Engaging older people in net-zero. Older Chinese migrants as an example

A Thesis Submitted for the
Degree of Doctor of Philosophy

By

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Declaration

Parts of this thesis have been published in peer-reviewed journals.
The author confirms that all published materials included in the thesis were written and developed as part of the doctoral research at Brunel University London.
Permission has been obtained from the publishers where required.

The following publications are based on the research presented in this thesis:

1. **Ni, Q.**, Dong, H., & Kaniadakis, A. (2025). *Empowering Older Migrants: Co-designing Climate Communication with Chinese Seniors in the UK. Journal of Ageing and Longevity, 5(4), 37.*
2. **Ni, Q.**, Dong, H., & Kaniadakis, A. (2025). *Low-carbon Practices and Cultural Adaptation among Older Chinese Migrants: Insights from Walking Interviews on Environmental Policy and Social Integration. International Journal of Environmental Research and Public Health, 22(6), 832.*
3. **Ni, Q.**, Dong, H., Kaniadakis, A., Wang, Z., & Ge, C. (2025). *Investigating Older Adults' Response to Climate Change. International Journal of Environmental Research and Public Health, 22(2), 154.*

These publications correspond to Chapters **4–6** of this thesis.
All other work presented in the thesis is the author's original contribution unless otherwise stated.

The author confirms that only generative AI tools, such as OpenAI's ChatGPT were used for language translation, language improvement purposes during the preparation of this thesis. All research plan, data collection, data analysis and thesis writing were completed by the author.

List of Publications

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Abstract

As the UK government accelerates its net zero emissions target, gaps remain in the participation of older people, particularly those from ethnic minority communities, in the low-carbon transition. Older people account for a significant portion of household energy use but are often overlooked; older immigrants also face language, cultural, and digital barriers that further prevent them from participating in such public discourse.

This research, focusing on older Chinese migrants in the UK, employs a design-oriented, exploratory, and constructivist approach to examine their low-carbon practices, perspectives on the UK's net-zero agenda, and preferred climate communication models. It also incorporates comparative insights from local older people in the UK to foreground cultural and contextual contrasts, as well as designer workshops to deepen understanding of climate interventions.

Guided by the Design Research Methodology (DRM), the project comprised seven interrelated studies (A-G) spanning exploration, description, prescription, and evaluation phases. A range of methods were used, including surveys and interviews; walking interviews; co-design workshops; focus group; and designer workshops. Through the design intervention research, a bilingual visual climate education toolkit and policy brief were produced. The evaluation method employed observation and questionnaires, informed by the Kirkpatrick model. This study synthesises practice theory, ageing and migration research, and theories of behaviour change.

The findings indicate that older adults' sustainable behaviours are rooted in cultural values of thriftiness and caring; they are often excluded from formal climate narratives. Older people generally perceive net zero as abstract and technical; language/institutional access can play a key role. Visual, bilingual, and interactive/gamified design tools can make abstract concepts concrete, evoke personal stories, enable intergenerational and cross-cultural dialogue, and enhance understanding and self-efficacy. Based on this, this paper proposes a multi-level engagement strategy from individual → family → community → society/policy.

Contributions to knowledge include: (1) rich qualitative and visual evidence of the daily low-carbon practices of older Chinese migrants; (2) identification of barriers and facilitators to cross-cultural and intergenerational climate communication using culturally sensitive design tools and interventions; and (3) actionable recommendations

for policymakers, businesses, and communities to translate lived experiences into potential improvements in services and systems to achieve more equitable and culturally aware net zero strategies.

Keywords: older adults; Chinese migrants; net zero; visual communication; low-carbon practices; inclusion.

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Chapter 1: Introduction

The growing urgency of climate change demands not only technological innovations and policy reforms but also profound shifts in everyday practices. Among the populations most vulnerable to climate risks, older adults have been largely framed as passive recipients of protection, despite their latent potential to contribute to sustainable transitions.

1.1 Background & Problem Statement

While research has increasingly examined behavioural drivers of climate action, the perspectives of older adults—particularly those from ethnic minority and migrant backgrounds—remain understudied (Shwom et al., 2010; Wells et al., 2011; Whitmarsh et al., 2012). In public climate discourse, older generations are sometimes represented as having failed to take sufficient action on climate change (Nairn, 2019), which has influenced perceptions of their role in climate action (Broome, 2021). Recent studies also suggest generational and demographic differences in perceptions of the UK's net-zero transition. Younger people are more likely than older adults to believe that the net-zero target is attainable, while members of the public perceive that white and younger individuals are more likely to benefit from net-zero policies than ethnic minorities and older populations (Poortinga, Demski, et al., 2023; Poortinga, Whitmarsh, et al., 2023).

However, such generalisations risk obscuring significant variations across cultures, communities, and everyday practices. Older Chinese migrants, for example, may already engage in environmentally responsible behaviours through habits of thrift, reuse, moderation, and resourcefulness. These practices may align with low-carbon living, yet they are not always recognised within the formal language of UK net-zero policy or mainstream climate communication. The issue, therefore, is not simply how to persuade older Chinese migrants to adopt low-carbon behaviours, but how to recognise, translate, and support the sustainable practices that already exist within their everyday lives.

At the same time, older Chinese migrants in the UK may face multiple barriers to participation, including language difficulties, unfamiliarity with policy terminology, limited trust in official communication channels, and uneven access to culturally

appropriate information. These factors can hinder their participation in mainstream climate discourse, despite their existing commitment to resource-saving lifestyles (Hobson, 2003; Shove, 2010).. Furthermore, conventional behaviour change approaches often pay insufficient attention to the cross-cultural, generational, and migration-related factors that shape how people understand and respond to climate action.

This research therefore draws on inclusive design thinking (Clarkson & Coleman, 2010), particularly the principle that designing with and for users at the margins can reveal barriers that are less visible in mainstream approaches. Older Chinese migrants are not treated here as an exceptional or isolated group, but as an "edge user" group through which broader issues of accessibility, cultural relevance, communication, and participation in net-zero transitions can be examined (Patrick et al.; Patrick et al.; Treviranus, 2018). Addressing the barriers experienced by this group may generate insights and interventions that are also relevant to wider communities, including other older adults, migrant groups, and people who find current climate communication inaccessible.

This research investigates how older Chinese migrants perceive, practise, and engage with the UK's net-zero agenda. It responds to the need for design-led and participatory approaches that recognise migrants' lived experiences and cultural values while addressing structural barriers to participation.

1.2 Context of Study

This study focuses on older Chinese migrants in the UK as a critical but underrepresented group in climate action discourse. Three factors underpin the selection of this group.

First, older Chinese migrants may hold culturally embedded practices that already resonate with low-carbon living. Everyday habits such as saving resources, reusing materials, avoiding waste, and passing items between family members are often shaped by values of thrift, care, and intergenerational responsibility (Boffa, 2015). However, these practices may not be explicitly described by participants as "sustainable" or "low-carbon", particularly when they are understood instead as cultural habits, economic prudence, or family responsibility.

Second, older Chinese migrants may face specific barriers to participation in the UK's net-zero agenda. These include language barriers, difficulty accessing English-language policy information, unfamiliarity with institutional systems, and uneven confidence in using unfamiliar digital platforms. These barriers can create entry costs that limit meaningful engagement with mainstream climate communication and public participation.

Third, Chinese migrant communities often maintain strong interpersonal and intergenerational ties through families, community organisations, churches, and social networks. These networks create opportunities for bilingual communication, storytelling, visual methods, and community-based forms of climate engagement. They also provide a basis for developing interventions that connect abstract net-zero concepts with everyday practices and culturally meaningful values.

These factors make older Chinese migrants an important group through which to examine how climate communication and design interventions can become more inclusive, culturally relevant, and socially grounded.

1.3 Research Aim and Methodological Overview

This research investigates the motivations, perceptions, and everyday practices of older Chinese migrants in relation to low-carbon living and the UK's net-zero transition. It aims to develop and evaluate culturally relevant, user-centred design interventions that enhance older Chinese migrants' understanding of, motivation for, and engagement with climate action.

The main research question is:
How can inclusive design interventions be developed and applied to enhance older Chinese migrants' understanding, motivation, and engagement with low-carbon living and the UK's net-zero transition?

To address this overarching question, seven sub-research questions were developed and mapped to the corresponding studies, as shown in Table 1.1.

Table 1.1: Mapping of Research Questions to Corresponding Studies.

Research Questions		Corresponding Study
RQ1.	What are the current low-carbon practices and perceptions of net zero among older Chinese migrants?	**Study A**
RQ2.	What are the motivations of older Chinese migrants to engage in low-carbon behaviour?	**Study B**
RQ3.	How do older Chinese migrants' daily routines, social roles, and information preferences shape their engagement with climate action?	**Study C**
RQ4.	How do local British older adults understand net zero, and what comparative insights can they offer for engaging migrant older adults?	**Study D**
RQ5.	How can designers translate insights from seniors into inclusive intervention strategies?	**Study E**
RQ6.	How can design interventions be developed to support older Chinese migrants' understanding of and engagement with net zero?	**Study F**
RQ7.	What are the perceived impacts of the toolkit on knowledge, engagement, and intended behaviour change?	**Study G**

To answer these questions, the thesis adopts a multi-stage research programme structured around Design Research Methodology (DRM) (L. T. Blessing & A. Chakrabarti, 2009). Rather than relying on a single method, the research progresses from exploratory investigation, to participatory engagement, design development, and evaluation. Across seven interlinked studies (Studies A–G), the thesis first examines older Chinese migrants' existing low-carbon practices, perceptions of net zero, motivations, and information barriers. It then expands the inquiry through walking interviews, co-design workshops, comparative perspectives from local British older adults, designer workshops, research-through-design, and toolkit evaluation.

The seven studies are organised across the four DRM phases. The Research Clarification phase explores the existing practices, motivations, and communication needs of older Chinese migrants. Descriptive Study I broadens the understanding of the problem through local older adults' perspectives and designers' interpretation of the

findings. The Prescriptive Study translates these insights into a bilingual climate intervention toolkit and accompanying policy brief. Descriptive Study II evaluates the toolkit through mixed methods, including qualitative feedback, observation, and assessments of participants' understanding and behavioural intentions.

This staged structure allows the thesis to move from understanding lived experience, to translating insights into design opportunities, and finally to evaluating practical interventions and policy implications. Figure 1.1 illustrates the sequence, logic, and interrelationships among the studies, showing how each phase contributes to the overall aim of designing and evaluating inclusive net-zero engagement interventions for older Chinese migrants.

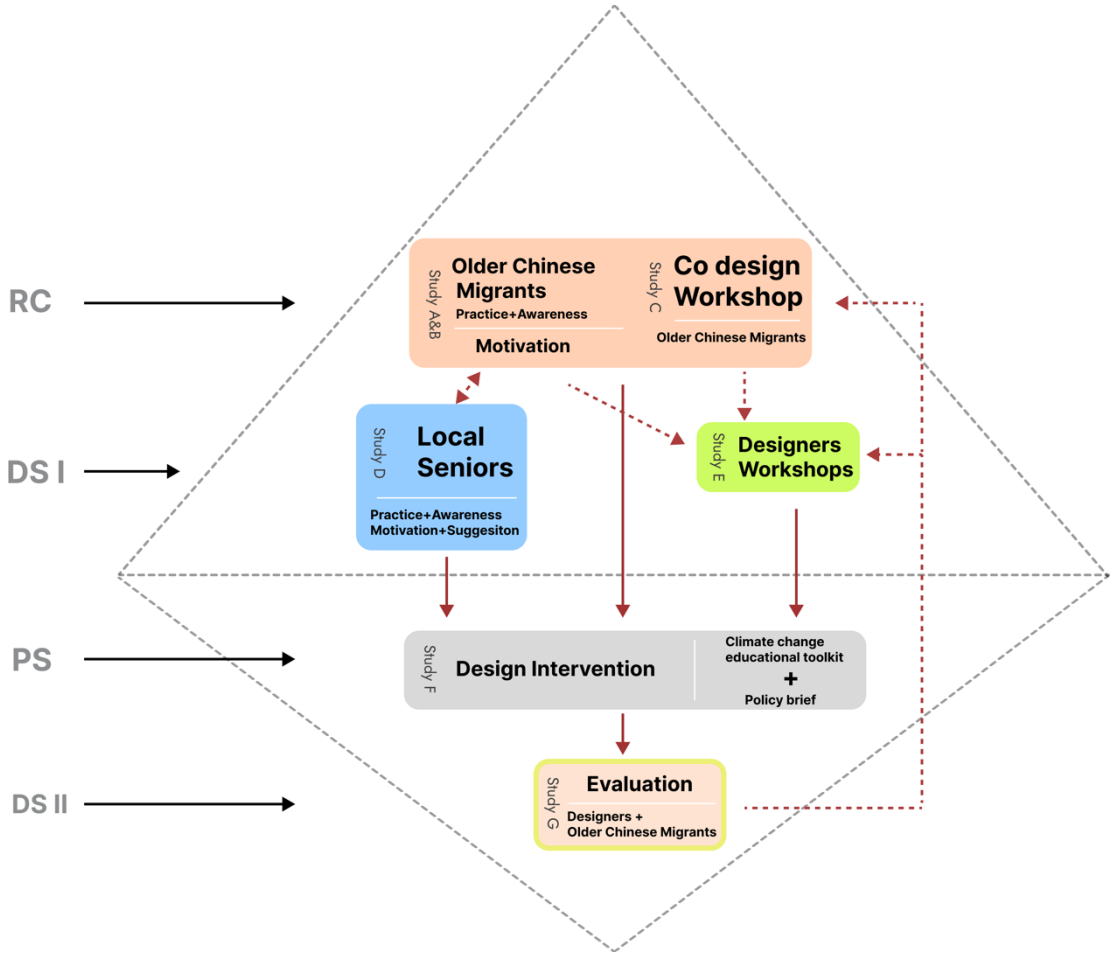


Figure 1.1 Research Programme Structure Across DRM Phases.

1.4 Theoretical and Methodological Approach

This thesis is informed by a constructivist approach, which understands knowledge and meaning as socially constructed through experience, interaction, and context (Crotty,

1998; Schwandt, 1994). From this perspective, older Chinese migrants' understandings of climate change and net zero are not treated as fixed or universal, but as shaped by migration histories, family relationships, cultural values, language practices, community networks, and everyday routines.

This theoretical position is important because the research does not assume that a lack of engagement with formal net-zero terminology indicates a lack of environmental concern. Instead, it investigates how participants make sense of climate-related issues through their own lived experiences, cultural practices, and social relationships. For example, practices such as thrift, reuse, saving energy, and caring for family members may carry environmental significance even when they are not described using formal sustainability language.

Methodologically, this constructivist position supports the use of qualitative, participatory, and design-led methods. Interviews, walking interviews, co-design workshops, designer workshops, research-through-design, and evaluation activities were used to generate and translate knowledge across different stages of the research. In this sense, knowledge was not simply extracted from participants, but progressively developed through dialogue, interpretation, visualisation, design experimentation, and feedback.

The thesis therefore combines constructivist inquiry with a staged design research process. This enables the research to examine how climate meanings are constructed in everyday life and how these meanings can be translated into culturally relevant and accessible climate interventions.

1.5 Contributions

This thesis makes three main contributions.

First, it makes a theoretical contribution by bringing together debates on climate engagement, ageing, migration, and culturally embedded low-carbon practices. It challenges deficit-based assumptions that position older adults primarily as vulnerable or disengaged, and instead considers how older Chinese migrants may already practise forms of sustainability through everyday habits such as thrift, reuse, moderation, and family-based care.

Second, it makes a methodological contribution by developing a staged, design-led research framework informed by inclusive design thinking. By focusing on older Chinese migrants as an edge-user group, the thesis shows how barriers experienced by underrepresented communities can reveal broader challenges in climate communication, accessibility, and participation. Through mixed methods, walking interviews, co-design workshops, designer workshops, research-through-design, and evaluation, the research demonstrates how participant insights can be progressively translated into intervention strategies.

Third, it makes a practical contribution through the development of a bilingual climate toolkit and policy brief. These outputs aim to support more inclusive net-zero engagement by translating abstract policy concepts into accessible, culturally meaningful, and socially grounded forms of communication for older Chinese migrants and potentially wider communities.

1.6 Thesis Structure

This thesis is structured to reflect the progression from conceptual framing and methodological design, to empirical investigation, intervention development, evaluation, and final discussion.

Chapter 1 introduces the research background, rationale, aims, research questions, theoretical orientation, methodological overview, and contributions of the thesis. It establishes the focus on older Chinese migrants in the UK and explains why this group provides an important lens for examining inclusive net-zero engagement.

Chapter 2 reviews the literature that informs the thesis. It examines debates on climate change and net-zero transitions, ageing and climate action, migration and cultural practices, behaviour change, inclusive design, and participatory approaches. This chapter establishes the conceptual foundation for understanding older Chinese migrants not only as a potentially vulnerable group, but also as active participants in everyday low-carbon practices.

Chapter 3 presents the methodological framework of the research. It explains the constructivist orientation of the thesis and outlines the use of Design Research Methodology (DRM) to organise the seven studies. It also introduces the mixed-

methods, qualitative, participatory, visual, gamified, and research-through-design methods used across the research programme.

Chapter 4 presents Study A, which explores older Chinese migrants' current low-carbon practices, perceptions of net zero, and barriers to climate communication. This chapter provides the empirical starting point for the thesis by identifying the gap between participants' existing sustainable practices and their limited engagement with formal net-zero terminology.

Chapter 5 presents Studies B and C, which deepen the understanding of older Chinese migrants' everyday practices, cultural motivations, social roles, and communication preferences. Walking interviews and co-design workshops are used to explore how low-carbon behaviours are embedded in daily routines, family relationships, and culturally specific values.

Chapter 6 presents Study D, which introduces a comparative perspective through research with local British older adults. This chapter broadens the analysis by examining how older adults from different cultural and social backgrounds understand net zero and what recommendations they offer for supporting migrant older adults' climate engagement.

Chapter 7 presents Study E, which brings the insights from earlier studies into dialogue with professional designers. The designer workshops translate empirical findings into possible intervention strategies, identifying opportunities for visual, bilingual, narrative-based, and community-oriented climate communication.

Chapter 8 presents Study F, the research-through-design phase. It describes the development of the bilingual climate toolkit and policy brief, showing how findings from the previous studies were translated into practical design outputs. This chapter demonstrates how abstract net-zero concepts can be reframed through culturally meaningful, accessible, and interactive formats.

Chapter 9 presents Study G, which evaluates the climate toolkit through workshops, observations, questionnaires, and participant feedback. This chapter assesses the toolkit's usability, accessibility, perceived learning value, and potential to support intergenerational dialogue and future climate engagement.

Chapter 10 brings together the findings of the thesis and discusses their theoretical, methodological, practical, and policy contributions. It reflects on the limitations of the research and outlines future directions for inclusive climate communication, participatory design, and engagement with older migrant communities.

Together, the chapters form a staged argument. The thesis begins by identifying the invisibility of older Chinese migrants in mainstream net-zero communication, then builds empirical understanding of their lived practices and barriers, translates these insights into design interventions, evaluates the resulting toolkit, and finally discusses the implications for inclusive design, climate engagement, and policy.

Chapter 2: Literature Review

Achieving net-zero is not merely a matter of technological innovation or supply-side reform; it represents a profound transformation in social practice and systems of governance. Although the net zero agenda has attracted increasing academic interest, existing research remains fragmented, scattered across climate policy and communication, aging studies, immigration and cultural adaptation research, as well as various behavioural or practice-based theoretical fields.

To establish a solid context and theoretical foundation for this research, a two-part comprehensive literature review is conducted in this chapter.

Part 1 Contexts (Sections 2.1–2.4) outlines the contextual landscape of the research, covering net-zero policy and climate change communication in the UK, the socio-environmental roles of older populations, and the climate-related experiences of migrant and diaspora communities.

Part 2 Theories (Sections 2.5) explores the theoretical frameworks that inform this study, focusing on behaviour change models, environmental communication with marginalised groups, and the development of a multi-level integrative design framework.

Literature retrieval is mainly conducted using Scopus, Web of Science and Google Scholar, supplemented by official policy and strategic reports (such as IPCC, the UK Climate Change Commission and related ministerial publications). The reason for choosing these academic databases is that they comprehensively cover cross-disciplinary peer-reviewed journal articles, especially in the fields of environmental studies, behavioural science, immigration and design studies. All of these are at the core of this research. Meanwhile, policy documents from recognized climate authorities have also been incorporated to ensure they are relevant to the real-world policy context and consistent with the current net zero strategy, which is crucial for understanding the practical significance of the research. The main time frame is from 2000 to 2025, and the time window for policy documents issued in the past five years has been extended.

Inclusion criteria were as follows:

1) direct relevance to net-zero transitions, low-carbon behaviours, or climate communication;

2) focus on older people, migrants, ethnic minorities, or UK-based Chinese communities;

3) methodological or theoretical contributions transferable to design-led or inclusive approaches, such as visualisation, participatory communication, bilingual tools, or impact evaluation.

Part I Contexts：

2.1 Contextualising Net Zero in the UK

Climate change refers to the long-term alteration of global temperatures, weather systems, and atmospheric conditions. Although the Earth's climate has historically fluctuated due to natural drivers such as volcanic activity, solar cycles, and orbital variations (Ahmed et al., 2023; Farooqi et al., 2022), the accelerated warming observed since the Industrial Revolution is primarily the consequence of anthropogenic greenhouse gas emissions, with natural factors exerting only a marginal, modulating influence (Kumar, 2018).

2.1.1 The UK's Net Zero Strategy and Policy Landscape

The net zero concept has become a core pillar of global climate governance, representing the balance between greenhouse gases emitted into the atmosphere and those eliminated through natural sinks or technological solutions (Fankhauser et al., 2022). The Paris Agreement set out the global ambition of keeping the rise in average surface temperature well below 2°C above pre-industrial levels, while pursuing efforts to limit warming to 1.5°C (Hoegh-Guldberg et al., 2019). Meeting this threshold requires halving global emissions by 2030 and reaching net zero by 2050.

The urgency of this transition is underscored by scientific consensus: the continued accumulation of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) is the principal driver of global warming (Filonchyk et al., 2024). Global mean surface temperature has already increased by approximately 1.1°C compared with pre-industrial levels, resulting in heightened extreme weather events, biodiversity loss, sea-level rise, and growing threats to human health and livelihoods (Banu & Fazal, 2025; Jha & Dev, 2024; Warren et al., 2024).

Achieving net zero is therefore not solely a technical or economic undertaking but a profound socio-cultural transformation. It necessitates behavioural change, systemic reconfiguration, and inclusive participation across all sectors of society (Arun Kumar et al., 2024; Awashreh, 2025; Meadowcroft & Rosenbloom, 2023). Particularly in developed economies such as the UK, citizens' everyday practices and consumption choices are central to the success of low-carbon transitions (Moloney et al., 2010).

Scholars argue that behavioural and social change policies aimed at achieving net zero can be advanced through two interdependent strategies (Nelson & Allwood, 2021; Steg & Vlek, 2009):

(i) enabling individuals to adopt concrete low-carbon practices that collectively deliver large-scale emissions reductions; and
(ii) creating supportive socio-institutional environments that normalise and sustain public engagement with climate action.

2.1.2 The Public Engagement of Net Zero

Public engagement is often described as the "missing piece of the puzzle" in the UK's pathway to net zero. While national targets and sectoral reforms are clearly articulated, their success ultimately depends on the extent to which individuals and communities are willing and able to participate in the transition.

System-wide transformations

Given the scale of the challenge, emissions reductions are required across all major sectors, including electricity generation, industry, buildings, transport, food systems, and finance. These transformations affect everyday practices: how households are powered and heated, how people travel, how cities are designed, and how food is produced and consumed. Scholars argue that decarbonisation must not only reduce emissions but also address wider issues of social equity, ensuring that vulnerable groups, such as women, ethnic minorities, and low-income households, are not further disadvantaged (Andersen, 2022; Rogelj, 2023). The integration of net zero with the Sustainable Development Goals reflects this dual imperative of climate action and social justice.

The role of communities

The transition will inevitably touch every community in the UK (Copeland et al., 2023). Yet many citizens remain uncertain about what practical steps they can take to reduce their own carbon footprint. Community-level initiatives and trusted local intermediaries can play a crucial role in translating abstract national targets into everyday action (Moloney et al., 2010). Examples include improvements in public transport, uptake of energy-efficient heating systems, and enhanced local recycling schemes—all of which require public trust, participation, and collective ownership (Skidmore, 2022).

Individual contributions

Household-level consumption is particularly significant: it is estimated to account for around two-thirds of global greenhouse gas emissions (Capstick et al., 2020). In the UK, the average household emits approximately 8.5 tonnes of CO_2 annually, primarily from travel, heating, and the embedded emissions of goods and food (Ivanova and Wood, 2020). These impacts can be grouped into several domains (Fig. 2.1):

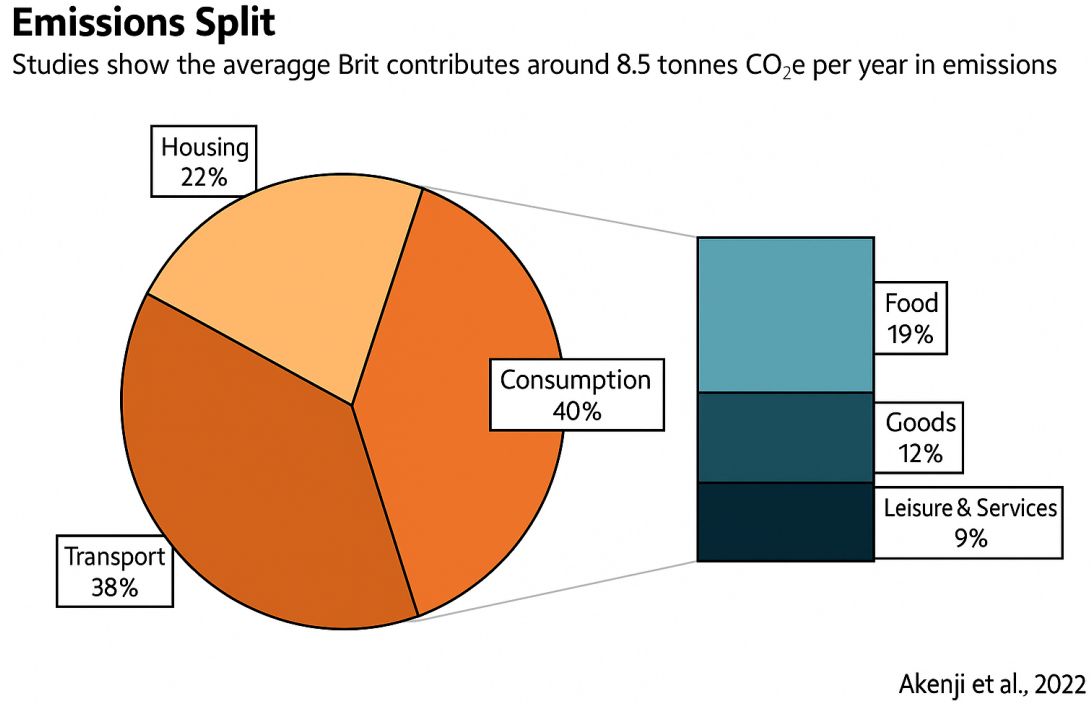


Figure 2.1 Average lifestyle carbon footprint for a UK individual (Adapted from Skidmore, 2022)

2.1.3 Policy and NGO Guidance on Net-Zero Communication

Existing UK policy and public guidance increasingly recognises that achieving net zero requires more than technological innovation, industrial decarbonisation, and regulation (Carmichael, 2019; Dixon et al., 2022; Shahzad et al., 2024). The UK's net-zero target provides the national policy context for decarbonisation, while subsequent strategies and delivery plans have focused on emissions reductions across sectors such as energy, transport, buildings, industry, and land use (Energy, 2020). However, policy and advisory bodies also acknowledge that public engagement is essential to achieving these targets. The Climate Change Committee (CCC) argues that reaching net zero will require greater involvement from people, as many emissions reductions depend on consumer choices, technology adoption, and changes in everyday practices. It also notes that people need accessible information, resources, and policy support to make low-carbon choices possible (Change, 2019).

International policy guidance similarly frames net zero as a whole-of-society transition. The OECD emphasises that citizens are not only recipients of climate policy, but also active participants whose choices, trust, and involvement shape the success of implementation. Its guidance highlights the importance of transparent information, clear and responsive communication, meaningful public participation, and behavioural insights in sustaining climate action (OECD, 2025). This is relevant to the present study because it shifts the focus from one-way policy dissemination towards participatory and people-centred approaches.

NGO and communication guidance further stresses that climate communication should be relatable, locally grounded, and connected to everyday values. The UN guidance on communicating climate change recommends using authoritative information while also making climate issues personal, local, solution-oriented, and linked to justice (United Nations, n.d.). Similarly, guidance from organisations such as Climate Outreach and the International Institute for Sustainable Development suggests that net-zero communication should avoid long technical explanations, use familiar language, and connect policy goals to tangible benefits such as health, wellbeing, community, family, cleaner air, and future generations (Barras, 2021; Climate Outreach, 2025). These principles are particularly important for audiences who may not engage with abstract policy terminology but may respond to stories, practical examples, and trusted community-based communication.

Behavioural and public engagement guidance also emphasises the need to move beyond awareness alone. The Behavioural Insights Team and Smart Energy GB argue that net-zero communication must address awareness, acceptance, access, and adoption. This includes increasing knowledge of meaningful green choices, demystifying new technologies, providing practical "how-to" guidance, signposting financial support, and building trust in institutions (Behavioural Insights Team, 2024). Such guidance is especially relevant for older adults and migrant groups, for whom barriers may include not only knowledge gaps, but also cost, language, confidence, trust, and access to appropriate support.

At the same time, standards and business-oriented guidance highlight the risk of confusion around the term "net zero". The BSI Net Zero Guidelines seek to provide a common understanding of net zero and related concepts, including transparent communication, credible claims, and consistent reporting (British Standards Institution, 2022). Although these guidelines are primarily aimed at organisations, they demonstrate a wider problem: net zero is a technical and contested concept that requires careful translation when communicated to non-specialist audiences.

Despite this growing body of policy and NGO guidance, there remains limited attention to older ethnic minority migrants as a specific audience for net-zero communication. Existing guidance tends to address the general public, consumers, citizens, organisations, or broad demographic groups (Behavioural Insights Team, 2024; Climate Outreach, 2025; OECD, 2025). It rarely considers how language barriers, migration histories, cultural values, family roles, community trust, and platform preferences shape climate understanding and participation among older migrants. This gap is important because older Chinese migrants may already practise low-carbon behaviours through thrift, reuse, moderation, and family-based care, yet these practices

may not be recognised within mainstream net-zero discourse (Hobson, 2003; Shove, 2010). Therefore, this thesis responds to a gap between existing policy guidance and the lived realities of older Chinese migrants by developing bilingual, culturally relevant, visual, and participatory approaches to climate engagement.

2.1.4 Demographic Implications of Net Zero Policies

Public attitudes towards net zero policies in the UK are strongly shaped by socio-demographic, regional, and political factors. Evidence from large-scale surveys reveals both broad support for decarbonisation measures and persistent concerns over cost, fairness, and lifestyle change.

Behavioural preferences and perceived costs

A national survey of 3,002 adults found that the most widely supported low-carbon practices were recycling and reuse (63%), improving home insulation (53%), reducing air travel (52%), and purchasing or driving an electric vehicle (52%). In contrast, reducing meat consumption received the lowest support (34%) (Sarygulov, 2020). Cost remains the dominant barrier across all groups: over half of respondents indicated they were unwilling to pay higher household electricity (52%) or heating costs (51%) to support decarbonisation.

Generational and housing differences

Age cohorts show distinct patterns of engagement. Older people (aged 55 and over) are more likely to have already adopted practical measures such as recycling or installing home insulation, whereas younger adults (18–34) express greater willingness to take up new behaviours in the future (Sarygulov, 2020). Housing tenure is also an important determinant of engagement. Homeowners are generally more likely than renters to invest in energy efficiency improvements. However, this distinction is not uniform, as financial capacity, landlord–tenant dynamics, and living arrangements (e.g., younger adults remaining in parental homes) significantly shape the ability to adopt such measures.

In particular, renters often face structural constraints such as limited control over property modifications and split incentives between landlords and tenants, which can inhibit investment in low-carbon technologies (Percy, 2024).

Regional and political variations

Geographic and political context also shape attitudes. Support tends to be stronger in large urban centres and in the South East of England, whereas Conservative or right-leaning voters are generally less receptive to pro-net-zero arguments (CAST, 2022). This divergence highlights the need for tailored communication strategies that resonate with local priorities and political identities.

Perceptions of fairness and inclusion

Perceived fairness is a further dividing line. Younger respondents are more likely to consider the net-zero policy fair, while the support rate among those aged 75 and above has dropped significantly. Even among groups concerned with climate change, doubts about distribution fairness and who will bear the costs of transition still exist. Gender differences are also quite obvious: Women have a slightly higher level of support for net-zero measures and are more susceptible to both positive and negative information. As core influencers in families and communities, mobilizing women as advocates may have a multiplier effect (Sarygulov, 2020).

Limits of short-term incentives

While financial incentives such as subsidies and rebates can generate short-term behavioural shifts, their impact often diminishes once the incentive is removed (Allcott, 2011; Bertrand et al., 2010).

Summary

Table 2.1 summarises the main socio-demographic and regional factors influencing the British public's attitude towards net zero emissions, as well as representative examples and communication impacts. According to these pieces of evidence, although public support for net zero policies is generally positive, it is fragile when it comes to personal costs or lifestyle constraints. Therefore, effective climate engagement depends on formulating policies around common interests such as health, comfort and local employment. While ensuring that measures are accessible and equitable across demographic groups.

Table 2.1 Public Attitudes Towards Net Zero Policies

Source: Author's summary based on multiple public opinion studies (e.g. BIT, Ipsos, Sarygulov, CEPR).

Public Attitudes Towards Net Zero Policies – Key Dimensions and Strategic Communication Insights (UK)

Dimension	Key Differences / Patterns	Representative Policies / Examples	Communication / Design Recommendations
Political Affiliation	Right-wing / Conservative supporters show lower overall persuasiveness from pro-net zero arguments; Labour, Lib Dems, and left-leaning voters are more receptive to supportive framing.	General trend across policies	Acknowledge concerns about cost and fairness upfront, then explain benefits. Use tailored messaging addressing left/right values.
Region Type	Urban areas and South-East England are more persuadable by supportive arguments; rural and former mining regions (Central Scotland, Northern England, South Wales) are less persuadable.	Applies to multiple policies	In "harder-to-reach" areas, emphasise local co-benefits such as jobs, air quality, and heating comfort as entry points.
Gender	Women are more persuaded by "necessary climate action" framing, but also more sensitive to cost/unfairness arguments. Women often make household food decisions – potential for multiplier effect.	EV subsidies: Women are both more supportive and more concerned about equity	For women, combine cost mitigation and fairness design (e.g. eligibility, transition periods), then highlight health and family co-benefits.
Age	On Low Traffic Neighbourhoods (LTNs), older adults (55+) are less persuaded by supportive arguments and more receptive to opposition messages (NatCen Social Research, 2023).For EV subsidies, older participants are particularly sensitive to cost objections .When it comes to meat and dairy taxes, younger people tend to be more accepting (Kmeťková et al., 2025).	LTN, EV subsidies, meat/dairy tax, gas boiler phase-out	For older groups, clearly explain financial support, disruption timeline, and available options. Provide accompaniment services. Be more direct with youth on diet.
Economic Status / Poverty	Research has shown that individuals living in the most deprived areas, as well as those with lower levels of climate engagement, tend to express significantly lower support for net-zero policies—particularly those perceived as costly or behaviourally restrictive (Ipsos & CAST, 2022).	Carbon pricing, etc.	Always announce support and cushioning measures alongside policy; use messaging focused on accessibility and convenience to reduce perceived barriers.
Urban vs Rural	Opposition messages such as "EV subsidies make petrol driving more expensive" tend to resonate more with rural communities, reflecting their reliance on petrol vehicles and concerns about limited charging infrastructure (House of Lords Environment and Climate Change Committee, 2023).	EV subsidies	Emphasise charging/travel infrastructure roll-out in rural areas to reduce concerns of being "left behind".
Education (from national polls)	Individuals with lower levels of education tend to show reduced support for high-salience climate policies. However, they are not necessarily strongly opposed; rather, they are more likely to be undecided or uncertain—suggesting untapped potential for targeted engagement strategies (Petrov, Carattini, & Bento, 2023).	Carbon taxes, fossil investment taxes, corporate disclosures	Use clearer, more visual materials to lower cognitive load; combine with pilots/ demonstrations to reduce uncertainty and improve trust.
Cross-cutting Theme	Cost arguments resonate universally—nearly all groups are persuadable by financial concerns, as shown by ISEP (2024) research.	Boiler phase-out, EV subsidies, carbon pricing	Do not avoid cost: provide clear info on subsidies, instalment options, payback periods, and stress co-benefits (health, comfort, jobs). Demonstrate effectiveness.

2.2 Climate Justice and Communication

Global and national reports increasingly stress that achieving the 1.5 °C target requires not only rapid, system-wide transitions in energy, housing, transport, food, and finance, but also that these transformations are **fair and inclusive**.

2.2.1 From Climate Action to Climate Justice

UNEP's *Emissions Gap Report 2022* calls for "fast, broad and systemic change" within this decade, highlighting that marginalised groups should not be left behind. Similarly,

the UK's *Net Zero Strategy* and the independent *Mission Zero Review* argue that technological and regulatory measures alone are insufficient. Instead, governments must collaborate with "trusted actors", for example local organisations, community networks, businesses, faith groups, and families. And ensure that citizens are empowered at everyday touchpoints (e.g. , energy bills, home retrofit decisions).

This framing reflects a broader shift from **climate action** to **climate justice**: the recognition that climate change disproportionately affects low-income and minority ethnic communities, who must be engaged not only as beneficiaries but also as co-creators of sustainable solutions. Older people's knowledge, resilience, and capacity for intergenerational leadership are likewise essential in building inclusive and climate-resilient futures.

2.2.2 Inclusive Communication in Climate Policy

The research emphasises the need for targeted and differentiated climate communication methods. Bright Blue's *Going Greener?* report (2020)shows that although the British public widely supports net-zero emissions, the views of the government, enterprises and individuals on responsibility vary. Therefore, effective communication requires audience segmentation:Policymakers respond to narratives emphasising the high costs of inaction and the necessity of a just transition.

- Businesses are motivated by early-mover advantages, innovation, and competitiveness. Citizens and communities are more receptive to narratives linking climate action to concrete everyday choices.

Toolkits from universities and communication institutes, e.g. Union (2023), recommend simplifying scientific information, balancing urgency with empowerment, and avoiding "doom narratives" that erode agency. Importantly, they advocate participatory storytelling and co-design, ensuring that affected groups, which including migrants and minority communities, act as narrative owners rather than passive audiences. Evidence shows that participatory and gamified approaches (e.g., role play, board games, scenario-based workshops) increase engagement by transforming abstract "what should be done" into the tangible "what I can do within my constraints."

2.2.3 Public Engagement and Message Framing

While scientific information is vital, communication studies caution that data alone can deepen polarisation (Hart et al., 2011). Alternative approaches, such as art, narrative, and visualization can help make abstract risks emotionally salient and personally relevant (Kidd et al., 2016; Sheppard et al., 2008; Spence et al., 2011). Visual methods

(e.g., images, maps) and participatory tools (e.g., storytelling, journey mapping, co-created scenarios) create alternative forms of "direct experience," connecting climate change to memories and everyday routines (Lammi, 2024; Venhoeven et al., 2013). Empirical evidence indicates that emphasising co-benefits (e.g. lower bills, better health) and policy effectiveness can lead to higher public support. Inclusive approaches, such as citizens' assemblies, can further enhance both public acceptance and collective efficacy (CAST, 2022). In cultural and faith contexts, Climate Outreach (G. Marshall, 2016) notes that care, stewardship and balance are resonant themes within—and can be communicated across—traditions while blame or obedience-based framings of the issue are disempowering. For climate-induced migration, they suggest that we must build collaboration with migrant-led organizations in order to challenge the "othering" and to amplify migrant voices (Outreach, 2021).

2.2.4 Digital Divide, Misinformation, and Climate Literacy

Inclusive participation is hindered by a range of structural impediments. For instance, the *Mission Zero* review highlights unequal affordability of green choices, persistent digital exclusion (7% of UK households lack fixed internet), and gaps in skills and supply chains. Together, these factors risk contributing to a low-carbon transition that disproportionately excludes older people and migrant communities (Skidmore, 2022). In this context, trusted intermediary actors play a crucial role. Community leaders, faith-based organisations and family networks are effective messengers, especially for marginalised groups. Evidence suggests that community-level demonstration initiatives, such as "Community Champions", can be effective in expanding participation and building trust (Karras et al., 2024). Over all this period policy evaluations converge on the need for a systematic public relations strategy, with special attention devoted to older people and ethnic minorities who do not often get heard in general climate discussion (Arun Kumar et al., 2024; Middlemiss et al., 2023).

2.3 Older Adults and Climate Action

Academic opinions are divided over whether to refer to ageing in definitive terms. Using labels such as "elderly", "old" and "aged", or emphasize ageing as a relative process (Andrews, 1999).

2.3.1 Rethinking Ageing: Lifespan, Generations, and Roles

Ageing is an interesting process, and it contains two aspects: the changing body and the changing cognitive abilities (Rowe & Kahn, 1997). Not only is ageing a deeply personal experience, and one experiences physical changes that no one else can understand or understand, but ageing also means changes in social relationships (Hooyman & Kiyak, 2008). Increased longevity means that, for some people, "old age" can span 30 years or more, but we do not homogenize other life-extending phases like ageing does (Biggs, 2014).

The meaning of ageing can be a symbol of wisdom and experience (Clayton, 1975) or an image of dependence and burden (Palacios et al., 2022). Despite different definitions of ageing, most societies are organised in a patterned way that corresponds to different 'phases' in our lives. In this sense, ageing is not simply a matter of bodily or cognitive change, but is also shaped by wider social attitudes towards older age, including assumptions about dependence, productivity, and social value.

Lifespan

There are several explanations from the life cycle perspective (Williams & Nussbaum, 2013):

The first perspective rejects the generally accepted notion of almost universal (cognitive, mental, physical, and social) decline with age.

The second point of view emphasises that development is multi-directional. Throughout life, individuals have potential, resources, and characteristics that should not be ignored.

The third point emphasises that longevity should not be seen as a process of continuous growth or decline. Growth and decline go hand in hand.

The fourth point of view is that there is a lot of diversity within and between individuals as they develop throughout their lifespan. These individual differences affect our interactive lives.

In sum, the life cycle perspective holds that people and their environment interact and are influenced by each other. To help understand human development, one must fully grasp the many economic, political, social, and material conditions in which development occurs.

Age groupings in the UK

The British Ministry of Health divides older people into three categories, namely: entering old age, the Transitional phase, and Frail older people. At different stages, the

government and society have different ways of caring for older people, and the care goals of the older people are also different (Health, 2001).

Entering old age: Among them, the older people whose age ranges from 50 to the state retirement age can be defined as those who have just entered old age. They usually have completed or will complete their careers, and their children are already independent. They can have a lot of time and energy to stay mentally active and live independently.

Transitional phase: Older people in the age range of 70 to 80 are defined as transitional older adults, who are experiencing the transition from a healthy and normal life to a weak physical condition. Care aims to help them to actively respond to their new physical and mental problems, to ensure that they actively and effectively respond to changes in their physical and social roles, and to prevent the emergence of emotional loneliness crisis.

Frail Older People: Older people in the frail phase will have different degrees of health problems, some of which require social care, and as time progresses, they will often experience frailty in their later years.

2.3.2 Environmental Risks and Vulnerabilities in Later Life

Challenges of ageing

While ageing, people experience more and more physical discomfort in their lives. Factors such as social and family relationships, and social roles and activities also change with age, thus the status granted may also change with age, and are increasingly challenged (Steptoe et al., 2015). Also, when people's age is emphasised, a sense of threat is created, which reduces cognitive ability, memory, and physical performance (Bennett & Gaines, 2010; Chasteen et al., 2005). In fact, later life is characterised by considerable diversity in lived experience, rather than a single, homogeneous process of decline (Rabbitt & Abson, 1991).

The challenges encountered by older people can be summarised as follows:

1) Intergenerational communication: Ageing can create barriers to intergenerational communication (Luo et al., 2021). Differences in health, attitudes, and lifestyles between younger and older groups are exaggerated by society. Although independent living is a possible option and avoids conflict with children (Gao et al., 2022), some older adults maintain the traditional view of multigenerational living.
2) Age Stereotypes: Mass media portrayals of older adults also focus primarily on vulnerable and dependent stereotypes and narratives of decline (Amundsen, 2022; Reul et al., 2022; Zhang & Liu, 2021). The high-enthusiasm, low-ability stereotype

of older adults is also reflected in a well-meaning ageist language, such as "elderspeak" (Shaw & Gordon, 2021).

3) Loneliness: Many seniors experience a sense of loss and low mood and "depression" after retirement (Carr & Fang, 2021). Loneliness exists throughout the lifespan, but increases with age due to retirement, physical changes (cognitive and physical disability), loss of peers (spouse and friends reduced socialisation), and living alone or in institutions (Cornwell & Waite, 2009b).
4) Social interaction: Ageing bodies, living alone, or limited social networks lead to an increased sense of vulnerability in the everyday social world of older adults (Colucci et al., 2022).
5) Technology: Many older adults are excluded from emerging technologies for a variety of reasons (e.g., money, skills, attitude). Older adults are less engaged in technology (Köttl et al., 2021).
6) Learning: As they age, most adults generally process less information and process information in a slower, less efficient manner (Glisky, 2007).

Lifelong learning in later life deserves more attention (Findsen & Formosa, 2012). The Active Ageing Framework (Kalache & Gatti, 2003) acknowledges that lifelong learning, like formal education and literacy, may help older learners stay healthy for some time to come (Narushima et al., 2018).

Social support and attitude change

Studies have shown that subjective well-being and subjective social status are closely related to the positive emotions and mental health of older people (Operario et al., 2004; Steptoe et al., 2015). To enable older people to engage in activities that contribute to health and life satisfaction can reduce the cost of physical and emotional illness. In the past two decades, various countries have adjusted their policies regarding the care of older people. Older people are not only recipients and caregivers of the welfare system, but also social participants and economic consumers (Gilleard & Higgs, 1996; Miller et al., 2020; Schutte, 2020).

