to mitigate climate change (for example, changing travel habits). However, less attention has focussed on other roles and contexts of action. In particular, there are few studies on the effectiveness of climate activism, including longitudinal impact of protest events or which tactics are most effective.

Climate migration

Climate migration may also come more to the fore in the coming decades, as increases in extreme weather events and average temperatures displace people from their homes. This is already happening in some areas of the world, such as Pacific island nations, like Kiribati, and countries with low-lying coastal areas, such as, Bangladesh (for a summary see Heslin et al., 2019). Climate breakdown also exacerbates socio-economic

vulnerabilities, and can stoke political tensions (Ide, 2018). Future research should explore the effects of climate migration and more broadly how to foster a globally just net zero transition.

Intervention studies

More generally, the evidence base for intervention studies which explore the effectiveness of particular communication and behaviour change strategies is poor. Future research could test the effectiveness of communication strategies and interventions..

Qualitative perspectives

Finally, much of the current research on climate change adopts quantitative approaches, and much can be gleaned from qualitative and discursive explorations of the climate literature (for a review see Kurz and Prosser, 2021). Understanding how people talk about climate change amongst their own communities and exploring their own priorities for climate action could help to increase the effectiveness of measures.

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Note: The references are divided into report sections.

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