Ageing is no longer an inevitable process of physical decline, but a life course that can maintain autonomy and independence through continuous participation (Narushima & Kawabata, 2020; Paúl et al., 2017). Current initiatives include encouraging older people of different ages to adopt a healthy lifestyle (Bernard & Phillips, 2000); helping the older people to solve health problems and loneliness problems through digital technology; facilitating older people to age in place (Francis et al., 2019; Kononova et al., 2019; Wang et al., 2019); and formulating policies and taking steps to encourage

older adults to participate in health care (Lim et al., 2020) and physical activity (Muellmann et al., 2018). In public and social media, opposing equating older people with poor health and weakness (Gilleard & Higgs, 2010).

Moreover, positive family relationships are also important for older people, especially in a transnational context. It includes helping the aged people view health care information, make health care decisions, bridge language/cultural gaps, and aid and help with transportation and finance management (Alden et al., 2018; Reckrey et al., 2020).

The climate risk for older people

As an age group, older people are particularly susceptible to the multiple dangers of a world with changing climate patterns, and prospects will only worsen as societies age further. An older population might present a variety of difficulties related to Climate Change, including: 1). greater susceptibility to natural disasters, such as illness resulting from extremes in weather. This is on top of the fact that they are less mobile due to old age (Haines et al., 2006); 2). economic difficulties, as older people may experience reduced incomes after retirement, leaving them more vulnerable to resource shortages caused by climate-related disasters (Gasper et al., 2011); and 3). Social isolation, which could be exacerbated by extreme weather and natural disasters, as older adults are often more prone to isolation (Filiberto et al., 2009).

In the UK, extreme heat events pose significant health risks to older adults, with extreme temperature events contributing to excess mortality among this vulnerable population (Arbuthnott & Hajat, 2017). Data from the Office for National Statistics (ONS, 2021) further support this, showing that older adults face disproportionately higher mortality rates during extreme climate events (Rustemeyer & Howells, 2021). In addition to these direct risks, climate-driven migration has exerted additional pressure on family and social support networks (McMichael et al., 2006), and the intersection of population ageing and climate change is expected to increase public health spending and exacerbate health and social inequalities (Paavola, 2017).

2.3.3 High-Carbon Lifestyles and Structural Barriers

High-carbon living among older people

Despite the increasing global attention to climate change, the specific challenges of balancing the needs of an ageing society with climate change mitigation remain

insufficiently addressed (O'neill et al., 2010). Research shows that the main drivers of greenhouse gas (GHG) footprint growth in most countries are the expenditure effect (rising per capita spending) and the household effect (growth in household numbers), with the latter being particularly significant in ageing societies (Zheng et al., 2022). This indicates that the demographic shift towards older populations is exerting an increasingly important influence on carbon emissions.

The literature highlights several mechanisms through which ageing contributes to higher carbon expenditure:

- **Housing and household structure**: Older adults tend to spend more time at home and are more likely to live alone in relatively large houses, resulting in higher per capita energy use (Carvalho et al., 2021; Shigetomi et al., 2014)..
- **Dietary patterns**: Older people in Western countries often consume more meat and dairy products. While red meat provides protein, it is strongly linked to chronic disease and has a disproportionately high carbon intensity (Hallström et al., 2015; O'Leary et al., 2020).
- **Transport dependency**: Older people living in suburban or rural areas often rely heavily on private cars to access services and maintain social networks, leading to increased fuel consumption (Schipper et al., 1989).
- **Consumption of manufactured goods**: Older adults' consumption patterns in the West continue to generate outsourced emissions in developing countries such as China, Russia and those in the Middle East (Bošnjaković, 2012).
- **Rigid lifestyles and time horizons**: With shorter expected lifespans, older people may discount long-term benefits and place lower priority on climate action. This can reduce their willingness to change behaviour or participate in environmental protection initiatives (Wu et al., 2021).
- **Migration and urbanisation**: Migration also influences carbon emissions. Countries with ageing populations often rely on younger migrant workers. However, migrants moving from low-carbon contexts to high-carbon societies can increase per capita carbon footprints (Zheng et al., 2022). Importantly, these changes are not limited to migrants themselves but extend to their older family members, particularly in the context of transnational families. Older adults may experience shifts in living arrangements, care expectations, and everyday consumption practices, which in turn shape their engagement with sustainability and carbon-related behaviours.

In conclusion, the lifestyle of the older people is intertwined with climate change through housing, consumption, transportation usage and social environment. Although the older population faces unique challenges in reducing emissions, they are also key

actors, and their behaviours and values will shape the path to achieving net zero emissions.

2.3.4 The Potential of Older Adults as Environmental Agents

Scholars have proposed “legacy thinking” as a valuable perspective for understanding how older people view climate change and sustainability. Legacy thinking refers to a psychological tendency to be responsible for future generations, hoping to pass on positive values or behavioural patterns (Frumkin et al., 2012). For many older people, the accumulated experience throughout their lives and their acute awareness of the long-term time scale enhance their awareness of the persistent and intergenerational impacts of global threats such as climate change (Frumkin et al., 2012).

Research suggests that this sense of legacy may inspire the older people to make lifestyle choices that help mitigate climate change, such as reducing household energy consumption, limiting high-carbon travel, and adopting more sustainable eating habits. The research emphasises that in the context of responding to climate change, the older people tend to show strong environmental concerns, usually manifested as prosocial behaviours (Cutler et al., 2021). This prosocial perspective is rooted in their altruistic tendencies and is often guided by a focus on emotionally meaningful relationships and deeper connections with family and friends (Carstensen, 1992). Their concern for future generations, driven by the consciousness of inheritance and creation, further inspires them to participate in actions that benefit others and the environment. These prosocial tendencies are reflected in behaviours such as fostering social bonds, caring for others, and providing support in close social networks (Baldassarri & Abascal, 2020; Carstensen, 1992; Dong et al., 2020).

This generational concern can extend to climate action, where older adults may adopt low-carbon behaviours like using energy-saving technologies or participating in sustainable travel options to ensure a better future for their descendants (Kaluarachchi & Jones, 2014). For instance, organisations such as "Senior Climate Action" and "Angry Grandmothers International" have highlighted the unique role that seniors play in promoting sustainability and intergenerational dialogue (Ayalon et al., 2022; Chazan & Baldwin, 2019). With the full support of policies and society, this intrinsic motivation can be utilized to further encourage the older people to participate in meaningful and influential climate actions.

2.3.5 Global Practices of Senior Environmental Engagement

More and more research and practice have shown that the older people are not passive recipients of environmental change, but can become active contributors to climate action through various initiatives. Globally, their participation takes various forms:

1) **Government and National Initiatives:** Programs such as the U.S. Senior Environmental Employment (SEE) scheme or Brazil's TAMAR sea turtle protection project provide opportunities for older adults to engage directly in environmental protection (Agency; Pegas, 2009). Civil society groups like Elders Climate Action in the U.S. or Mud on Boots in India mobilise seniors to act as advocates and knowledge holders within their communities (Action; Hui, 2024).
2) **International Networks and Alliances:** Older adults are also involved in transnational efforts, for example through the Senior Environmental Corps or The Elders, which position older leaders as voices for a just transition (Elders; Jacobs, 1994; Mitchell & Maxwell, 2010).
3) **Intergenerational Initiatives:** Many projects link older adults with youth, emphasising knowledge transfer and shared responsibility, such as Kenya's Green Belt Movement or Canada's Indigenous Climate Action (Asher & Cooper, 2025; Maathai, 2003).
4) **Local and Community Initiatives:** At the grassroots level, older adults have actively engaged in diverse environmental initiatives, including coral reef conservation in Kenya, biochar projects worldwide, and community-led educational programmes such as "RISE" in Europe and North America (Gideon, 2023; Pillemer et al., 2017).
5) **Citizen Science and Public Participation:** Technology-enabled initiatives, such as Earth Challenge 2020, provide platforms for older adults to contribute to global environmental data collection and monitoring (Network, 2020).

These examples show that the older people are already contributing to environmental sustainability in various ways. However, their full potential remains underutilized, and the support they receive in climate policies and discourse is also uneven.

2.3.6 The Untapped Potential of Older people in Climate Action

Recognising older adults solely as a vulnerable group overlooks their potential as active contributors to climate action. With the continuous growth of the global older population, policies and research are increasingly emphasising the importance of incorporating the insights and actions of the older people into climate strategies. Reports by the United Nations Department of Economic and Social Affairs (UNDESA) highlight the role of older people as key actors in addressing climate challenges (Pillemer et al., 2021a). Further studies stress the benefits and challenges of their participation in environmental activities (Pillemer et al., 2022). Targeted interventions, such as Age UK's Parliamentary Briefing: (Age UK, 2021) and the Healthy Ageing in

a Changing Climate report (Woolrych et al., 2023), advocate for inclusive, age-friendly approaches that combine community education with better access to resources. However, although government programs such as the UK's Green Home Grant aim to enhance household energy efficiency, there are still significant gaps in addressing the needs of the older people in climate adaptation and sustainable transition (Age UK, 2020).

Older adults lack a strong voice in climate discourse, and there is a shortage of communication strategies tailored to their needs (McMichael et al., 2006). Furthermore, their low participation in environmental actions and the lack of attention to their specific requirements in climate adaptation policies and technological innovations exacerbate existing social inequalities (Pillemer et al., 2021a).

2.3.7 Engaging Older People in Climate Dialogue: Challenges and Enablers

Research has shown that many older people are often willing to make significant sacrifices to ensure a healthy climate for future generations (Pillemer & Filiberto, 2017). Having lived through varied social and environmental changes, older people share a collective understanding of how to adapt to shifting circumstances. Their collective experiences can offer deeper insights into the complexity of climate issues, and older people often approach problem-solving with practicality and a focus on feasible solutions. This makes them more likely to reach a consensus and push for actionable climate policies (Steg & Vlek, 2009).

In addition, older people often have more discretionary time compared with younger generations, providing them with unique opportunities to actively participate in climate action. Their availability to engage in activism and advocacy represents an underutilised resource in the fight against climate change (Pillemer et al., 2021b). Older people can contribute meaningfully as community leaders, mentors, and activists in climate action initiatives. Their roles may include organising local environmental events, advocating for policy changes, and sharing traditional ecological knowledge with younger generations to foster intergenerational collaboration (Wethington et al., 2000). Additionally, as preservers of traditional ecological knowledge, they serve as vital conduits for passing down sustainable practices, such as composting and planting techniques, within their communities (Pillemer et al., 2021b).

However, there are notable barriers to older adults' involvement in climate change actions:

1) **Lack of inclusion:** Although their potential to contribute meaningfully to climate action, older adults are often insufficiently included in climate-related discussions

and decision-making processes. Although they are more likely to vote and many older leaders have also been involved in the formulation of climate policies, these do not necessarily reflect the different voices and needs of the older population. Social structures, such as age discrimination and hierarchical power dynamics, often marginalize the voices of the older people in policy-making and public discussions, thereby further exacerbating this lack of inclusiveness (Petriwskyj, 2018).

2) **Knowledge gaps:** Many older people feel they lack the specialised knowledge needed to contribute effectively to climate action. There is currently a shortage of accessible climate change education specifically tailored for older adults. This lack of knowledge, combined with a lack of confidence in their ability to engage with complex issues, can prevent older adults from taking action (Gutterman, 2022).
3) **Limited opportunities for participation:** Access to participation in climate action is often restricted for older adults. Many initiatives rely on online recruitment and participation, which can be difficult for older individuals who may not be as proficient in digital technology. Furthermore, many climate action activities tend to cater to younger or professional demographics, overlooking the unique needs and capabilities of older people. By combining digital resources with offline engagement opportunities, such as in-person workshops or local community events, participation can be made more accessible and inclusive for older populations (Gutterman, 2022).
4) **Lack of adaptation to older people's life stage:** Many climate initiatives are not designed with the specific needs of older people in mind. For example, older adults may face mobility issues or reading difficulties, and there are limited climate action activities that accommodate these challenges (Pillemer et al., 2021b).
5) **Systemic barriers to older adults' climate action:** Older adults face significant systemic barriers to participating in climate action, including the lack of age-friendly design in urban planning (Organization, 2007), government policies that fail to address their specific needs (Thomas & Twyman, 2005), the high costs of low-carbon technologies (Sovacool & Del Rio, 2020), and insufficient community support (Dyball et al., 2007).
6) **Intersecting barriers in climate participation:** Barriers to participation, such as knowledge gaps and limited opportunities, intersect with gender (Terry, 2009), socioeconomic status (Adger, 2010), and cultural backgrounds (Hofstede, 2011). For instance, older women from lower-income households may face compounded challenges due to restricted access to resources and societal expectations regarding

their roles. Similarly, cultural differences can shape how older adults perceive and engage with climate action.

Despite these challenges, involving older adults in climate mobilisation delivers benefits at multiple levels:

Individual level: Engagement alleviates loneliness, strengthens purpose, and improves self-esteem. It also enhances physical wellbeing through active participation (Ayalon et al., 2023; Katey & Zanu, 2024).

Community level: Older adults act as stewards of environmental knowledge and bridge generations. Their involvement strengthens community cohesion and facilitates the transmission of sustainable practices (Bals et al., 2015; Nelson et al., 2007).

Global level: With their historical awareness and long-term perspective, older adults bring essential insights to climate adaptation strategies. Their participation in climate negotiations amplifies the voices of vulnerable populations and highlights the need for climate justice (Schlosberg et al., 2017).

2.4 Migrants, Acculturation, and Climate Engagement

2.4.1 Migration and Acculturation

Migration is a broad and multi-faceted concept, encompassing various forms of movement. According to the process of movement and potential motives, mobile personnel can be classified as migrants, refugees, asylum seekers or internally displaced person (Wickramasinghe & Wimalaratana, 2016). At its simplest, migration can be defined as a change of residence across political or administrative boundaries, often termed “relocation” (Sinha, 2005). Also, migration is not merely a geographical migration; it is a complex social process shaped by structural factors, cultural background and personal motives. It not only involves cross-border actions, but also includes adaptation in new social and cultural environments, response to administrative procedures, resettlement, and consultation within local cultural norms to achieve integration into the host society (Kim, 2017).

Migration Processes and Influencing Factors

For many people, migration is not a well-planned process, and insufficient preparation often makes it more difficult for them to adapt to the new environment (Farcas & Goncalves, 2017; Saar & Nase, 2021). After entering the host country's society, immigrants will encounter challenges such as institutional differences, language barriers and cultural norms, all of which can affect their mental health and overall well-being. The cross-cultural adaptation process is generally divided into four stages: the honeymoon period, the culture shock period, the adjustment period and the adaptation

period (Sawyer & Chen, 2012). This process is usually described by the "Culture shock Curve Model" (Figure 2.2), which shows the changing trends of an individual's psychological and emotional responses during the resettlement process.

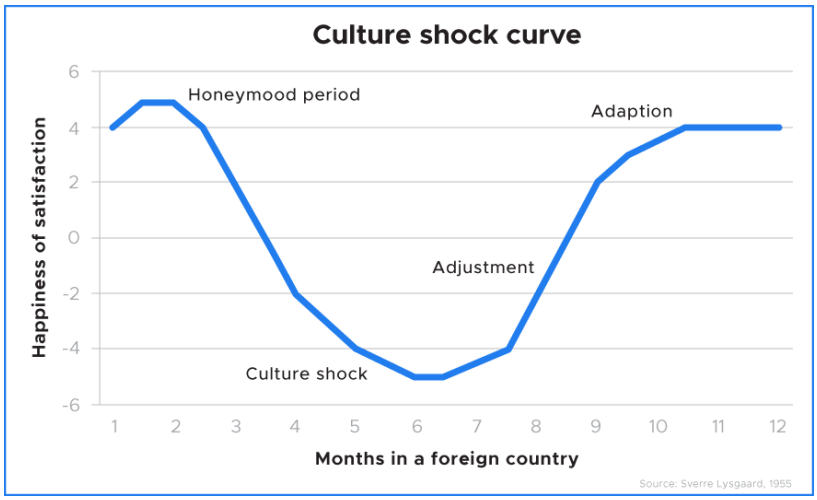


Figure 2.2 The Culture Shock Curve Model (Istrate, 2018).

Migration reasons

The main reasons for migration (Ebzeeva et al., 2018) are shown in Figure 2.3：

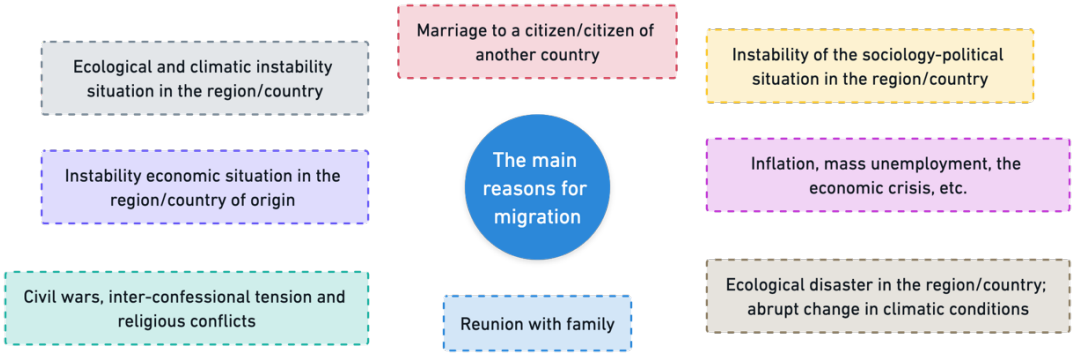


Figure 2.3 The main reason for migration (drawn by the author).

Cultural Adaptation

Migration is not a single event but a long-term and dynamic process, jointly influenced by multiple factors at the individual and social levels (Bhugra, 2004). As shown in Figure 2.4, different stages of migration are influenced by multiple interrelated variables.

In the pre-migration stage, factors such as social skills, self-concept, and existing psychological, social or physiological vulnerabilities play a crucial role in shaping an individual's resilience and adaptability. The voluntary or forced nature of transfer behaviour further influences an individual's cognition and coping methods towards subsequent challenges.

During the resettlement stage, immigrants often encounter additional stressors, including major life events, the pain of losing a loved one, the loss of familiar

relationships and social support, as well as the reduction of material resources. These experiences may cause psychological stress and emotional fluctuations, but they also mark the beginning of the cultural adaptation process - that is, the continuous negotiation and adjustment between the original culture and the social norms of the host country (Bhugra, 2004; Bhugra & Becker, 2005).

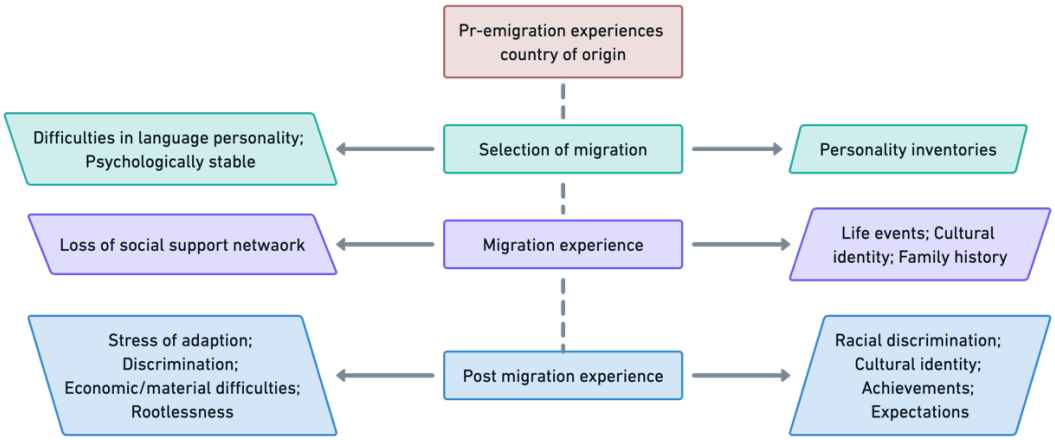


Figure 2.4 Stages of Migration & Psychopathology (drawn by the author).

2.4.2 The Context of Older Chinese Migrants in the UK

Chinese migration to the UK dates back to the early 19th century and has grown steadily over time. Since the 1990s, migration from mainland China has increased rapidly (Benton & Gomez, 2011; X. Li, 2022). More recently, China has also emerged as the world's largest source of internationally mobile students, with 1.53 million Chinese citizens studying overseas in 2019, many of them in English-speaking countries such as the UK (Atlas, 2017; Yang et al., 2022). Educational migration often paves the way for long-term or permanent settlement, indirectly contributing to later-life family reunification and the growth of older Chinese migrant populations in Britain.

In the UK, the Chinese community is far from being a homogeneous group. It is composed of multiple dialects and regional backgrounds, including Cantonese, Hakka, Mandarin, Minnan dialect and Vietnamese Mandarin, etc. The diversity of languages and regions has to some extent caused communication barriers within communities and made the process of social integration more complex, especially for older migrants, the impact is particularly prominent (Wei & Hua, 2010).

Furthermore, gender dynamics have further shaped the life experiences of migrants. The global trend of "feminization of migrants" is closely related to changes in labor division and care models (Hofmann & Buckley, 2013). In many families, Chinese older people are brought to the UK to provide support in child-rearing and household chores for cross-border families, becoming an important part of the family care network.

2.4.3 Intersectional Challenges: Loneliness, Language, and Structural Disadvantages

Older Chinese migrants, as a unique ethnic and linguistic minority group, face multiple adaptation challenges in the UK, including language and transportation barriers, cultural dislocation and psychological stress (Ip et al., 2007; Lievesley, 2010; Pan et al., 2021). Compared with their peers in China, they generally reported a higher degree of functional limitation and a lower quality of life (Mao et al., 2018).

In traditional Chinese culture, the older people are usually regarded as authoritative and respected members of the family (Pinquart & Wahl, 2021). Many older migrants in the UK still continue this care role, taking on the responsibilities of grandparents and household chores (Chen & Liu, 2012; Silverstein et al., 2006). However, intergenerational cultural differences and social distances often weaken intergenerational integration (Kwong & Yan, 2021; Pan, 2011). The differences in values between Chinese and Western cultures have further exacerbated family tensions: older people born in China tend to attach importance to economic support and intergenerational obligations, while young family members who grew up in the UK place more emphasis on emotional communication and psychological support (Giles et al., 2003; Walton & Takeuchi, 2010). This kind of intergenerational conceptual conflict is often further magnified by the cultural adaptation pressure during the migration process.

According to the 2011 UK Census data, there were approximately 393,141 Chinese residents in the UK, accounting for 4.9% of the ethnic minority population, an increase of 69% compared to 2001 (Gale & Thomas, 2020; Krausova).

Although Mandarin is the official language of China, it is not the main language of communication among many older migrants, which leads to communication barriers within the community and to some extent hinders social integration and access to services (Caidi et al., 2020). Some older migrants experienced a significant sense of loneliness after reuniting with their children in the UK. They gave up the familiar and low-cost social life in China in exchange for a relatively isolated environment in the UK, and language and economic restrictions often further exacerbated this loneliness (Victor et al., 2021).

However, their vulnerability has not received sufficient attention in mainstream policies and social services, which often view older migrants as homogeneous groups, ignoring their language diversity, mobility restrictions and digital exclusion issues (Norman et al., 2005).

In conclusion, the literature indicates that there are six interrelated factors that significantly affect the quality of life of the older migrant group, as shown in Figure 2.5.

- **Gendered Care Roles**: In transnational families, older women, especially grandmothers, usually take on the responsibilities of caring for grandchildren and managing household affairs, which to some extent reinforces the phenomenon of "migrant feminization" (Castles & Miller, 2009; Christou & Kofman, 2022). However, these care expectations often overlook the health and emotional needs they themselves face during the aging process.

- **Mental and Physical Health**: Anxiety, mobility impairments, and digital exclusion reduce autonomy and social participation (Hill et al., 2015).

- **Timing of Migration**: Compared with early migrants, older migrants face more difficulties in the process of social integration, and these difficulties are often further exacerbated by age-related physical and psychological decline (Ehsan et al., 2021; Guo et al., 2021; Weeks & Cuellar, 1983).

- **Language Proficiency**: Limited English restricts access to services, networks, and public activities, deeply undermining social inclusion (Eriksson-Backa, 2008; Kim et al., 2021).

- **Intergenerational Tensions**: Confucian values sometimes leave elders feeling marginalised, particularly when younger generations adopt Western lifestyles (Gao et al., 2021).

- **Socioeconomic Status**: Higher income enables better access to resources, health care, and networks, supporting smoother integration (Dong & Chang, 2017).

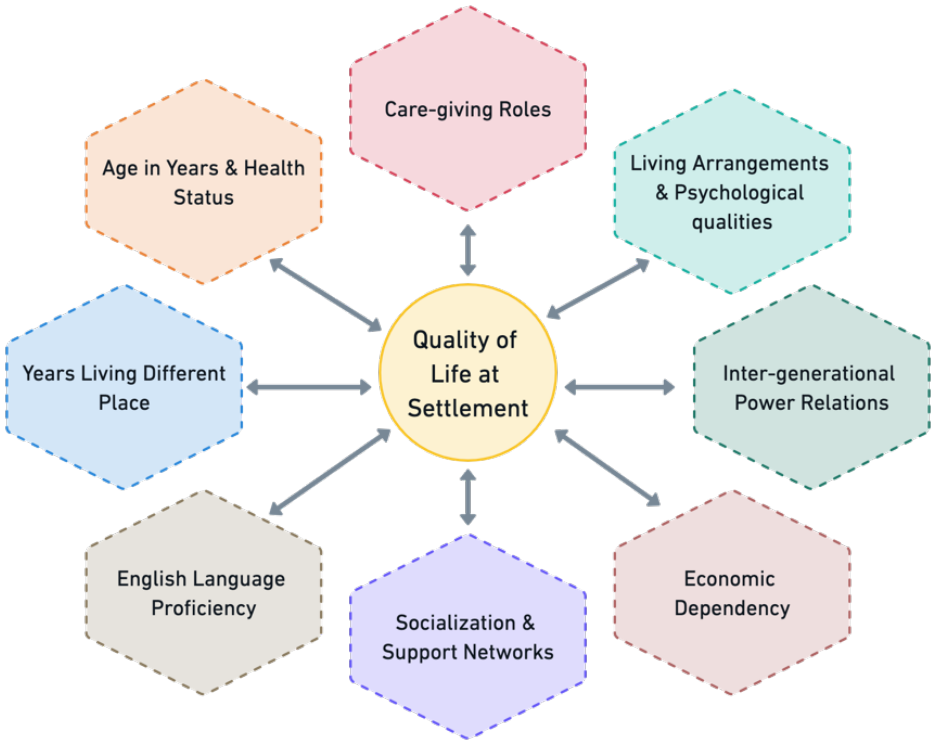


Figure 2.5 Factors influencing the quality of life of older migrants (drawn by the author).

2.4.4 Cultural Norms, Everyday Sustainability

Sustainable development is commonly understood as development that meets present needs while protecting the ability of future generations to meet their own needs (Brundtland, 1987). This concept has become one of the most urgent global challenges today, as it concerns not only environmental protection but also social equity and economic development (Doyle & Stiglitz, 2014). In recent years, ethnic minority groups have gradually been regarded as important participants in sustainable development issues. Studies show that these communities often bear a disproportionate environmental burden, but at the same time contribute unique knowledge systems and practical experiences, providing diversified solutions for sustainable development (Bullard & Wright, 2009; Magni, 2017; Rainey & Johnson, 2009). Older Chinese migrants, for example, bring with them a repertoire of low-carbon behaviours shaped by cultural values and material histories.

Low-Carbon Practices among Older Chinese Adults

Unlike the generally high carbon emission lifestyles of the older people in many Western countries, the Chinese older people usually exhibit relatively low-carbon living behaviours. These behaviours are jointly influenced by socio-economic conditions and long-established cultural traditions.:

- **Travel behaviour**

Older Chinese people mainly rely on walking, cycling and public transportation rather than private cars. Part of the reason lies in their relatively low income level and the low holding rate of driving licenses (Feng, 2017; Hu et al., 2013).

- **Dietary patterns**

  A diet mainly based on plant-based foods is very common among the older Chinese people. More than 95% of the respondents reported a relatively high intake of vegetables (Lee et al., 2017). Compared with the Western dietary pattern, older Chinese people tend to eat more rice and vegetables and less meat. This not only conforms to the concept of health but also reflects the characteristics of a low-carbon diet.

- **Frugal consumption**

  Frugality is a deeply rooted cultural principle in Chinese philosophy and daily life. Traditional ethics emphasize the restraint of material desires. Mozi once regarded frugality as an important characteristic of a moral person (Zhou, 2006). This cultural norm continues to influence Chinese seniors, who remain cautious spenders, shaped by collective memories of scarcity and austerity (Fleischer, 2010; Hanser, 2010). Many older Chinese continue to avoid waste, reuse materials, and adopt pragmatic lifestyles, contrasting with Western consumerist cultures (Chen & Bao, 2020; Liebman, 2019; Mukai, 1999).

- **Frugality as Cultural Capital**

  For older Chinese migrants, frugality is not only a living habit, but also a cultural capital deeply rooted in moral traditions, historical memories and collective identities (Boucher, 2017; Evans, 2011). In Chinese society, thrift is long linked to Confucian virtues such as moderation and responsibility (Liu, 2019; Tu, 1996). The moral ideal embodied in the idiom "thrift and frugality" still influences the behaviour and values of several generations to this day.

It is sustained by three key cultural orientations.

- **Man–nature orientation**

  Rooted in Taoist philosophy, the principle of “harmony between man and nature” emphasises that humans are part of nature and should live in accordance with natural order (Jiang et al., 2019). Taoist ideals of “inaction” (wu wei) and respect for natural processes have reinforced environmental Chinese’s awareness in everyday practices.

- **Moral responsibility**

  The traditional cosmology emphasizes the relationship of cause and effect, believing that disrupting the natural balance will lead to corresponding punishment.

This belief reinforces the notion that protecting the environment is the foundation of human survival.

- **Collectivist values**

  Collectivist culture emphasizes the binding force of group norms, thereby enhancing the willingness for pro-environmental behaviours (Mancha & Yoder, 2015). Meanwhile, Taoism and other religious traditions also advocate altruism and public participation in environmental protection (Zeng et al., 2020; Zheng et al., 2022).

Chinese migrants generally maintain energy-saving and thrifty living habits, such as reducing the use of electrical appliances or avoiding food waste. This kind of behaviour stems more from deep-seated cultural values rather than explicit environmental ideology (Liang et al., 2024; Ma, 2019; Tu, 1996; Yan, 2020). Meanwhile, social norms have further strengthened the practice of frugality, as waste is often regarded as an act of losing dignity or "losing face" (Zhang, 2012).

Cultural Memory, Scarcity, and Sustainable Practices

Frugality among older Chinese migrants reflects not only Confucian values but also lived experiences of material scarcity, particularly among those born before the 1960s who endured famine and hardship (Liang et al., 2024; Yan, 2020).

Frugality is also economically rational: many migrants manage limited financial resources while facing higher living costs in host countries.

Studies have shown that precautionary savings for healthcare and old-age security play a significant role (Blanchard & Giavazzi, 2006). Additionally, expenditures on children's education and housing impose considerable financial pressure (Kraay, 2000; Kuijs, 2005; Prasad & Chamon, 2008). Research indicates that households with children tend to save more in preparation for future costs such as marriage and home purchases (Leung & Shek, 2011).

2.4.5 Barriers to Participatory in Climate Initiatives

Older Chinese migrants face a complex set of barriers when participating in sustainability and climate initiatives. These challenges are not singular but intersect across generational, linguistic, social, and economic dimensions.

- **Intergenerational Differences in Environmental Behaviour**

Research on the intergenerational transmission of environmental behaviour shows that values and practices are passed down through both explicit teaching and everyday routines (Barr & Gilg, 2006; Hastings et al., 2007). Among Chinese migrants, the older generation usually continues a thrifty lifestyle, such as reusing items and minimizing energy consumption. The younger generation that has grown up in a globalised

environment is more influenced by formal environmental education and digital communication. Young people tend to express environmental awareness by recycling or purchasing eco-friendly products, but such behaviours often coexist with a relatively high-consumption lifestyle (Handy et al., 2021; Liang et al., 2024).

This generational difference in a family may either cause friction or create opportunities for mutual learning. The younger generation may advocate the adoption of new technologies or digital tools to achieve sustainable goals, while older family members demonstrate another form of sustainability through frugal practices deeply rooted in cultural values (Stern, 2000).

- **Language Barriers**

Language is one of the most significant obstacles. Historical education gaps left many Chinese born between the 1950s and 1970s without formal English training (Marku, 2020; Meng & Zhao, 2021). Census data show that over 22% of Chinese women above 65 in the UK cannot speak English (Statistics, 2018).

Language barriers are the primary difficulty encountered by the older Chinese migrants, leading to many communication problems (Lu et al., 2019).

Language barriers can also make navigating information and daily life difficult for transnational seniors (Caidi et al., 2020). For example, some existing tools, maps or publicity materials have different levels of understanding for older people from different backgrounds.

The language ability determines the range and type of information that older people inquire about. In a study of Chinese migrant seniors in Australia (Du et al., 2019), most Chinese seniors rely on WeChat to socialize and obtain information.

Ruiz acknowledges that language as a inequality resource (Ruiz, 1984). He suggests that providing more accessible and culturally specific language resources could help minority communities. Some service providers may not have developed the cultural understanding to assist older migrants or immigrants in a respectful manner, which may make immigrants reluctant to seek help and services (Sultana Husne Ara, 2016).

- **Limited Social Networks**

Social support networks are important for the emotional and physical health of older people (Cugmas et al., 2021). Both intimacy and relationships with those around them are linked to the mental as well as physical health of older people because they provide connection and social support (Buys et al., 2015; Gallagher, 2012; Neville et al., 2016). Age directly affects the social engagement of older adults (Cornwell & Waite, 2009a). Studies (Cornwell & Waite, 2009a; Hämmig, 2019; Miyawaki, 2015) have shown that social disconnection becomes more common with age. Migrant older adults experience social isolation to varying degrees.

- **Environmental and economic issues**

Lack of representativeness and leadership: Minority voices remain underrepresented in sustainability leadership and policymaking. Studies in the U.S. found that only 12% of staff and 4.6% of board members in environmental organisations are people of colour (Taylor, 2014). This lack of representation perpetuates top-down solutions that fail to resonate with migrant communities, sometimes even exacerbating inequalities (Lakhan, 2024).

Similarly, many public consultations or climate meetings are conducted solely in English, effectively silencing older migrants. Even when translation is provided, cultural nuances are often lost, undermining participation (Lakhan, 2024).

Difficulty in obtaining information: When sustainability promotional materials and policy announcements are only released in mainstream languages, many minority groups simply cannot understand the key information. This includes environmental pollution early warnings, resource usage guidelines, participation in project processes, etc. Proficiency in language ability determines the type and range of information sources accessed (Goodall et al., 2014). Lacking language skills may prevent older migrants from participating in local community networks.

Participation opportunities: Many public meetings and consultation activities are only conducted in mainstream languages, which directly "silences" those who do not speak that language, even if translation services are provided (Lakhan, 2024).

2.4.6 Culturally Inclusive Climate Initiatives

Everyday Environmental Behaviours of Migrants

Migrant environmental behaviours do not occur in isolation; they are shaped by both past experiences in the country of origin and the socio-political context of the host country (Mavroudi & Nagel, 2023; Schatzki, 2010). In China, discourses such as the *circular economy* and *ecological civilisation* have gained policy prominence in recent years (Lila, 2022). However, older migrants who left before these discourses emerged often rely on practical norms rooted in necessity.

In the UK, the concept of sustainable development has been promoted through a variety of institutionalized measures, including recycling schemes, housing insulation subsidies and various public climate actions (Peters et al., 2010; Revell, 2013). However, for older migrants with limited English proficiency and unfamiliarity with the bureaucratic system, these policy measures often seem distant and inaccessible. Due to language barriers and administrative complexity, many people have difficulty effectively participating in mainstream sustainable development projects and instead

rely more on ethnic community networks or individual-level coping strategies, such as reducing indoor heating to save costs (Head et al., 2021; Ma, 2019).

This divergence illustrates a broader issue: sustainability policy and migration governance often operate in silos (Fry, Zickgraf, et al., 2024). Migrants' voices are seldom included in environmental planning, which may reinforce the perception that sustainability schemes are not designed for them (Fry, Boyd, et al., 2024; Listerborn, 2007; Mah, 2023). This reflects Martinez-Alier's (2002) distinction between affluent forms of environmentalism and resource-constrained forms of environmentalism. While the former often involves ecological concern and costly technological investment, the latter emerges from thrift, necessity, and social justice. For many older Chinese migrants, sustainable practices are therefore less about explicit climate morality than about saving money, avoiding waste, and managing everyday life under constraint (Hards, 2011; Head et al., 2021).

Quiet Sustainabilities and Cultural Values

The connection between climate change and migration as well as displacement is becoming increasingly close. Contrary to the common media narrative of "large-scale southward migration", research shows that climate impacts more often lead to short-distance or domestic movements, such as post-disaster migration, temporary displacement, and even "climate standstill" phenomena - that is, people are forced to stay where they are due to resource scarcity (Sand Olsen, 2025). This perspective repositions the role of migrants, viewing them as actors who actively negotiate livelihood strategies under structural constraints rather than passive victims.

When communicating climate with immigrant groups, research and practice institutions have put forward several key principles (Outreach, 2024):

• Based on shared values - Anchor information in shared cultural or ethical values rather than being fear-oriented;

• Emphasise empathy and respect - highlight human dignity and initiative in the narrative rather than vulnerability;

• Giving Voice - Ensuring that affected groups have a say in climate policy and communication;

• Cooperative communication - Collaborating with overseas Chinese organisations and community institutions to achieve more culturally relevant communication.

Faith-based Narratives and Values-based Communication

Narratives based on values and beliefs have been proven to be highly effective in promoting broader climate engagement. Climate Outreach (2016) proposed five interfaith frameworks that can resonate among different religious and cultural groups:

1) The Earth as a precious gift entrusted to humanity;

2) Climate change is a moral challenge, especially concerning the protection of vulnerable groups;
3) Restore natural balance and maintain a harmonious relationship between humans and the environment;
4) Practice faith through a simple and anti-waste lifestyle;
5) Personal pledges framed as “I” rather than “we”.

These frameworks avoid using distant language (such as abstract "justice" or moral condemnation), but instead emphasise fairness, local influence and personal connections, thereby enhancing the emotional resonance and social relevance of climate communication. For older Chinese migrants who typically hold collectivist values and have a strong intergenerational identity, such narratives help promote intergenerational climate learning and community-based intervention practices.

2.4.7 Communication Channels in Ethnic Minority Communities

Effective climate change communication requires sensitivity to cultural contexts, lived histories, and material conditions. As Moser and Dilling argue, the framing of climate messages strongly influences acceptance, particularly among marginalised groups (Moser & Dilling, 2011a). Migrants often bring environmental knowledge and practices from their countries of origin, which shape how they perceive and respond to sustainability initiatives in host societies (Head et al., 2019; Head et al., 2021). For instance, migrants from environmentally degraded or resource-scarce regions tend to be more receptive to conservation-oriented messaging (Pfeffer & Stycos, 2002).

Linking sustainability to lived concerns

Research highlights that climate communication is more persuasive when linked to immediate, tangible concerns such as health, financial security, or community wellbeing. For older migrants in particular, framing sustainability around cost savings (e.g., energy bills), household wellbeing, and intergenerational responsibility may enhance engagement.

Trusted networks and intergenerational communication

In ethnic communities, the credibility of the messenger is as important as the message itself. Research on opinion leadership shows that trusted community figures and networks often act as intermediaries in disseminating information (Theall et al., 2015; Yang et al., 2022). Intergenerational dynamics also play a critical role: younger family members often act as “cultural brokers,” helping older relatives to interpret and apply information (Cayetano, 2020; Tyyskä, 2013). For older Chinese migrants in the UK, trusted media and social platforms such as Chinese-language television, WeChat, and local associations serve as central information channels (S. Li, 2022; Sun & Yu, 2022).

Implications for Chinese migrant communities

Taken together, this body of work suggests that climate communication strategies targeting older Chinese migrants should emphasise three dimensions:

1) **Practical framing**: messages should connect sustainability to cost savings, health benefits, and family wellbeing.

2) **Cultural adaptation**: bilingual and visually accessible materials are crucial to overcome language and literacy barriers.

3) **Relational channels**: ethnic community organisations, faith-based networks, and intergenerational family communication provide trusted pathways for message dissemination.

These insights inform this thesis's focus on **community-level interventions and co-created communication materials**, which were designed to bridge structural disconnections between climate policy and older migrant' everyday practices.

Part II Theories：

2.5 Theoretical Review

This section reviews the major theoretical frameworks used to explain environmental attitudes and low-carbon behaviours. These frameworks span individual psychology, social and cultural perspectives, and theories relevant to design, ageing and migration. Through critical comparison, this review identifies gaps in the existing literature and explains the theoretical foundation of the research. In this research, the integration of multiple theoretical perspectives is both necessary and well-considered. To understand the participation of older Chinese migrants in low-carbon living, it is necessary to go beyond the single-disciplinary explanation of their behaviours. Because behaviour is influenced by factors such as culture, migration, information reception and dissemination in the environment. By integrating insights from environmental psychology, communication studies, and inclusive design, this study constructs a multi-level framework that links the systematic structure of individual motivation, cultural adaptation, and participation.

2.5.1 Individual and Cognitive Approaches

A significant body of scholarship on pro-environmental behaviour has emerged from psychological and behavioural sciences, focusing on the individual as a rational actor whose decisions are guided by attitudes, beliefs, values, and perceived control. These frameworks have been widely employed to explain sustainable actions and provide a

strong foundation for understanding low-carbon practices. They are particularly relevant to older adults, as their behaviour is often shaped by cognitive processes and personal capacities.

Rational Choice Theory suggests that, in decision-making processes, individuals tend to choose options that maximise utility by weighing costs and benefits (Scott, 2000). In the context of environmental behaviour, this implies that individuals are more likely to adopt low-carbon practices when they perceive clear personal benefits, such as cost savings or improved health. For older people, especially those with limited income, this cost–benefit-oriented decision-making may be particularly prominent, shaping their engagement with energy use and low-carbon practices. For instance, choosing energy-saving appliances or reducing energy consumption to lower living expenses reflects a rational response to economic constraints.

However, scholars have also criticised rational choice theory for oversimplifying social behaviour, reducing complex decision-making processes to economic calculations, and ignoring the profound influence of culture, structural constraints, and emotional factors on behaviour (Burns & Roszkowska, 2016). For older Chinese migrants, these restrictions are particularly evident - language barriers, social exclusion and unfamiliarity with the host country's system may all weaken their space for "rational choice" in environmental behaviour. In addition, decision-making in this context is often located not only at the level of the individual, but also within family or household units, where environmental choices are negotiated through intergenerational relationships, shared economic resources, and everyday caregiving responsibilities.

The Theory of Planned Behaviour (TPB) (Ajzen, 1991) is among the most frequently applied models in environmental psychology. It posits that behaviour is determined by three key factors: attitudes toward the behaviour, subjective norms, and perceived behavioural control. For example, an older adult may decide to use public transportation if they view it positively (attitude), perceive that peers and family members approve (subjective norm), and feel capable of doing so (perceived control). The TPB has been shown to predict a variety of pro-environmental actions, from recycling to energy conservation (Kaiser et al., 2005). Its critics note that it overlooks habitual behaviours and structural constraints, such as infrastructure limitations, which may be particularly salient for older immigrants facing mobility challenges. Figure 2.6 shows the TPB model.

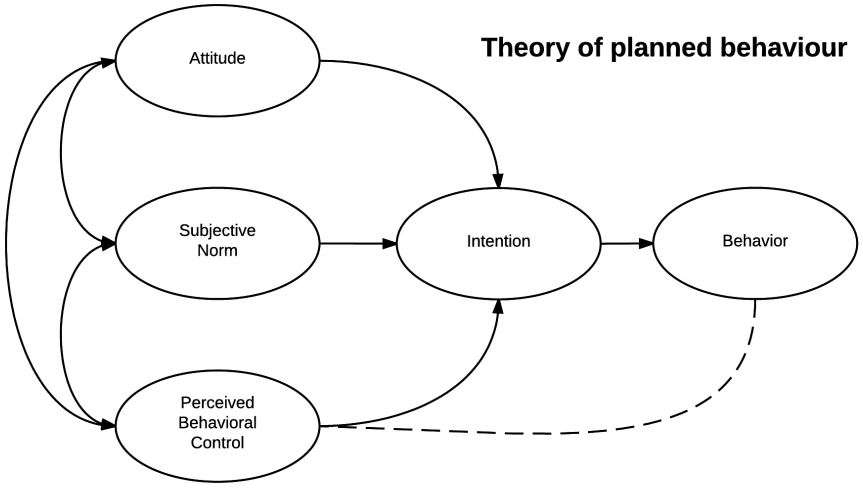


Figure 2.6 The Theory of Planned Behaviour model (Ajzen, 1991).

The Theory of Reasoned Action and knowledge-sharing research foreground subjective norms, trust, reciprocity, and shared language in shaping willingness to exchange and adopt information (Tsai et al., 2012). With credible ties and common codes, individuals are more likely to share and enact low-carbon behaviours. Among older Chinese migrants, clan networks, family chats, and Chinese-language media shape "who speaks; who is trusted; who follows."

The Value–Belief–Norm (VBN) Theory (Stern, 2000) extends beyond attitudes by incorporating moral and normative dimensions. It proposes a causal chain linking environmental values to ecological beliefs, personal responsibility, and moral obligation, ultimately motivating pro-environmental behaviour. This theory is especially pertinent to older adults, whose sense of responsibility may extend to future generations. For Chinese migrants in the UK, cultural traditions such as Confucian values of intergenerational duty and collective well-being may reinforce moral obligations to act sustainably. Yet, while VBN highlights the ethical drivers of action, it risks overemphasising values at the expense of material and structural barriers that often constrain older adults' everyday practices.

Social Cognitive Theory (SCT) (Bandura, 2001; Luszczynska & Schwarzer, 2015) provides a more relational perspective by emphasising observational learning, self-efficacy, and social reinforcement (Figure 2.7). Older people may adopt sustainable practices by observing peers, family members, or community leaders as role models. Self-efficacy is crucial in this framework. For older migrants, however, self-efficacy may be limited by unfamiliarity with new technologies (e.g., online energy platforms) or by physical health constraints. SCT highlights the motivational role of social learning,

but it has been critiqued for insufficiently addressing structural barriers such as policy frameworks or infrastructural inequalities.

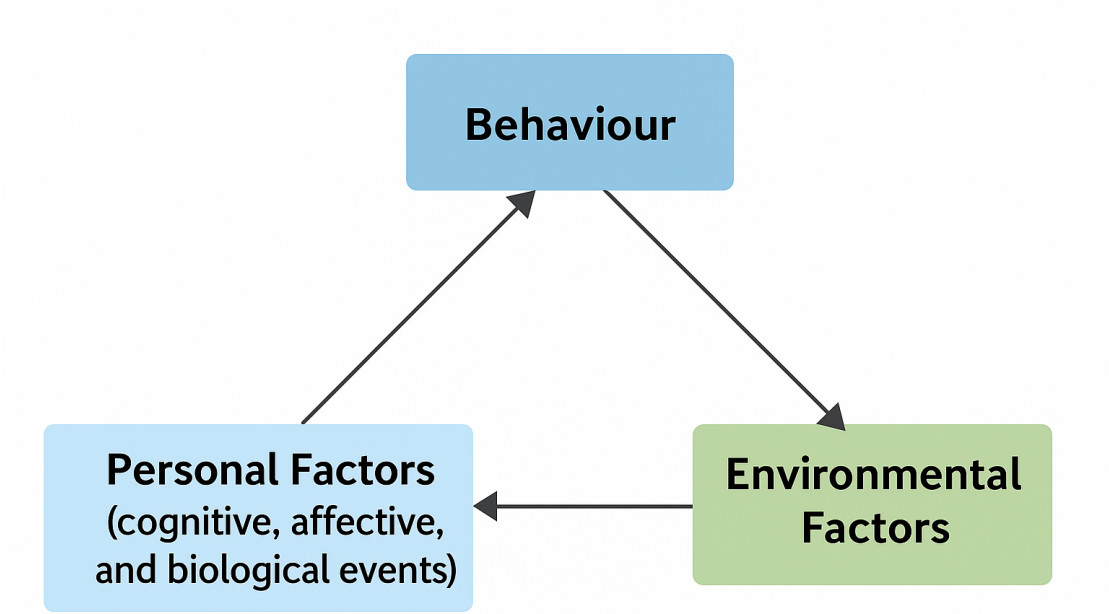


Figure 2.7 Social Cognitive Theory (SCT) (Bandura, 2001).

Finally, the **Biopsychosocial Model** (Engel, 1977) provides an integrative perspective that considers biological, psychological, and social factors as interconnected determinants of behaviour. This model is highly relevant for older populations, whose health conditions, cognitive capacities, and social supports significantly shape their actions. For instance, an older adult with mobility limitations may struggle to use active transport, but family encouragement may facilitate his participation in recycling or gardening initiatives. However, its broad scope can present challenges when seeking precise operationalisation in specific domains such as environmental behaviour.

In summary, individual and cognitive approaches illuminate how values, attitudes, beliefs, and perceived efficacy shape low-carbon behaviours. These models are particularly valuable in identifying psychological and motivational drivers and in explaining inter-individual differences. However, their explanatory power is limited when it comes to cultural traditions, habitual routines, language barriers, information channels, and broader structural constraints. In the case of older Chinese migrants, whose practices are mediated by migration trajectories, health vulnerability, and intergenerational dynamics, there models need to be complemented by socio-cultural frameworks that capture the collective, structural, and everyday contexts of behaviour.

2.5.2 Social and Cultural Approaches

While cognitive approaches emphasise the individual as a rational decision-maker, social and cultural theories argue that environmental behaviours are embedded in collective practices, institutional arrangements, and cultural worldviews. These perspectives are particularly relevant for understanding older migrants, whose behaviours are shaped not only by personal attitudes but also by family networks, community norms, and the process of cultural adaptation.

Practice Theory represents a critical departure from individualistic models such as the ABC framework (Attitude–Behaviour–Choice). Instead of assuming that attitudes drive choices, practice theorists conceptualise daily routines—such as cooking, laundry, or transportation—as the fundamental units of analysis (Reckwitz, 2002; Schatzki, 2002; Shove, 2010). Individuals are regarded as "carriers" of practices, reproducing and adapting them across time and space. For example, Chinese older migrants may continue energy-saving habits learned in China, such as reusing plastic bags or minimising food waste, not as explicit "choices" but as the reproduction of cultural practices of thriftiness. Practice theory highlights how infrastructures, technologies, and social conventions co-produce behaviour.

Socio-Technical Transitions Theory (Figure 2.8), particularly the multi-level perspective (MLP), offers a systemic account of how societal change occurs through interactions between niches (innovations), regimes (established practices and institutions), and landscapes (broader societal trends) (Geels, 2019). Applied to sustainability, it emphasises that large-scale transformations, such as the transition to a low-carbon society, cannot be achieved solely through individual action but require systemic shifts in infrastructures, markets, and governance. For older migrants, these transitions shape behavioural opportunities: the introduction of low-emission buses or renewable energy schemes may facilitate participation, while the lack of culturally accessible information may constrain engagement.

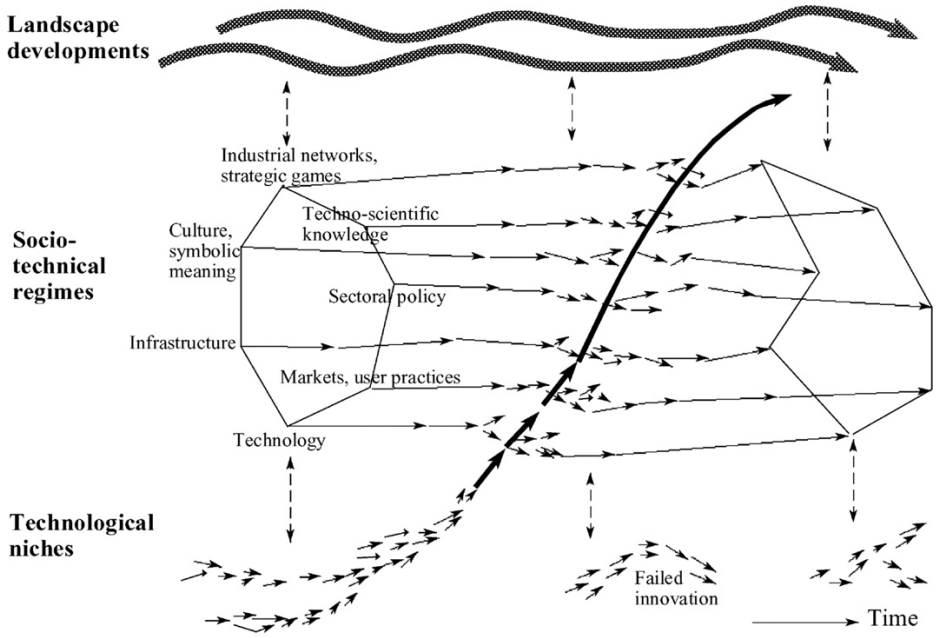


Figure 2.8 Socio-technical regimes and sustainability transitions (Lawhon & Murphy, 2012).

Social-Ecological Systems (SES) Theory draws attention to the nested layers of influence shaping behaviour, ranging from the individual to family, community, and policy contexts (Bronfenbrenner, 2013; Partelow, 2018). For older Chinese migrants, family plays a pivotal role in enabling or constraining low-carbon practices—for example, adult children may encourage recycling or assist with navigating public transport systems. Community organisations, such as Chinese associations or religious groups, may also act as intermediaries for climate communication. Figure 2.9 shows the Bronfenbrenner's Ecological Systems Theory model.

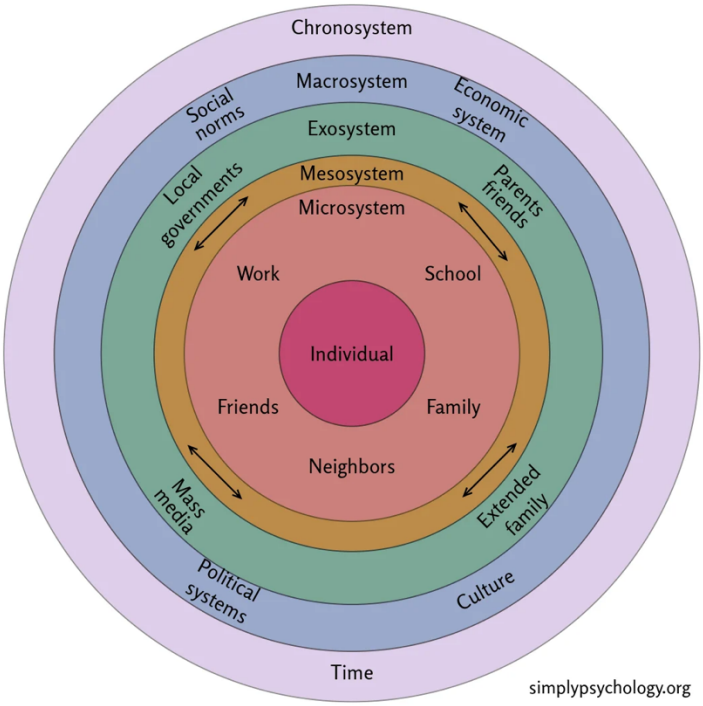


Figure 2.9 Bronfenbrenner's Ecological Systems Theory (adapted from Simply Psychology, based on Bronfenbrenner, 1979).

Cultural Theory of Risk (Douglas & Wildavsky, 1982) argues that people's perceptions of environmental risks are not neutral but shaped by cultural biases and worldviews. The theory distinguishes between hierarchical, egalitarian, individualist, and fatalist orientations, each associated with distinct attitudes toward environmental challenges. For instance, egalitarian orientations tend to produce greater concern for climate change, while fatalist orientations may lead to resignation and passivity. Among Chinese older migrants, cultural orientations such as collectivism and deference to authority may shape how risks are perceived and how responsibility for climate action is assigned, no matter individuals, families, or the state. While influential, this theory has been critiqued for oversimplifying cultural categories and underestimating hybrid or fluid identities, which are common among migrants.

Sensemaking Theory (Weick, 1995, 1999) provides a micro-level perspective on how individuals interpret complex phenomena such as climate change. Rather than assuming perceptions are fixed, sensemaking emphasises that meanings are constructed through narratives, interactions, and lived experiences. For older migrants, climate change and net-zero may be understood through intergenerational conversations, memories of environmental change in their homeland, or narratives from ethnic media. This framework is especially relevant to understanding how migrants reconcile conflicting cultural frames and make sense of global sustainability discourses in their everyday lives.

Memes theory (Figure 2.10) treats ideas, norms, styles, and behaviours as replicable cultural units that spread, mutate, and are selected through imitation and symbolic communication (Blackmore & Blackmore, 2000; Dawkins & Davis, 2017). The cycle of assimilation, retention, expression, transmission explains why certain routines (e.g., thrift, reuse) persist or are reconfigured after migration. It helps trace how low-carbon habits are preserved, re-labelled, and aligned with host-society norms across family and diasporic networks. In this research, it can help clarify the pathway from "habit" to "reframed low-carbon meaning."

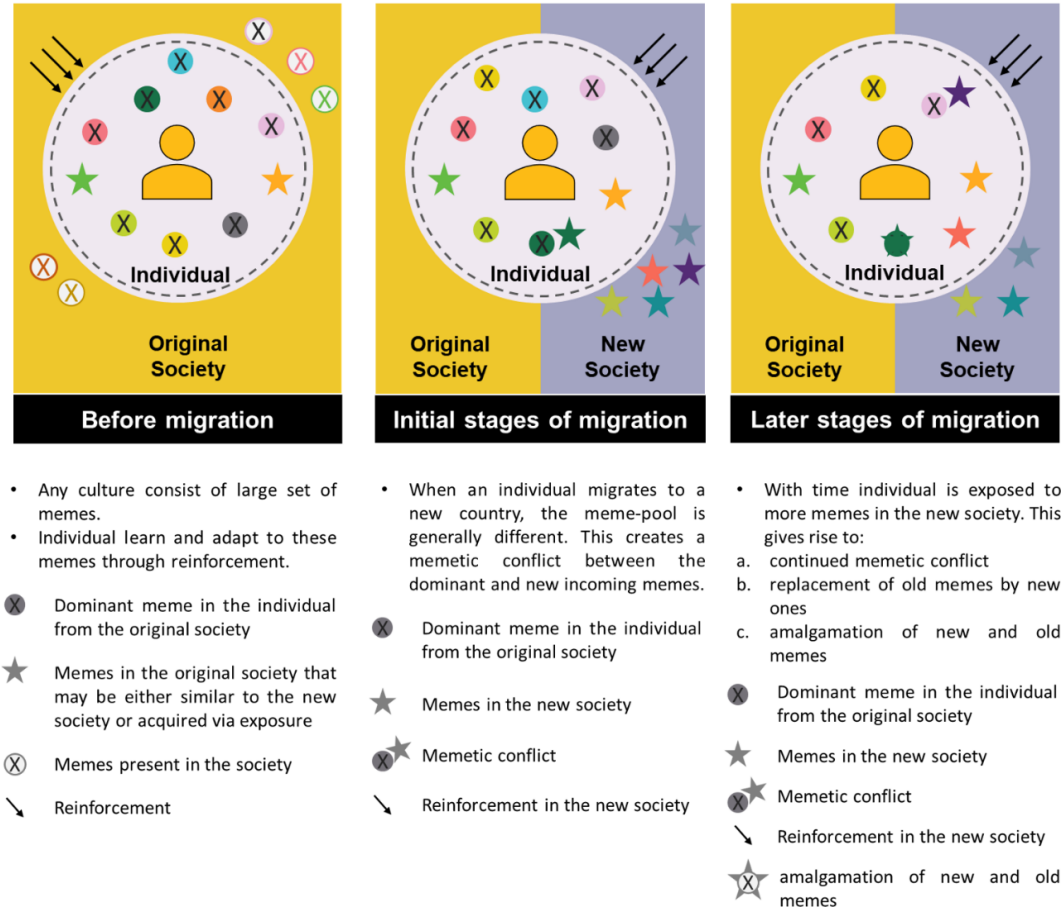


Figure 2.10 Changes in meme-pool of an individual during migration (Ramakrishnan et al., 2018).

In summary, social and cultural approaches reframe climate-related behaviours as embedded within practices, cultural worldviews, and systemic structures, rather than being reducible to individual cognition alone. These perspectives are particularly relevant for analysing older Chinese migrants, whose low-carbon practices emerge at the intersection of cultural heritage, community relations, and host-country institutions. While such frameworks provide richer and more context-sensitive accounts, they also introduce methodological challenges, as practices, meanings, and cultural identities are multifaceted and often resistant to reduction. Nevertheless, by shifting attention from

attitudes to **practices**, and from **individual choice** to **systemic** and **cultural processes**, these approaches address critical blind spots in psychological models and offer essential conceptual models for this research.

That said, these approaches still do not fully capture the differentiated capacities, vulnerabilities, and adaptive challenges shaped by ageing and migration. The following section therefore turns to ageing and migration frameworks to address these gaps.

2.5.3 Ageing and Migration Frameworks

Older migrants encounter distinctive circumstances in relation to climate change and sustainability: their practices are shaped not only by individual values and cultural traditions but also by health conditions, life-course trajectories, and processes of social integration. The following perspectives illuminate these dimensions and provide valuable insights into the lived realities of older Chinese migrants.

The Active Ageing Framework (Kalache & Gatti, 2003) advances a positive view of ageing by emphasising participation, independence, and social engagement. Rather than portraying older adults as passive or dependent, it highlights their potential as active contributors to society. Applied to sustainability, this framework suggests that older adults can advance low-carbon practices through volunteering, knowledge-sharing, and intergenerational engagement. For older Chinese migrants, such contributions may be expressed through family-oriented roles, such as guiding grandchildren towards environmentally responsible habits, or through involvement in ethnic associations. However, critics observe that the framework often assumes equal opportunities for participation, thereby neglecting barriers of poverty, discrimination, or language that disproportionately affect migrant elders.

The **Lifecourse Perspective** (Elder Jr, 1998) emphasises how earlier experiences and socio-historical contexts shape present-day behaviours. For older Chinese migrants, formative experiences in China, such as living through periods of material scarcity, practising frugality, or witnessing rapid industrialization, may profoundly influence their current environmental attitudes. These life histories can manifest in behaviours such as conserving resources, reusing materials, or valuing collective well-being. The lifecourse approach also underscores intergenerational dynamics: older adults often frame their climate responsibility in terms of leaving a legacy for their children and grandchildren. While this perspective offers critical insight into continuity and change, it poses methodological challenges, as capturing the complexity of life histories often requires longitudinal research.

Acculturation Theory (Berry, 2005; Berry & Sam, 1997) in Figure 2.11 provides a widely used framework for analysing how migrants adapt to new cultural environments.

It identifies four strategies: assimilation (adopting the host culture), separation (maintaining heritage culture), integration (combining both), and marginalisation (rejecting both). These strategies significantly shape how migrants engage with sustainability discourses. For instance, older Chinese migrants adopting an integration strategy may combine British recycling norms with traditional Chinese practices of thrift, whereas those pursuing separation may maintain environmentally relevant behaviours rooted in their heritage, such as minimising waste, while disengaging from host-country discourses of net zero. Acculturation theory is particularly useful for linking cultural adaptation to low-carbon practices, but it may not fully capture the fluid and negotiated nature of cultural identities across time and generations.

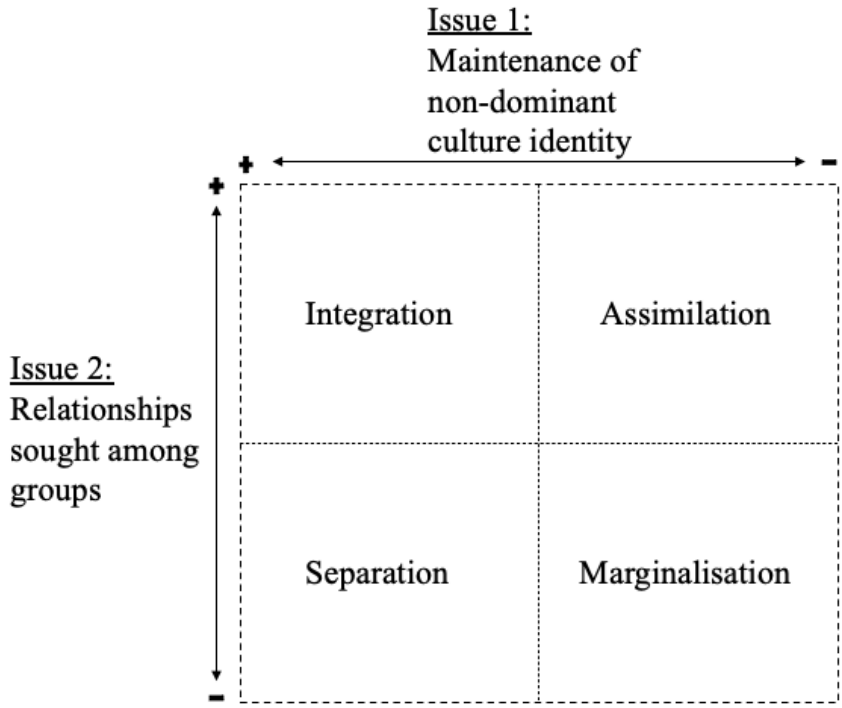


Figure 2.11 Berry's model of acculturation (1997).

Cultural Intelligence (CQ) Figure 2.12 operationalises cross-cultural adaptation via four capabilities, drive, knowledge, strategy (metacognition), and action (Kurpis & Hunter, 2017; Van Dyne et al., 2010). It explains how people anticipate, monitor, and adjust verbal/non-verbal behaviour to enhance effectiveness. For older Chinese migrants, CQ clarifies differential engagement with recycling schemes, energy subsidies, public transport, and digital services. In this research, CQ illuminates variation in participation and the learn–transfer–apply pathway beyond value/attitude

models. Its limitation is the tendency to underplay structural constraints such as language access, and policy hurdles.

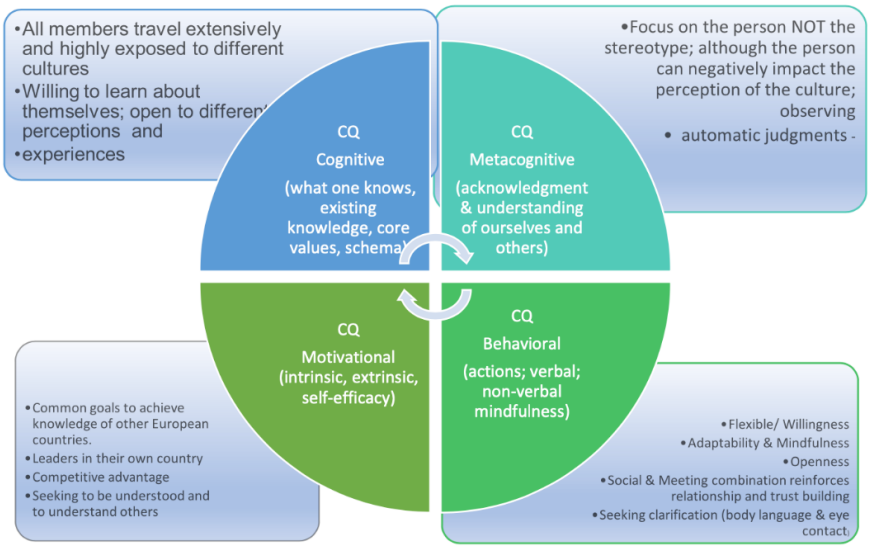


Figure 2.12 Schematic model of cultural quotient (Kurpis & Hunter, 2017).

Resilience Theory posits that individuals maintain, recover, or even grow under adversity by mobilising internal and external protective factors such as self-esteem, coping, and social support (Rutter, 2006; Seiler & Jenewein, 2019). Its mechanism emphasises the dynamic alignment of risk, resources, and adaptive outcomes (Tam et al., 2020; Tusaie & Dyer, 2004). For older Chinese migrants, compounded pressures from ageing and migration make resilience a key lens to explain how low-carbon practices are sustained or reshaped under constraints. In this study, resilience helps account for how participants draw on frugality, family reciprocity, and community support to continue energy-saving and waste-avoidance routines, and why adaptation varies across individuals.

The **Theory of Language Barriers (TLB)** decomposes migrant communication challenges into interactional obstacles, unequal information diffusion, acceptance barriers, and performance barriers, linking psycholinguistic features to social stratification (Croucher & Kramer, 2017). It shows how terminology, accent, literacy, and institutional language impede access from exposure to comprehension to action. For older Chinese migrants, TLB is central to explaining difficulties in understanding net zero discourses and accessing schemes (e.g., recycling, energy support). In this study, it justifies visual and bilingual tools (e.g., cards, images, videos) as accessibility measures.

In summary, the ageing and migration frameworks discussed above highlight the diverse social, cultural, and structural conditions that shape the everyday lives of older

Chinese migrants. They draw attention to the legacies of life-course experiences, the negotiation of cultural adaptation, and the barriers of language, health, and inequality. Yet, while these perspectives provide essential context, they do not fully explain how individuals and communities shift their practices in response to climate imperatives. Behaviour changes theories help provide a fuller picture.

2.5.4 Behaviour Change

The Behaviour Change Wheel (BCW) (Figure 2.13) integrates behaviour sources, intervention functions, and policy categories to guide intervention design and strategy mapping (Michie et al., 2011). It systematically links identified barriers/enablers to functions such as education, persuasion, training, environmental restructuring, incentivisation, and modelling.

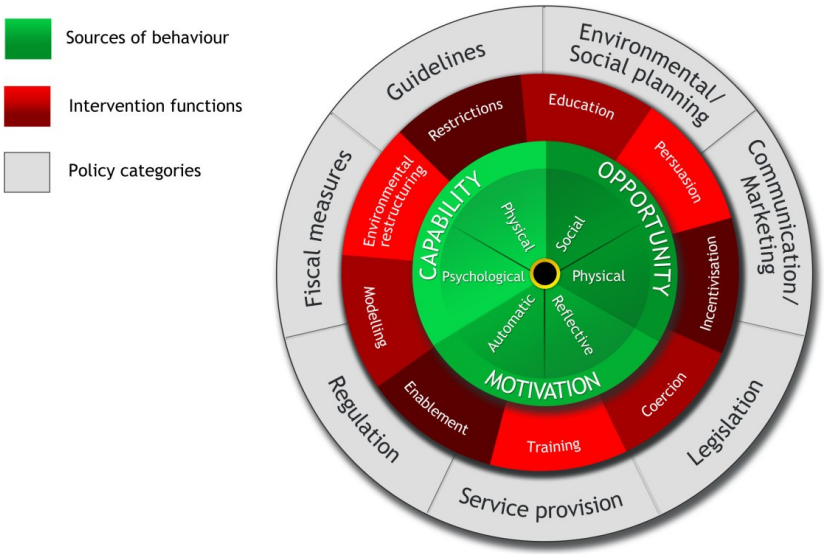


Figure 2.13 The Behaviour Change Wheel (Michie et al., 2011).

2.5.4.1 Behaviour Change for Net Zero

Human behaviour in the context of net-zero transitions is shaped by both internal and external factors (Akenji & Bengtsson, 2014).

- **Influencing Internal and External Variables**

Internal variables: These are individual-level psychological factors, including knowledge, attitudes, values, emotional states, perceived self-efficacy, and habitual patterns. These variables are dynamic and shaped by age, life stage, and personal histories.

External variables: These refer to the socio-cultural, infrastructural, economic, and policy environments that enable or constrain behaviour. Examples include access to

information, cultural norms, local infrastructure, financial incentives, and institutional frameworks (Wang, Shen et al. 2021).

In addition, **demographic variables**, such as age, gender, education, and personality, mediate how individuals respond to both internal motivations and external constraints (Wang, Shen et al. 2021). For example, gender, age, education level, personality, etc.

Behavioural change towards lower carbon living can be supported by strengthening both internal capacities (e.g., education, moral values) and external conditions (e.g., supportive policies, social institutions, norm shifts) (Vasseur et al., 2019). In addition, People's behaviour is influenced by emotional factors rather than from cognitive or conscious deliberation (Koole & Rothermund, 2011; Zhu & Thagard, 2002). Human behaviour derives from social, moral and altruistic motives in addition to self-interest (Khalil, 1990).

- **Behavioural Change Among Migrant Groups**

Migrant individuals live in dynamic social contexts, where behaviour is constantly co-constructed through social interaction (Burke et al., 2009).

1) **Information intervention:** The right information will lead to appropriate and responsible environmental behaviour (Barr, 2003). Information can be an important first step in motivating people to change their behaviour. However, it is not possible for information alone to motivate people to change as a matter of course. Information is also unlikely to lead to sustained behavioural change after a particular activity has been completed, as enthusiasm for a "new" behaviour or action tends to diminish and engagement declines in the absence of sustained reinforcement (Moloney et al., 2010).
2) **Social construction:** During the migration process, new information constantly affects the migrant and it touches all aspects of life, such as consumption patterns, eating habits, thought patterns, language (Zachrison, 2014). This information comes from society and life and starts to influence from outside to inside.
3) **Individual Differences:** The degree to which migrants adopt new behaviours depends on personal resilience, migration history, and exposure time (Cassarino, 2004).
4) **Habits and Disruption:** Many low-carbon behaviours are deeply habitual and resistant to change (Brette et al., 2014; Gardner, 2015). Habits are an important barrier to lifestyle change as they fix individual behaviours and maintain their automatic repetition over time (Brette et al., 2014). Disruptions such as those triggered by crises like COVID-19 which can open windows for rapid lifestyle

change (Kikstra et al., 2021; Verplanken & Wood, 2006).

- **Strategies for Low-Carbon Behaviour Change**

In high-income countries like the UK, achieving net zero requires individuals to make tangible changes in daily life, particularly regarding home energy, transportation, and diet (Stern & Valero, 2021).

The Avoid–Shift–Improve Framework (Capstick et al., 2020) suggests these categories of strategies for low-carbon behaviour change.

(i) The **avoidance** category refers to reducing energy or carbon demand by foregoing certain aspects of consumption. (e.g. reduce travel, reduce appliances).

(ii) The **shifting** category includes behavioural shifts towards less carbon-intensive consumption patterns (e.g. choosing walking, cycling or public transport over private vehicles; plant-based diets).

(iii) The **improvement** category refers to reducing greenhouse gas emissions by improving efficiency or replacing technology with low-carbon technologies without changing basic consumption activities; this category includes improving vehicle efficiency and switching to battery electric vehicles (BEVs), efficient household appliances, renewable energy for the home and consumption of organically grown food.

Low carbon behaviour change can also be divided into three areas: transport/mobility, housing and food (Carmichael, 2019).

2.6 Critical Synthesis and Research Gaps

To synthesise the diverse theoretical perspectives reviewed, the author proposes an integrated framework for understanding low-carbon behaviour among older migrants (Figure 2.14). The framework brings together insights from three interrelated levels of analysis. At the **individual and cognitive level**, theories such as Rational Choice, the Theory of Planned Behaviour (TPB), the Value - Belief - Norm (VBN) framework, Social Cognitive Theory (SCT), and the Biopsychosocial model highlight the psychological and motivational drivers of pro-environmental action. These are situated within **social and cultural practices and systems**, including Practice Theory, Socio-Technical Transitions, Social-Ecological Systems (SES), Cultural Theory of Risk, and Sensemaking Theory, which reframe behaviour as embedded in everyday routines, infrastructures, and shared meanings. Both layers are further contextualised by **ageing**

and migration frameworks, including Active Ageing, the Lifecourse Perspective, Acculturation Theory with Cultural Intelligence (CQ), Intersectionality, Resilience Theory, and the Theory of Language Barriers (TLB), which draw attention to how ageing processes and migration experiences shape capacities, vulnerabilities, and opportunities for engagement with sustainability.

The framework also recognises the powerful influence of policy and media discourses, particularly the role of language and framing, in shaping perceptions and opportunities across all levels. Finally, it maps these theoretical insights to intervention design through the Behaviour Change Wheel (BCW), which operationalises nine intervention functions as a methodological tool for translating theory into practice. By integrating cognitive, cultural, and ageing–migration dimensions, this framework (Figure 2.14) provides a multi-level foundation for analysing how older Chinese migrants navigate and enact low-carbon behaviours within the UK context.

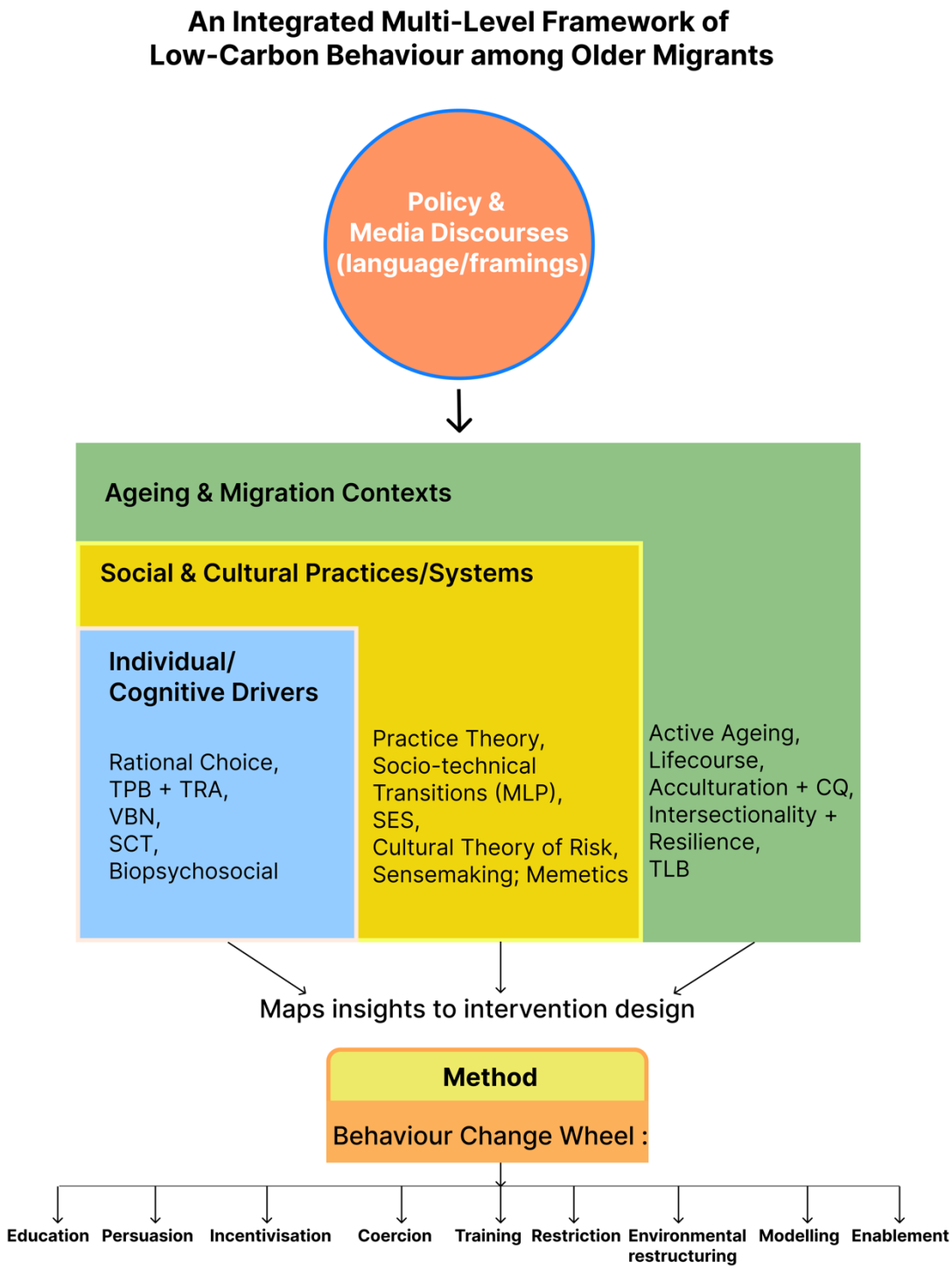


Figure 2.14 An integrated multi-level framework for understanding low-carbon behaviour among older migrants.

Policy and media discourses shape all levels through language and framing, while insights are mapped to intervention design via the Behaviour Change Wheel (its nine functions). *Source: Author's own compilation.*

2.7 Summary

This chapter has traced the intersection of net zero policies, climate justice, ageing, migration, and behaviour change, highlighting their relevance for understanding sustainability among older Chinese migrants in the UK. The review shows that while policy and communication studies emphasise systemic transformation and inclusive engagement, they often underrepresent older and minority populations. Research on ageing and migration demonstrates how cultural traditions, life-course experiences, and structural barriers shape everyday practices, yet these insights are rarely connected to climate discourses. Meanwhile, behavioural theories provide useful psychological explanations but insufficiently account for cultural and structural contexts.

To address these limitations, this chapter presents a comprehensive multi-level model (Figure 2.14) to analyze low-carbon behaviours.

Chapter 3: Research Methodology

This chapter presents the methodological architecture of the thesis, structured around Design Research Methodology (DRM) (Blessing & Chakrabarti, 2009). The programme comprises seven interlinked studies (A–G) distributed across the four DRM phases: Research Clarification (RC), Descriptive Study I (DS I), Prescriptive Study (PS), and Descriptive Study II (DS II). Additionally, each study specifies the purpose and research questions, design and sampling, procedures for data collection and analysis, as well as contributions to subsequent stages.

3.1 Introduction

A research paradigm consists of ontology, epistemology, and research methodology; ontology and epistemology constitute research philosophy, and the combination of research philosophy and research method constitutes a research paradigm. Among them, ontology is used to explain reality, epistemology is used to clarify how we know it, and methodology is used to guide the researcher to discover it.

Researcher positionality. As a bilingual design researcher with access to Chinese community networks, I occupy both insider and practitioner roles. To mitigate bias and power asymmetries, I used member-checking in community events, peer debriefings with non-Chinese colleagues, and bilingual transcript review (back-translation for key excerpts).

Each research paradigm can span philosophical perspectives, methodological approaches, research design, and specific research methods (Weil, 2017). At the initial stage of research, the philosophical epistemological perspective is usually determined first, and then the methodological approach is determined based on the philosophical perspective.

Applying philosophical practice to design research helps clarify the researcher's theoretical framework (Crossan, 2003). Elements like philosophy and epistemology largely determine the methodological structure, choice of research methods, and the researcher's institution, giving shape and precision to the whole act (Žukauskas et al., 2018). Philosophical/epistemological perspectives include positivism (Alakwe, 2017), constructivism (Denzin, 2008), interpretivism(Weber, 2004), subjectivism (Diesing, 1966), transformative (Mertens, 2007), and pragmatism (Bacon, 2012).

This research adopts a **constructivist** paradigm with a **pragmatic** orientation for intervention design. Knowledge is understood as co-constructed through participants' experiences of ageing and migration; pragmatism guides the selection of methods capable of producing actionable insights for design and policy.

Figure 3.1 outlines each paradigm in more detail. Each philosophical paradigm corresponds to a different ontology and epistemology; different theoretical viewpoints, and methodologies and methods. Each research project would have a separate research paradigm and hence a different theoretical perspective (Patel, 2015).

Paradigm	Ontology What is reality?	Epistemology How can I know reality?	Theoretical Which approach do you use to know something?	Methodology How do you go about finding out?	Method What tools do you use to find out?
Positivism	There is a single reality or truth	Reality can be measured and hence the focus is on reliable and valid tools to abtain that	Positivism Post-positivism	Experimental research Survey research	Usually quantitative: Sampling Measurement and scaling Statistical analysis Questionnaire Focus group Intervies
Constructivist Interpretive	There is no single reality or truth. Reality is created by individuals in groups (less realist)	Therefore, reality needs to be interpreted. It is used to discover the underlying meaning of events and activities	Interpretivism 1. Phenomenology 2.Symbolic Interactionism 3.Hermeneutics Critical Inquiry Feminism	Ethnography Grounded Theory Phenomenological research Heuristic inquiry Action Research Discourse Analysis Feminist Standpoint research	Usually qualitative: Qualitative interview Observation Participant Non participant Case study Life history Narrative Theme Identification
Pragmatism	Reality is constantly renegotiated, interpreted in light of its usefulness in new unpredictable situations	The best method in one that solves problem. Finding out is the means, change is the underlying aim	Deweyan pragmatism Research through design	Mixed methods Design-based research Action research	Combination of any of the above and more, such as data-mining expert review, usability testing, physical prototype
Subjectivism	Reality is what we perceive to be real	All knowledge is purely a matter of perspective	Postmodernism Structuralism Post-structuralism	Discourse theory Archaeology Genealogy Deconstruction	Auto ethnography Semiotics Literary analysis Pastiche Intertextuality
Criticalism	Realities are socially constructed entities that are under constant internal influence	Reality and knowledge is both socially constructed and influenced by power relations from within society	Marxism Queer theory Feminism	Critical discourse analysis Critical ethnography Action research Ideology critique	Ideological review Civil actions Open-ended interviews Focus group Open-ended questionnaires Open-ended observation Journals

Figure 3.1 Research paradigms adapt from (Patel, 2015).

This research is grounded in the **constructivist paradigm**, as it seeks to understand how older Chinese migrants in the UK perceive, interpret, and engage with low-carbon

behaviours within their social and cultural contexts. Constructivism posits that knowledge is not passively received but actively constructed through experiences, interactions, and interpretations of the world. In this study, the participants' understanding of climate change, low-carbon practices, and active ageing is shaped by their personal histories, migration experiences, and social networks. Rather than assuming an objective, universal approach to low-carbon behaviours, this research acknowledges that environmental engagement is context-dependent, influenced by language barriers, cultural identity, generational shifts, and access to information. The study does not seek to establish a single "truth" about older migrants' climate awareness but instead co-constructs knowledge through qualitative inquiry, participatory methods, and iterative design interventions.

By employing co-design workshops, thematic analysis, and real-world design evaluations, this research aligns with constructivism by engaging participants as active contributors, rather than passive subjects.

The findings are therefore interpretative rather than deterministic, aiming to uncover how older Chinese migrants make sense of and adapt to climate-related challenges in ways that are meaningful within their lived realities.

3.2 Qualitative & quantitative research

This research adopted both qualitative and quantitative methods. The comparison of the two types of research is shown in Table 3.1.

Table 3.1 The comparison of qualitative and quantitative research.

	Qualitative research	**Quantitative research**
Definition	To define the specific properties and characteristics of things or objects of study. The study was not required to be statistically significant, but placed more emphasis on experience and description (Merriam, 2002).	Analyse the numerical value or quantity of the research object to prove the research theory from the data level. Its purpose is to answer the attributes of things and their quantities (Bhasin, 2020).
Worldview	Subjective	Objective
Sampling	Purposeful	Random
Presentation	Text	Data or charts

Data collection methods	e.g., Interviews, focus groups, case studies, observations, literature analysis	e.g., Questionnaires, secondary data, experimental methods
	Mixed research	
Definition	The combination of qualitative and quantitative research methods, involving triangular correction, embedded, interpretive, and experimental designs (Mayring, 2014).	

This research comprises seven interconnected studies (Studies A–G). Table 3.2 gives an overview.

Table 3.2 Summary of Research Types.

Study	Research Type	Summary
Study A	Mixed-methods (Quantitative & Qualitative)	This study investigated the current low-carbon practices, perceptions of net zero, and information barriers experienced by older Chinese migrants. Data were collected through surveys providing quantitative insights, complemented by qualitative interviews to explore the participants' personal experiences and deeper attitudes toward net zero concepts.
Study B	Qualitative	This study utilised walking interviews to delve deeply into the cultural motivations and personal experiences of older Chinese migrants concerning low-carbon lifestyles. The qualitative approach allowed an in-depth exploration of underlying cultural factors and adaptation issues that influence the participants' environmental behaviours.
Study C	Qualitative	Co-design workshops were conducted to engage older Chinese migrants in exploring their daily routines, social roles, informational interests, and preferences regarding communication forms. This qualitative approach gathered rich participant-generated insights through discussions, observations, and creative interactions to inform subsequent design interventions.
Study D	Qualitative	This study involved interviews with local British seniors to understand their perceptions, practices regarding net zero, and recommendations for older Chinese migrants. The participants provided qualitative insights into broader societal contexts, including policies and corporate roles in achieving net zero,

		expanding the research perspective beyond initial individual-level concerns.
Study E	Qualitative	Designer workshops brought together professional designers to collaboratively generate ideas and strategies for effective climate interventions. This study focused on capturing expert suggestions, creative insights, and practical recommendations for designing culturally relevant interventions tailored to older migrants.
Study F	Qualitative (Research-through-Design)	This study focused on developing a practical climate action toolkit and an accompanying policy brief based on insights from earlier studies. The research-through-design approach emphasised iterative prototyping and qualitative design reasoning, integrating theory and practice to create tangible educational tools and the policy brief.
Study G	Mixed-methods (Quantitative & Qualitative)	The final study evaluated the effectiveness of the climate toolkit through mixed methods, including qualitative observations and workshop discussions, as well as quantitative questionnaires. Participants consisted of older Chinese migrants and younger design professionals who provided comprehensive feedback, insights, and practical suggestions for further improvements.

3.3 Research Design

Research design is the framework and process for deciding how data will be collected and analysed (McCombes, 2021). It is the process of collecting, analysing, and interpreting data and insights to inspire, guide, and provide design context. It often applies quantitative and qualitative research methods to help make informed design decisions.

3.3.1 Justification of the Chosen Methodology

There are many design research methodologies. This section lists a few of them and discusses the reasons for choosing the Design Research Methodology (DRM) in terms of definition, contribution, output, evaluation, and field of use. See Table 3.3.

Table 3.3 Comparison of different methodologies.

	Definition	Output	Evaluation	Domain of use
Design Research Methodology (DRM)	DRM helps researchers identify research challenges and select appropriate methods to address them (Blessing & Chakrabarti, 2009).	A form of "support" to improve practice, including strategies, methods, procedures, tools, guidelines, etc.	Includes an evaluation phase to verify whether the "support" improves design outcomes.	e.g., Design Ephemeral Design
Action Research (AR)	A method from social sciences that combines action and reflection to solve real-world problems while generating knowledge. Action research includes four stages: plan, act, observe, and reflect (Coghlan, 2011).	Improve existing systems, programs, products, or procedures	Trial-and-error cycles support ongoing reflection and refinement (Dick, 2014) .	e.g., Education Social Science
Grounded Theory (GT)	A systems approach, mainly applied by social scientists to qualitative research. This approach involves constructing hypotheses and theories by collecting and analysing data. The advantage of this methodology is that it facilitates the exploration of new phenomena and focuses on the discovery of common experiences with participants. The downside is that it usually generates a lot of data that is difficult for researchers to manage and interpret (Khan, 2014).	Core categories, theoretical frameworks, or conceptual models grounded in empirical data.	Not focused on evaluation of an intervention.	e.g., Social processes, relational dynamics
Design Science Research (DSR)	The invention of a new purposeful artifact to solve a general type of problem." Its main goal is to develop knowledge that professionals can use to provide design solutions to	Validated design artifacts and actionable knowledge.	Validate hypotheses, evaluate solutions, and compare goals using artifacts	e.g., Information Systems, Computer Science, Service Design

	problems in their field (Venable et al., 2012).		with actual observed results; Validate research and promote other applications.	

The reason for choosing the Design Research Methodology (DRM) is because it was specifically designed for design research and proved effective by many design researchers. It provides a systematic framework to plan all studies and link them to the research clarification. Also, the Design Research Methodology shows many advantages : it helps the researcher to understand the phenomenon and find out the key issues; it leads the researcher to design and develop support to address the issues in the desired situation; the evaluation phase helps refine the design and provides insights for future research.

3.4 The DRM Methodology

Professors Blessing and Chakrabarti provide types of design studies associated with appropriate research methods (Blessing & Chakrabarti, 2009) in their book on Design Research Methodology (DRM). DRM primarily aims to help researchers identify research areas and projects and select appropriate research methods to address these issues. The full version of this methodology consists of four stages (Figure 3.2).

- **Research Clarification:** The researcher's task at this stage is to identify their research objectives and develop measures and measurable criteria for success. The work that researchers can do at this stage includes literature reviews, desktop research, and secondary data.
- **Descriptive StudyI:** Following a literature review, researchers increased their understanding of the factors that could be measured. This provides the basis for improved design. Researchers often begin to collect relevant data to provide more details for evaluating the design's support for development.
- **Prescriptive Study:** The task at this stage is to develop a “support”, which can be a model or theory. This model helps to explain and predict phenomena of interest.
- **Descriptive Study II:** Different types of evaluation methods can be used to evaluate the “support” of the development at this stage. Researchers need to

evaluate whether the design support meets the actual needs and solves the problems it is supposed to solve.

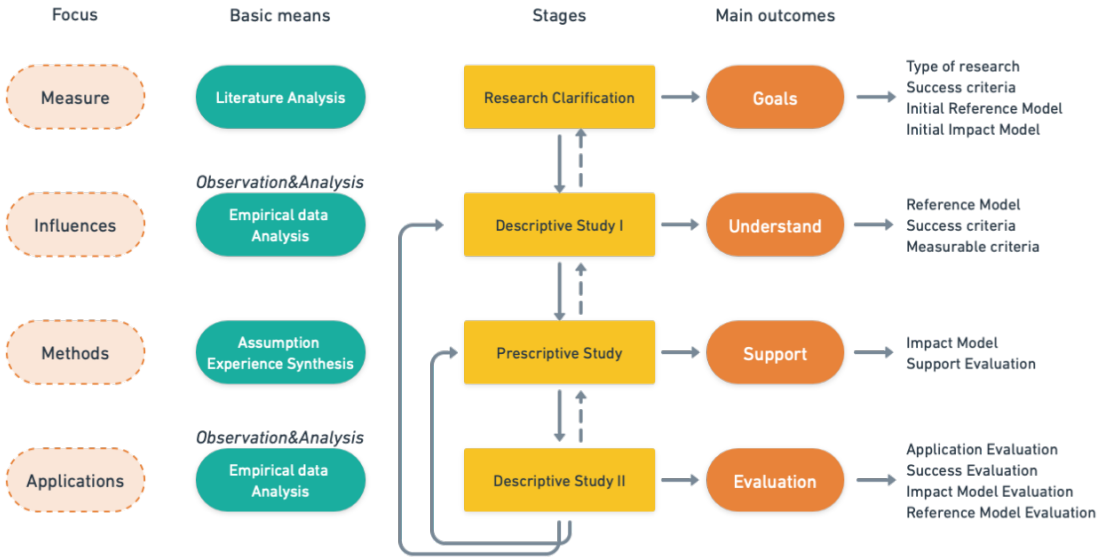


Figure 3.2 The DRM model (L. T. Blessing & A. Chakrabarti, 2009).

3.4.1 Theory of change: pathways from intervention to impact

This research considers how design tools can be specifically developed to enhance older Chinese migrants' understanding of net-zero concepts, promoting their participation in low-carbon practices and ensuring their equal involvement in societal climate actions. It offers insights that can inform **broader strategies**, applicable not only to other **minority ethnic communities, organisations** but also benefiting **future generations** through intergenerational knowledge sharing. Furthermore, the research provides actionable recommendations for **businesses and policymakers,** derived from individuals' lived experiences and viewpoints. The ultimate goal is to facilitate inclusive climate action that supports behaviour change across all levels of **society**, as illustrated in Figure 3.3.

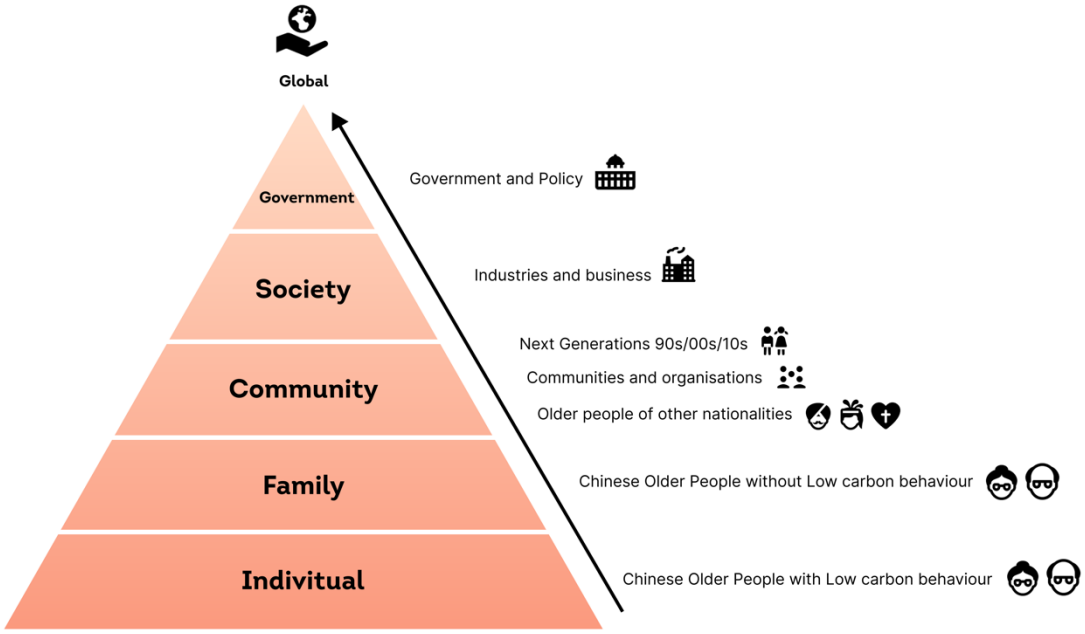


Figure 3.3 Multi-level engagement strategy (drawn by the author).

Figure 3.3 summarises the intended pathways by which the design intervention scale from individual practice changes to family, community, societal and governmental levels, and ultimately contribute to global net-zero goals.

The methodological framework in Figure 3.4 outlines the main studies involved in this research. The research is divided into six phases, each focusing on addressing specific research questions that contribute to the overall aim of the research project. Arrows denote iterative feedback loops (e.g., insights from DS II informing revisions to PS).

3.4.2 Programme of studies across DRM phases

The seven studies are sequenced and interlinked as shown in Figure 3.4.

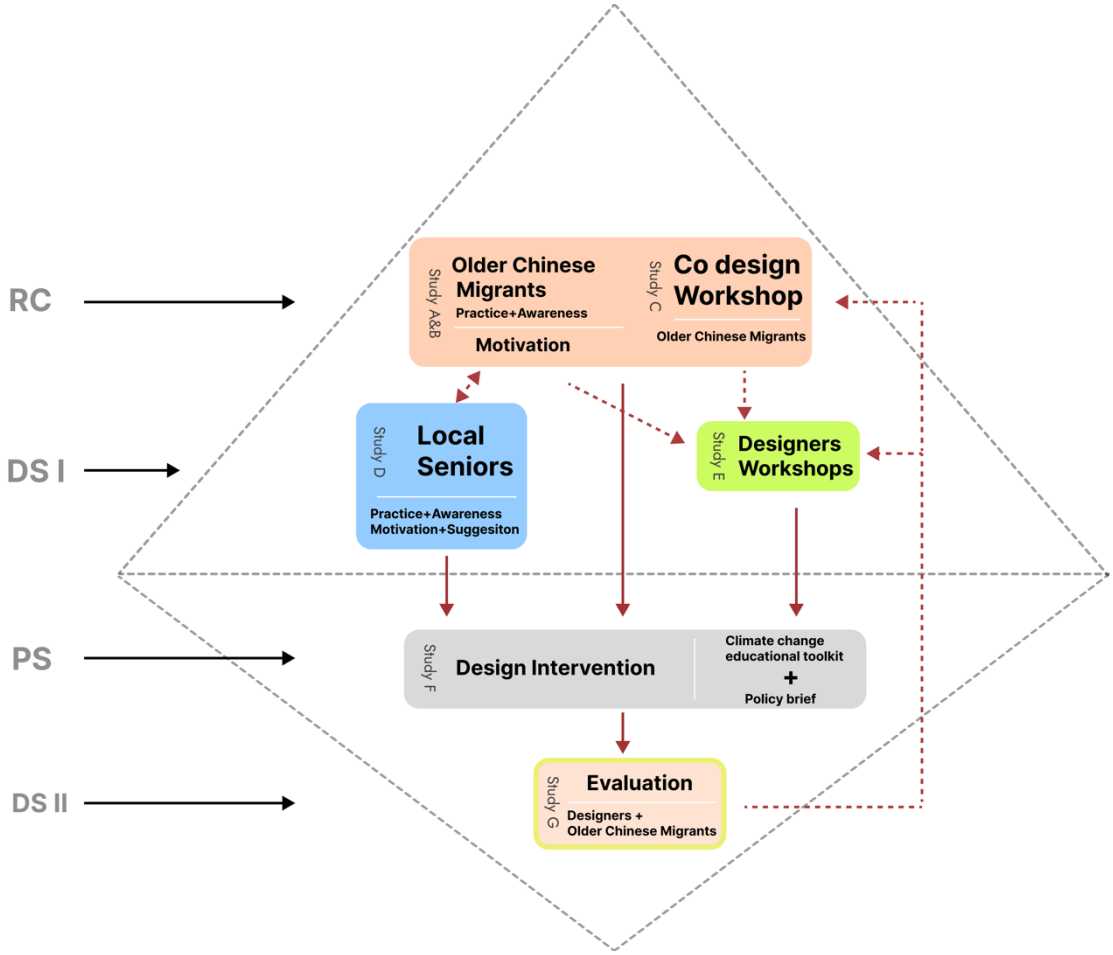


Figure 3.4 Main studies mapped to the DRM phases.

Studies A–C **(RC)** examine practices, awareness and motivations among older Chinese migrants through a survey, interviews and a co-design workshop. Study D **(DS I)** elicits perspectives from local British seniors to provide a comparative lens, and Study E **(DS I)** engages professional designers to translate user insights into design opportunities. Study F **(PS)** develops the bilingual toolkit and policy brief. Study G **(DS II)** evaluates the intervention with both older Chinese migrants and designers. Solid arrows denote iterative refinement; dotted lines indicate cross-phase consultation with designers and community stakeholders.

3.4.3 Data Collection and Analysis

This section sets out the *principles* of design, data collection and analysis used across the thesis. Specific study procedures, instruments and sampling specifics are reported in Chapters 4–7 and the Appendices.

Data collection techniques (cross-studies)

This research mainly followed a qualitative strategy, but combined different methods. Across the DRM phases, eight approaches were used:

1) Questionnaire (Study A)

Purpose: to capture demographic details (age, gender, language, acculturation) and provide baseline information on climate awareness and everyday practices.

Output: descriptive statistics useful for profiling the sample and highlighting basic associations.

2) Semi-structured interviews (Study A)

Purpose: to explore participants' low-carbon routines, their understanding of "net zero," and perceived barriers.

Advantage: complementary to the questionable study, allowed comparison across cases, while still giving space for participants' own stories.

3) Walking interviews (Study B)

Purpose: to observe practices in context (e.g. home, shopping, travel) and to uncover everyday motivations.

Advantage: increased validity by reducing recall bias and encouraging "show-and-tell" explanations.

4) Co-design workshops with older migrants (Study C)

Purpose: to map daily activities, social roles and values, and preferred ways of receiving information.

Advantage: gave participants more agency and helped reveal culturally specific preferences, using visual materials (e.g., journey maps, photos).

5) Focus groups with local seniors (Study D)

Purpose: to compare how British seniors think about climate issues and to collect practical suggestions relevant to older migrants.

Advantage: highlighted shared norms and differences through group discussion.

6) Expert design workshops (Study E)

Purpose: to co-develop ideas for interventions, based on insights from earlier studies.

Format: online workshops (Miro + Teams) with prompts derived from RC/DS I findings.

7) Research-through-Design (Study F)

Purpose: to prototype a bilingual toolkit and a policy brief that addressed needs identified in earlier phases.

Process: ideas and requirements from Studies A–E were translated into low-fidelity prototypes, refined through informal feedback.

8) Evaluation workshops and survey (Study G)

Purpose: to test the toolkit with older migrants and design experts, assessing reactions, knowledge gained, and intended behaviour change (drawing on Kirkpatrick's first three levels)(Kirkpatrick, 2015).

Instruments: hands-on activities with the toolkit, Likert-scale survey, and group debriefing.

Sampling and recruitment (overarching principles)

The strategy of this research is purposive and maximum-variation sampling (age 55–85; migration routes; language repertoires; socio-economic backgrounds) to capture heterogeneity within older Chinese migrants; comparative purposive sampling for local seniors; convenience-plus-snowball for designers with sustainability interest.

The Sites and access includes London/West London community organisations, churches and social networks (offline and WeChat/Facebook); university and professional design networks for experts.

The recruitment criteria for this study include that participants have the ability to actively agree to participate in the research; Basic reading and writing skills (in migrant workers' workshops); Personal safety during walking interviews (risk assessment route).

Data analysis strategy (cross-studies)

- Thematic Analysis (Braun & Clarke, 2006): applied to interview, focus-group and workshop transcripts. The process includes familiarisation → open coding → theme construction → review/refinement → definition and reporting.
- Quantification where appropriate: descriptive statistics and simple associations for the questionnaire; frequency counts of codes to indicate salience.

Researcher positionality and reflexivity

The author is a bilingual Chinese design researcher. This affords rapport and cultural fluency but introduces risks of over-familiarity and confirmation bias. Mitigations include external peer review of coding and using participant quotes to ground interpretation.

3.4.4 Sampling Framework, Samples and Participant Continuity

Across the research programme, sampling was adapted to the purpose of each study. In this thesis, the sampling framework refers to the recruitment logic, inclusion criteria, and access routes used to identify appropriate participants, while the sample refers to the participants who were actually recruited and took part in each study. This distinction is important because the thesis involved seven interconnected studies with different participant groups, recruitment contexts, and research aims.

Overall, the research used purposive sampling to recruit participants with relevant lived experience or professional expertise, including older Chinese migrants, local British older adults, and design professionals. Snowball sampling was also used where appropriate, particularly when recruiting older Chinese migrants through community organisations, churches, social networks, WeChat groups, and peer referrals. Maximum

variation was sought within practical limits, including variation in age, gender, migration background, language ability, place of origin, length of residence in the UK, and levels of community participation.

Participants did not form a single longitudinal cohort across all stages. Instead, the research adopted a staged and partially overlapping sampling approach. This was particularly relevant in studies involving older Chinese migrants, where selected participants from earlier stages were invited to take part in later activities where they had agreed to further contact. At the same time, new participants were recruited at later stages to introduce additional perspectives. The overall sample should therefore be understood as mixed and partially overlapping, rather than as either a completely new sample at each stage or a fully longitudinal cohort. This approach reflected the community-based nature of the research, where trust, familiarity, and ongoing relationships supported participation, while the inclusion of new participants helped to broaden the range of perspectives. Table 3. 4 summarises the sampling framework, actual sample and participant continuity across the studies.

Table 3.4 Sampling Framework, Sample and Participant Continuity Across Studies

Study	Sampling framework	Actual sample	Participant continuity
Study A	Purposive and snowball sampling of older Chinese migrants through community organisations, church settings, WeChat, Facebook and peer referrals.	36 older Chinese migrants aged 50–85.	Initial participant pool; some participants were invited to later stages.
Study B	Purposive follow-up sampling from Study A, based on participants' willingness, relevance to key themes, migration background, and suitability for walking interviews.	20 older Chinese migrants aged 55–85.	Returning participants selected from Study A.
Study C	Purposive community-based sampling through London Mandarin Evangelical Church and North London Chinese Association.	13 older Chinese migrants across two co-design workshops.	Mixed community sample; possible overlap with earlier community networks.
Study D	Purposive sampling of local older adults through Brunel Older People's Reference Group,	30 local older adults across seven focus groups.	Separate comparative sample.

	Uxbridge Library and churches in West London.		
Study E	Purposive and snowball sampling of design researchers, designers and related experts through Brunel Design School and professional networks.	16 participants across five online designer workshops.	Separate expert sample.
Study F	Research-through-design phase based on findings from Studies A–E; no formal participant recruitment.	No new formal participant sample.	Translated previous findings into toolkit and policy brief.
Study G	Purposive and snowball sampling of older Chinese migrants and design researchers/related professionals for toolkit evaluation.	26 participants: 12 older Chinese migrants and 14 design/professional participants.	Mixed sample of returning and newly recruited participants.

3.4.5 Ethical Approval and Research Ethics

Ethical approval was obtained from Brunel University London before the relevant stages of data collection were conducted. The ethics approval documents, participant information sheets, consent forms, and recruitment materials are provided in the relevant appendices.

Across all empirical studies, participants received clear information about the purpose of the research, what participation involved, how their data would be used, and the voluntary nature of participation. Informed consent was obtained before data collection. Participants were informed of their right to withdraw, and their identities were anonymised through participant codes or pseudonyms in all transcripts, analysis files, and thesis reporting.

Particular attention was paid to the ethical considerations associated with working with older adults and migrant participants. These included language accessibility, cultural sensitivity, confidentiality, participant comfort, fatigue, mobility, and the avoidance of discomfort when discussing personal circumstances such as housing, income, family relationships, migration experience, or access to services. Research materials were provided in Chinese and/or English where appropriate, and participants were given opportunities to ask questions before deciding whether to take part.

For walking interviews, additional attention was paid to participant safety and physical comfort. Routes and locations were discussed in advance, and participants whose mobility or health conditions might make walking interviews unsafe were not invited to take part in this method. For workshop-based and evaluation studies, participants were reminded that they could decline to answer any question, pause, or withdraw from the activity if they felt uncomfortable or tired.

All data were stored securely on Brunel University's OneDrive or password-protected university devices. Audio recordings, transcripts, photographs, worksheets, Miro outputs, questionnaires, and field notes were anonymised and handled in accordance with the approved ethics protocol. Ethics was therefore treated not only as a formal approval requirement, but also as an ongoing process of ensuring participant dignity, comfort, safety, and control throughout recruitment, data collection, analysis, and representation.

3.4.6 Translation of participants' quotations

The citations of Study A, B, C and G were initially collected in Mandarin, Cantonese mixed English. For study E, some data were collected in English and some in Chinese. It was later translated into English by the author. Based on the feedback from the supervisor, the language clarity and academic tone of the translation were subsequently reviewed. Without altering the original meaning or context of the participants' statements, minor modifications were made to the style to ensure grammatical accuracy.

3.5 Visual Mapping Tool for Thematic and Actor-Based Synthesis

To support the integration and translation of findings from following studies, this research developed a visual mapping tool that synthesises insights across two key analytical dimensions: thematic domains and levels of social actors (see Figure 3.5).

The vertical axis represents five intersecting themes that emerged from the literature and qualitative research: Culture, Technology, Economy, Society, and Intergenerational factors. These categories capture the structural, discursive, and behavioural influences that shape how older Chinese migrants engage with climate-related issues.

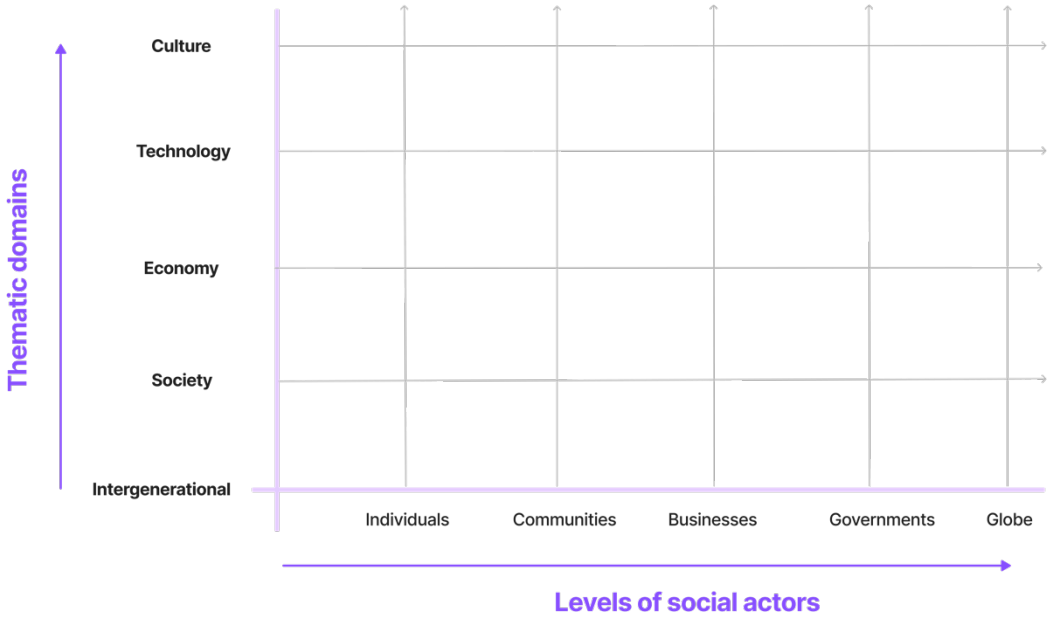


Figure 3.5 Visual Mapping Tool for Thematic and Actor-Based Synthesis.

The **horizontal axis** reflects the different levels of **social actors** involved in climate action and communication: Individuals, Communities, Businesses, Governments, and the Global scale. This dimension is inspired by ecological models of behaviour change and related theories, which recognise that interventions can be designed to target change at multiple societal levels.

This matrix-like tool enables researchers and designers to visually categorise, compare, and prioritise findings for intervention development. It also helps to identify under-addressed areas, serving as a reference for subsequent design interventions and strategic decision-making.

Beyond its analytical function, the mapping tool acts as a knowledge translation mechanism, bridging empirical insights with design planning. Its development contributes a novel, user-centred approach to climate communication research and offers a replicable method for integrating complex data into actionable design insights.

3.6 Creative and Participatory Methods: Visual and Gamified Approaches

A key methodological innovation in this study lies in the combination of visual methods and gamification strategies for application in data collection and intervention design.

Traditional qualitative climate research usually relies on semi-structured interviews, focus groups and other methods, but for older migrants, these forms may bring certain challenges, including language barriers, unfamiliarity with professional terms (such as "net zero"), and difficulties in adapting to the formal research environment.
By introducing visual and gamification methods, this study effectively reduced the reliance on abstract language expression and embedded complex climate concepts into specific daily life scenarios. This approach not only enhances the inclusiveness of the research process but also creates a more attractive and interactive participation space for the participants, thereby promoting in-depth communication and understanding across language and cultural contexts.

Visual methods

Climate change is often perceived as abstract, distant, and technical (Roosen et al., 2018). Visual prompts help to concretise these issues, making them emotionally salient and personally relevant. Images, maps, and artefacts can also reduce linguistic load, supporting cross-lingual and cross-cultural communication when participants prefer Chinese or are unfamiliar with policy terminology.

Moreover, visual cues naturally trigger memories and storytelling, linking personal experiences to broader sustainability debates (Harper, 2002; Pink, 2013).
In this research, visual strategies were employed flexibly across studies:
In **Studies A and B**, short educational videos on climate and net zero provided shared grounding; photographs and persona illustrations were later used to support thematic analysis and communication of migrant profiles. In **Study C**, participants co-created journey maps and annotated worksheets, using drawings and stickers to express routines, values, and preferences. In **Study D**, local seniors engaged with data cards and self-test checklists, which served as warm-up prompts to initiate discussion.In **Study E**, designers collaborated on the Miro platform using visual boards, icons, and voting stickers to organise and evaluate ideas. In **Study F and G (intervention and evaluation)**, bilingual brochures, illustrated cards, and interactive puzzles provided accessible, non-text-heavy formats for climate communication.

Across these stages, visual methods worked both as elicitation tools (helping participants articulate experiences) and as design media (transforming insights into tangible artefacts).

Gamified approaches

Games and playful elements represent another pathway to stimulate engagement, motivation, and collaborative meaning-making. Although gamification research often focuses on younger populations, evidence suggests that older adults can also benefit when game elements are carefully designed (Koivisto & Malik, 2021). Key principles include the use of familiar metaphors, attention to accessibility (cognitive load, readability, physical ease), and opportunities for intergenerational play.

In this research, gamified strategies were particularly prominent in the Prescriptive (Study F) and Evaluation (Study G): The climate toolkit included interactive puzzles, a "memory turntable," and conversation cards designed to make climate issues less abstract and to spark discussion in family or community settings. Also, during evaluation workshops, these tools were tested with older Chinese migrants, who often responded positively to the playful, collaborative elements, reporting that the activities made climate concepts more memorable and less intimidating.

Through gamification, abstract policy targets (e.g., *net zero by 2050*) were reframed into embodied, experiential learning opportunities, allowing the participants to co-create meanings and see relevance in their own lives.

3.7 Summary

This chapter has outlined the methodological framework guiding the research, drawing on the Design Research Methodology (DRM) to structure the investigation into older Chinese migrants' perceptions and practices of climate action. The study followed a staged and iterative process, progressing from Research Clarification (RC), through Descriptive Study I (DS I), Prescriptive Study (PS), and concluding with Descriptive Study II (DS II). Each stage was designed to incrementally build understanding, generate design requirements, and test practical interventions.

A qualitative-dominant, mixed-methods strategy was employed to balance breadth with depth. Surveys and semi-structured interviews (Study A) provided an initial overview of awareness, behaviours, and barriers, while walking interviews (Study B) offered contextualised insights into lived practices and motivations. Co-design workshops with older migrants (Study C) and focus groups with local seniors (Study D) enriched the understanding of cultural, information and generational perspectives. Design workshops with experts (Study E) translated user insights into potential solutions,

which were consolidated in the development of a bilingual climate toolkit (Study F). Finally, evaluation workshops and surveys (Study G) assessed the effectiveness and usability of the interventions.

Across these stages, the research integrated innovative visual and gamified methods—such as journey maps, interactive cards, and climate-related games—to reduce linguistic barriers, elicit tacit knowledge, and enhance participant engagement. These creative approaches complemented more conventional qualitative techniques, ensuring accessibility and inclusivity for participants with diverse backgrounds.

By combining iterative inquiry, participatory design, and thematic and statistical analyses, the methodology not only ensured credibility and validity through triangulation but also advanced a novel approach to studying climate engagement among older migrants. This provides foundation for the empirical chapters that follow, where findings from each study are presented and critically discussed.

Chapter 4: The Net Zero Knowledge and Climate Action of Chinese Older Migrants in the UK

4.1 Introduction

Following the literature review, the author adopted a qualitative approach to examine how older Chinese migrants understand net-zero policies, engage in low-carbon behaviours, and adapt to cultural changes.

This chapter consists of two studies (A&B), both of which align with the research clarification RC stage of the DRM framework. They aimed to investigate the interplay between cultural integration, external influences, and individual motivations in shaping sustainable lifestyles.

Study A: Survey and interviews

Study A involved a questionnaire and semi-structured interviews with older Chinese migrants. The primary aim was to assess their awareness of the UK's net-zero policies, their existing low-carbon practices, and the barriers they encounter in adopting climate-conscious behaviours.

Study B: Walking interviews

Study B built upon the findings from study A and focused on the real-life practices of older migrants. Compared to seated interviews, walking interviews provided stronger contextual grounding and interactive potential, particularly suitable for uncovering the lived motivations, cultural routines, and spatial memories of older adults. Through walking interviews, study B sought to uncover the motivations behind these behaviours and explore the underlying cultural influences shaping older Chinese migrants' environmental engagement.

4.1.1 Background

With growing global concerns over climate change, achieving "net-zero emissions" has become a shared objective for governments and societies worldwide (Sasse et al., 2020a). Literature indicates that in the UK, low-income groups and older adults are key target populations for future net-zero policy outreach (Shahzad et al., 2024). At the same time, climate action within migrant communities from diverse cultural backgrounds is emerging as an important research area (Sovacool et al., 2019). Although Chinese migrants do not constitute the largest immigrant group in the UK,

their perspectives on net-zero policies and engagement in climate action offer a unique viewpoint (Jeffs, 2023).

Culturally, frugality is often regarded as a virtue among Chinese communities. This mindset frequently stems from past experiences of resource scarcity and is particularly evident among older generations (Boffa, 2015). In daily life, common practices such as repurposing containers or upcycling waste contribute to reducing individual or household carbon footprints (Onyenokporo et al., 2024). Additionally, home-cooked meals tend to incorporate seasonal vegetables and fruits, aligning, at least to some extent, with low-carbon dietary principles (Sovacool et al., 2019). Strong family and community ties within Chinese culture also create opportunities for collective or community-based environmental and low-carbon initiatives (Li & Lange, 2022).

In China, public transport (buses, metro systems) and electric vehicles (such as e-bikes) are widely used. Many Chinese migrants continue to prefer public transport, walking, or cycling, which may indicate a tendency towards low-carbon travel habits.
Although literature suggests that Chinese individuals engage in low-carbon behaviours, little research demonstrates that these actions are explicitly motivated by climate change concerns. Moreover, existing studies have not explored whether older Chinese migrants modify their behaviours following cultural adaptation, nor whether they support the UK's net-zero policies.

Research Gap

- **Academic Research Gap:** Existing studies on climate action and low-carbon practices among migrant communities predominantly focus on mainstream society or younger populations. However, older Chinese migrants constitute a significant demographic within UK communities, yet there remains a lack of systematic research on their perceptions, behaviours, and challenges in low-carbon engagement.
- **Understanding Cross-Cultural and Intergenerational Factors:** Older Chinese migrants often face language barriers, cultural differences, and potential gaps in environmental awareness and practices between themselves and both local society and younger generations. Exploring these dynamics is crucial for understanding their engagement with sustainability initiatives.
- **The Dual Need for Climate Governance and Social Integration:** The UK government has prioritised "net-zero emissions" as a national goal, seeking to mobilise diverse communities in addressing the climate crisis. Older Chinese

migrants, as part of the British society, bring unique perspectives on sustainable living from their cultural background. Simultaneously, their social integration and well-being remain key concerns for policymakers and community organisations.

- **Practical Implications and Policy Recommendations:** The challenges faced by older migrants in low-carbon practices and community participation. Such as limited access to information and engagement channels are often overlooked. Addressing these barriers can enhance the implementation of net-zero policies in multicultural and intergenerational contexts, ensuring more inclusive and effective climate action.

Study A examines the community background and lifestyles of older Chinese migrants in the UK, exploring their perceptions of climate issues and the concept of "net zero." Then, Study B analysed their low-carbon behaviours in daily life, such as consumption, transportation and energy usage, and identified the obstacles they faced. The discussion then shifts to their participation in climate action at both community and societal levels, highlighting the potential challenges and opportunities. Finally, the chapter delves into the deeper cultural and psychological factors that shape their environmental attitudes and behaviours.

4.1.2 Theoretical Models

Individuals' daily behaviours can significantly affect personal energy consumption, yet policies designed to encourage low-carbon lifestyles among residents and households often yield uncertain outcomes. To promote low-carbon practices, especially among specific groups such as older Chinese migrants in the UK, it is crucial to understand the internal psychological drivers of behaviour and the external social and cultural context that shapes these drivers.

The theoretical model can offer a unique lens through which to explore how attitudes, subjective norms, perceived behavioural control, and contextual factors interact to influence behaviour. When applied to Chinese older migrants, the models help explain how cultural, demographic, and situational elements intersect in shaping everyday energy-use decisions. This chapter mainly uses three theoretical models.

1) Theory of Planned Behaviour (TPB)

TPB posits that attitude, subjective norms, and perceived behavioural control jointly determine an individual's intention to perform a specific behaviour (Ajzen, 1991; Ajzen & Madden, 1986). Researchers have expanded the TPB model by incorporating

variables such as moral obligation, environmental concerns, environmental knowledge, and willingness to pay (Chen & Tung, 2014; Kaiser & Scheuthle, 2003).These additions enhance the model's ability to explain energy-saving and carbon-reduction intentions. For instance, moral and ethical considerations can motivate individuals to adopt greener habits, while environmental knowledge empowers them to overcome practical barriers to change (Chen, 2016).

2) Low-Carbon Behaviour Model

The low-carbon behaviour model (Figure 4.1) conceptualises three main factors influencing low-carbon actions: internal factors (e.g. personal values, attitudes), external factors (e.g. government policies, social norms), and situational factors (also referred to as contextual variables). Most of the internal elements align closely with TPB constructs. However, external factors, such as economic incentives, technological availability and policy changes, vary more greatly and also differ in different societies. For Chinese older migrants in the UK, contextual elements may include the unfamiliar policy environment, local energy pricing, or community-based support programmes. Such situational factors, originating outside the individual, can enable or constrain a person's capacity to engage in low-carbon practices (Boldero, 1995). Integrating both internal and external factors is therefore crucial for a more holistic understanding of low-carbon behaviour in this group (Wang et al., 2021).

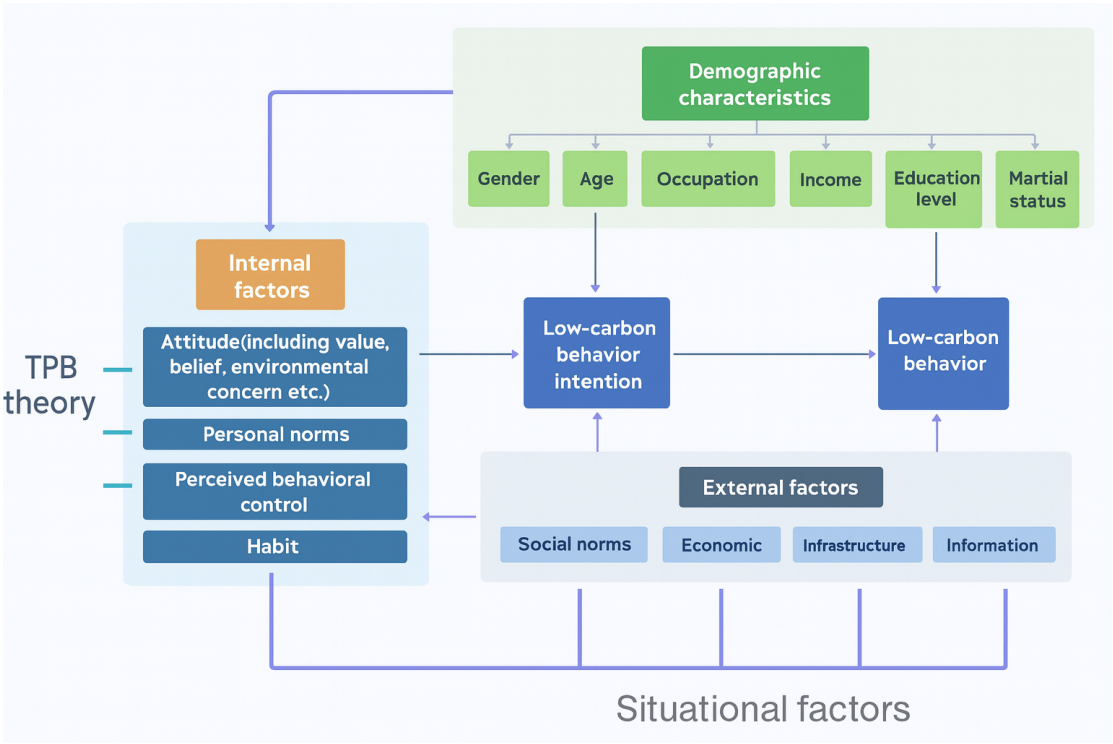


Figure 4.1 Influencing factors affecting low carbon behaviours (Wang et al., 2021).

3) Acculturation Theory Model

As depicted in Figure 4.2, acculturation unfolds at both micro (individual) and macro (societal) levels. Micro-level factors include language proficiency, cultural identity, social support, and personality traits. Macro-level factors encompass the social, economic, and political contexts of both the origin and settlement countries.

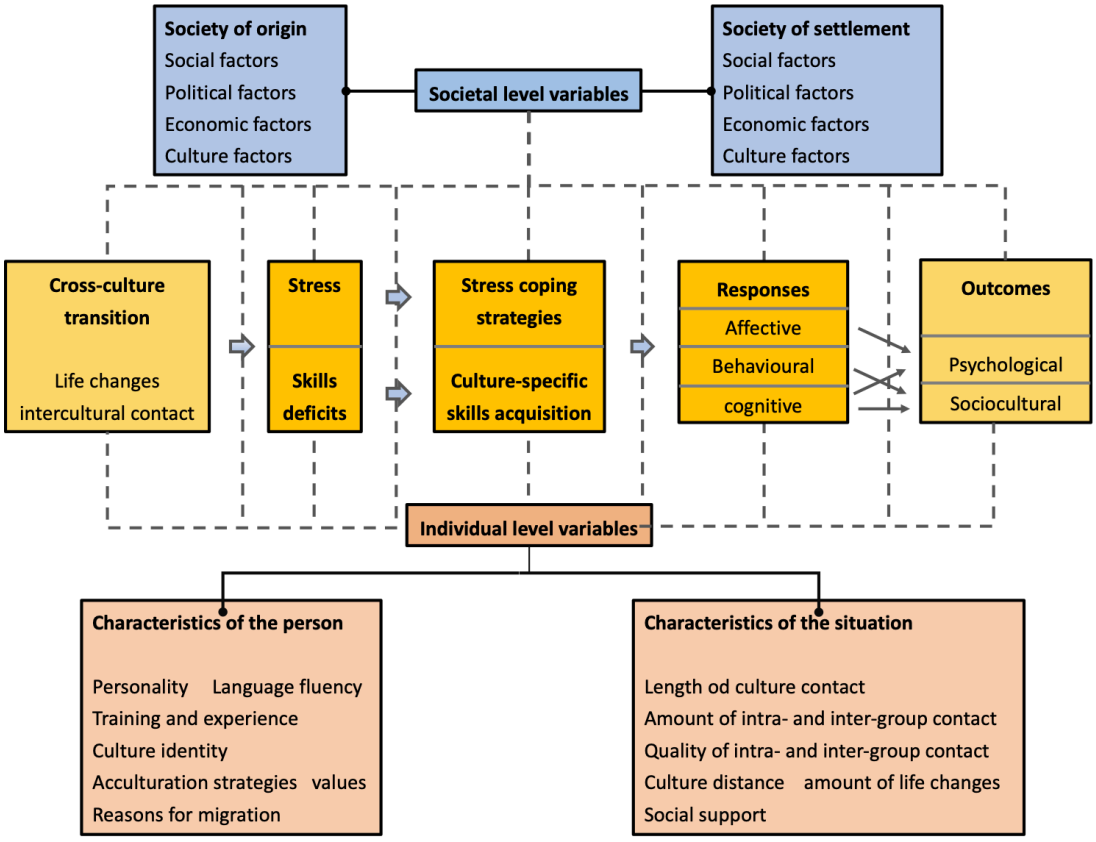


Figure 4.2 The acculturation process (adapted from Ward, Bochner and Furnham 2020).

For Chinese older migrants, acculturation can directly influence low-carbon behaviour. New cultural norms and social networks in the UK may shape attitudes towards energy use, while enhanced language skills or local community connections can increase perceived behavioural control. Likewise, macro-level factors, such as the UK government's climate policies or culturally inclusive community organisations, may either strengthen or hinder sustainable practices.

4) Model Integration

Since the factors influencing low-carbon behaviour and cultural adaptation overlap significantly, integrating acculturation theory into low-carbon frameworks can illuminate how migrants navigate this transition.

In the TPB model, subjective norms capture the social pressure that influences an individual's intentions and actions. For Chinese populations, traditional collectivist values often heighten the power of subjective norms relative to other variables (Wang et al., 2014). Cultural values have thus been identified as a significant antecedent in some adaptations of TPB (Lao & Wang, 2015; Mancha & Yoder, 2015; Wang & Wu, 2016).

Perceived behavioural control concerns individuals' ability to engage in a behaviour, given the resources, opportunities, or knowledge available. Moral beliefs and environmental knowledge can also enhance individuals' willingness to adopt low-carbon lifestyles (Chen, 2016). Attitude reflects a person's evaluation of the pros and cons of a certain behaviour, and these factors are influenced by the traditional Chinese concept of harmony between man and nature.

External (situational) factors such as policies, local infrastructure, social norms, and technology can affect how new information about energy use is understood and acted upon (Darby, 2010). Moreover, demographic variables like age, education, and income strongly correlate with low-carbon behaviours (Echegaray & Hansstein, 2017). For migrants, cultural adaptation can alter or moderate these demographic influences over time.

Figure 4.3 presents a consolidated TPB model, designed by the author, which incorporates acculturation factors into the standard TPB framework. The reasoning of the model leads to the following hypothesis:

- **H1:** Cultural adaptation influences attitudes and traditional beliefs, shaping individuals' low-carbon behaviour.
- **H2:** Cultural adaptation provides new resources, knowledge, and opportunities, which increase migrants' perceived behavioural control.
- **H3:** External factors in the new environment (e.g. policies, economic conditions, social norms) influence changes in low-carbon behaviour.
- **H4:** Demographic differences and personality traits lead to variations in low-carbon behaviour.

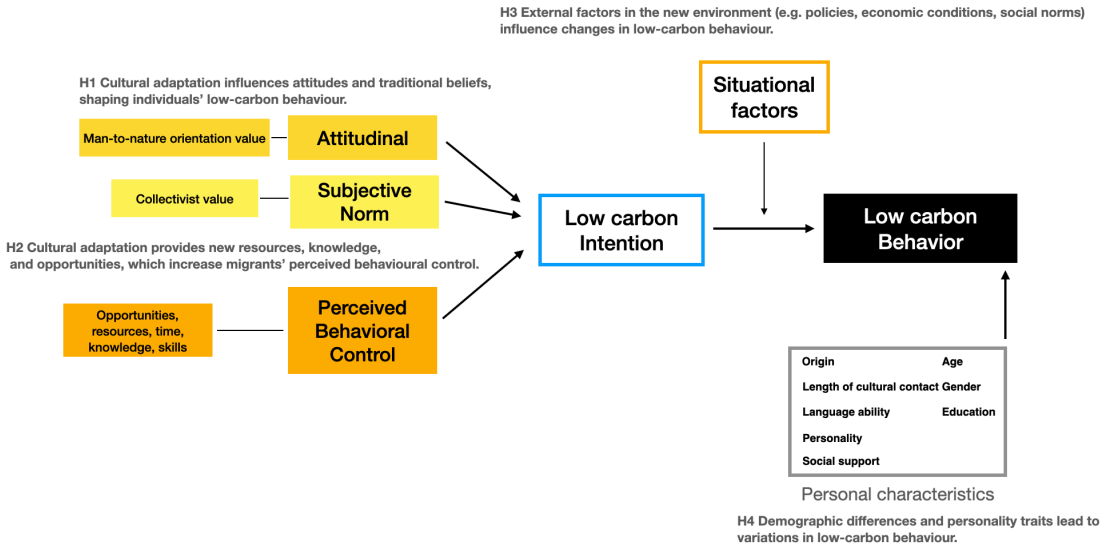


Figure 4.3 The consolidated TPB model (drawn by the author).

Figure 4.4 illustrates the final Integrated Model, showing how acculturation intersects with TPB elements. At the micro level, personal characteristics (e.g. language skills, length of residence) can affect attitudes, subjective norms, and perceived behavioural control. At the macro level, factors within the host society (e.g. UK climate policies, economic incentives) shape situational influences on low-carbon behaviours. Demographic variables, meanwhile, are dynamic and can be modified by the process of cultural adaptation.

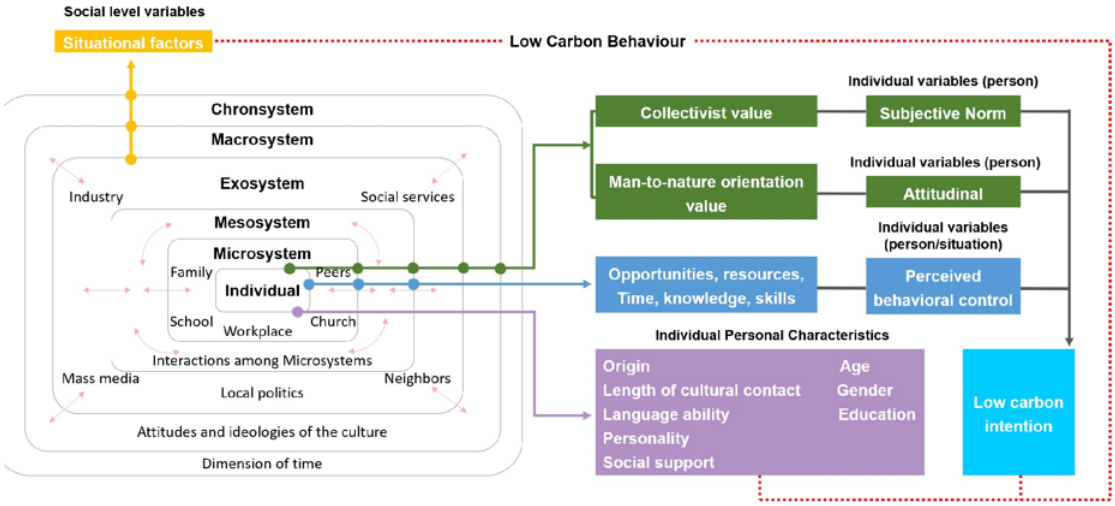


Figure 4.4 Integration Model (drawn by the author).

4.2 Methods

Study A includes a questionnaire and semi-structured interviews, while Study B involves a walking interview. Figure 4.5 illustrates the positioning of these studies within the overall research framework. Both Study A and Study B fall under the Research Clarification (RC) stage of the DRM framework and focus on exploring the low-carbon practices, net zero perceptions, and motivations of older Chinese migrants in London. The studies address the following research questions:

Study A:

- **Question 1:** What are the current low-carbon practices of older Chinese migrants?
- **Question 2:** What are their perceptions of net zero?

Study B:

- **Question 1:** What are the motivations of older Chinese migrants to engage in low-carbon behaviour?

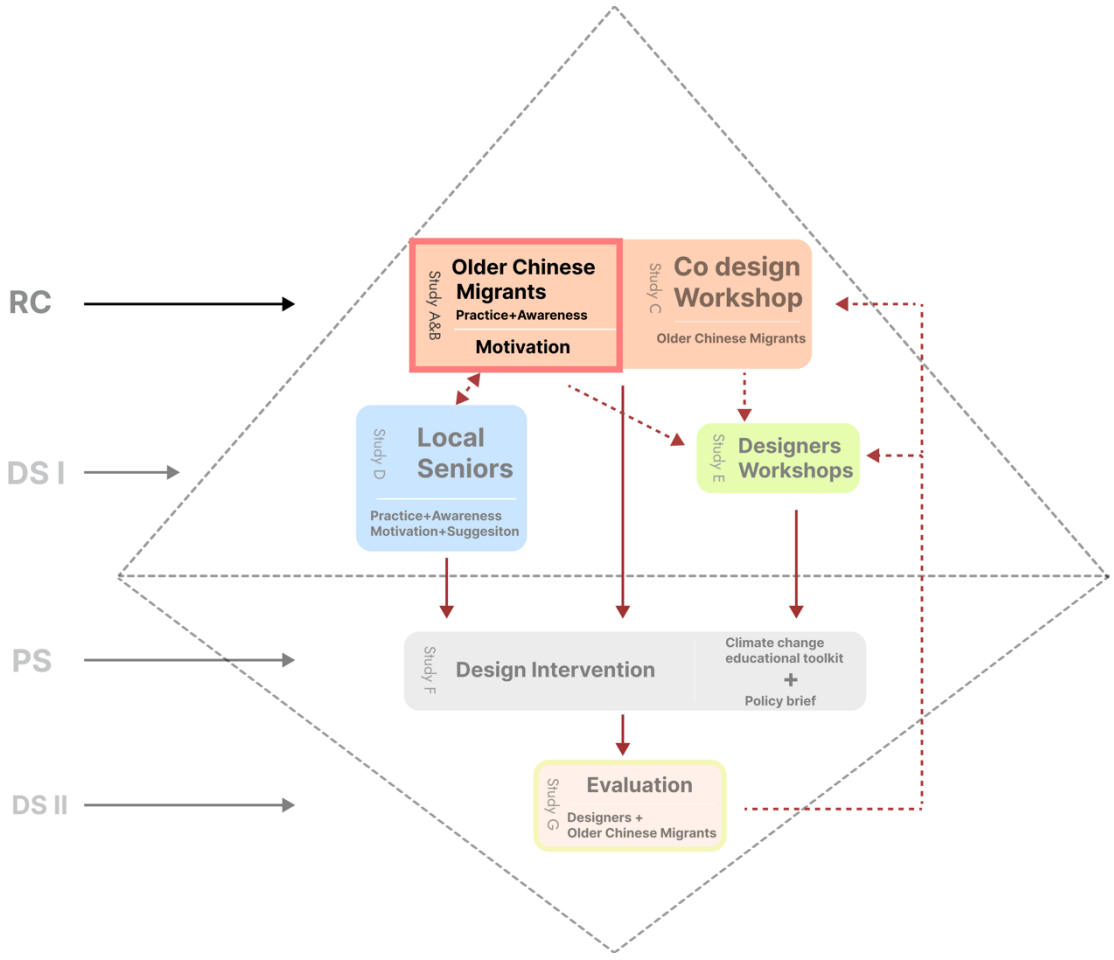


Figure 4.5 Studies A&B as part of Research Clarification.

4.2.1 Recruitment and Procedure

Study A: Survey and interviews

Participants for Study A were recruited through both offline and online channels. Offline recruitment took place in community settings such as the Kingston Chinese Community and the London Chinese Church, where permission was obtained to distribute recruitment posters. A total of 24 participants were recruited through direct engagement during weekend church services, tea gatherings, festival celebrations, and other community activities. These settings primarily attracted socially active older Chinese migrants who were already engaged in community life.

In addition, some individuals participating in these activities may represent more "hidden" migrant groups, as community events can provide a culturally familiar and relatively safe space for engagement without requiring formal disclosure of personal or migration-related information.

For online recruitment, the researcher utilised Facebook, WeChat, and a snowball sampling strategy to reach a wider and potentially less visible population. Recruitment messages were shared in Chinese social media groups, enabling individuals who were less willing or able to participate in face-to-face or video-based interactions to take part. Many of these participants preferred to remain anonymous or used pseudonyms, reflecting characteristics commonly associated with hard-to-reach populations.

Taken together, the combination of offline and online recruitment strategies helped to access both socially visible and more hidden segments of the older Chinese migrant population. However, this approach may also introduce sampling bias, as participants who are socially active or digitally engaged are more likely to be included, while those who are more isolated or digitally excluded may remain underrepresented.

Inclusion Criteria

The study did not impose economic or occupational restrictions, selecting participants solely based on age. However, observations during recruitment revealed that those recruited through Chinese community centres tended to have better financial stability and actively participated in various cultural activities. In contrast, some individuals recruited via social media were from lower-income backgrounds and initially expressed scepticism towards the study. Their concerns were alleviated after assurances of data anonymity and the research's potential impact, leading them to participate to voice their experiences and perspectives.

In total, 40 older Chinese migrants aged between 50 and 85 were initially approached, with 36 valid responses received for analysis. The participant information is summarised in Table 4.1:

Table 4.1 Study A: Participant Demographic and Migration Profile (N = 36).

Variable	Category/Range	Nember	Percentage (%)
Gender	Female	23	64%
	Male	13	36%
Age Group	50–59 years	20	55.6%
	60–69 years	11	30.6%
	70–79 years	3	8.3%
	80 years and above	3	5.6%
Home Country/ Region of Origin	Mainland China	21	58%
	Hong Kong (or dual: Hong Kong/Mainland)	8	22%
	Malaysia	4	11%
	Taiwan	2	6%
	Singapore	1	3%
Length of Residence	< 5 years	6	17%
	5–10 years	3	8%
	10–20 years	9	25%
	> 20 years	18	50%
Primary Migration Reason	Reunion with Family	~12*	~33%*
	Education	~8*	~22%*
	Job Opportunities	~11*	~31%*
	Travelling	1	3%
	(Some participants reported multiple reasons)		
Migration Frequency	Once	26	72%
	Twice	5	14%
	Three times	3	8%
	More than five times	2	6%
Language Use	Mandarin (common across sample)	Most cases	80%
	English (common across sample)	Most cases	46%
	Cantonese (predominantly among Hong Kong migrants)	Many cases	38%

*Note: For migration reasons, some participants reported more than one reason (e.g. “Education/Job opportunities/International Families”), so percentages are approximate and may overlap.

Interviews were conducted in two modes:

- **Offline sessions** took place at community centres and church venues.
- **Online sessions** were conducted via one-on-one video conferencing and phone calls.

The overall recruitment and interview process spanned approximately seven weeks.

Study B: Walking Interviews

Building on Study A, walking interviews were adopted to access more situated narratives and to better understand the intersection between thrift, cultural identity, and environmental action, particularly as expressed through everyday practices such as food preparation, reuse behaviours, shopping choices, and energy use in domestic and community settings (Bartlett et al., 2023).

Why walking interviews?

Walking interviews allow participants to anchor their reflections in familiar spaces. As they moved through gardens, kitchens, or neighbourhood stores, participants could point to specific practices, such as vegetable growing, reusing containers, or hunting for discounted items, embedding abstract narratives into tangible routines.

In practice, some participants were initially reserved during seated interviews due to cultural or migratory sensitivities. However, when placed in familiar environments, they became more relaxed and willing to share. For instance, one participant proudly showcased vegetables grown in his backyard; another described annual foraging traditions with younger migrants; and another demonstrated how household waste was repurposed into useful items. Such insights might not surface in static seated interview contexts.

Walking interviews provided rich, contextualised data and deepened the researcher's understanding of the spatial, cultural, and emotional dimensions of low-carbon behaviour, highlighting the method's unique value in migration and sustainability research.

Inclusion Criteria

Study B was designed as a follow-up to Study A, with participants selected based on prior interview data analysis. Three key criteria guided the selection of participants:

- Participants had previously agreed to be contacted for further research and were comfortable engaging in discussions within their everyday environments.
- Their personal backgrounds and circumstances aligned with the aim of the study.
- Their initial interviews indicated the potential for rich data for key themes.

Based on these criteria, a shortlist of eligible participants was compiled. Those who met the most relevant criteria were invited. Participants were between 55 and 85 years old, in line with the ethical considerations for research involving older adults. From Study A, two key dimensions guided the selection process, ensuring the inclusion of participants whose backgrounds and experiences would provide valuable insights.

1) Migration Background:
Highly educated professionals (former international students who settled in the UK)
Marriage migrants (Chinese women who immigrated through marriage)
Labour migrants (migrants who moved for employment opportunities)
Dependent family migrants (older people who moved to care for grandchildren)

2) Low-Carbon Behaviour Categories
The Environmental Pioneer (actively engages in sustainability initiatives)
The Frugal Practitioner (low-carbon behaviours driven by economic concerns)
The Passive Adapter (adopts sustainability practices under external influence)
The Isolated Group (limited engagement due to language or access barriers)

Exclusion Criteria

Participants whose mobility or health conditions might make participation in walking interviews unsafe were not invited to take part in this specific method. This decision was made to ensure participant safety and wellbeing. Table 4.2 summarises participant information, participants use their alias:

Table 4.2 Summary of the characteristics of the participants in Study B (N = 20).

Category	Distribution
Gender	13 Female, 7 Male
Age Range	55–64 (10), 65–74 (6), 75+ (4)
Migration Background	- Former professionals/international students (4) - Marriage migrants (3) - Labor migrants (7) - Family dependents (6)
Low-Carbon Behaviour Type	- Environmental Pioneers (3) - Frugal Practitioners (9) - Passive Adapters (5) - Isolated Participants (3)
Country/ Region of	- Mainland China (16)

	- Hong Kong (1) - Malaysia (2) - Taiwan (1)
Cross-national Family Background	4 participants

4.2.2 Data Collection

Ethical approval was obtained before data collection for Study A. Participants received a participant information sheet and consent form before taking part, either by email, WeChat, or in printed form. Informed consent was obtained prior to the questionnaire and interview. All participant data were anonymised using codes such as P01 and P02, and the relevant ethics approval documents, information sheet, consent form, and recruitment materials are provided in Appendix Study A.

Study A: Data Collection Process

- Structured Questionnaire: captured demographic information, degree of acculturation, and levels of net-zero awareness.
- Semi-Structured Interview: investigated the participants' low-carbon practices and their needs for net-zero-related information.

The semi-structured interviews were based on a questionnaire that served as a blueprint for data collection. At the initial stage, the researcher consulted Chinese community leaders, who reviewed the research materials and provided feedback. A pilot study was conducted with three community staff members to refine the questionnaire and the interview approach. During the pilot study, community leaders raised concerns that certain questions, such as those relating to housing type and marital status, might be perceived as sensitive, particularly among low-income participants and those living alone. While these variables could provide useful contextual information, they were considered potentially intrusive and might have affected participants' willingness to engage openly. To minimise discomfort and build trust, the researcher revised or softened the wording of these questions and avoided direct inquiry where appropriate.

Three days before the interview, the participants received an information sheet and a consent form via email, allowing them sufficient time to review the documents and ask any questions. For those who did not use email, the researcher offered to send the materials via WeChat (a popular social media among Chinese migrants) instead.

Interview Process

All interviews were conducted individually and lasted approximately one hour. The participants could choose to fill in the questionnaire themselves or have the researcher

assist them, as some older participants were unfamiliar with using digital editing tools on computers or mobile devices. Each interview began with an icebreaker conversation to establish trust and encourage open sharing. In addition, participants' opinions and attitudes were fully respected, and the researcher remained neutral, avoiding any leading questions or judgement.

The adapted framework informed the design of the questionnaire (see Appendix Study A). Three primary sources shaped the questionnaire items:

- Demographic Factors (Individual personal characteristics): Age, Gender, Education, Origin, Length of cultural contact, Language ability, Personality, Social support.
- Internal Factors (Individual variables for person): Traditional beliefs such as Man-to-nature orientation value or Collectivist value.
- Internal Factors (Individual variables between person and situation): Opportunities, Resources, Time, Knowledge, Skills.
- External and Situational Factors (Societal level variables): Influences from the wider social context, such as the COVID-19 pandemic, energy crisis, and net-zero policy recommendations.

Study B: Data Collection Process

Study B focused on asks the following questions:

1) How are low-carbon behaviours among older Chinese migrants in the UK shaped by cultural memory, migration experience, and everyday adaptation to their new environment?

2) How do older Chinese migrants perceive generational differences in sustainability attitudes and behaviours within their families or communities?

3) How do social networks and migrant-specific contexts influence their access to low-carbon information?

Pre-Interview Preparation and Ethical Considerations

Ethical approval for Study B was obtained before the walking interviews were conducted. In addition to informed consent, particular attention was paid to participants' physical comfort, mobility, and safety. Walking routes, duration, and locations were discussed and agreed with participants in advance, and participants could pause, stop, or withdraw from the interview at any time. The relevant ethics approval documents, information sheet, consent form, and walking interview materials are provided in Appendix Study B.

Two pilot walking interviews were conducted. In the first pilot, a participant led the researcher on an extended outdoor walk, which proved logistically and physically challenging. As a result, the protocol was adjusted to prioritise shorter, more accessible walking routes. In the second pilot, a participant chose a crowded supermarket as the location, where ambient noise disrupted audio recording. Subsequent interviews were therefore conducted in quieter public settings or seated areas conducive to reflective conversations.

These pilot interviews informed the final walking interview. The interview questions were open-ended and designed to prompt reflections on daily routines, past experiences, environmental values, and community engagement.

Informed Consent and Confidentiality

At the beginning of each interview, the researcher obtained written consent from the participants, explaining the consent form in detail to ensure they understood the data collection process. The participants were informed of their right to withdraw at any time; however, none of them chose to leave the study.

To protect confidentiality, all data were anonymised, and each participant was assigned culturally appropriate pseudonyms. The researcher asked if she could accompany participants on walks that were part of their daily routines, such as grocery shopping, visiting gardens, or showing personal belongings. The interview locations were chosen based on the participant's daily environments, including homes, parks, and markets.

The route, walking duration, and schedule were mutually agreed upon through discussion between the researcher and the participant. The suggested minimum walking duration was 15 minutes. During the walk, the researcher used open-ended questions to encourage discussion around key topics, such as: "What inspired your low-carbon behaviours?" However, the duration of the walking interviews varied significantly, ranging from 30 minutes to 1 hour 50 minutes, depending on the participant's preferences and chosen routes.

Research Questions

Interview questions were semi-structured and open-ended, designed to elicit the participants' reflections on themes such as:

- Everyday low-carbon behaviours;
- Frugality and consumption;
- Cultural adaptation and community life;

- Experiences with UK climate policies or environmental programmes.

The flexible format allowed the participants to guide the conversation toward aspects of daily life most meaningful to them. The interviews were conducted in Mandarin, Cantonese or English, according to each participant's preference, and recorded using a portable audio recorder.

4.2.3 Data Analysis

Study A: Survey and interviews

Confidentiality was ensured by assigning coded identifiers (e.g., P01, P02) to each participant. All data were securely stored on the OneDrive platform provided by Brunel University.

The collected data were categorised into two sets for analysis:

1) **Survey Data** Quantitative responses, including scaled responses and multiple-choice questions, were recorded in Excel and use SPSS for statistical analysis.
2) **Interview Data** Semi-structured interview transcripts were analysed using NVivo to identify key themes and explore recurring patterns related to cultural adaptation, motivations for low-carbon behaviour, and perceptions of net-zero policy.

Survey Data: Basic **descriptive counts** were used to highlight key trends, such as:

- Demographic composition (e.g., "64% of participants were female").
- Language proficiency levels (e.g., "80% of the participants identified Mandarin as their primary language, but only 46% were fluent in English").
- Environmental awareness (e.g., "Only 40% of participants demonstrated familiarity with 'Net Zero' policies").
- Behavioural engagement (e.g., "92% of participants reported complying with local recycling rules").

To examine the relationship between personality traits, cultural adaptation, and environmental engagement, Pearson's correlation analysis was applied.

Interview Data: A thematic analysis approach was employed to systematically examine the qualitative data, ensuring a structured exploration of the participants' perspectives.

The data analysis processes are shown in Figure 4.6.

This study employed Braun & Clarke's (Braun & Clarke, 2006) six-step thematic analysis to systematically extract key themes from qualitative data. This approach enabled a structured exploration of older Chinese migrants' lifestyles, cultural

adaptation strategies, and their attitudes and behaviours towards low-carbon practices and net-zero policies in the UK.

The six steps of thematic analysis are as follows:

1) Familiarisation Repeatedly reading interview transcripts, reviewing survey responses, and taking initial notes.

2) Generating Initial Codes Applying open coding to highlight key segments of text relevant to the research questions.

3) Searching for Themes Grouping similar or related codes to develop potential themes.

4) Reviewing Themes Refining, merging, or adjusting themes to ensure coherence with the data and theoretical framework.

5) Defining and Naming Themes Clarifying the scope and meaning of each theme to establish distinct conceptual boundaries.

6) Producing the Report Integrating themes with the research context and literature, supported by representative quotes and case examples.

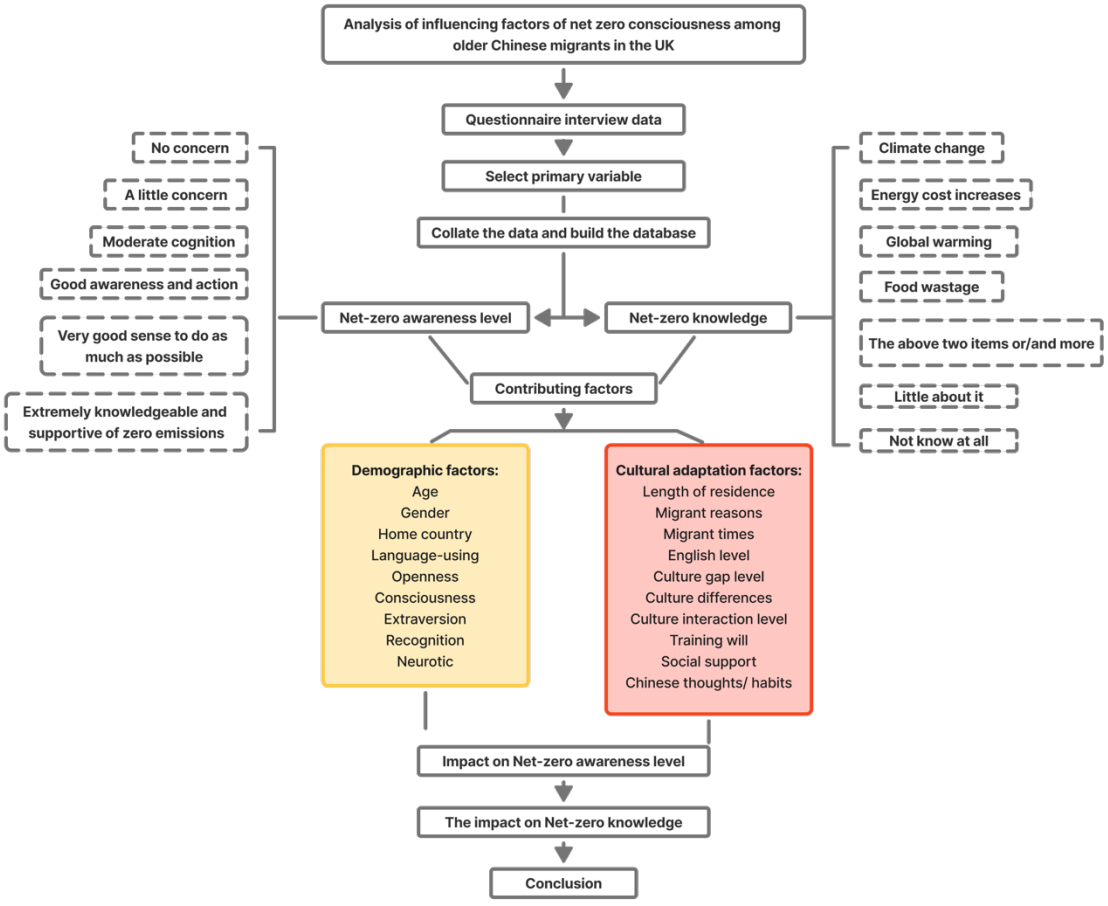


Figure 4.6 Data analysis processes for study A.

After completing familiarisation and open coding, the study identified numerous preliminary labels, such as "cultural differences," "language barriers,"

"family roles," "community support," "awareness of energy conservation," "grocery shopping and cooking habits," "attitudes towards plastic bag charges," "waste reuse," "understanding of Net Zero," and "concerns about ageing and health." These labels were then grouped and refined, into seven key themes (with sub-themes) for further analysis.

Next, the participants' backgrounds and interview content were systematically organised to develop personas. The thematic analysis approach was also applied to persona construction, using open coding to identify the following key dimensions:

- Migration background (e.g., international students, marriage migrants, labour migrants, family-dependent migrants).
- Cultural adaptation (degree of integration into British society, primary social networks).
- Language proficiency (English fluency and its impact on daily life).
- Information sources (how participants access UK policies and environmental information).
- Daily practices (habits related to diet, consumption, energy use, and transport).
- Understanding of net-zero policies (awareness, acceptance, and engagement with low-carbon behaviours).

Through this process, it became evident that different types of migrants demonstrated significant variations in cultural adaptation, language proficiency, and access to information.

Study B: Walking Interviews

The walking interviews produced a rich set of qualitative data, including audio transcripts, field notes, and contextual photographs taken during the participants' daily routines. The researcher reviewed the transcripts and visual data repeatedly alongside field notes to capture both spoken narratives and the environmental settings in which they occurred.

The analysis followed Braun and Clarke's (2006) thematic approach. An initial round of open coding identified 18 recurring topics, such as language barriers, cultural adaptation, financial pressures, and social integration. Because of overlaps and interconnections, these codes were gradually refined and consolidated through iterative clustering. For example, "language difficulties" and "lack of access to public information" were merged under the broader theme of "Information Barriers," while "use of second-hand items" and "creative reuse" were grouped under "Practical

Frugality". This process yielded a final set of eight core themes, each supported by a hierarchy of sub-themes.

Visual data were analysed as complementary evidence rather than stand-alone artefacts. Photographs of participants' homes, shopping practices, and neighbourhoods were coded for salient features (e.g. reuse of containers, growing vegetables, handmade chothes). These were then cross-referenced with interview transcripts to examine how the participants described and explained their practices. In many cases, images acted as elicitation devices during the interviews, triggering personal stories and reflections. Incorporating these materials into the thematic analysis strengthened ecological validity by grounding abstract themes in observed routines and material contexts.

While Study A and Study B surfaced similar themes, the use of walking interviews introduced additional layers of contextual and embodied data. This combination not only confirmed the robustness of themes across methods but also revealed variations in how low-carbon behaviours were motivated, narrated, and enacted in situ.

4.2.4 Data Rigour and Triangulation

To ensure the rigour and credibility of the studies, method triangulation, researcher reflexivity, and participant validation were employed. Given that Study A and Study B utilised different data collection methods. Study A combined semi-structured interviews and surveys, while Study B adopted walking interviews for more in-depth exploration, triangulation not only facilitated cross-verification of findings but also provided a more nuanced understanding of Chinese migrants' low-carbon practices and cultural adaptation.

1) Method Triangulation

Study A, through surveys and semi-structured interviews, provided a broad understanding of older Chinese migrants' awareness of net-zero policies and their low-carbon behaviours in the UK. However, due to time constraints and privacy concerns, Study A had limitations in uncovering the underlying motivations and contextual factors influencing these behaviours. Study B, employing walking interviews in familiar environments, allowed the participants to narrate their lived experiences within their daily routines. This contextualised approach enriched the data while simultaneously validating key themes identified in Study A.

2) Complementarity of Study A and Study B

Although Study A and Study B covered similar themes, such as cultural adaptation, economic pressures, social networks, and environmental awareness. The different data collection methods provided varying levels of detail:

- Low-carbon behaviours: In Study A, the participants primarily self-reported their low-carbon practices. In contrast, Study B enabled researchers to observe behaviours in situ, such as carrying reusable shopping bags, preferring walking over other modes of transport, or paying attention to food packaging when shopping.
- Cultural influences on consumption patterns: While both studies highlighted the impact of culture on consumption, Study B provided deeper insights into how environmental awareness intersects with traditional values of frugality.

3) Researcher Reflexivity and Participant Validation

To mitigate researcher bias, reflexive memos were maintained throughout the research process, particularly during Study B, where the researcher sought clarifications or elaborations from participants when necessary. Additionally, preliminary findings were shared with Chinese community organisations to ensure that the research conclusions aligned with the participants' lived experiences.

This triangulated approach enhanced the study's reliability.

4.3 Results for Study A

The analysis of the extensive interview data provides a nuanced understanding of the lived experiences of older Chinese migrants in the UK. Seven overarching themes were identified, each with multiple subthemes, as follows:

1) Motivation for migration & language use.
2) Cultural Adaptation and Identity Transformation.
3) Language Barriers and Communication Practices.
4) Understanding and Adoption of Net Zero/Low-Carbon Behaviours.
5) Lifestyle Changes: Energy Use, Waste Management, and Consumer Habits.
6) Social Integration, Information Sources, and Community Support.
7) Integration of Personality Variables with Cultural and Environmental Factors.

4.3.1 Motivation for migration & language use

In this study, the participants' motivation for migration varied, with family reunification (36%) being the most common reason, followed by employment (44%) and education (28%). At the same time, participants displayed significant variations in language proficiency. Nearly 80% identified Mandarin as their primary language, whereas only 46% considered themselves fluent in English. Among Hong

Kong participants, 90% primarily spoke Cantonese, though some also had proficiency in Mandarin or English.

Language use in daily life varied based on residential location, within Chinese communities, Mandarin and Cantonese were predominantly spoken, while in public spaces, most participants relied on English for communication.

4.3.2 Cultural Adaptation and Identity Transformation

A significant number of participants reported experiencing substantial cultural differences after migrating to the UK.

Cultural adaptation is a crucial process for older Chinese migrants as they navigate life in a new environment. This study applies Berry's acculturation model (Berry, 1997), which categorises adaptation strategies into four distinct types: A small group of participants (12%) appeared to have assimilated fully into British society, often finding that their original cultural identity became less prominent. In contrast, a larger proportion (45%) adopted an integrative approach, combining elements from both cultures to form a balanced, hybrid identity. About one-third (35%) maintained strong cultural separation by holding on to Chinese traditions and engaging minimally with British society. A few participants (8%) reported feelings of marginalisation and expressed that they no longer felt fully connected to either culture.

1) Preservation of Traditional Values

For many participants, protecting traditional values remains an important part of daily life. Family ceremonies, language and festival celebrations continue to provide a sense of belonging and cultural continuity. One participant shared :*"I came here mainly for a family reunion. Despite living in London now, I still observe the Chinese festivals with my family every year."* – (P01, 69, Female, Hong Kong)

Some respondents explicitly mentioned continuing practices such as cooking Chinese meals and celebrating cultural holidays. *"Even in this foreign land, I continue to prepare traditional Chinese dishes and celebrate our festivals, as these rituals keep me connected to my roots."* – (P08, 54, Female, Hong Kong/Mainland China)

2) Transformation and Integration

At the same time, some participants demonstrated significant transformation and flexibility in their cultural practices. Participants described a merging of old and new values. Nearly half of the participants (16 out of 36) noted that their lifestyles now reflected a hybrid of Chinese traditions and British practices. *"Living here has made me*

adopt some new habits—like relying on public transport and even adjusting my daily routines—while still cherishing my cultural heritage." – (P26, 83, Female, Hong Kong) Such adaptation often coincided with intergenerational tensions. A number of interviewees (approximately 30%) reflected on how cultural expectations have evolved in their families, with some expressing concerns that the next generation is drifting away from traditional practices. *"I worry that my children, who are more exposed to British culture, may not understand the importance of our traditions."* – (P20, 55, Male, Mainland China)

3) Migration History and Cultural Identity Shift

Migration history and personal background also shaped how cultural identities evolved. As shown in Table 4.3, those who had lived in the UK for more than 20 years tended to display a higher degree of cultural integration, while more recent arrivals retained a stronger attachment to Chinese cultural norms.

Table 4.3 Migrant background and cultural identity change.

Variable	Assimilation	Integration	Separation	Marginalization
Less than Five years	5%	20%	65%	10%
Stay for 5-10 years	10%	45%	40%	5%
Stay for >20 years	30%	55%	10%	5%

One participant who had lived in the UK for over two decades described how his sense of identity had changed over time: *"When I first arrived in the UK, I kept all my Chinese habits, such as wearing red during festivals, cooking meals every day, and shopping at Chinese stores. But now, I see myself as a 'blend of East and West.' I still eat Chinese food, but I have also adapted to British social customs, like having afternoon tea and going to the pub."* – (P20, 55, Male, Mainland China)

4) Generational and Regional Cultural Differences

Generational and regional differences added further complexity. First-generation migrants, typically aged between 50 and 80, showed stronger identification with Chinese traditions, especially values of frugality, family responsibility, and respect for elders. In contrast, younger participants who had grown up or been educated in the UK were more likely to identify with British social norms and lifestyles. Regional origins also played a role. Participants from mainland China often relied on Chinese-speaking networks and community associations, while those from Hong Kong, Malaysia, or

Singapore showed greater adaptability, partly due to earlier exposure to bilingual or multicultural environments. One Malaysian-born participant commented :
"Back in Malaysia, I was already used to an environment where both Chinese and English were commonly spoken, so adapting to life in the UK was easier for me. I have both British and Chinese friends." – (P15, 58, Female, Mainland China)

4.3.3 Language Barriers and Communication Practices

Language emerged as a central theme that affects both cultural adaptation and the adoption of environmental practices. Over 80% of respondents commented on the role of English proficiency. Table 4.4 shows the language proficiency level.

Table 4.4 Language proficiency level.

Language proficiency Level (1-5)	Number of respondents
5 (Fluency)	7
4 (Intermediate)	6
3 (Basic)	15
2 (No proficiency)	8

1) Challenges in Acquiring and Using English

For many, the initial period after arriving in the UK was characterised by considerable language-related stress. Limited English proficiency often restricted their ability to interact socially, navigate everyday systems, and access important public information. One participant reflected on her early struggles:
"The environmental guidelines are mostly in English, and in my early days, my limited language skills meant I often missed important details. I rely on my children to translate official documents for me. Sometimes, I feel like I am missing important information." – (P02, 57, Female, Mainland China)

Some participants described gradual improvement over time through active learning and community-based initiatives. Approximately 40% described active efforts to improve their language skills through formal training and daily practice. As one participant shared:
"I took free English classes offered by the community; over time, my confidence grew, and I now communicate comfortably in both work and social settings." – (P11, 57, Female, Taiwan)

2) Impact on Social Integration and Information Access

Despite these efforts, language barriers continued to shape the extent of social participation and the ways in which migrants accessed information. Many participants expressed a preference for staying within Chinese-speaking networks, as communication with local residents was often intimidating or tiring. One male participant explained:

"I tend to stick with fellow Chinese migrants because, frankly, I find it easier to communicate in Mandarin than to try and follow complex English discussions about local policies." – (P23, 57, Male, Mainland China)

To overcome communication difficulties, participants employed various strategies, including: Using translation apps (WeChat, Google Translate), Relying on ethnic media (Chinese newspapers, WeChat groups), Attending free English classes in community centers, shown in Table 4.5. Several participants elaborated on how these strategies had improved their confidence and autonomy:

"I joined a local English class, and it helped a lot. Now I can at least understand basic conversations at the supermarket." – (P11, 64, Male, Malaysia)

"We have a WeChat group where we translate and discuss government announcements in Chinese. It makes things easier for us." – (P22, 66, Female, Mainland China)

Table 4.5 The methods used to overcome language barriers.

Coping Strategy	Number of mentions	Percentage (%)
Translation apps	21	58%
Relying on family members for help	18	50%
Attending English classes	9	25%
Watching English TV/radio	12	33%

4.3.4 Understanding and Adoption of Net Zero/Low-Carbon Behaviours

This theme focuses on the participants' environmental awareness, their understanding of net zero concepts, and the extent to which they incorporate low-carbon practices into their lives.

1) Awareness of Net Zero Concepts

More than two-thirds of participants exhibited a relatively low level of awareness regarding net zero, which aligns with interview findings, indicating a lack of understanding of technical terminology and insufficient access to relevant training.

Although 14 out of the 36 participants expressed some awareness of net zero goals, many described it as an abstract concept disconnected from their daily actions.

"China also talks about environmental protection, such as banning plastic bags in some areas and implementing waste separation. However, people back home still see environmental protection as the government's responsibility, unlike in the UK, where everyone is expected to be involved." – (P25, 55, Male, Mainland China)
"I've heard of 'net zero,' but I don't know what it really means. I just know that electricity bills are very high now, so I try to save energy." – (P29, 68, Male, Mainland China)

Participants also equated **energy conservation with financial savings** rather than environmental responsibility.
"I don't waste electricity because I want to save money, not because of environmental policies." – (P35, 70, Female, Hong Kong)

The participants with higher education or longer residence (e.g., P20, P29) tended to have a more nuanced understanding:
"Through my work and regular reading, I now understand that net zero means reducing carbon emissions gradually. I try to adapt my behaviours accordingly." – (P20, 55, Male, Mainland China)

2) Barriers to Net Zero Participation

Despite widespread interest in sustainability, several barriers limit active participation in net-zero initiatives. The first is restricted access to information. About 65% of participants noted that most official materials and campaigns are presented only in English, which makes it difficult for those with limited language proficiency to engage meaningfully. Second, low trust in policy initiatives emerged as another concern. Around one-third of respondents viewed environmental policies with scepticism, perceiving them as primarily benefiting governments or corporations rather than individuals. Finally, a lack of behavioural motivation was also evident. Although half of the participants reported practicing energy-saving behaviours, these actions were largely motivated by financial prudence rather than environmental concern.
"We Chinese people have always been frugal, but that doesn't necessarily mean we do it for environmental reasons—it's more about saving money." – (P18, 63, Male, Mainland China)

3) Suggestions for Learning about Net Zero

The participants provided various suggestions on how to enhance understanding and promote net zero policies. These recommendations primarily focused on information dissemination, educational approaches, community support, and policy transparency.
Overall, while many participants had limited understanding of the net zero concept, they expressed a strong desire to access relevant knowledge through more practical, accessible, and community-based means.

4) Adoption of Low-Carbon Practices

While conceptual understanding of net zero remained limited, the majority of participants were already practising a range of low-carbon behaviours in their daily routines.

Energy consumption was one of the most commonly discussed areas of change. Over 60% of participants described efforts to reduce household energy use, particularly through simple behavioural adjustments such as turning off lights, unplugging appliances, and lowering heating levels when not at home.

"With rising energy bills, I always turn off lights and lower the thermostat when I'm not home." –(P29, 58, Female, Mainland China)

Waste management and recycling were also prominent themes. Around 70% of participants reported using reusable shopping bags, recycling household materials, and trying to reduce single-use plastic.

"I always bring my own shopping bag and separate recyclables from other waste. Every small step helps." – (P26, 83, Female, Hong Kong)

Nearly half of the interviewees discussed how their **diets have shifted**, with more emphasis on home-cooked meals and less reliance on takeaways.

"I cook most of my meals at home now using local produce. It saves energy and reduces the packaging waste that comes with takeaways." – (P29, 58, Female, Mainland China)

4.3.5 Lifestyle Changes: Energy Use, Waste Management, and Consumer Habits

Older Chinese migrants in the UK have adopted various lifestyle adjustments due to economic constraints, cultural habits, and environmental policies. These changes manifest in energy consumption patterns, waste management behaviours, and consumer habits. While some participants linked their actions to environmental concerns, many framed them as financially prudent choices rather than conscious sustainability efforts.

1) Changes in Energy Use

Energy conservation was a prevalent practice among the participants, primarily motivated by the **rising cost of energy bills** rather than an awareness of climate change (Table 4.6).

Table 4.6 The energy-saving practice.

Energy-Saving Practice	Number of mentions	Percentage (%)
Turning off lights/appliances when not in use	26	72%
Lowering the thermostat or reducing heating time	23	64%
Wearing more layers indoors instead of using heating	15	42%
Using electric blankets instead of central heating	11	31%
Using insulation or home renovations to conserve heat	6	17%/

The distribution of practices in Table 4.6 reveals a clear pattern: participants tended to adopt low-cost, behaviour-based strategies, such as turning off appliances (72%) and reducing heating use (64%), rather than investing in structural improvements such as insulation (17%).

This difference appears to be shaped by practical constraints rather than a lack of awareness. Behavioural adjustments are relatively easy to implement and require little financial investment, whereas structural changes such as insulation often involve higher costs and, in many cases, require property ownership or landlord approval.
For example, some participants noted that their ability to make changes to their living environment was limited:
"I rent this place, so I can't really change things like insulation. It's too expensive to install insulation, and I'm not sure how long I'll stay here." - (P14, 60, Male, Taiwan)

In addition, differences in housing conditions—such as insulation quality and heating systems—may also influence energy practices. These structural factors can enable or constrain the extent to which individuals rely on heating.

At the same time, participants' energy practices were also shaped by culturally embedded understandings of thrift and everyday routines. For many, reducing energy

use was not framed as an environmental decision, but as a familiar and practical response to rising costs:
"With energy prices going up, I've made it a habit to turn off all appliances when not in use. I also try to only heat one room instead of the whole house." – (P29, 68, Male, Mainland China)
"I wear more clothes indoors rather than relying too much on heating. It's what we did back home in winter, so I'm used to it." – (P22, 66, Female, Hong Kong)

These practices often reflected long-standing cultural values of thrift and moderation, which unintentionally aligned with low-carbon living. As one participant noted:
"I brought an electric blanket from China. I don't think we need central heating at all—just turn on the blanket at night." – (P10, 72, Male, Malaysia)
However, access to financial support could alter these patterns. Participants receiving government energy subsidies reported different behaviours:
"I get energy subsidies, so I don't worry about bills. My heating is on almost every day." – (P19, 68, Female, Mainland China)

2) Waste Management and Recycling Practices
Most respondents (92%) reported **complying with local waste separation rules**, but only a minority (40%) were aware of the **environmental reasons behind recycling policies**. Table 4.7 shows recycling habits among the participants.

Table 4.7 Recycling habits among older Chinese migrants.

Recycling Practice	Number of mentions	Percentage (%)
Following local waste separation rules	33	92%
Using reusable shopping bags	26	72%
Repurposing old clothes for cleaning rags	17	47%
Composting food waste or using scraps for gardening	6	17%

"At first, I didn't sort my waste. Then my children educated me, and I was embarrassed to see that everyone else in my neighborhood was doing it properly." – (P07, 63, Female, Mainland China)

Some participants compared the UK's recycling system to stricter models abroad:

"In Japan, recycling is enforced much more strictly. In the UK, I feel like many people still throw recyclables into the general waste bin." – (P30, 65, Male, Taiwan)

Food waste reduction was another consistent theme, rooted in traditional Chinese values that condemn wastefulness.

"I never waste food. Leftovers are stored properly and eaten the next day. In Chinese culture, wasting food is shameful." – (P33, 72, Female, Hong Kong)

"I compost vegetable peels and food scraps in my garden. It's a natural way to reduce waste." – (P04, 70, Male, Malaysia)

3) Consumer and Clothing Habits

Consumer habits varied among participants, with generational differences influencing attitudes toward shopping, clothing consumption, and sustainability. Table 4.8 shows shopping behaviours among older Chinese migrants.

Table 4.8 Shopping behaviours among older Chinese migrants.

Shopping Behaviour	Number of mentions	Percentage (%)
Avoiding impulse purchases	22	61%
Buying second-hand or donating clothes	14	39%
Sewing or mending old clothes	11	31%
Buying imported Chinese goods	9	25%

"I rarely buy new clothes. If something gets damaged, I try to repair it first before replacing it." – (P25, 69, Female, Mainland China)

Women tended to own more clothes than men, but many still **practiced thriftiness**.

"I have over 100 pieces of clothing, but I don't think I'll live another 100 years to wear them all. Sometimes I buy things and forget to wear them." – (P21, 60, Female, Malaysia)

"During COVID-19, I didn't buy any new clothes. I realised I didn't need so many things." – (P05, 55, Female, Hong Kong)

Several participants also contrasted their own modest consumption with the perceived materialism of younger generations:

"My daughter and granddaughter buy new clothes every season, while I still have clothes from 20 years ago. The younger generation doesn't understand the value of money." – (P31, 74, Male, Mainland China)

When it came to buying imported Chinese products, opinions were mixed. Some participants preferred local British goods for reasons of cost or freshness:

"I prefer buying local British food—it's fresher and cheaper. I only buy imported goods if I can't find the ingredients I need." – (P15, 62, Male, Taiwan)
"Chinese supermarkets here charge too much for imported goods. I try to find local substitutes whenever possible." – (P09, 68, Female, Hong Kong)

4) Transportation Choices

Most participants relied on public transport and walking, viewing them as convenient and economical options. Table 4.9 summarises these preferences.

Table 4.9 Transportation preference.

Mode of Transport	Number of mentions	Percentage (%)
Public transport (bus, train)	24	67%
Walking for short distances	14	39%
Driving private cars	12	33%
Biking	6	17%

"I don't drive because public transport is free for seniors. I take the bus everywhere." – (P16, 70, Female, Hong Kong)
"Walking keeps me fit, and I save money by avoiding unnecessary bus fares." – (P13, 72, Male, Taiwan)
However, participants living in suburban or rural areas faced different circumstances:
"If you live in the countryside, you have to drive. Public transport here isn't as frequent as in London." – (P06, 64, Female, Malaysia)

4.3.6 Social Integration, Information Sources, and Community Support

Social integration plays a crucial role in shaping older Chinese migrants' cultural adaptation, language use, and awareness of policies such as net zero initiatives. Many respondents rely on ethnic communities and social media for information and support, while language barriers and cultural differences continue to hinder deeper engagement with the British society.

1) Social Networks and Community Engagement

Most participants reported that their social interactions primarily occurred within Chinese-speaking networks. As shown in Table 4.10. Older Chinese migrants tend to socialise within ethnic communities, often maintaining strong ties with family, Chinese friends, and local Chinese associations. While these networks provide emotional and practical support, they may also limit cultural integration.

Table 4.10 The primary social networks of older Chinese migrants.

Primary Social Circle	Number of Respondents (n=36)	Percentage (%)
Mostly Chinese community	25	69%
Mixed (Chinese + local British)	8	22%
Mostly local British society	3	8%

"I mostly socialise with other Chinese people. It's easier to communicate, and we understand each other's culture." – (P08, 66, Female, Mainland China)
"I have both Chinese and British friends, but I still feel more comfortable speaking in Mandarin or Cantonese." – (P11, 70, Male, Hong Kong)

Language difficulties (reported by 72% of respondents) and cultural differences (55%) were cited as the main barriers to deeper integration.
"I would love to interact more with British people, but my English is not good enough for deep conversations." – (P23, 74, Female, Malaysia)
Others noted that cultural differences in socializing styles made integration difficult.
"British people are polite but distant. In China, we visit each other's homes frequently, but here, social interactions feel more formal." – (P30, 69, Male, Taiwan)
However, some participants actively engaged with multicultural groups, citing their open-mindedness and curiosity about British culture.
"I joined a local gardening club. Even though my English is limited, we communicate through shared interests." – (P05, 67, Female, Hong Kong)

2) Sources of Information and Media Consumption

Access to information about local policies and environmental initiatives reflected a similar pattern of dependency on culturally familiar and linguistically accessible channels. As illustrated in Figure 4.7, participants reported using a combination of traditional and digital media to stay informed. While television, friends, and family remained common sources, digital platforms such as WeChat, TikTok, and Xiaohongshu ("Red") were increasingly central to their daily information flow.

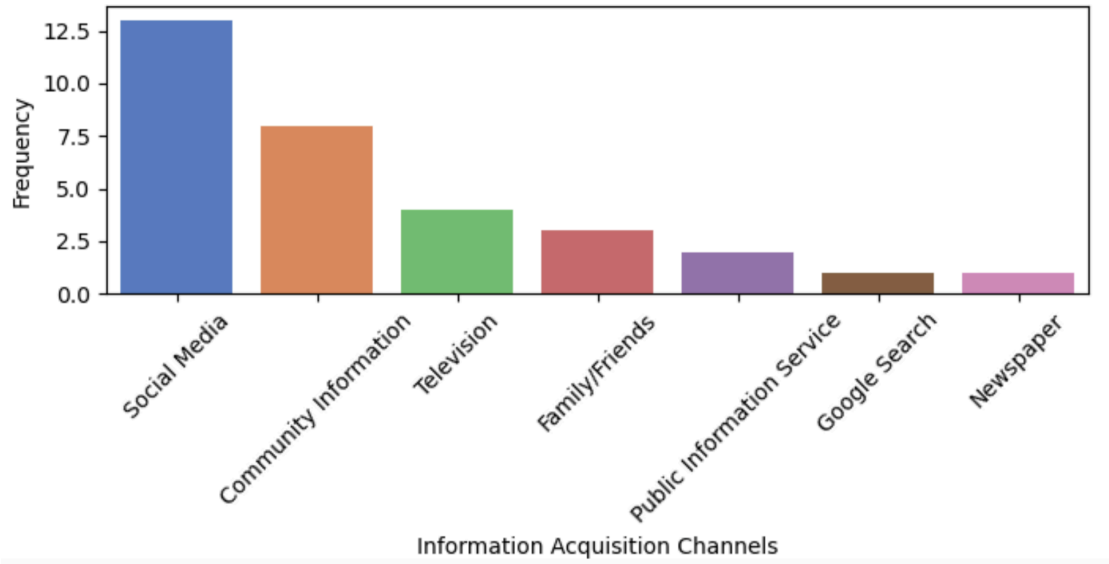


Figure 4.7 Information Acquisition Channels of Older Chinese Migrants.

"I rely on WeChat for news, especially Chinese-language community groups. They explain policies in a way I can understand." – (P19, 62, Female, Mainland China)

"Sometimes my children translate important news for me, but I rarely read English newspapers myself." – (P33, 70, Female, Taiwan)

Many noted that language barriers and differences in presentation style affected how they understood official communications about net zero and environmental guidelines. Figure 4.8 shows the barriers to information acquisition channels of older Chinese migrants.

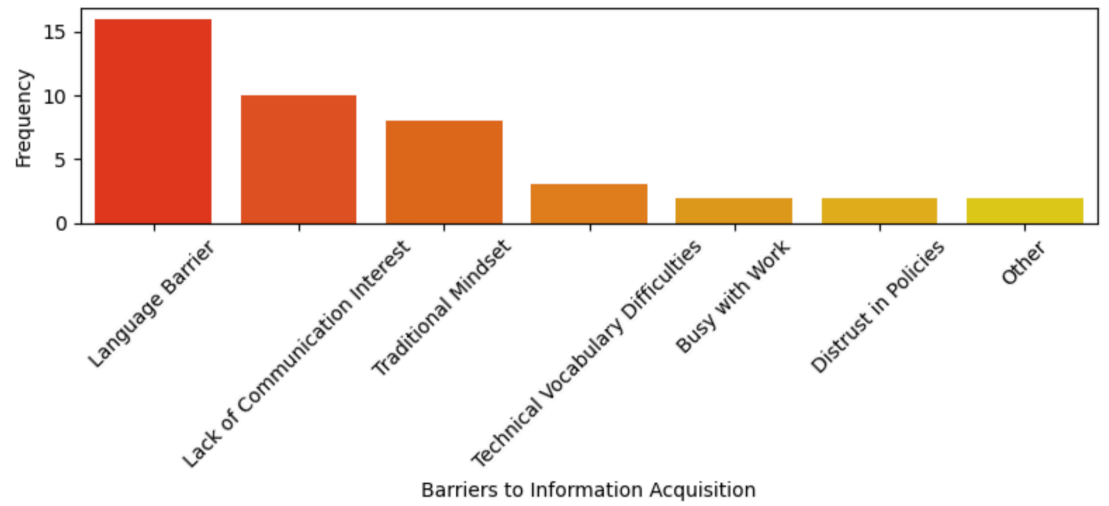


Figure 4.8 Barriers to information Acquisition Channels of Older Chinese Migrants.

"Government information is often too technical. I don't understand the terminology they use about net zero." – (P12, 67, Male, Mainland China)

"I wish there were more translations or simplified explanations of policies for older migrants." – (P26, 72, Female, Malaysia)

Trust also emerged as a key dimension in participants' media consumption. Several expressed scepticism towards Western media and a stronger sense of reliability toward Chinese-language outlets:

"British media presents things from a Western perspective. I trust Chinese news sources more." – (P29, 74, Male, Hong Kong)

However, a few actively sought balanced perspectives from multiple sources.

"I compare Chinese and Western news to form my own judgment. Both have biases, so I like to see different viewpoints." – (P14, 60, Male, Taiwan)

4.3.7 Integration of Personality Variables with Cultural and Environmental Factors

To further explore how individual dispositions influence cultural and environmental engagement, participants were invited to self-assess their personality using a brief Big Five inventory (EGAN, 2009), which measures five dimensions that capture individual differences relevant to adaptation and behaviour: These self-ratings provide additional insight into individual differences that may influence cultural adaptation and other behaviours observed in the study. Openness captures the willingness to embrace new ideas and experiences; conscientiousness reflects organisation, reliability, and goal orientation; extraversion indicates sociability and assertiveness; agreeableness relates to cooperation and compassion; and neuroticism refers to the tendency to experience anxiety and emotional instability. These personality self-ratings provided a nuanced understanding of individual differences that may underpin variations in cultural adaptation and environmental engagement among older Chinese migrants.

Figure 4.9 presents a correlation matrix illustrating the relationships between personality traits and selected cultural and environmental variables. The colour scale represents the strength and direction of the correlations, with red tones indicating positive correlations and blue tones indicating negative correlations. Darker shades reflect stronger relationships, while lighter shades indicate weaker associations.

Correlation coefficients (r) range from -1 to +1, where values closer to +1 indicate a strong positive relationship, values closer to -1 indicate a strong negative relationship, and values near 0 suggest little or no linear association between variables.

Only statistically meaningful or relevant correlations are visualised for clarity.

First, English proficiency (C09) was strongly and positively correlated with cultural interaction level (C12; r = 0.59, p < 0.01), indicating that stronger language skills substantially facilitate engagement with the host society.

Second, age (C02) was negatively correlated with cultural interaction (C12; r = -0.22, p < 0.05), suggesting that older participants were comparatively less active in intercultural exchanges.

English proficiency was positively associated with net-zero awareness (C23; r = 0.24, p < 0.05), implying that better language ability enables access to, and understanding of, climate-related information.

In contrast, the Big Five personality traits (C17–C21) show generally weak and inconsistent correlations with the cultural and environmental variables, indicating that individual dispositions may play a less significant role in this context. Instead, these findings highlight the importance of structural and socio-cultural factors, such as language and social interaction, in shaping environmental engagement among older Chinese migrants.

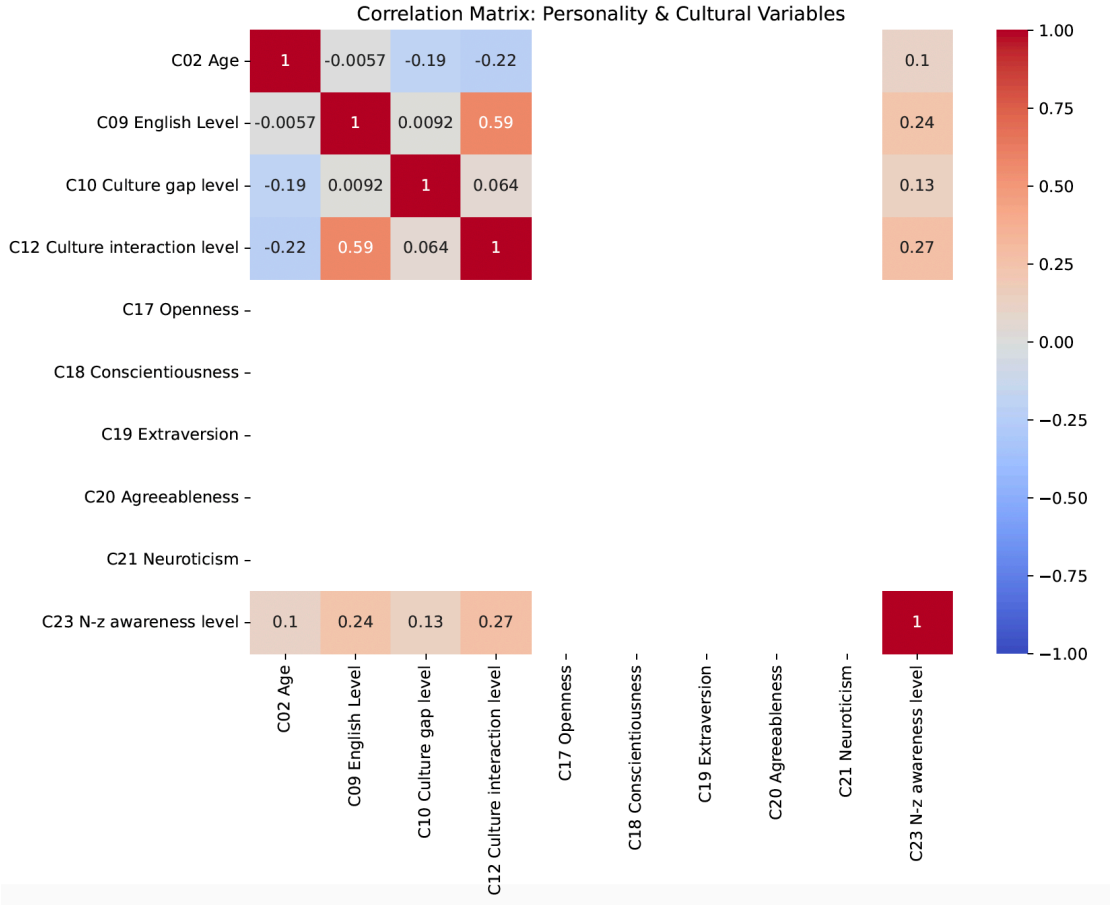


Figure 4.9 Correlation Matrix: Personality & Cultural Variables.

4.4 Discussion for Study A

This section discusses the findings of Study A in relation to existing theories, comparing them with current literature, identifying the study's limitations, and outlining directions for future research.

Based on the results, representative personas were developed to illustrate different adaptation and low-carbon behaviour patterns among older Chinese migrants. These findings also inform the design of the next phase, the walking interviews, to explore the participants' motivations in greater depth.

4.4.1 Summary of Key Findings

1) The Influence of Cultural Adaptation on Low-Carbon Behaviour

Findings indicate that participants with higher levels of cultural adaptation (assimilation/integration) were more likely to accept the UK's low-carbon policies and actively adjust their lifestyles, such as using public transport, complying with waste separation rules, and conserving energy. The participants who adhered to traditional Chinese values (e.g., frugality, family-oriented living) also exhibited certain low-carbon behaviours, albeit primarily for economic rather than environmental reasons. Those in the integration category demonstrated the greatest balance, combining traditional frugality with contemporary environmental policies.

2) The Impact of Language Barriers on Low-Carbon Awareness and Practices

Language proficiency plays a critical role in social integration, policy implementation, and engagement with low-carbon behaviours.

80% of the participants predominantly used Mandarin or Cantonese in their daily lives, with many self-reporting limited English proficiency. Participants with higher English proficiency exhibited greater perceived behavioural control (Ajzen, 1991) over low-carbon actions, such as accessing net-zero policy information and applying for environmental subsidies. Many participants relied on translation apps (e.g., WeChat), Chinese-language media, or assistance from family members to understand environmental policies, which reinforced information isolation: *"Government information is often too technical. Terms like 'net zero' are difficult to understand. I wish there were more translations or simplified explanations of policies."*- (P12, 67, Male, Mainland China)

3) External Factors (Policies, Economy, and Social Norms) Shaping Low-Carbon Behaviour

Low-carbon behaviour is influenced not only by individual attitudes but also by external constraints, such as government policies, economic conditions, and social norms.

Economic Factors as the Primary Driver: The 2022 energy crisis prompted many participants to adopt energy-saving behaviours, yet their primary motivation was financial rather than environmental responsibility: *"Electricity bills are too high, so of course, I try to save energy—but not because of environmental concerns, simply to cut costs."*- (P35, 70, Female, Hong Kong)

Policy-Driven Behavioural Change and Information Barriers: The UK's waste separation system influenced the participants' recycling habits. However, language barriers and difficulties in accessing information prevented some from fully adhering to regulations: *"Initially, I did not separate my waste, but my children taught me, and I realised that everyone else in the community was doing it."*- (P07, 63, Female, Mainland China)

The Role of Social Support in Low-Carbon Engagement

The participants involved in local British community groups were more receptive to environmental initiatives, influenced by peer engagement:

"I joined a gardening club, where we discuss ways to reduce plastic waste. My habits have changed because of these conversations."- (P05, 67, Female, Hong Kong)

69% of the participants relied primarily on Chinese-language networks (WeChat groups, Chinese newspapers, churches) for information, while only 22% had significant engagement with local British society.

4) The Influence of Demographic Variables and Personality Traits on Low-Carbon Behaviour

Participants' demographic characteristics, education levels, and personality traits also influenced their low-carbon behaviours.

Older Women Engaged More in Frugal and Resource-Conserving Behaviours

Women were more likely than men to engage in low-carbon behaviours, particularly in terms of thrifty consumption and reusing materials: *"I never throw away clothes; if they get damaged, I mend them instead of buying new ones."*- (P25, 69, Female, Mainland China)

Higher Education Correlated with Greater Net-Zero Awareness

Highly educated participants were more likely to adjust their lifestyles in response to environmental policies.

Variations in Cultural Adaptation Across Migrant Backgrounds

Mainland Chinese migrants tended to rely heavily on Chinese-language communities and exhibited slower cultural adaptation. However, the migrants from Hong Kong, Malaysia, and Singapore adapted more easily, as they had prior experience with bilingual or multicultural environments.

4.4.2 Comparison with Existing Literature

Study A contributes to existing research on migration and environmental behaviour by offering new perspectives. The findings align with Berry's (1997) acculturation model, confirming the four adaptation strategies. However, this study further highlights how migration backgrounds (e.g., employment, education, family reunification) influence adaptation strategies.

The results support Schwartz (Schwartz et al., 2010), who argued that limited language proficiency restricts social participation and access to information, subsequently affecting individual behaviours, including the adoption of low-carbon practices.

Additionally, this study aligns with Stern's (Stern, 2000) theory of environmental behaviour, which emphasises economic incentives as key drivers of sustainable actions. The findings suggest that older Chinese migrants engage in low-carbon behaviours primarily due to a culture of frugality rather than environmental responsibility, reinforcing Stern's (Stern, 2000) argument.

4.4.3 Limitations

Study A study examined the low-carbon behaviours of 36 older Chinese migrants in the UK and their perceptions of net-zero policies. While several key themes emerged, the study has certain limitations:

1) **Limited Sample Representativeness**

   The participants were primarily based in London and surrounding areas, whereas Chinese migrants in other parts of the UK, particularly rural areas, may face different cultural adaptation challenges and environmental behaviours. For example, urban migrants may have greater access to environmental information, whereas those in rural areas may experience more barriers in accessing resources, social networks, and policy participation.

2) **Self-Reporting Bias**

   Due to language barriers, privacy concerns, or cultural norms, some participants may not have fully expressed their true thoughts. For instance, some may have overstated their environmental awareness due to social desirability bias, even if they do not consistently practise low-carbon behaviours.

3) **Lack of Longitudinal Data**

This study adopted a cross-sectional approach, capturing participants' behaviours and perspectives at a single point in time. However, cultural adaptation and low-carbon behaviours evolve over time. Factors such as length of residence, policy changes, and socio-economic shifts may influence behavioural patterns. A longitudinal study would provide deeper insights into these dynamic changes.

4.4.4 Future Research Directions

To gain a deeper understanding of the low-carbon behaviours of older Chinese migrants, future research should adopt a more differentiated and inclusive approach that recognises the diversity within this population. The findings from this study reveal significant variations in adaptation experiences and environmental engagement, reflecting differences in migration history, social networks, language proficiency, cultural values, and access to information. These insights suggest that future investigations could benefit from developing distinct *personas* that represent the varied experiences and behavioural patterns among older migrants.

(1) Diversity in Cultural Adaptation and Social Integration

The interviews revealed that older Chinese migrants in the UK are far from a homogeneous group. Individuals' adaptation experiences are strongly shaped by their migration background and life circumstances. For example, highly educated migrants, such as former international students who chose to remain in the UK, demonstrated smoother cultural adaptation and broader social networks. Their familiarity with English and prior exposure to local culture helped them navigate daily life more easily. Interview data indicated that different migrant backgrounds led to varied cultural adaptation patterns:

"At university, I became accustomed to using English, and after starting work, most of my friends were locals. I never really experienced major 'cultural shock'." -(P12, 56, Male)

By contrast, marriage migrants showed mixed adaptation experiences. Some gradually integrated through their spouses and children, while others remained primarily engaged within the Chinese community.

"My husband is British, so our home life includes many Western customs, like eating Western food and celebrating Christmas. But I still prefer drinking tea and chatting with my Chinese friends." - (P18, 61, Female)

Labour migrants and dependent migrants, such as grandparents faced more challenges integrating into British society due to language barriers and limited social networks. They tended to rely on Chinese community networks for information and support.
"I don't speak English and feel nervous shopping in regular supermarkets, so I only go to Chinese stores." - (P25, 67, Female)

(2) Language Barriers as a Key Challenge
Despite some participants possessing strong English skills, most older Chinese migrants still faced language difficulties, affecting their daily lives and access to information. Many relied on Chinese-language social media (e.g., WeChat, Chinese websites) instead of official UK government sources.
"I can't read government policy documents, but people explain them in my WeChat group, so that's how I learned about the recent energy price increases." -(P32, 69, Female)
Language barriers also impacted social interactions, leading them to seek support mainly within the Chinese community.
"When I see British people in the park, they greet me politely, but I don't know how to respond, so I just smile."- (P27, 74, Male)

(3) Awareness and Attitudes Toward Net Zero
Awareness and perceptions of the UK's net-zero policies varied significantly between subgroups. Highly educated migrants tended to have greater exposure to sustainability discourse and demonstrated higher levels of policy comprehension and behavioural engagement.
"I know the government is promoting low-carbon lifestyles, so I try to use public transport instead of driving." - (P15, 58, Female)
In contrast, labour migrants and dependent migrants often viewed net-zero initiatives with scepticism or frustration, seeing them as abstract or financially burdensome.
"Net-zero policies just mean more expenses for ordinary people. Energy bills keep rising, how are we supposed to save electricity?" - (P33, 65, Male)
Some participants unconsciously practised low-carbon behaviours (e.g., conserving energy, reusing materials) due to traditional frugality rather than environmental concerns.

(4) Generational Conflicts and Cultural Transmission
Generational tensions also surfaced as a recurring theme, particularly among dependent migrants. Many participants felt that younger family members adapted more easily to

British cultural norms, sometimes at the cost of losing touch with traditional Chinese values.

"My daughter complains that I keep the heating too low, but back in our day, we never wasted energy like this."- (P22, 70, Female)

"My grandson doesn't speak Chinese anymore; he only speaks English. It makes me sad." - (P36, 68, Male)

(5) Community Support and Information Dissemination

Finally, the role of Chinese community networks emerged as central to the adaptation and learning process. Community organisations, such as Chinese churches, cultural associations, and seniors' clubs, provided spaces for social interaction, information exchange, and informal education.

"Going to the Chinese church every week is the highlight of my life. I can chat with others and hear about the latest news." - (P30, 73, Female)

Some suggested that the UK government could improve Chinese-language accessibility in policy communication to help migrants understand environmental policies better.

"If there were official policy translations in Chinese, it would be much easier for us to understand." - (P19, 65, Male)

(6) Policy Implications

To enhance the accessibility and effectiveness of the net-zero policy for older Chinese migrants, this study puts forward several key suggestions:

First, the accessibility of policies can be enhanced. For groups facing severe language barriers, such as labour migrants and dependent grandparents, the government and community organisations should provide more Chinese resources, such as bilingual policy explanations and support services, to enhance their understanding of British regulations.

Secondly, it can encourage cross-cultural communication. Chinese migrants with higher education tend to be more capable of integrating into British society. They can act as cultural intermediaries to assist groups with poorer adaptability. Initiatives such as volunteer programs and peer support groups can promote greater community interaction and knowledge sharing.

Given the strong alignment between traditional Chinese frugality and the UK's net-zero target, community initiatives can also leverage culturally relevant approaches to promote sustainable lifestyles. Strategies can include storytelling techniques to illustrate how low-carbon behaviours can help reduce household expenses, as well as

community activities that provide practical and cost-effective ways to adopt sustainable practices.

Based on the insights from the above discussion, it is evident that older Chinese migrants in the UK constitute a distinctive and underexplored group whose experiences of adaptation and engagement with low-carbon practices vary considerably. These variations are shaped by an interplay of social, linguistic, cultural, educational, and intergenerational factors. To translate these complex findings into a more structured and actionable framework, this study adopted a persona-based approach. Identifying and summarising distinct migrant profiles not only captures this diversity but also provides a useful foundation for future research to recruit targeted participants and design context-specific intervention strategies.

The study identified four distinct migrant profiles, personas which help illustrate the diversity in adaptation patterns and sustainability engagement within the Chinese older migrant community.

Personas, as data-driven user models, provide a structured approach to categorising different types of older Chinese migrants. By constructing personas, this study enhances the understanding of how various migrant groups adapt to net-zero policies and engage in low-carbon practices. Additionally, personas offer valuable insights for policymakers to design targeted interventions, such as tailored environmental education and community support.

Based on key characteristics and migration backgrounds, four representative personas were developed:

Persona 1: Highly Educated Professionals (Former International Students Turned Migrants) —— High level of cultural adaptation and openness to change; Actively seek and engage with information from diverse sources; More likely to embrace net-zero policies and integrate low-carbon behaviours (Figure 4.10).

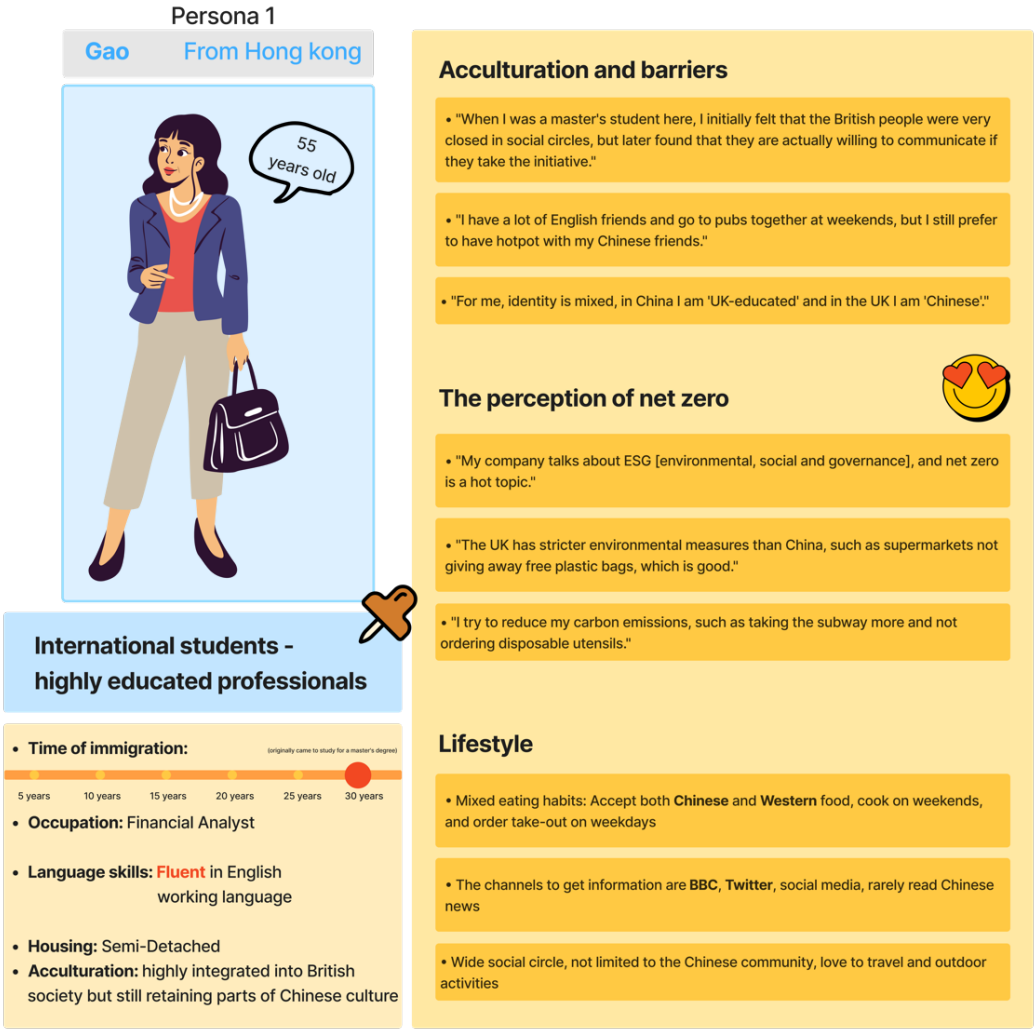


Figure 4.10 Highly Educated Professionals Persona.

Persona 2: Marriage Migrants (Chinese Women Who Moved to the UK for Marriage) — Their behaviours are strongly shaped by family influence, with only partial adaptation to British culture. They maintain close ties within the Chinese community for social interaction, and their low-carbon practices appear to arise more from traditional values than from policy awareness (Figure 4.11).

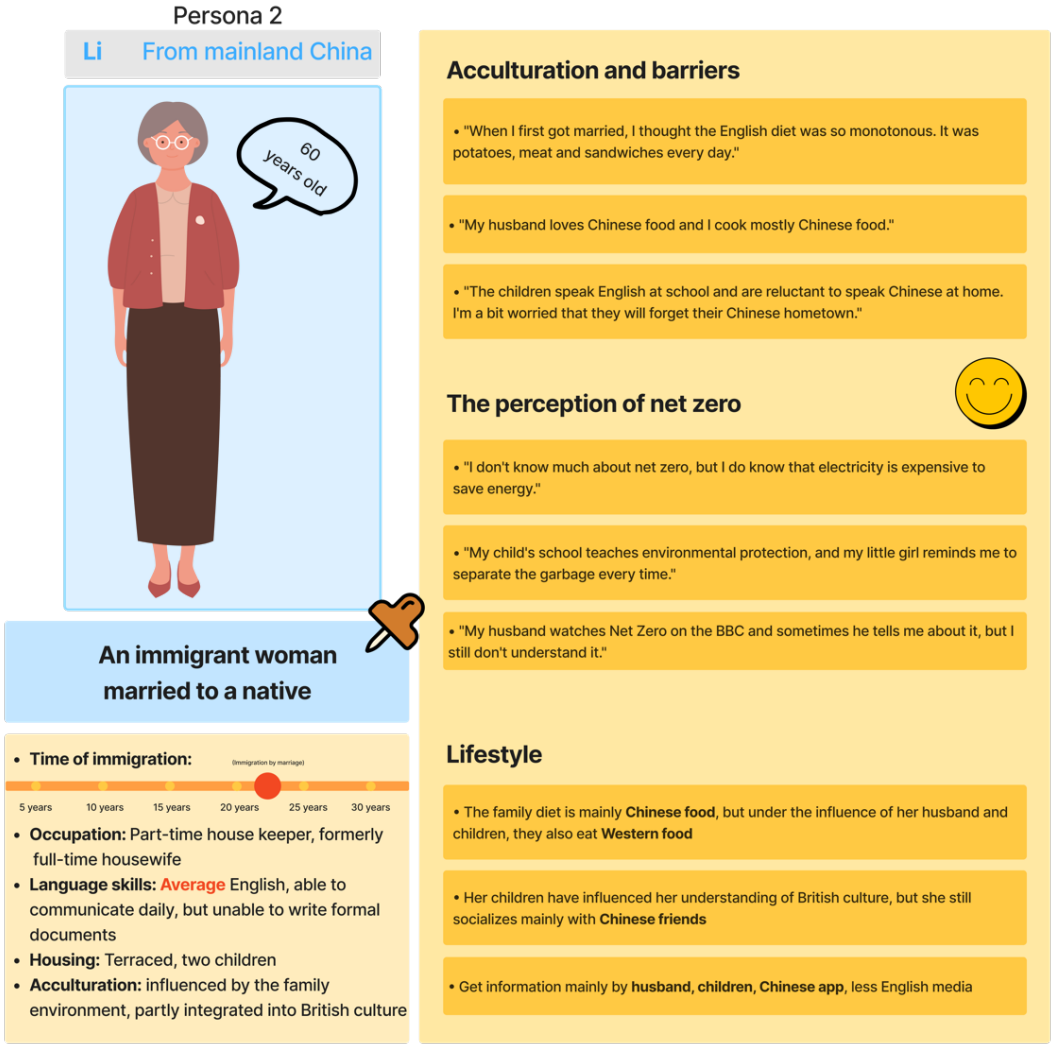


Figure 4.11 Marriage Migrants Persona.

Persona 3: Labour Migrants (Economic Migrants Seeking Work Opportunities) — This group generally has limited English proficiency and tends to interact mainly within Chinese social circles. Their awareness of local policies, including net-zero initiatives, is low, and their environmental behaviours are more strongly shaped by financial constraints than by sustainability concerns (Figure 4.12).

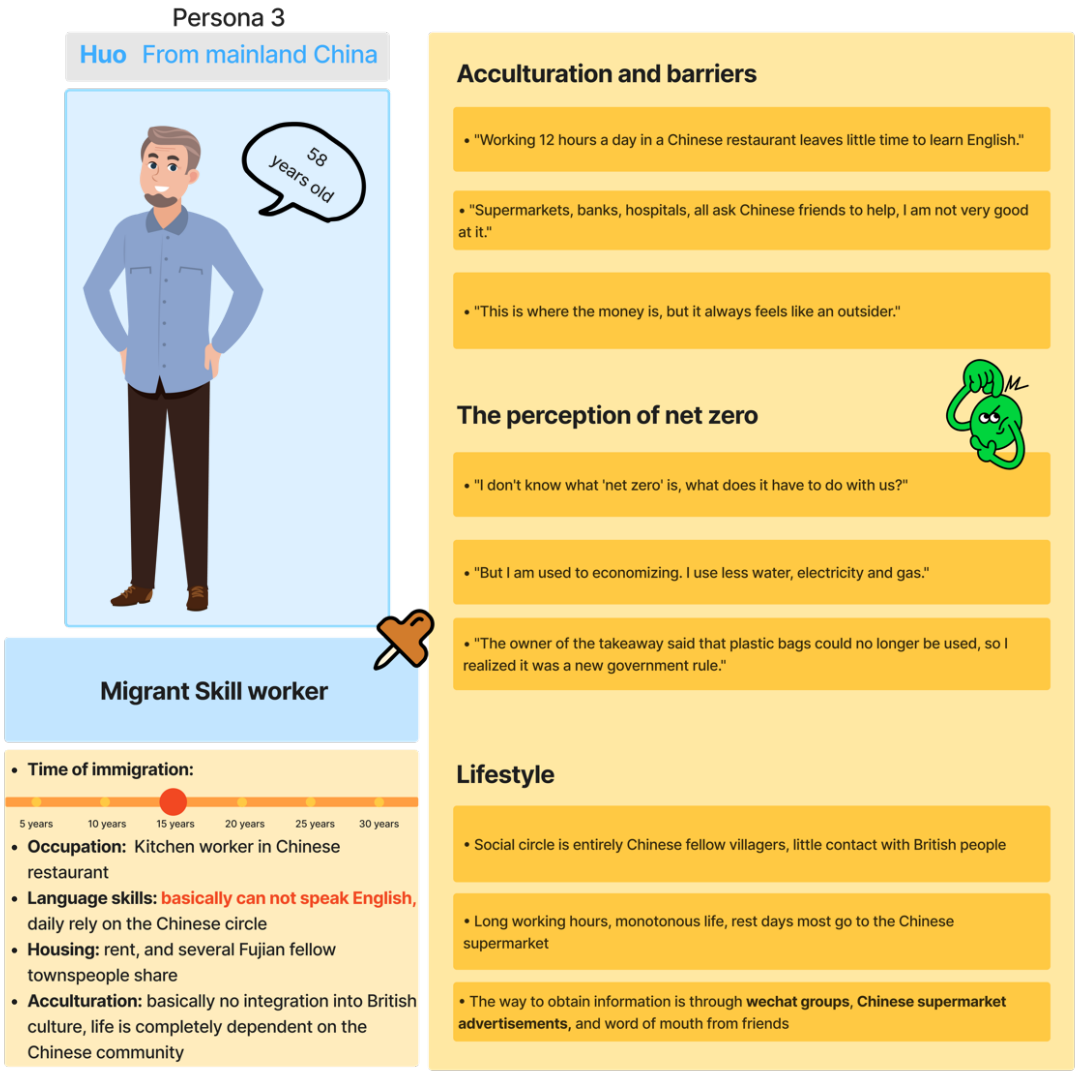


Figure 4.12 Labour Migrants Persona.

Persona 4: Dependent Migrants (Grandparents Providing Childcare in the UK) — This group shows low levels of social integration and faces significant language barriers. They rely heavily on family members for daily activities and decision-making, and their low-carbon behaviours largely reflect traditional frugality rather than deliberate climate action (Figure 4.13).

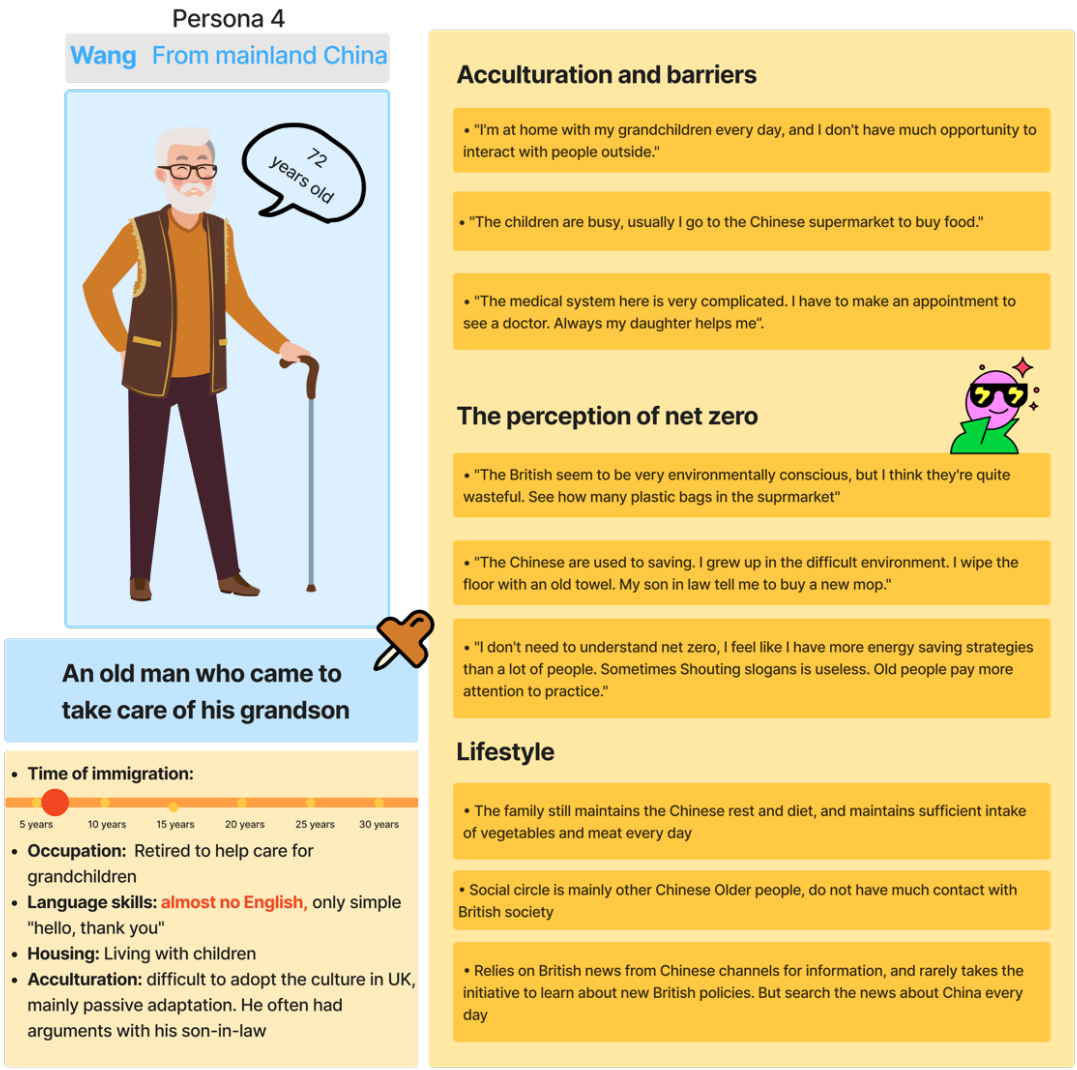


Figure 4.13 Dependent Migrants Persona.

Rather than representing an alternative classification, these persona types reflect a second analytical dimension focused on environmental engagement. While the four migrant profiles (Personas 1–4) are primarily defined by migration background and

levels of cultural adaptation, the categories presented in Table 4.11 capture variation in low-carbon practices and net-zero awareness.

Together, these two dimensions—socio-cultural positioning and environmental engagement—provide a more comprehensive understanding of the diversity among older Chinese migrants.

Table 4.11 Four typical portraits - based on low carbon practices.

Persona Type	Level of Cultural Adaptation	Net-Zero Awareness	Key Behavioural Characteristics	Main Challenges
The Environmental Pioneer	High	High	Actively learns about environmental policies, uses energy-efficient appliances, strong awareness of waste sorting	Limited access to information, lack of Chinese-language resources
The Frugal Practitioner	Low	Low	Conserves energy primarily for financial reasons (e.g., minimizing heating use), but lacks environmental awareness	Believes environmental policies are "irrelevant" to them
The Passive Adapter	Medium	Low	Follows some environmental practices under the influence of their children, such as reducing plastic bag use	Relies on family members for information, struggles to engage in environmental activities independently
The Isolated Group	Low	Low	Faces language barriers, struggles to understand UK environmental policies, social network mainly limited to the Chinese community	Lacks government support, distrusts UK environmental policies

2) Introducing Walking Interviews: Understanding the Interaction Between Environmental Behaviour and Cultural Adaptation

Walking interviews provide a valuable method for capturing participants' behaviours and decision-making processes in real-life contexts, addressing the limitations of traditional interviews, which often lack direct behavioural observation . Compared to static interviews, walking interviews allow participants to describe their habits in familiar environments such as neighbourhoods, parks, supermarkets, and bus stops. This approach helps minimise recall bias, as participants can explain their thoughts while engaging in real-time actions, such as: *"Why do you choose to walk instead of taking public transport?"* or *"How do you decide whether to recycle certain waste items?"*

While other spatially oriented methods, such as cultural mapping and participatory GIS (P-GIS), have been used to explore the relationship between people, place, and environmental behaviour, walking interviews offer a more accessible and flexible approach in this study.

Given the participants' age, language barriers, and varying levels of digital literacy, walking interviews allowed for more natural and conversational engagement, without requiring technical skills or formal mapping tasks.

In **Study A**, the research primarily employed semi-structured interviews and questionnaires to examine older Chinese migrants' perceptions of low-carbon behaviour, net-zero policies, and cultural adaptation. However, due to time constraints and privacy concerns, the researcher was unable to gain deeper insights into the underlying motivations and practical applications of participants' environmental behaviours. To address this gap, **Study B** incorporated walking interviews to further explore how Chinese migrants adapt to British culture and engage in sustainable practices in their everyday lives.

To effectively implement walking interviews, study B emphasised the following:

- Conducting walking interviews in various real-life settings (e.g. supermarkets, parks, community centres) to collect context-specific data.
- Encouraging the participants to discuss their daily low-carbon practices, such as shopping habits, waste disposal routines, and energy-saving strategies.
- Using visual materials, such as photos or short recordings, to capture the participants' interactions with their environment (e.g. using translation apps to understand sustainability policies or interpreting government signage on waste sorting).

4.5 Results for Study B

This section presents the key findings from the walking interviews, which offer rich, situated accounts of older Chinese migrants' daily experiences and sustainability practices. Building on the thematic structure introduced in the methodology, the analysis is organised around four core areas that directly correspond to the study's guiding research questions:

Section 4.5.1 examines the barriers that prevent older Chinese migrants from engaging with local communities and environmental policies.
Section 4.5.2 explores the generational divergence between environmental awareness and actual low-carbon behaviours.
Section 4.5.3 unpacks the historical, cultural, and economic roots of frugality as a form of sustainable practice.
Section 4.5.4 extends the analysis by examining the dynamic interplay between adaptation and continuity in post-migration life, highlighting why some lifestyle habits shift while others persist.

A summary of the eight major themes and their subthemes identified through thematic analysis of the walking interview data is presented in Figure 4.14.

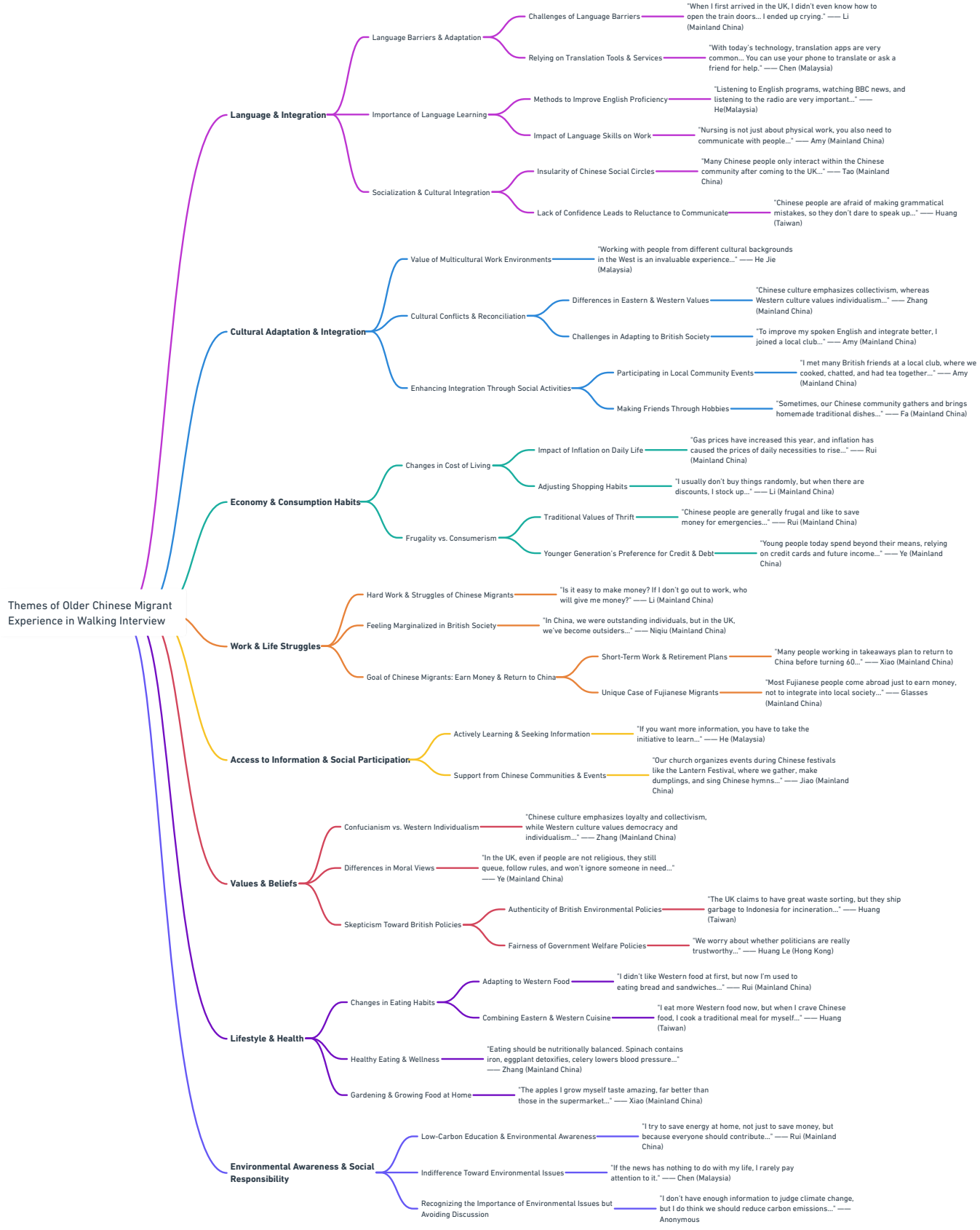


Figure 4.14 Thematic analysis.

4.5.1 Integration and Policy Engagement: Barriers to Local Participation Among Older Chinese Migrants

This section examined why some older Chinese migrants struggle to integrate into local communities and engage with UK policy initiatives. Findings from the walking interviews reveal that multiple structural and cultural factors shape these challenges, including language barriers, cultural norms, economic pressures, and reliance on self-contained ethnic networks.

1) Language Barriers: The First Hurdle to Integration

Limited English proficiency was consistently cited as one of the most significant obstacles to participation in the UK society. Many older Chinese migrants relied primarily on Chinese-language media and social networks, which limited their exposure to local policies and services. As a result, some participants described feelings of isolation, anxiety, and disempowerment in their early years of migration.

"When I first arrived in the UK, I didn't even know how to use the bus or read the coins. Life felt completely disorienting, like being a newborn, except filled with fear."— Shun (Female, 55+, Mainland China)

"At university, I studied Russian, not English. When I came to the UK, I was too afraid to ask for directions. Now I can handle daily conversations, but I still struggle with formal language, such as legal documents, for example, are a nightmare. But I keep learning, even now at 79." — Rui (Female, 75+, Mainland China)

As shown in Figure 4.15, Rui often used English environmental learning materials during self-directed language study.

"Many migrants make the mistake of staying within their language bubble. But that means you never really know what's happening in the country." — He (Female, 60+, Malaysia)

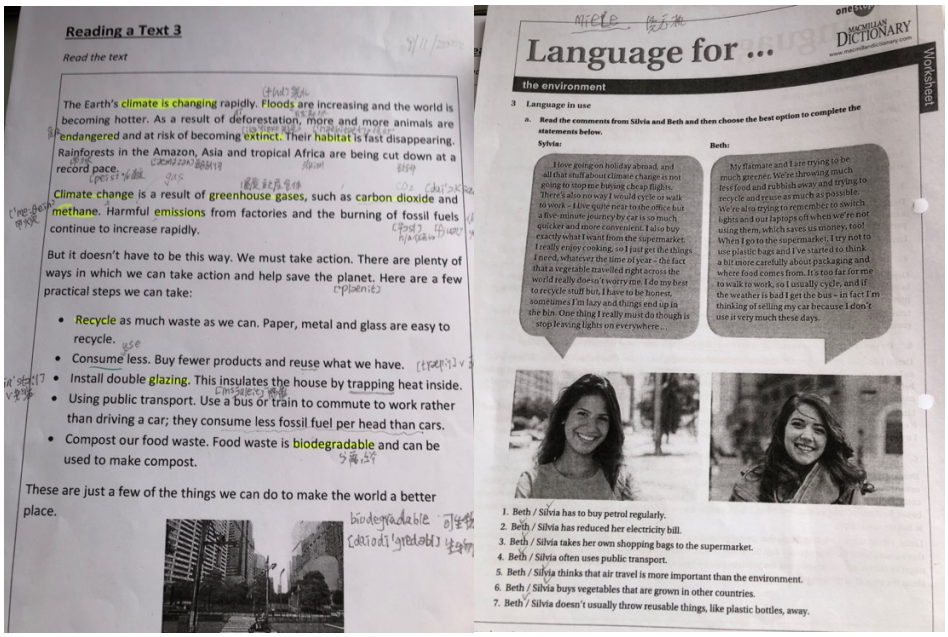


Figure 4.15 English learning materials used by Rui during language self-study sessions. Some handwritten notes in Chinese are visible, reflecting the participant's bilingual approach to language learning.

2) Cultural Differences and Social Barriers

Differences in Social Interaction Patterns

Western societies often emphasise individualism and independence in social life, while many Chinese migrants are used to family-centered and network-based relationships. This contrast can make participation in broader local communities feel unnatural or unimportant.

"Most of my weekdays revolve around my children and grandchildren. Now that they're older, I finally have time to attend weekend dance classes at the Chinese community center." — Fa (Female, 65+, Mainland China)

Discrimination and Prejudice

Several participants reflected on past experiences of racial or gender-based discrimination, which shaped their views on integration and social trust.

"As a Chinese woman, I faced both sexism and racism in my early career, but I pushed through. You must keep improving yourself if you want to succeed in the West." — He (Female, 60+, Malaysia)

"We came in the 1980s, and discrimination was everywhere. We tried to hide us 'Chinese-ness' just to blend in. Things have changed now—but I can't tell if that's because of our age or because China's status has risen." — Jiao (Female, 60+, Mainland China)

"Back home, we were the 'pillar generation'. Here, we're invisible." — Niqiu (Male,

55+, Mainland China)

These experiences of discrimination, while not directly linked to environmental motivations, often resulted in a sense of social detachment from the mainstream British society. In response, many older migrants turned inward, relying more heavily on ethnic networks and traditional cultural values, including thrift and self-reliance.

3) Political Apathy and Scepticism

Political Apathy

Some participants, especially from mainland China and Malaysia, admitted to a general indifference to local politics, shaped by past political environments where civic engagement was either discouraged or inaccessible.

"If something doesn't directly affect my life, I don't pay attention to it." — Chen (Male,55+, Malaysia)

"I understand the importance of sustainability. But not everyone listens—especially Chinese people. Many just don't care." — Shun (Female, 55+, Mainland China)

Scepticism Towards Local Policies

Others expressed cynicism toward government motives behind environmental and social policies, viewing them as revenue-driven rather than genuinely sustainable.

"The government keeps changing, but meaningful environmental policies? Rare. I don't really trust what politicians say." — Huang (Female, 60+, Taiwan)

"A lot of these so-called 'green policies' are just hidden tax schemes. They create the problems, then sell the solutions." — Huang (Male, 70+, Hong Kong)

4) Personality Traits and Self-Perception

Several participants attributed their reluctance to integrate to self-consciousness or fear of embarrassment in language use. This self-perception reinforced avoidance, creating a feedback loop of limited engagement.

"Chinese and Taiwanese people tend to be shy. We fear making grammar mistakes. But why? They can't speak our language either. We should be confident." — Huang (Female, 60+, Taiwan)

"Many migrants isolate themselves in the Chinese circle. Their English doesn't improve, so they become even more reluctant to speak. It's a mindset issue." — Tao (Female, 55+, Mainland China)

5) Economic Pressures and Ethnic Self-Sufficiency: Survival First, Integration Later

For many older Chinese migrants, economic survival and family responsibility consis-

tently took precedence over community involvement or political engagement. Migration was often viewed pragmatically—as a way to support families in China, not necessarily as a path toward integration or civic participation in the UK.

"Many Chinese in the takeaway industry came as undocumented migrants. They plan to return home before retirement as they've already built houses back in China." — Xiao (Female, 60+, Mainland China)

"Fujianese people abroad care only about one thing: making money. Integration doesn't even cross their mind." — Glasses (Male, 55+, Mainland China)

"I need to save for my son's wedding and house. In China, parents still carry these responsibilities, even when the child has grown up." — Amy (Female, 55+, Mainland China)

"My duty was to raise my child. Now that she's graduating, I'll return to China for retirement." — Zhang (Male, 55+, Mainland China)

As a result, many Chinese migrants remain functionally self-sufficient within "ethnic enclaves". In urban areas like Chinatowns or predominantly Chinese suburbs, access to familiar services, such as Mandarin-speaking doctors, Chinese supermarkets, and bilingual legal support, reduces the need for language acquisition or broader social integration.

"I don't have many friends in the UK, and those I do have are mostly Chinese. Especially during the pandemic, since my last holiday in February 2020, I've barely left my small town. For older people, the virus was a major concern, so I avoided any external contact." — Xiao (Female, 60+, Mainland China)

"I lived in Australia for years—there are even more Chinese there. You can do everything in Mandarin: groceries, banking, even getting legal help." — Li (Female, 55+, Mainland China)

This form of "ethnic self-sufficiency" reinforces traditional practices such as frugality, re-use, and self-reliance. Behaviours that align with low-carbon living even if they are not environmentally motivated. By reducing exposure to consumerist norms and bypassing mainstream cultural expectations, older migrants maintain habits rooted in economic prudence and cultural continuity.

4.5.2 Awareness–Action Gap Across Generations: Why Younger Migrants Understand Policies Better, but Older Migrants Practice More

This section addresses Research Question 2, which explores the apparent paradox between younger migrants' higher awareness of environmental policies and older migrants' stronger engagement in low-carbon practices. The analysis reveals how

generational differences shape environmental knowledge, values, and everyday behaviours.

1) Information Access and the Awareness–Practice Gap

The research results show that there is a significant generation gap in the way older Chinese migrants obtain environmental information and transform environmental awareness into daily low-carbon practices. The **first-generation migrants** (aged 55 and above) mainly rely on traditional Chinese media, such as community newspapers, radio programs and word-of-mouth on local networks. Their exposure to formal environmental policies or government campaigns is therefore limited. However, although they have little theoretical understanding of concepts such as net zero or sustainability, their daily behaviours are often closely related to low-carbon principles. Rooted in values of thrift, moderation, and resourcefulness, many participants described practices such as conserving energy, avoiding waste, and repairing items rather than replacing them. The walking interviews further revealed these seemingly ordinary daily routines such as turning off unused lights, reusing containers, and limiting household waste which reflecting an "unconscious environmentalism" deeply rooted in their cultural growth.

In contrast, **younger or second-generation migrants** (including former international students) access environmental information more readily through digital media, formal education, and social networks. Their stronger English proficiency and greater exposure to the UK education system allow them to engage with sustainability discourses more actively. However, there is often a gap between their environmental awareness and the actual changes in their behaviour. As an older participant reflected,
"My son often sends me news articles and links to keep me updated. That's how I first learned about 'low-carbon' policies. But in China, this topic still isn't discussed much."— Rui (Female, 75+, Mainland China)
Another participants noted the linguistic advantage of younger generations:
"The next generation definitely has better English. Many of them were born here and fully understand the local system." — Huang (Male, 70+, Hong Kong)

Examples of Frugal, Low-Carbon Practices

The following examples illustrate the diverse ways in which older Chinese migrants practise sustainability in everyday life, often through simple yet meaningful acts of thrift, reuse, and care.
(1) Conscious Spending and Minimal Waste

"I only buy clothes when I really need them, or during big discounts. I hate waste. If something can still be used, I use it or donate it." — He (Female, 60+, Malaysia)
"If you go to the supermarket before it closes, bread that costs £1 can go down to 20p. Vegetables too. You just need to know where to look." — Jian (Female, 65+, Mainland China)
(2) Energy Efficiency
"We don't turn on the heating all day. We keep curtains shut to preserve heat and only adjust the temperature when needed. We even use firewood when possible." — Zhang (Male, 55+, Mainland China)
(3) Composting and Rainwater Use
"We compost fruit peels and collect rainwater in barrels for our plants. I reuse laundry water to mop the floor. It's just how we live." — Xiao (Female, 60+, Mainland China)
In the walking interviews, some participants eagerly demonstrated their repurposing skills at home. As illustrated in Figure 4.16, the photo on the left shows a creative gardening setup by Xiao, an female participant passionate about horticulture. She transformed a discarded bathtub and sink into makeshift planters, exemplifying how older migrants engage in low-carbon gardening practices using salvaged materials.



Figure 4.16 Waste repurposing practices: (left) discarded bathtub used for planting; (right) soap remnants wrapped in stockings.

The right image captures a clever frugality practice by another participant, Yi. She collected small remnants of soap, typically too soft and slippery to use, wrapped them in worn-out stockings, and used the mesh to create foam while preserving every last bit

of the soap. This practice reflects an embodied knowledge of resourcefulness rooted in cultural norms of thrift and waste avoidance.

(4) Repurposing Clothes

"If something doesn't fit anymore, I alter it. If it's damaged but still usable, I fix it and wear it again." — Rui (75+, Mainland China)

Sewing and mending were also frequently mentioned as frugal and culturally significant practices among older female participants. Many recalled learning to sew from their mothers or older sisters during their youth in China, often out of necessity. For example, younger siblings would typically wear hand-me-downs from older children, and homemade clothes were standard.

Despite living in a consumer-rich society today, the participants expressed a sense of pride in maintaining these skills. As shown in Figure 4.17, Rui, a grandmother participant, was seen designing and stitching a prom dress for her granddaughter using leftover fabric and sewing patterns. For Rui, sewing was not only a means of saving money but also a way to transmit care and family values through handmade labour. These practices, while no longer essential in an economic sense, remain meaningful expressions of cultural continuity and sustainable living.

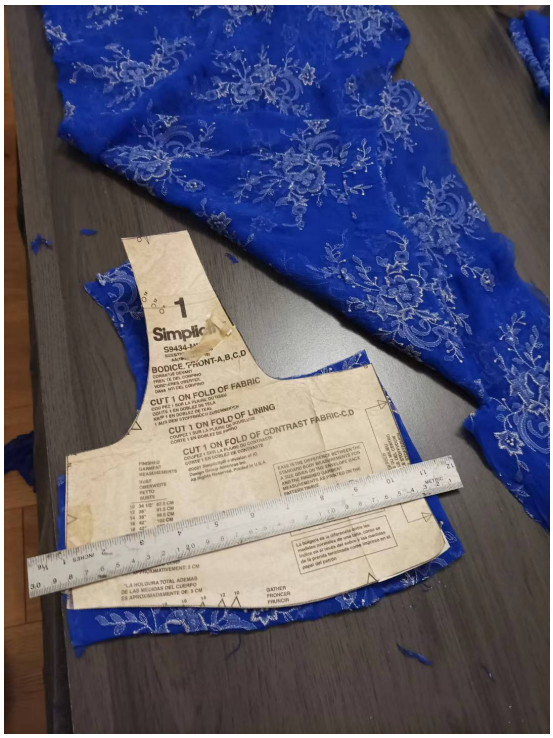


Figure 4.17 Modified clothing made by participant.

(5) Avoiding Food Waste

"I never waste food. I use what I have and fix what I can. Christmas sales? I don't buy unless I really need something." — Huang (Female, 60+, Taiwan)

(6) Reusable Bags and Household Recycling

The participants often repurposed materials as part of their daily sustainability practices, driven by both thrift and creativity. As illustrated in Figure 4.18, the image on the left shows a collection of used paper gift bags, neatly stored for reuse during shopping or gift-giving.

On the right, a handmade shopping bag has been sewn from a pair of old jeans. This particular item was created by Ye, a male participant in his 60s from Mainland China, who proudly shared:

"We haven't bought plastic bags in years. I sew shopping bags from old clothes and even my children's school uniforms."

This act of reusing not only avoids single-use plastic but also extends the lifespan of textile materials that might otherwise become waste. Such practices, though often overlooked in formal sustainability discourse, reveal a deep cultural ethic of reuse, repair, and responsibility that underpins many older migrants' low-carbon lifestyles.



Figure 4.18 Repurposed shopping bags made from old jeans and uniforms.

(7) Growing Vegetables at Home

As shown in Figure 4.19, home-grown vegetables and fruits were an important aspect of many participants' lives. The image displays the produce from Jian's garden, which includes tomatoes, apples, and various herbs. Jian not only cultivated food for personal use but often shared surplus produce with neighbours and friends. During the interview, she expressed ongoing enthusiasm for experimenting with new crops, saying:

"I grow chives, coriander, and spinach, more than we can eat. I share with friends and enjoy seeing them happy." "I think gardening is something very Chinese. In rural China, every household had chilies, eggplants, and vegetables growing in their yard. It's not about money, of course, we can afford supermarket food. it's about making

use of our time meaningfully and staying healthy in retirement." — Jian (Female, 65+, Mainland China)

Gardening served as more than a cost-saving measure; it was a way of sustaining cultural traditions, fostering neighbourly ties, and maintaining a sense of purpose and physical activity.



Figure 4.19 Vegetables and fruits grown by the participants.

"Homegrown food just tastes better. Since retiring, I hardly buy vegetables anymore."— Ye (Male, 60+, Mainland China)

As illustrated in Figure 4.20, participants not only grew their own vegetables but also actively incorporated them into home cooking. The left image displays a harvest of squashes and gourds, while the right image shows handmade pumpkin pancakes prepared by Ye, a male participant in his 60s from mainland China. During the interview, Ye also proudly shared:

"Vegetables grown by yourself just taste different. The process—from planting to cooking—makes you appreciate food more."



Figure 4.20 Cooking with vegetables participants have grown.

2) Historical Memory and the Habit of Saving

.The generation gap among Chinese migrants is formed by completely different historical experiences. The older generation grew up in an environment of extreme scarcity, rationing and hardship, which instilled lasting habits of thrift, reuse and anti-waste. These behavioural patterns span time and space, influencing their daily decisions even after migration.

Older adults internalized frugality through lived experience, often linked to famine, war, and national austerity campaigns. The younger generations, raised during periods of economic reform and expansion, had more access to material goods and developed different consumption habits, even though they may still respect the values of thrift.

"As my parents say, 'Each generation is less frugal than the last.' My children don't waste on purpose, but they haven't lived through hardship, so they don't see the value in small savings." — Leng (Female, 60+, Mainland China)

"My grandmother lived through starvation. She would never waste a single grain of rice. That kind of experience stays with you." — Huang (Male, 70+, Hong Kong)

"Now we have Chinese supermarkets everywhere. Back in my day, my mother had to send me parcels from China every month." — He (Female, 60+, Malaysia)

"The older people in my village grew up starving. In Luoyang, people didn't say 'Have you eaten?' they asked 'Have you had soup?' That's how poor we were. Even now, the older people always finish their meals and save everything. Their children don't understand why they keep so much 'useless junk.'" — Xiao (Female, 60+, Mainland China)

"Older people never waste food. We younger ones never experienced that kind of hunger, so we don't really understand. But hearing their stories, it makes sense—they

lived through starvation in the 1950s. Those were very hard times." — Jian (Female, 65+, Mainland China)

These accounts highlight how memory of hardship functions as a "moral anchor and behavioural driver", reinforcing low-consumption lifestyles that align with sustainability. Even when living in materially more secure environments, older migrants continue to embody a frugal ethic passed down through family and community. This intergenerational gap in environmental behaviour is less about ideology, and more about "lived memory and value transmission".

3) Spending Habits and Consumer Culture

Patterns of financial behaviour among Chinese migrants reflect a clear generational divide shaped by socialisation, migration timing, and cultural exposure. Younger migrants, especially those who arrived during or after China's reform era are more exposed to Western consumerism, often embracing credit use, lifestyle consumption, and instant gratification. Older migrants, by contrast, tend to maintain more conservative financial habits rooted in thrift and delayed gratification.

"Today's young people spend too freely, luxury handbags, fast fashion. Our generation saves first, spends later." — Huang (Female, 60+, Taiwan)

"Western thinking is catching on, borrow now, enjoy today. Mortgages make sense sometimes, but saving gives peace of mind." — Ye (Male, 60+, Mainland China)

These contrasting approaches to spending also inform environmental behaviour. While younger migrants may be more environmentally informed, their higher material consumption can contradict low-carbon ideals. Older migrants, on the other hand, practise quiet sustainability through habits of moderation and resource conservation. As such, economic values, whether shaped by cultural upbringing or external consumer pressures, play a critical role in structuring sustainable or unsustainable practices across generations.

4.5.3 Frugality as Cultural Practice

This section explores the historical, cultural, and economic underpinnings of frugality as a sustainable lifestyle among older Chinese migrants. Their low-carbon behaviours are not necessarily framed in environmental terms, but emerge from lived experience, moral values, and structural constraints. Four key subthemes illustrate how thrift is practiced and maintained across time and contexts.

1) Confucian Values and Social Norms

Beyond survival, thrift is also a cultural virtue. Rooted in Confucian teachings, frugality is seen as morally appropriate and socially responsible. These values are passed down through family and reinforced by community expectations.

"Traditional Chinese culture values loyalty, collectivism, and personal sacrifice. Frugality is part of this. It's about being responsible to your family and community."— Zhang (Male, 55+, Mainland China)

"We were taught not to waste anything, don't use paper unnecessarily, don't buy things you don't need. It's just a habit from our generation." — Xiao (Female, 60+, Mainland China)

2) Economic Conditions and Welfare Adaptation: Between Scarcity Memory and Present Stability

Although many older Chinese migrants now enjoy greater financial stability in the UK, their frugal behaviours are shaped by a dual awareness: the memory of past hardship and a comparative understanding of current economic conditions in China. Rising costs of housing, healthcare, and education in their home country continue to validate thrift as a rational long-term strategy, especially for those supporting family members across borders.

"Back in China, I was laid off. But here in the UK, I can rely on my husband's pension. I don't talk to my old friends in China anymore—their lives are too different. I can travel and enjoy life, while they're still struggling just to get by." — Piao (Female,60+, Mainland China)

"If I were still in China, I'd have only 2,000–3,000 yuan a month in pension. That's not enough to live on. But here, the UK government supports us. I can retire without fear." — Xiao (Female, 60+, Mainland China)

Upon migrating, many participants adapted to the UK's more generous welfare system. Pensions, healthcare access, and disability support reduced their immediate financial anxieties and created a sense of long-term security.

"When my husband got brain cancer, the UK system really helped us. They immediately gave us disability status, plus £500 per month, daily nurse visits, and transport subsidies. It's not just words—it's a real safety net." — Xiao (Female, 60+, Mainland China)

Despite improved material conditions, participants largely maintained frugal habits. Saving, reusing, and avoiding waste were not simply economic choices, but "culturally ingrained responses to insecurity".

4.5.4 Continuity and Change After Migration

This section explores the dynamic interplay between change and continuity in the lives of older Chinese migrants. While many aspects of daily life, such as language, diet, and consumption have adapted to the host environment, deeply rooted cultural values, particularly frugality and identity, remain remarkably resilient.

1) External Adaptation: Language, Diet, and Consumption

Upon migration, older Chinese migrants naturally adjust their lifestyles in response to changes in the physical environment, access to familiar resources, economic conditions, and social networks.

(1) Environmental Adaptation

Limited access to traditional ingredients has led many to modify their eating habits, often blending Chinese and Western food practices, especially within mixed nationality households.

"There were no Chinese supermarkets back then. Every weekend, I had to travel from Oxford to London's Chinatown with a full backpack just to bring home enough ingredients. Now, Chinese food is trendy, even British supermarkets stock condiments. But back in those days, we couldn't even find spring onions or ginger." — Jiao (Female, 60+, Mainland China)

"I eat more Western food now. But when I crave Taiwanese or Chinese dishes, I cook them for myself. My husband sticks to his usual Western meals, we each enjoy our own preferences." — Huang (Female, 60+, Taiwan)

(2) Social Influence

Cross-cultural contact has also reshaped cooking and language practices. Many participants noted a growing openness toward Western norms and convenience focused lifestyles.

"At Chinese gatherings, people used to bring homemade food. But now, especially in mixed-nationality families, many bring store-bought items from British supermarkets. At first, I thought they'd taste bad. But they're actually quite good. We used to make everything from scratch, but now I find supermarket options more convenient." — Fa (Female, 60+, Mainland China)

"Working in a multicultural environment really broadens your perspective. You learn how different cultures communicate and how to collaborate beyond just your own circle." — He (Female, 60+, Malaysia)

"To improve my English, I joined a local club where I chat, cook, and have tea with British people. It helped me speak more naturally and get used to their communication style." — Amy (Female, 55+, Mainland China)

(3) Economic Shifts and New Spending Patterns

Many migrants experience increased income or financial stability after moving abroad. This enables new consumption habits, often contrasting sharply with their past lifestyles in China.

"In the UK, I've bought a lot of luxury items, but always on sale. Back in China, I wouldn't even consider these things. But now my kids are grown up, and I have the freedom to enjoy life. People say it's materialistic, I call it pleasure." — Li (Female, 55+, Mainland China)

Figure 4.21 Luxury items shared by participant Li, who purchased discounted branded clothing and accessories from Bicester Village.



Figure 4.21 Luxury goods and shopping bags shared by the participants.

"During the pandemic, I couldn't travel, so I had extra money. I even treated myself to beauty services for the first time. I shop with my neighbours now—sometimes I buy too much and just give it away if I don't like it later." — Piao (Female, 60+, Mainland China)

"Here, if your savings go over £15,000, your benefits are reduced. So people say, 'spend aggressively' to keep entitlements. It's the opposite of China, where you save in case of illness. With free healthcare here, you don't need to stockpile savings." — Piao (Female, 60+, Mainland China)

These behaviours reflect more than just increased purchasing power, they also signal a psychological shift. For some, spending becomes a way to reclaim pleasure and autonomy after decades of sacrifice and financial caution. In this context, consumption may function as a "reactive or compensatory response" to past deprivation and the

abrupt contrast between two welfare systems. While these practices may appear to contradict earlier frugality, they also highlight the complexity of migrant adaptation.

2) Cultural Continuity: Deeply Rooted Values Persist

Despite significant changes in lifestyle, core cultural values such as frugality and traditional identity continue to shape behaviour, emphasizing the flexibility of early life experiences and family education.

"Frugality is part of my culture, and I've always kept that belief. I may wear jeans now, but during Lunar New Year, I still put on traditional Chinese clothes. I've adapted to Western life in some ways, but Chinese values remain." — He (Female, 60+, Malaysia)

"We Chinese save for emergencies. Many British people rely on credit, they spend first and worry later. That kind of lifestyle creates stress, especially now with inflation and strikes." — Rui (Female, 75+, Mainland China)

"Even after so many years in the UK, I haven't changed my financial habits. I still save. Spending next month's salary in advance just feels wrong to me. I guess it's an Asian thing—we need that sense of security." — Huang (Female, 60+, Taiwan)

Despite visible lifestyle changes following migration, many participants continue to uphold core cultural values, especially frugality, family responsibility, and ethnic identity. These values shaped by early life experiences, Confucian moral teachings, and intergenerational socialization remain stable even in the face of new economic opportunities and host society norms.

4.6 Discussion of Study B

As a follow-up to Study A, Study B utilised walking interviews to further explore the cultural integration of older Chinese migrants in the UK, intergenerational differences, the significance of frugality as a cultural value, and the complexities of cultural identity. The findings were analysed in relation to existing literature and theoretical frameworks, providing deeper insights into the motivations and impacts of migrant behaviour.

4.6.1 Summary of Key Findings

1) Cultural Integration and Social Participation

A core theme of this study is the reluctance of some older Chinese migrants to integrate into local communities or actively engage with local policies. This phenomenon is influenced by multiple factors, including language barriers, cultural differences, and economic priorities.

Language Barriers and Social Isolation

Findings indicate that language is a major obstacle to social integration, particularly for first-generation migrants. Limited English proficiency often makes interactions with the wider society challenging, restricts access to information, and prevents participation in community activities. This aligns with previous studies highlighting language ability as a key determinant of social engagement among migrants (Morrice et al., 2021). Many older migrants continue to feel uncomfortable in English-speaking environments, leading them to rely on Chinese communities, which in turn reinforces social isolation and limits interaction with mainstream society.

Cultural Differences and Social Networks

Cultural differences also play a significant role in shaping patterns of social integration. Many Chinese migrants prefer socialising within familiar networks, such as family, close friends, or Chinese community groups, rather than engaging in broader local activities. Furthermore, political disengagement among many Chinese migrants, especially those from mainland China, contributes to their lack of participation in community affairs. Some perceive themselves as outsiders in British society, prioritising economic security and personal stability over social involvement.

Economic Considerations and Practical Priorities

Economic stability is a primary concern for many migrants, influencing their social behaviour. For many participants, securing financial stability and supporting their families take precedence over community participation or policy engagement. This supports existing research that highlights the impact of economic priorities on migrant social participation (Portes & Rumbaut, 2001; Waters & Jiménez, 2005). Additionally, some migrants view the UK primarily as a place for economic opportunity rather than long-term settlement. This "return-oriented" mindset is particularly prevalent among Fujianese migrants, who focus on accumulating wealth for property investments and retirement in China rather than establishing long-term social connections in the UK.

2) Intergenerational Differences: Policy Awareness vs. Low-Carbon Practices

The study reveals clear generational differences in policy awareness and low-carbon behaviours among Chinese migrants. Younger migrants (e.g., second-generation individuals and international students) are more familiar with sustainability policies due to exposure through education and digital media. In contrast, older migrants are more likely to adopt low-carbon practices, such as energy conservation and resource reuse, because of lifelong habits shaped by economic hardship. This supports the argument that sustainable practices often stem from cultural values rather than policy incentives (Inglehart, 2020; Stern, 2000).

3) Frugality as a Cultural Value

Frugality emerged as a key theme in study B, deeply embedded in the lived experiences and cultural values of Chinese migrants. This behaviour is shaped by historical experiences, Confucian values, and economic considerations.

Historical Context and Frugality

Many Chinese migrants emphasised the importance of frugality and resourcefulness, linking these values to past experiences of economic hardship and material scarcity. This finding aligns with existing research that highlights the influence of historical events on financial behaviours among migrant communities (Inglehart, 2020; Liebman, 2019; Tie et al., 2015). The emphasis on frugality as a virtue also reflects Confucian values, which promote thrift as a moral principle. Despite living in a more affluent environment, these values continue to shape financial decision-making and lifestyle choices.

Financial Security and Frugal Practices

Beyond cultural influences, frugal behaviours are also driven by economic concerns. Many participants see frugality as a means of ensuring financial security, particularly in the face of rising living costs and economic uncertainties. Some continue saving to support their children and grandchildren, reinforcing intergenerational financial obligations within the migrant community.

4) Cultural Identity and Change in the UK

While migrants adapt to new environments in terms of language, diet, and consumption patterns, core aspects of cultural identity remain intact. Many participants expressed a strong sense of pride in their Chinese heritage and actively sought to pass down cultural traditions to the next generation.

At the same time, the UK's comprehensive welfare system provides healthcare, education, and pension benefits, which contrast with the social security systems in China. Some participants noted that these provisions had reduced their reliance on personal savings, leading to changes in their financial habits. This reflects Berry's (1997) model of bicultural integration, where migrants can successfully adapt to a new culture while maintaining key aspects of their original identity.

4.6.2 Challenges and Limitations of the Walking Interview Method

Walking interviews provided valuable insights into the lived experiences of older Chinese migrants by allowing the researcher to observe their behaviours and daily routines in real-life settings. Compared to traditional interviews, this method captured real-time reflections and decisions made within contextual environments.

The decision to use walking interviews in Study B was based on interactions with participants during the survey and semi-structured interview in Study A. The study revealed that older Chinese migrants engaged in various low-carbon practices, but their motivations were rooted in cultural values and economic considerations rather than environmental awareness. The research also highlighted the unique challenges this group faces in integrating into the British society, particularly in terms of language barriers, reserved personalities, and a lack of belonging.

However, conducting walking interviews posed several logistical challenges. First, recruiting participants was difficult, as some were hesitant to commit, while others cancelled at short notice. Additionally, the participants were spread across different areas of Greater London, requiring careful scheduling and transport arrangements. Weather conditions also impacted data collection, limiting outdoor mobility for some participants.

Safety considerations were another important factor, as some interviews were conducted in the participants' homes. To mitigate risks, the researcher engaged in informal conversations with participants beforehand to establish trust and ensured a secure interview environment.

4.6.3 Limitations

Although Research Study B has made contributions, it also has some limitations: Such as the participants were primarily recruited from London and surrounding areas, meaning findings may not fully capture experiences in other regions, particularly in rural areas.

In addition, this study captures a snapshot of migrant experiences at a specific point in time. Future research could adopt a longitudinal approach to examine changes in cultural adaptation and environmental behaviours over time.

4.6.4 Applying the Sensemaking Framework to Understand Older Chinese Migrants' Perceptions of Net Zero and Cultural Adaptation

To better interpret how older Chinese migrants construct meaning around low-carbon living and net-zero policies, this study draws on Karl Weick's (1995) Sensemaking Theory. As a process of interpreting and organizing experiences, Sensemaking provides a useful analytical perspective for understanding how individuals act in complex social and cultural environments. In the context of migration, it explains how people connect new information (such as environmental policy information) with their existing identities, values and social networks.

Table 4.12 illustrates the application of Sensemaking Theory in studying low-carbon behaviours among older Chinese migrants in the UK.

Table 4.12 Sensemaking Framework (Weick, 1995) and its Application to Older Chinese Migrants' Low-Carbon Behaviour.

Sensemaking Elements (Weick, 1995)	**Application to Older Chinese Migrants in the UK**
Identity Construction	Migrants interpret low-carbon behaviour based on their identity. Many view environmental action as a continuation of traditional frugality rather than as a civic duty. Those integrated into British society engage with mainstream environmental narratives, while those with a separated identity rely on Chinese-language media for information.
Retrospective Meaning-Making	Migrants make sense of net zero policies based on past experiences. Many associate low-carbon behaviours with economic efficiency, having lived through resource-scarce periods in China. Their environmental actions are often framed in terms of cost-saving rather than ecological responsibility.
Cues (Environmental and Social Signals)	Migrants rely on specific channels to gather information about low-carbon policies, including WeChat, Chinese-language newspapers, community groups, and family discussions. The filtering process affects how they perceive and engage with policies.
Ongoing Sensemaking (Adjustment Over Time)	Migrants continuously adapt their behaviour based on external factors. For instance, rising energy costs influence heating and electricity use, and exposure to British environmental norms (e.g., recycling) shapes long-term habits.
Social Process	Social networks play a crucial role in shaping environmental attitudes. Migrants trust information circulated within their ethnic communities more than official English-language sources. Younger family members often act as policy interpreters, leading to generational gaps in awareness.
Plausibility Over Accuracy	Migrants evaluate policies based on perceived fairness and practicality rather than factual correctness. Some participants expressed scepticism towards net zero policies, viewing them as tax-driven rather than environmentally motivated. This reflects broader distrust of top-down government initiatives.
Enactment (Action-Driven Behaviour)	Migrants engage in low-carbon practices when they see tangible benefits. Some adopt sustainable behaviours (e.g., recycling, reducing waste) due to economic incentives, while others are influenced by visible community norms and peer behaviour.

Analysis shows that older Chinese migrants understand low-carbon behaviours through cultural logic rather than formal environmental narratives. For instance, sensemaking is usually carried out from the perspectives of frugality and family care. Participants view sustainability as a continuation of traditional Chinese values rather than a civic duty.

Social and linguistic factors can also shape sensemaking processes. Participants rely largely on credible clues within their ethnic communities, especially WeChat groups, Chinese newspapers and family discussions. At the same time, they are sceptical about the official English sources. This selective information filtering helps with reasonable-based reasoning, in which policies are judged not based on their factual accuracy but on their perceived fairness and relevance to daily life. This highlights a tension in participants' sensemaking processes: while official information is viewed with scepticism, alternative sources are not necessarily evaluated based on factual accuracy, but rather on perceived relevance and trustworthiness.

Furthermore, sensemaking is continuous and implemented through practice. Participants constantly adjust their behaviours to cope with new social and economic conditions, such as rising energy prices or the expectations of peers within community groups. These findings suggest that the low-carbon participation of older migrants is not maintained through abstract policy awareness, but through concrete practices and relationship trust.

Building on this framework, several intervention strategies can be derived to enhance engagement: Based on this framework of sensemaking, several potential intervention strategies have emerged to enhance the participation of older Chinese migrants in low-carbon initiatives.

First of all, it is essential to enhance a sense of responsibility and belonging. Community-led initiatives that take frugality as a sustainable value help combine environmental actions with cultural identity and foster a collective sense of contribution to climate goals.

Secondly, narrative-based communication provides an effective channel for engagement. Sharing personal stories of thrift, reuse, and care not only validates the lived experiences of older migrants, but also helps connect everyday practices with broader environmental meanings.

Thirdly, the use of bilingual and culturally relevant media, particularly Chinese-language platforms such as WeChat and Xiaohongshu (RED), can enhance both access

to and understanding of information. Ensuring that policy information is translated and contextualised in familiar terms may significantly improve engagement. However, accessibility alone may not be sufficient, as participants' trust in information sources also plays a critical role in shaping their responses to environmental policies.

Fourth, recognition and strengthening mechanisms can encourage sustained low-carbon behaviours. Emphasising the economic benefits, social recognition or community pride related to sustainable practices can enhance the sense of achievement and initiative of participants.

Fifth, intergenerational communication provides another approach. Young family members often act as translators and interpreters of environmental information, while older relatives offer practical wisdom and sustainable habits. Encouraging such two-way learning can bridge the cultural and knowledge gaps within families.

Sixth, establishing trust and transparency is crucial for effective policy communication. Cooperation among government agencies, Chinese community organisations and local media can help clarify the intentions, interests and responsibilities of net zero initiatives and dispel widespread doubts about taxation or fairness.

Finally, intervention measures need to be taken based on specific circumstances. Carrying out promotional activities in places frequented by older Chinese migrants such as community centres, Chinese supermarkets and religious sites can provide them with simple and feasible suggestions for their daily lives. This cultural-based approach can make low-carbon participation both practical and meaningful to individuals.

4.7 Summary

This chapter explored the low-carbon behaviours, net-zero awareness, and cultural adaptation processes of older Chinese migrants in the UK through two studies A&B. The research framework was informed by the Theory of Planned Behaviour, Low-Carbon Behaviour Model, and Acculturation Theory Model.

Study A found that cultural adaptation influenced low-carbon behaviours, with migrants more integrated into British society being more likely to adopt sustainable practices. Language barriers limited policy awareness, making Chinese community networks the primary source of information. While the participants engaged in energy-saving behaviours, economic motivations were more prevalent than environmental concerns.

Study B used walking interviews to examine social integration, consumption habits, and cultural identity. The findings revealed that while migrants adjusted their daily routines, frugality and cultural identity remained strong. Younger migrants were more

policy-aware but engaged in fewer sustainable practices, whereas older migrants, despite their limited policy knowledge, demonstrated more sustainable habits in daily life.

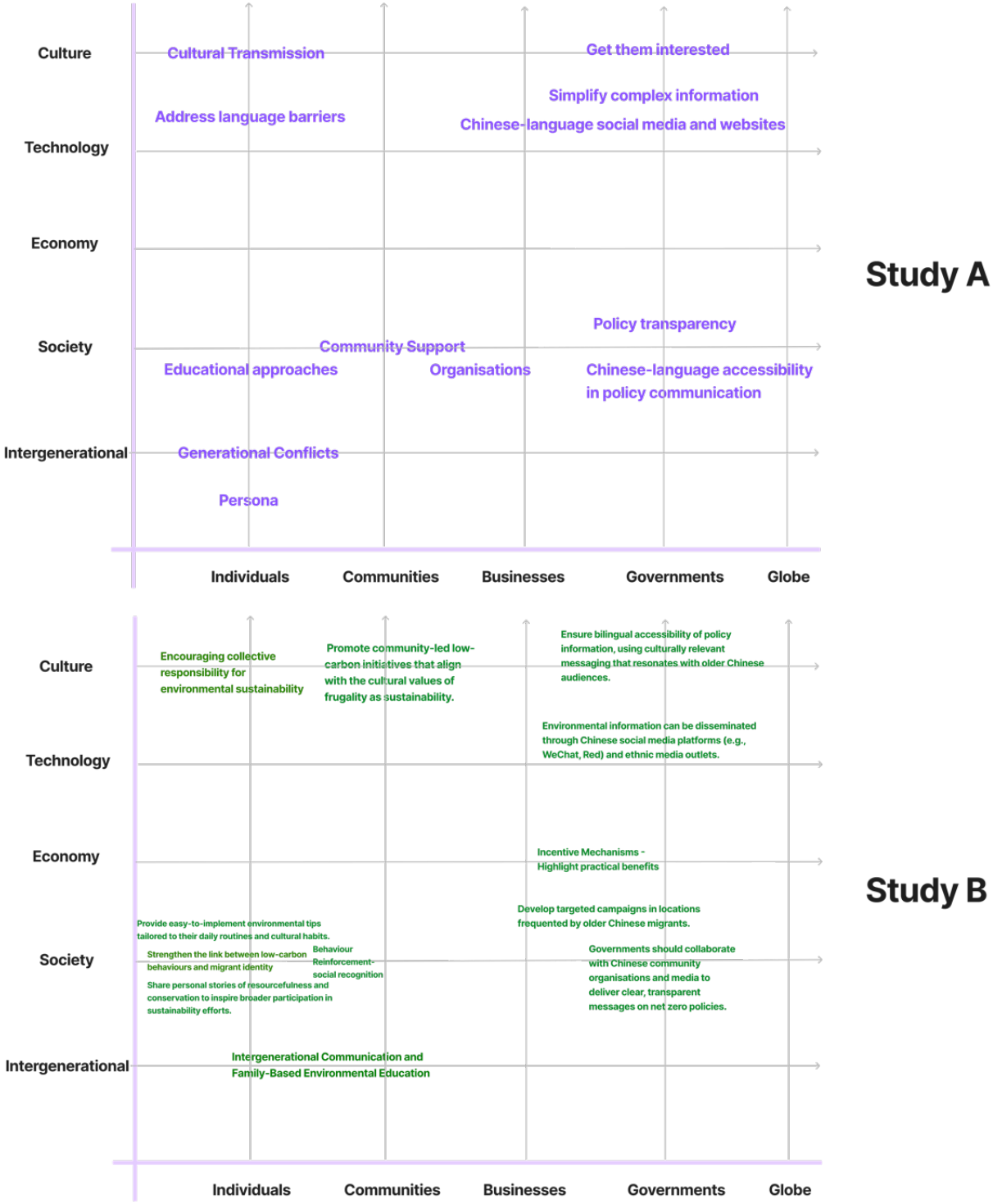


Figure 4.22 Climate-related opportunity (Study A&B).

The climate-related opportunities mentioned in the findings and recommendations of this section are shown in Figure 4.22 below. This visualization highlights the intersections and distributions of opportunities across dimensions such as intergenerational, technological, economic, and societal aspects. By aligning these dimensions with horizontal levels of engagement which from personal and community to business, government, and global.

While **Sensemaking Theory** has provided valuable insights into how older Chinese migrants interpret and practice low-carbon behaviours, several unresolved questions remain, particularly in information dissemination and policy adoption.

Key Research Questions to be answered:

1) Information Preferences: What types of environmental information do older Chinese migrants prefer? Which dissemination methods are most effective?
2) Social Roles: What roles do older migrants play within their families and communities? Can they serve as knowledge brokers for low-carbon awareness?
3) Cross-Cultural Comparisons: How do British older adults and Chinese migrants differ in their motivations, information sources, and engagement with low-carbon practices?
4) Intervention Design: How can communication strategies be refined to enhance comprehension and adoption of net zero policies among older migrants?

To address these questions, three follow-up studies were conducted, each focusing on different aspects of information dissemination and intervention strategies.

Chapter 5: Co-design Workshop with Older Chinese Migrants

Chapter 4 highlighted how cultural adaptation, social factors, and external influences shape the low-carbon behaviours of older Chinese migrants in the UK, as well as their motivation behind low-carbon behaviour. While these findings provide valuable insights, they also reveal gaps in designing culturally sensitive, practical interventions tailored to this group.

Climate change is a global challenge that demands collective action across all age groups and communities. However, older adults, especially those from immigrant backgrounds, are often overlooked in discussions about their role in achieving net-zero goals.

This demographic has unique perspectives shaped by cultural heritage and life experiences and faces specific challenges in accessing and using climate-related information, such as language and cultural adaptation, which may further complicate their engagement with net zero initiatives.

Existing studies often neglect how this group engages with climate information, chooses communication channels, and interacts with net-zero initiatives in their daily lives.

5.1 Introduction

Study C adopts a Co-Design approach to explore the key user journeys of older Chinese migrants, focusing on:

1) Identifying their key life experiences and the roles they play in their families, communities, and society.
2) Understanding how they select and use net-zero information channels.
3) Exploring their preferences for how climate information is presented.

By focusing on the perspectives of older Chinese migrants, Study C offers a pathway to more inclusive and culturally sensitive climate action strategies. It also highlights how co-design methods can engage traditionally underrepresented groups, providing insights for policymakers, designers, and community leaders to design practical and user-centred solutions for climate communication and action.

5.1.1 Research Stage Overview

Study C was designed as the second part of the Research Classification 1 (RC2) phase within the Design Research Methodology (DRM) framework.

Through co-design workshops, the aim was to explore the routes of older Chinese migrants' daily activities in the UK, to understand their roles and values in everyday life, and to capture their preference for net zero information.

Study C addressed the following research questions:

- **Question 1:** How do older Chinese migrants enact sustainability through daily routines?
- **Question 2:** How do their social roles, particularly within families, influence low-carbon engagement?
- **Question 3:** What information channels and message formats are trusted and accessible?

Figure 5.1 illustrates the positioning of this study within the overall research framework.

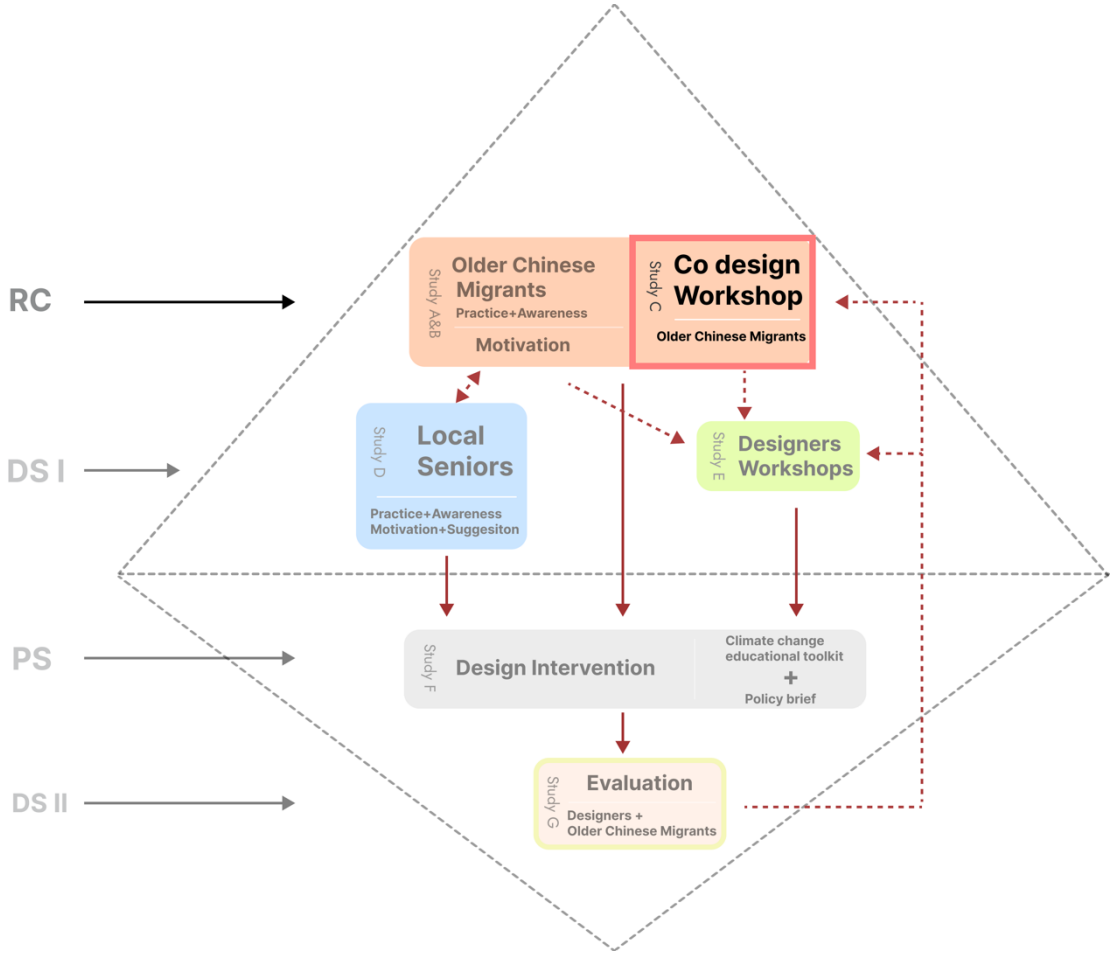


Figure 5.1 Study C as part of Research Clarification.

5.1.2 Research Background

Older Adults and Their Role in Climate Action

Older adults hold a key position in fostering sustainable practices within their families and communities (Farage et al., 2012). Their knowledge and life experiences are often excluded from discussions around climate strategies. Engaging this group effectively requires communication that is not only clear and accessible but also culturally relevant to their preferences and lived realities.

Older adults often encounter challenges that limit their participation, such as low levels of digital literacy (Kumar et al., 2013), mobility constraints (Metz, 2000), and a lack of tailored communication approaches designed to suit their needs (Pattison & Stedmon, 2006). For Chinese migrant communities, reliance on family connections and ethnic media as primary information sources can further narrow their exposure to mainstream climate campaigns, creating additional barriers to engagement with broader sustainability initiatives.

Co-Design as a Collaborative Approach

Co-design involves working collaboratively with end-users to ensure their voices and experiences shape design outcomes (Burkett, 2012). This participatory method has been widely recognised for addressing the needs of underrepresented groups, including older adults and migrant communities. By prioritising user input, co-design facilitates the development of culturally sensitive and inclusive solutions (Latulippe et al., 2020).

In environmental contexts, co-design has proven effective in designing community-led initiatives, such as recycling systems, and in developing low-carbon technologies that are accessible to diverse audiences (Mackenzie & Davies, 2019; Pillan et al., 2023). These applications highlight the potential of collaborative methods to address systemic barriers and support meaningful participation in climate action.

Preferences and Channels for Communication

Older adults benefit from straightforward, visually engaging, and interactive materials that simplify complex topics like climate change (Fisk et al., 2020; Roosen et al., 2018). For older Chinese migrants, culturally tailored approaches, such as bilingual resources, culturally significant imagery, and community-hosted events, can bridge communication gaps and foster a stronger connection to climate-related information (Lakhan, 2024; Stewart et al., 2010). These methods not only make information easier to understand but also ensure it resonates with their cultural and linguistic contexts.

Identifying Research Gaps

While climate communication research has grown, the intersection of ageing, immigration, and climate engagement remains underexplored. Current studies rarely examine how older Chinese migrants' experiences can inform climate solutions. Similarly, there is limited work on applying co-design methodologies to address the specific challenges faced by this group. Bridging these gaps is essential for creating effective, inclusive strategies that empower older migrants to contribute to sustainability efforts.

5.2 Methods

Study C adopted a co-design workshop methodology to explore how older Chinese migrants engage with climate-related behaviours and communication. The approach recognises that climate action among ageing, culturally diverse populations is shaped by personal experiences, social roles, and contextual understanding.

Given the limited literature on climate engagement within ageing migrant communities, co-design offers a participatory opportunity to uncover practical insights grounded in lived experience. The method enables participants not only to articulate their behaviours and values, but also to reflect on how identity, networks, and cultural background shape their information preferences.

5.2.1 Recruitment and Procedure

Participant Recruitment

Community-based recruitment strategies were employed to ensure inclusivity and relevance. London was chosen due to its high concentration of older Chinese migrant populations and the well-established Chinese community organisations that facilitated access and recruitment. Recruitment posters were shared with the London Mandarin Evangelical Church (LMEC) and North London Chinese Association (NLCA), leveraging the researcher's pre-existing connections with these communities. These organisations provided access to older Chinese migrants who fit the target demographic (aged 50–85).

The two organisations were intentionally selected to reflect internal diversity within the Chinese migrant community. The NLCA is one of the largest Chinese associations in

North London, with an active online platform and annual events such as Chinese New Year celebrations. Its broad membership base includes individuals with diverse regional and occupational backgrounds. The LMEC, located in central London, serves a transient, city-wide Mandarin-speaking population from various regions of China. This stands in contrast to other community hubs that may predominantly attract Hong Kong or Southeast Asian Chinese migrants. Together, these sites allowed the study to reach a wider cross-section of Mandarin-speaking older migrants in London.

The recruitment process prioritised participants who were fluent in reading and writing Mandarin or Cantonese, as the workshop involved active engagement, reading comprehension, and written responses. Special care was taken to avoid recruiting individuals with dexterity challenges or severe language barriers that could hinder participation. Moreover, attention was paid to sampling a demographically varied group in terms of education levels, occupational history, and gender, in order to enrich the data and capture multiple perspectives within the small sample size.

Pilot study

Before the formal workshop, three older participants were invited in the pilot co-design workshop at Brunel University. Following initial participant feedback, several refinements were made to enhance clarity, accessibility, and engagement:

1) Simplified worksheet structure: The user journey section was split into weekday and weekend activities for easier comprehension.
2) Pre-prepared sticker responses: Certain tasks were modified to use stickers, reducing cognitive and physical effort for participants.
3) Larger print formats: Worksheets were enlarged to A3 size to accommodate participants with minor vision impairments/reduced sights.
4) Clearer task instructions: Additional examples and visuals were incorporated to ensure the participants fully understood the tasks before discussions began.

This pilot phase ensured that materials were culturally and physically accessible for older Chinese participants, who may face challenges related to vision, mobility, or language processing.

5.2.2 Sampling Strategy

A purposive sampling strategy targeted small-group interaction (6–8 per session) while ensuring insight variation. Two workshops were conducted with a total of 13

participants from varied professions. It includes retirees, teachers, homemakers, and small business owners. Table 5.1 summarises participant information.

Table 5.1 Study C: Participant Information Form.

Participant Code	Job Role	Gender	Workshop Group
MEC01	Retired employees	Male	1
MEC02	Retired employees	Male	1
MEC03	University teacher	Female	1
MEC04	Nurse	Female	1
MEC05	Dancer	Female	1
MEC06	Chinese language teacher	Female	1
MEC07	Media worker	Female	1
NLC01	University teacher	Male	2
NLC02	Retired preschool teacher	Female	2
NLC03	Architects	Male	2
NLC04	Housewife	Female	2
NLC05	Business operator	Male	2
NLC06	University teacher	Male	2

5.2.3 Workshop Design and Procedure

Two 50–60-minute co-design workshops were conducted in February 2024 during Chinese New Year community events. Each began with an introduction, informed consent, and structured activities were delivered in Mandarin and English. The workshops followed a three-stage structure (Table 5.2):

- Stage 1: Daily Routine Mapping - Participants mapped weekday/weekend activities to reveal routine-based sustainability practices.
- Stage 2: Role and Community Mapping - They reflected on life roles, mapped key social spaces, and identified who benefits from their actions.
- Stage 3: Communication Preferences - Participants selected trusted information sources and co-created climate messages using visual templates.

Data collection involved completed worksheets, field notes, and photos of hand-drawn artefacts.

Table 5.2 Co-Design Workshop Structure and Tasks.

Stage / Task	Objective	Timescale	Justification
Stage 1: User Journey Mapping	Map routines and decisions across five time slots.	15 minutes	Identify habitual actions that may align with low-carbon practices.
Stage 2A: Personal Roles	Identify social roles and values using sticker prompts.	10 minutes	Understand participants' influence in family/community life.
Stage 2B: Community Spaces	Map regular social environments.	5 minutes	Locate trusted spaces for climate engagement.
Stage 2C: Stakeholders	Identify beneficiaries of personal actions.	5 minutes	Explore participants' social responsibility and reach.
Stage 3A: Information Channels	Choose trusted sources (TV, WeChat, friends).	5 minutes	Understand where and how participants access information.
Stage 3B: Sharing Strategies	Select climate themes and target audience.	15 minutes	Explore motivations and messaging style preferences.
Stage 3C: Message Design	Sketch message content and format.	10 minutes	Capture design preferences for communication tools.

Ethical approval was obtained before the co-design workshops were conducted. Participants received information sheets and consent forms before taking part and were informed about the use of workshop worksheets, drawings, photographs, field notes, and discussion data. All workshop materials were anonymised using participant codes such as MEC01 and NLC01. The relevant ethics approval documents, information sheet, consent form, and workshop materials are provided in Appendix Study C.

5.2.4 Visual Materials

Worksheets were developed to collect data of the workshop (e.g., Figure 5.2).



Figure 5.2 User Journey Mapping Template used in Stage 1. The participants marked their daily activities and motivations across five time periods.

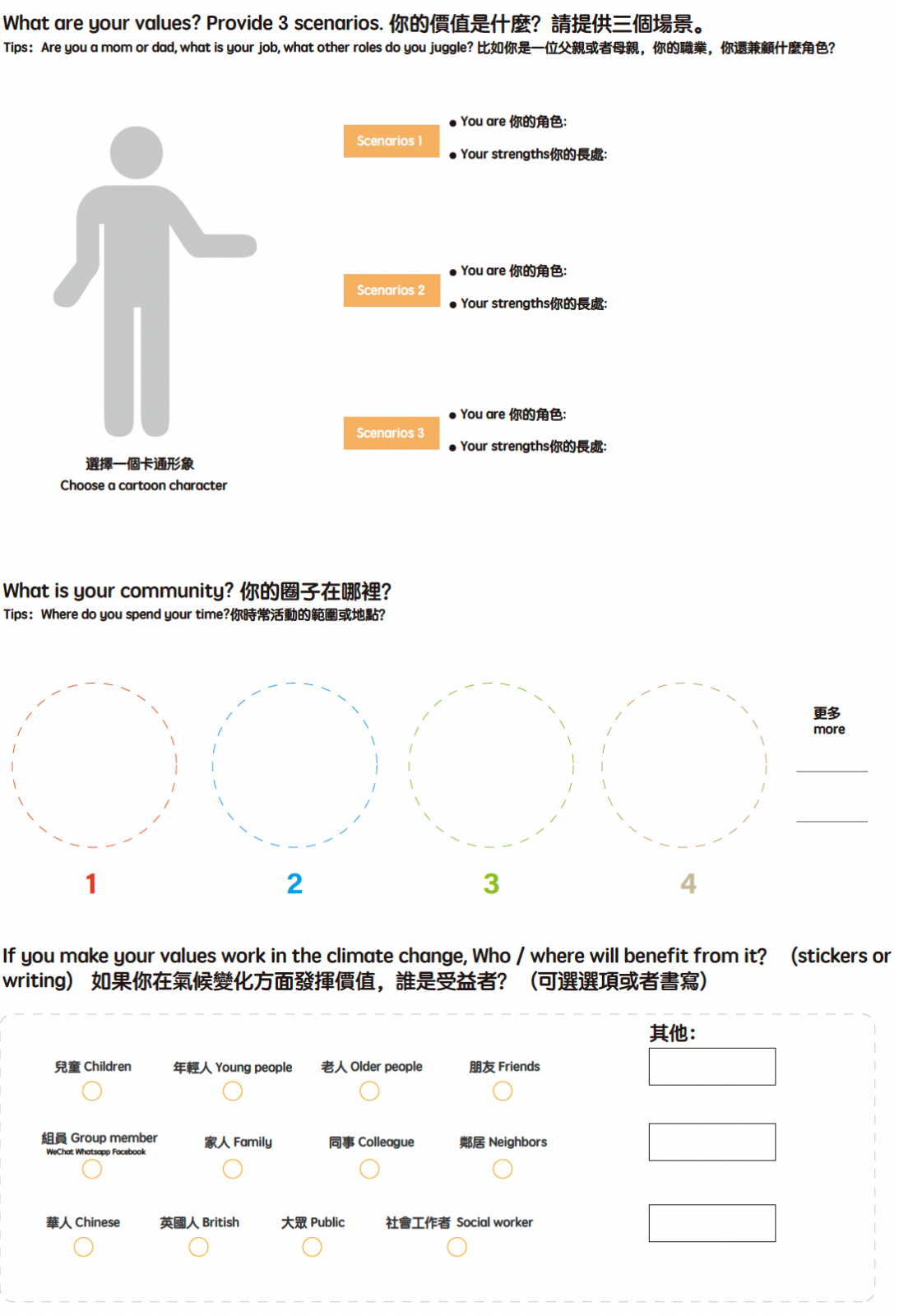


Figure 5.3 Visual aid used for exploring personal and social roles in Stage 2. The participants used cartoon stickers and wrote descriptions to represent their identities and networks.

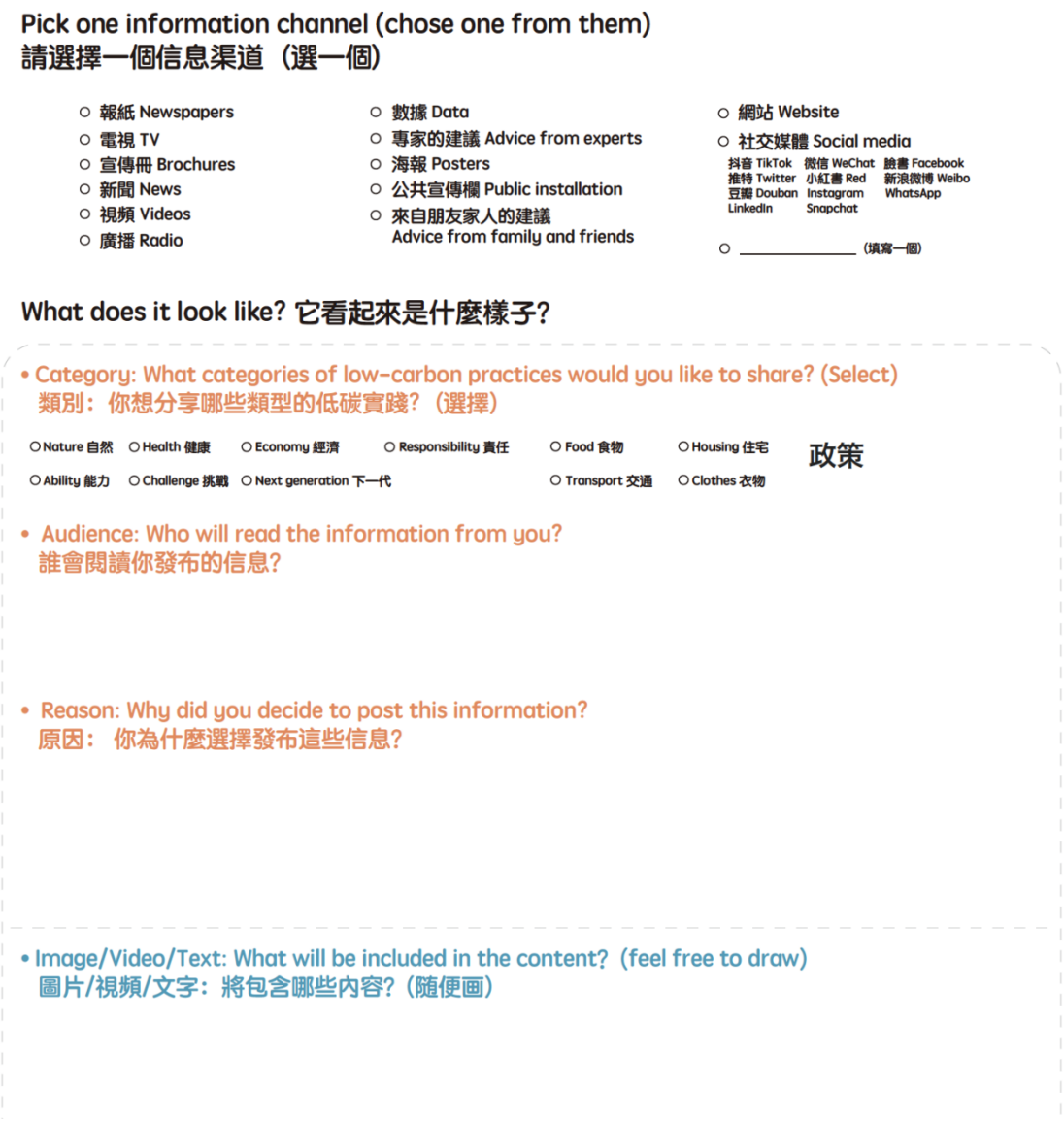


Figure 5.4 Communication preference exercise from Stage 3. The participants selected and customised preferred channels, messages, and audience types.

All visual materials were designed to be bilingual, easy to understand, and engaging for older adult participants.

5.2.5 Data Saturation

Following the first session, data richness and variation indicated sufficient coverage across key themes. Similar behavioural patterns were identified in the second session especially regarding language-based information barriers and cultural motivations (e.g., thrift, family care). The participants with higher English proficiency engaged more with policy or text-based content, while others relied on images, interpersonal support, and

Chinese-language media. These overlapping patterns suggest thematic saturation was reached within the small but diverse sample.

5.2.6 Data Analysis

All photos and completed worksheets were digitised and securely stored on a university-provided, password-protected laptop. All responses were anonymised using alphanumeric codes (e.g., MEC01, NLC02) to maintain participant confidentiality.

Visual analysis

A visual analysis was conducted on the climate-related paintings created by the participants during the workshops. The focus of the analysis is to understand how older Chinese migrants express their understanding of environmental issues and sustainable living through visual means.

These drawings are first classified according to their thematic content and symbolic representation, which allows for the identification of recurring themes such as natural elements, media and technology. Then, the symbols and images are combined with the oral explanations of the participants to reveal the underlying meanings embedded in their visual narratives.

A comparative analysis was also conducted to explore the similarities and differences among the participants' drawings. For instance, the repeated depictions of trees, flowers and animals reflect people's strong emotional connection with nature, while the frequent appearance of mobile phones indicates that people are increasingly inclined to use digital platforms as tools for climate communication.

Thematic Analysis

A special analysis was conducted on the responses collected from worksheets and group discussions. After transcription, the data is systematically organised and encoded to identify key repetitive concepts such as low-carbon behaviours, information sources and motivations.

Through repeated comparisons and improvements, several overall themes emerged, reflecting the underlying motivations and values of the participants. Among them, "caring for future generations" and "respecting nature" stand out particularly, revealing the moral and intergenerational aspects of how older migrants can participate in climate action.

The user journey included time sequences (daily activity schedules from morning to evening), activity categories (such as exercise, shopping, social interactions, religious practices, and work), social interactions (whether they involve family, friends, or the

community), and motivational information (reasons for certain behaviours provided by participants).

In analysing the user journey, four analytical methods were used. The specific steps include **frequency analysis**, which identified the most common activities and the most popular locations; **thematic analysis**, which summarised the low-carbon behavioural patterns of older migrants; **narrative analysis**, which examined the structure and changes in their daily routines; and **social network analysis (SNA)**, which explored how they obtain information through communities, friends, and family.

An independent review of the themes was conducted by a design assistant who participated in the workshops. The external perspective provided valuable insights.

Through a combination of narrative, visual, and thematic analysis were triangulated by an independent observer, this methodological approach enabled a deep understanding of how older Chinese migrants perceive their climate roles and make sense of low-carbon behaviours. By mapping daily routines, social influences, and information preferences, Study C surfaced how cultural identity and lived experience intersect with climate action. This empirical grounding was crucial for developing targeted, culturally resonant strategies for inclusive climate communication.

5.3 Results

The results and findings from the three stages of the workshop will be explained in this section, including the key user journeys in the lives of older people, the roles they play in their lives, the value that these roles can provide, the choice of net-zero information channels, and the kind of information channel they preferred.

5.3.1 "My Day": The Intersection of Everyday Life and Sustainable Living among Older Migrants

This section presents the analysis of the user journey data collected from older Chinese migrants, detailing their daily routines, motivations, and activity patterns on weekdays and weekends. The findings provided insights into their lifestyle habits, information consumption, and potential opportunities for integrating low-carbon behaviours.

Weekday–Weekend Contrasts: A Rhythmic Routine

The user journey data revealed a highly structured and domestically centered lifestyle among older Chinese migrants, especially during weekdays. Most participants spent the majority of their time at home, engaging in routine tasks such as cooking, cleaning,

consuming media, and occasionally performing remote work. Physical exercise, particularly morning walks, tai chi, and stretching routines, was widespread, often gendered. Among them, women tended toward group-based activities, while men preferred gardening or solo exercise.

Weekend routines, in contrast, were markedly more mobile and social. The participants frequently visited family, attended religious or cultural gatherings, and engaged in shopping or leisure activities such as visiting parks or attending community events. Public transport and free senior bus passes supported these activities, reinforcing sustainable habits through structural accessibility.

Overall, the analysis reveals that while weekdays offered predictable, low-mobility routines, weekends served as key touchpoints for social engagement and climate-related communication opportunities, especially in community and faith-based groups.

Daily Patterns and Behavioural Touchpoint

Table 5.3 summarises the frequency of key activities across the week. Patterns suggested that sustainability was not necessarily a conscious pursuit, but emerged incidentally through cost-saving, convenience, or cultural norms.

Table 5.3 Frequency of Activities in User Journeys (N = 13).

Activity Type	Weekdays (N = 13)	Weekends (N = 13)	Total Mentions (N = 26)	Notes on Behaviour Patterns
Home-based activities	10	6	16	Cooking, housework, watching TV, reading, online activities
Physical exercise	8	7	15	Walking, yoga, dancing, gym visits, park exercise
Social interaction	4	12	16	Family gatherings, meeting friends, community events
Shopping	3	9	12	Grocery shopping, second-hand markets, malls
Religious activities	2	5	7	Attending church, community prayer sessions
Cultural engagement	5	8	13	Attending music or dance events, theatre, playing instruments
Caring for grandchildren	3	4	7	Picking up from school, helping with homework, cooking for family

Working (paid employment or volunteering)	4	2	6	Teaching, working remotely, community volunteering
Information consumption	9	6	14	Watching TV, reading news, listening to radio, online browsing
Outdoor recreation	3	10	13	Trips to countryside, museum visits, hiking, visiting cafes
Sustainability-related activities	2	5	7	Visiting second-hand markets, engaging in recycling, environmental volunteering

On weekdays, the participants' activities are mainly family-centred (N=10), mainly including cooking, housework, watching TV, reading and other online activities. Physical exercise (N=8) is another common daily activity, usually including taking a walk, practicing Tai Chi or doing light exercise in the nearby park. In contrast, weekends are characterized by mobility and social interaction (N=12), as participants engage in family gatherings, community activities, shopping and outdoor entertainment (N=10).

Information consumption (N=14) is mainly carried out through traditional media such as television and newspapers, highlighting the ongoing importance of these platforms for environmental communication among older Chinese migrants. Interestingly, behaviours related to sustainable development, such as recycling, using public transportation or visiting second-hand markets (N=7) are often observed, but they are usually driven by frugality or practicality rather than explicit environmental issues.

Cultural participation (N=13) and physical exercise (N=15) have become two consistent aspects of the participants' lifestyles. These activities demonstrate that both cultural engagement and health-oriented initiatives can serve as effective entry points to promote low-carbon awareness and behaviour among this individual.

Media Habits and Trust Channels

Information access patterns reinforce the domestic and media-rich nature of weekday life. Television, newspapers, and social media, particularly WeChat, were the dominant channels. The participants’ preferences differed in entertainment, trusted knowledge, and sharable content, with traditional media often regarded as more authoritative, and social media as more accessible for peer sharing.

The user journey analysis also revealed insights into how older Chinese migrants access information, as shown in Table 5.4:

Table 5.4 Information Sources and Communication Preferences.

Information Source	Common Users	Trust Level
Television (Chinese channels)	Majority of participants	High
Newspapers and Radio	Older, less digitally literate individuals	High
Social Media (WeChat, Facebook)	More common among younger seniors	Moderate
Friends and Family	Used for informal knowledge sharing	Very High
Government/Official Websites	Rarely accessed	Low

Television, newspapers, and social media, particularly WeChat emerged as the dominant channels through which older Chinese migrants accessed information.

Family and friends are the most influential sources of knowledge, particularly for those with limited English proficiency. Official government websites are rarely visited and are often considered difficult to navigate or understand.

In their daily lives, participants rarely used explicit climate or sustainability terminology, but many of their practices aligned with low-carbon principles. Common behaviours included conserving energy, reducing waste, using public transportation, and recycling. These behaviours were motivated more by frugality and practicality than by environmental awareness. For example, some participants mentioned monitoring energy use due to rising costs, while others reduced food waste by reusing leftovers or repurposing materials.

5.3.2 "Who Am I": Intergenerational Roles, Social Identity, and Motivation

This section presents findings from Stage 2 of the co-design workshop, which explored how older Chinese migrants perceived their social roles and responsibilities, the communities they were embedded in, and their motivations for participating in climate-related actions. The results uncovered how intergenerational values, cultural affiliation, and professional identity shaped both climate awareness and communication behaviours.

Self-Perception and Core Value

Most participants described themselves primarily through the lens of family-oriented roles, emphasizing their responsibilities as parents or grandparents and their contributions to supporting and educating the younger generation.

In addition to their roles as family and caregivers, some participants also maintained professional identities as educators, researchers, or business leaders. For these individuals, expertise and social influence remained integral to their self-concept, reflecting their desire to remain productive and relevant in later life. Many also identified teaching, mentoring, and guiding others as core personal strengths, underpinned by values such as patience, diligence, and moral integrity.

Table 5.5 summarises the distribution of participants' self-perceived strengths. The most frequently cited roles were caregiving and education (N=8), followed by practical skills (N=6) and ongoing professional expertise (N=5). These findings suggest that older Chinese migrants tend to view themselves as active contributors to their families and society, with a sense of purpose grounded in intergenerational relationships and lifelong learning.

Table 5.5 Distribution of Self-Perceived Strengths (N=13).

Category	Example Strengths	Frequency (N)
Caregiving & Education	Teaching, mentoring, nurturing family	8
Practical Skills	Cooking, household tasks, maintenance	6
Professional Expertise	Business, research, engineering	5
Health & Fitness	Exercise, yoga, staying active	4
Leadership & Influence	Community leadership, mentorship	3

Community Participation and Social Networks

To understand the everyday social environments of the participants, the researcher asked them to identify key communities in which they regularly participate. Findings show strong ties to cultural, religious, and professional networks.

As shown in Table 5.6, Chinese community groups were the most frequently cited social spaces (N=7). These organisations provide cultural identity reinforcement, language familiarity, and peer-based social support, serving as crucial hubs for practical and emotional connection. Religious institutions (N=4) also played a significant role, providing a moral foundation and spiritual community, while parks and recreation centres (N=5) served as accessible venues for physical activity, relaxation, and informal socialising. For the participants who maintained professional activity, workplaces and professional circles (N=5) provided a sustained sense of engagement and purpose, enabling them to share expertise and maintain intellectual or business connections. Meanwhile, shopping malls and markets (N=4) were cited not only as daily necessities but also as social touchpoints where informal interactions occurred and local information was exchanged.

Table 5.6 Distribution of Social Circles (N=13).

Community Type	Purpose	Frequency (N)
Chinese Community Groups	Cultural identity, language, social support	7
Religious Institutions	Faith, socialising, moral support	4
Parks & Public Spaces	Health, relaxation, nature	5
Workplaces & Professional Circles	Continued engagement, expertise sharing	5
Shopping Centres & Markets	Daily errands, social interactions	4

These findings highlighted the importance of community-based engagement strategies for climate initiatives. Leveraging trusted networks, such as Chinese community groups and religious spaces, might increase participation and information dissemination.

Intended Beneficiaries of Climate Action

The participants were asked to reflect on who they believe would benefit from their engagement in low-carbon or climate-related behaviours. Their responses revealed that motivations for sustainable action were closely tied to intergenerational values, collective responsibility, and a desire to make meaningful contributions to family and society.

As shown in Table 5.7, the most frequently mentioned beneficiaries were the younger generation (N=6), with many participants emphasising their roles as parents or grandparents and their desire to support their children and grandchildren. This intergenerational focus reflects a moral and emotional investment in the future, viewing climate engagement as an extension of family care and legacy. Several participants also recognised the broader societal impact of environmental responsibility, citing the public (N=5) as the primary beneficiary of collective climate action.

At the community level, four participants noted that their own sustainable practices, such as recycling, energy conservation, or using public transportation, can inspire friends and neighbours, fostering peer learning and local awareness. A smaller group (N=3), particularly those with professional or technical backgrounds, believed that their knowledge and experience could inform policymakers or industry professionals, thereby contributing to systemic change.

Table 5.7 Distribution of Beneficiaries Identified (N=13).

Beneficiary Group	Example Mentions	Frequency (N)
Younger Generations	Children, grandchildren	6
General Public	Society, policy change	5
Friends & Neighbours	Peer education, community impact	4

Industry Professionals	Business leaders, policymakers	3

5.3.3 "How to Tell You": Climate Messaging Preferences and Strategies

This section synthesises findings from Stage 3, exploring how older Chinese migrants preferred to receive low-carbon information. The analysis focused on four key aspects: trusted channels, motivations for sharing, preferred formats, and audience strategies.

Trusted Channels: Between Familiarity and Credibility

The participants demonstrated a clear preference for digital communication platforms, particularly social media, messaging apps, and video-sharing services. As summarised in Figure 5.5, WeChat was the most frequently mentioned APP, followed by video platforms (e.g., YouTube, Kuaishou), WhatsApp, and Facebook. Traditional media, including TV, newspapers, and radio, remained relevant for some participants, particularly those less engaged with new digital technology.

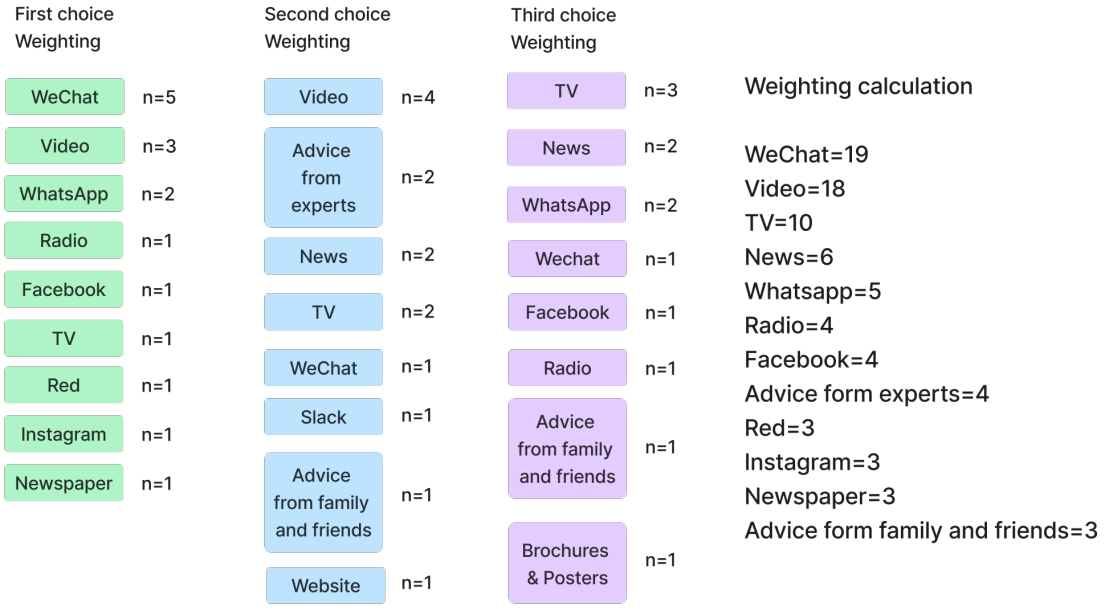


Figure 5.5 Information Channel Choice Ranking Map.

In Figure 5.5, information channels were ranked based on participant preferences. WeChat emerged as the most frequently selected platform, confirming its central role as the primary source of communication and information for the Chinese migrant community. Close behind were video and WhatsApp, both valued for their immediacy and ease of sharing information among peers and family members.

When determining their second-tier preferences, the participants most often chose video platforms, indicating a growing reliance on visually oriented news and

educational media. Online news sources, television, and expert commentary followed closely behind, reflecting a preference for a mix of informal and authoritative content.

For tertiary preferences, traditional media regained their influence: television was the most frequently mentioned, followed by online news media and WhatsApp.
It is evident that social media was the primary tool for information dissemination, while videos served as a key medium for communication. As one participant noted:
"I use WeChat every day; it's convenient for sharing with friends and family. I can post videos and photos that catch people's attention." (MEC05)
"Videos are very intuitive and easy to share. They attract attention, and people comment more." (NLC01)
At the same time, official news sources, television, and expert opinions were also frequently mentioned, highlighting a need for credible and reliable information among older Chinese migrants. The participants who preferred traditional media, such as Chinese-language TV programmes, cited language barriers as a key reason for their choice.
"I prefer expert advice or official news rather than social media posts, which are sometimes misleading." (MEC03)

Low-Carbon Topics of Interest

The participants expressed a strong interest in sharing practical, everyday sustainability practices, which they categorised into three broad areas:
First, social issues such as nature, health, economic benefits, and collective responsibility were frequently mentioned. Many participants linked environmental protection to social harmony and moral responsibility, rather than abstract policy frameworks.
Second, personal experiences reflected a strong sense of agency and intergenerational responsibility. Participants frequently discussed their personal ability to contribute to environmental goals, the challenges they faced in doing so, and how their efforts might influence the thinking of younger generations.
Third, lifestyle habits became a major focus, including sustainable choices in food, housing, transportation, and clothing. These topics were often framed through the lens of everyday practices, and the participants preferred to discuss energy conservation, waste reduction, or efficient cooking, rather than theoretical concepts or policy language.

Target Audience and Intended Impact

The most frequently cited **audiences for climate-related messages** were:

- The next generation (children and grandchildren).
- Peers, colleagues, and professional networks.
- The general public and policymakers.

A strong intergenerational focus was identified in the discussions, with many participants expressing a desire to pass on sustainable habits to their children and grandchildren.

"I want my children and grandchildren to be more environmentally conscious. They should waste less food and use public transport more." (MEC07)

"If I have a good experience, I would like to share it with more people, so that it benefits the next generation." (MEC04)

Beyond family members, some participants mentioned their peers and social groups, particularly those who might be interested in adopting similar sustainable behaviours. A few also highlighted policymakers and professionals in their respective fields, indicating an awareness that individual actions should be complemented by systemic change.

"I've started using an electric car, and I'd like to persuade my colleagues to do the same. If everyone does a little, we can save our planet." (MEC03)

Motivation for information sharing

The participants identified several motivations for sharing low-carbon information, with concern for the next generation and a sense of social responsibility being the most prominent reasons. Economic considerations, such as the benefits of saving energy and reducing costs, were also significant factors.

The main motivations for the participants to share low-carbon information can be divided into three categories (Table 5.8) :

Table 5.8 The main motivation of participants for low-carbon information.

Motivation	Description	Frequency (N)
Concern for the Next Generation	Many seniors felt a responsibility to educate younger family members about sustainable living.	6
Sense of Responsibility	A sense of duty toward nature motivated participants to spread awareness of environmental issues.	5
Economic Benefits	The benefits of saving energy and reducing costs	4

"I am very concerned about the next generation. I think modern young people lack responsibility."(MEC05)

For some, financial incentives and cost-saving strategies were equally compelling reasons for sharing sustainability practices.

"Saving energy is not just good for the environment; it's also good for our wallets." (NLC03)

Additionally, several participants indicated that they were motivated by a desire to contribute to community well-being, reflecting a broader sense of civic responsibility.

Preferred Formats for Climate Information

To understand how the participants visualised and structured climate-related information, they were invited to create simple hand-drawn content or describe their ideal information formats. Since many participants were unfamiliar with hand- drawing, they either provided written descriptions or received assistance from the researcher to complete their visual representations.

Figure 5.6 provides examples of participant-generated content.

Key Themes in Shared Content

The content older Chinese migrants intended to share centred around three recurring themes:

- **Nature and environmental conservation**: The participants frequently mentioned nature-related imagery, such as forests, clear skies, animals, and water. The goal was to evoke emotional connections and highlight the urgency of protecting natural ecosystems.

  "I want to share pictures about nature—snowy mountains, clean water, forests, and animals. If people see beautiful nature, they will want to protect it." (NLC01)
- **Practical low-carbon practices**: Several participants focused on energy-saving strategies, composting, transport choices, and waste reduction, reflecting their own daily sustainability efforts.

  "I recently switched to an electric car. If I can share my experience, maybe more people will follow. I think practical examples work better than slogans." (MEC01)
- **Intergenerational responsibility**: Some participants explicitly expressed their desire to educate younger generations, sharing content designed to encourage their children, grandchildren, and peers to adopt sustainable behaviours.

  "I tried to educate my son-in-law about saving energy, but he believes we should enjoy life instead. There's a big gap between generations in how we see sustainability." (NLC02)

These drawings reflected the participants' storytelling preferences, rooted in lived experience and visual communication. Rather than abstract or policy-driven messages,

they favoured emotionally resonant, personally relevant narratives that were easy to understand and culturally grounded.

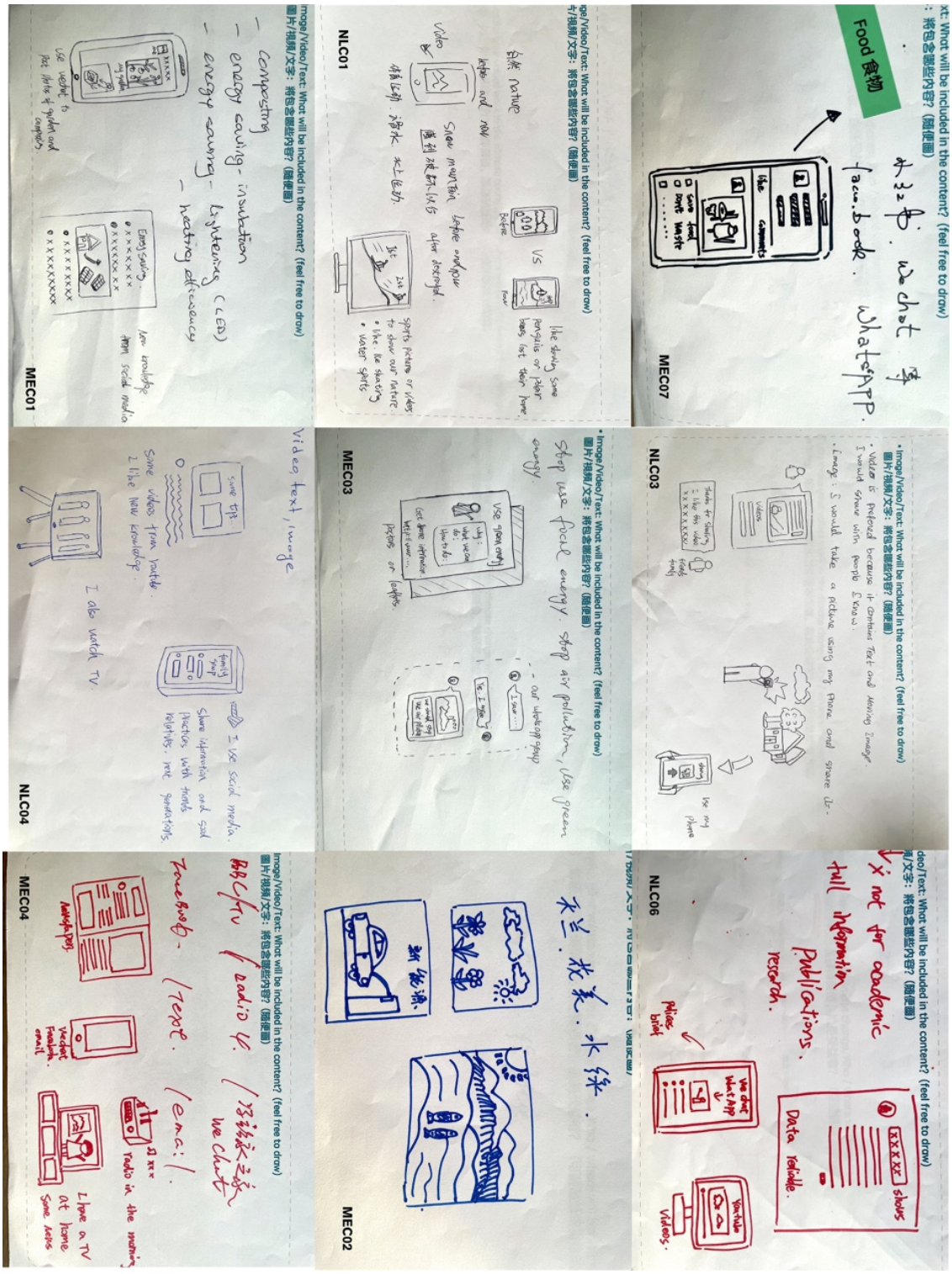


Figure 5.6 Participants generated content (visualized by the researcher).

Preferred Formats: Visual vs. Text-Based Communication

When discussing their preferred communication formats, the participants consistently expressed a preference for visual media over text. Video was considered the most engaging and accessible form of communication, praised for its ability to seamlessly integrate text, images, and audio. As one participant explained:

"Videos are easier to share and more interesting to watch. You can include text, images, and sound all at once." (NLC03)

Images and infographics were also highly valued for their clarity and immediacy, especially among participants facing language barriers. As one participant stated,

" Images work better than text. If the audience is highly educated, then maybe text is fine."(NLC05)

Text was considered suitable for academic or policy-related content, but less effective for general public engagement.

"I read academic papers, so I would prefer well-researched text. But for general climate information, videos work better." (NLC06)

Several participants further stressed the need to tailor content to different literacy levels:

"If the education level is low, I would use videos and pictures. For highly educated people, I think they can understand the text." (NLC05)

Media Platforms for Dissemination

The participants also expressed distinct preferences for where they would share climate-related information. Social media such as WeChat, WhatsApp, and Red were consistently cited as the most convenient and effective mediums for connecting with personal networks. These platforms are valued for their immediacy and interactivity, allowing users to quickly disseminate information within trusted circles. As one participant stated, *"I share things with my family on WeChat and Facebook. It's easy, and people can comment and discuss."* (MEC05)

In contrast, traditional media such as television, newspapers, and radio remain important sources of trusted information, especially for respondents with lower digital literacy or a greater reliance on familiar media environments. These channels are perceived as more reliable and less prone to misinformation. As one participant explained, *"I trust the news more than social media. There's too much misinformation online."* (MEC03)

Finally, a small but significant number of participants (typically those with higher education or professional experience) mentioned workplace and professional networks as channels for communicating with policymakers or expert audiences. One participant

stated, *"If I want to reach policymakers, I would use academic papers or formal reports, not social media."* (NLC06)

5.4 Discussion

Study C used co-design workshops with older Chinese migrants in London-based community settings to investigate how they acquire and disseminate low-carbon and climate change information in their everyday lives. The findings highlight how participants' daily activity patterns, social roles, and information preferences shape their engagement with sustainable behaviours and reveal key opportunities for intervention.

The discussion is organised around key insights drawn from the three stages of the co-design workshops: 1) "My Day": Everyday Life as a Foundation for Low-Carbon Practices; 2) "Who Am I": Social Roles and Intergenerational Motivation; 3) "How to Tell You": Climate Messaging Preferences and Strategies. These insights were then situated within the broader literature on ageing, migration, and design, followed by reflections on practical implications, study limitations, and directions for future research.

5.4.1 Key Findings

Everyday Routines as Entry Points for Climate Engagement

The analysis of user journeys (Stage 1) revealed that older Chinese migrants' weekday activities largely revolved around the home and local community, with a limited travel radius. At weekends, however, they showed increased levels of socialising and outings. This pattern echoes previous studies on older adults' routines, which often centre on familiar environments and a family–community sphere (Farage et al., 2012; van Hoof & Marston, 2021). In this study, these home-based and community-based activity patterns provided clear temporal and spatial touchpoints for designing sustainability interventions.

Figure 5.7 illustrates these touchpoints, key behaviours, and opportunity points.

Internal (Home-Based) Touchpoints: These included activities such as reading news or watching television, cooking, remote work, exercise, household chores, family care, and gardening. Climate change information can be introduced at these junctures. For instance, via the media channels they use, or through health and exercise themes that stimulate interest in climate knowledge. Practical examples, such as composting or gardening tips, can be linked with relevant aspects of net-zero learning, thereby

encouraging older Chinese migrants to adopt beneficial low-carbon practices through targeted informational design.

External Touchpoints: These encompass a variety of settings, including parks, public transport, restaurants, shopping centres, supermarkets, Chinese community venues, and churches. Older adults' activities here include exercise, visiting children, social gatherings, shopping, and learning. In each scenario, climate action messages can be interwoven, such as sharing net-zero tips with friends in group chats, presenting climate-related advertisements in public spaces, displaying informational posters or brochures in Chinese community hubs and churches, or placing sustainability messages in supermarkets and malls. These forms of information interventions at strategic touchpoints can help motivate behavioural change.

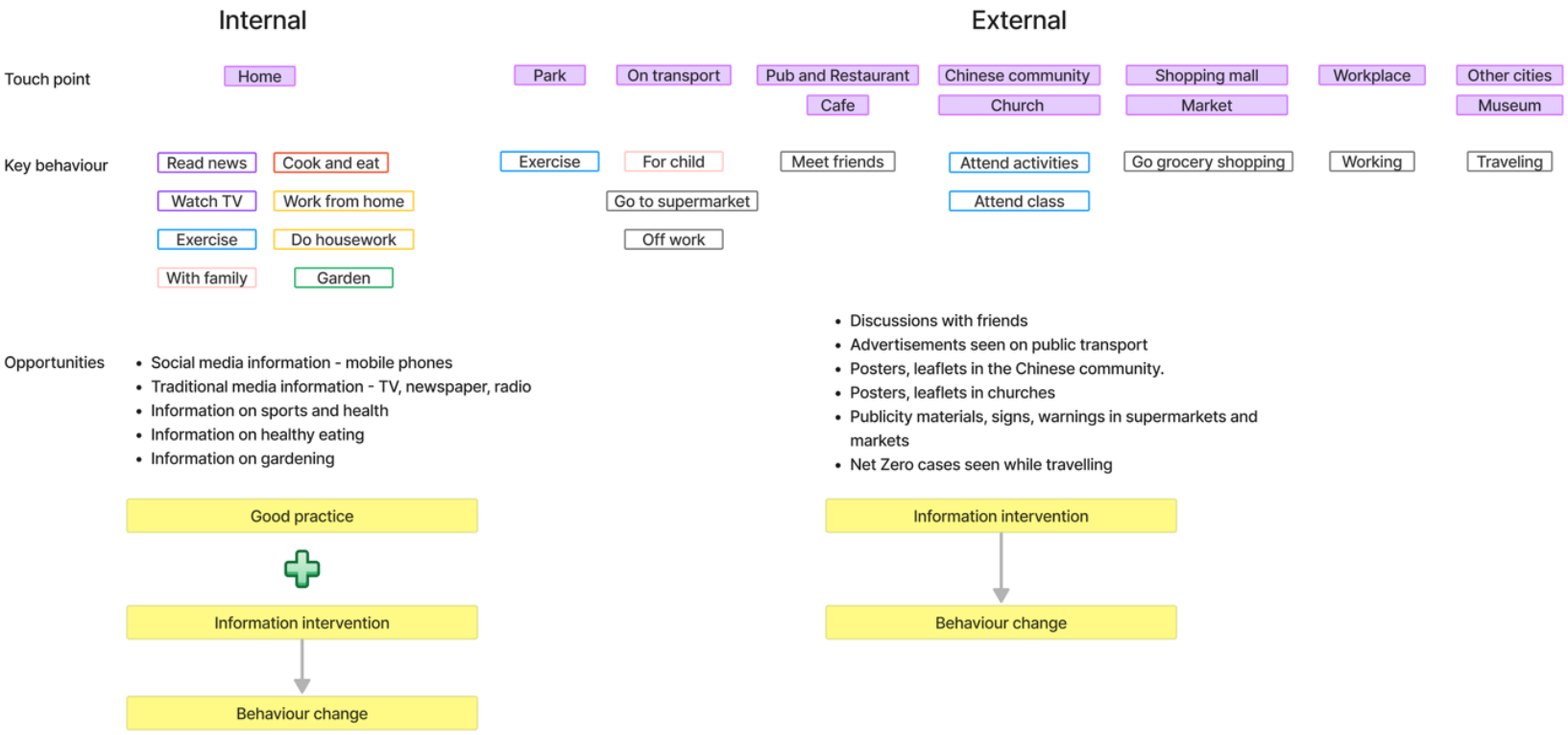


Figure 5.7 User Behaviour and Opportunity Point.

Family and Community Roles: The Dual Influence of Older Migrants

This study identifies three main roles undertaken by older Chinese migrants: those within the family, the workplace, and wider society. Each role involves different stakeholders and entails distinct responsibilities. For instance, as family members, they value educating and caring for their children and therefore place particular emphasis on the next generation. In their work roles, they draw upon professional expertise such as mentoring students, caring for patients, or managing businesses. Meanwhile, as members of society, they focus on staying healthy, planning their lives prudently, and practising thrift. Some individuals tended to underestimate their own worth—one participant remarked, "I want my children to succeed, but I have given up on myself." Recognising their strengths makes it possible to consider how they can offer support to others, and to which stakeholders they might provide this support.

Study C shows that (Figure 5.8): beyond role-specific groups, some participants selected "ALL people" or "PUBLIC" as the key beneficiaries of information. This reflected a broader commitment among older Chinese migrants to inspire change at a wider societal level.

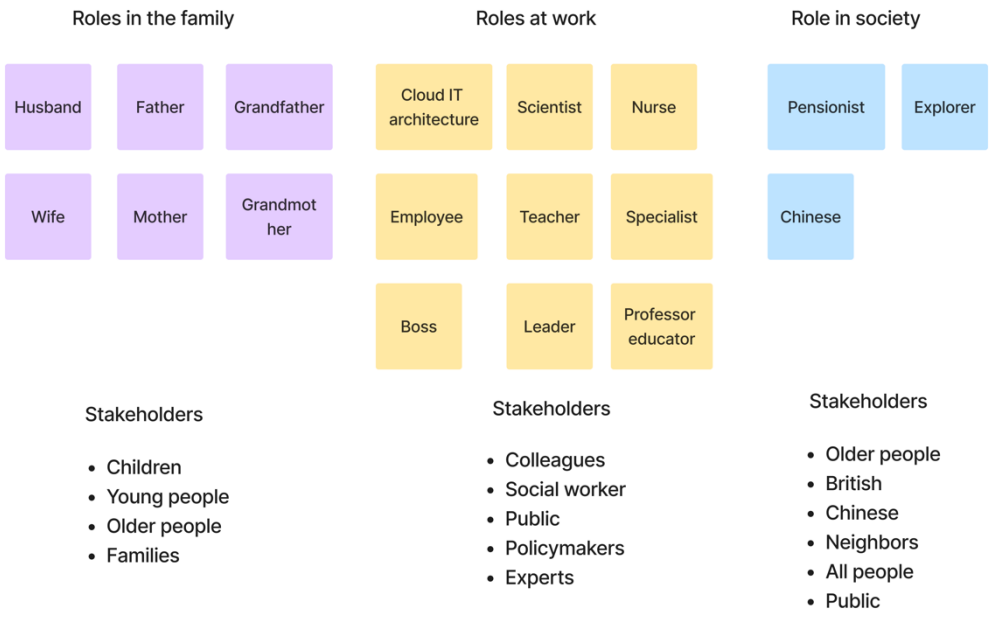


Figure 5.8 Role and Stakeholders Map.

In Stage 2, most participants highlighted their significant roles both within the family and in the wider community. While they shouldered responsibilities for children and grandchildren at home, they also participated in religious groups, cultural associations,

and other community activities, contributing their experience and skills to local development.

This "intergenerational and communal" link mirrors the themes of cultural adaptation, family ties, and mutual support networks noted in Chapter 4, and aligns with Berry's (1997) work on immigrant assimilation and integration. Unlike mainstream climate communication studies, which often focus on younger generations or middle-class families, this study highlights the distinctive contribution of older migrants, who act as cultural transmitters and social stabilisers within diasporic communities. Such as through family gatherings, childcare, and cooking advice, they pass on frugal values that naturally encourage resource-saving behaviours within younger family members' daily lives. Or some participants either continue working or serve as event organisers or opinion leaders, earning considerable trust from peers and local communities.

Information Channels and Content Preferences: Merging Traditional and Digital Media

Findings from Stage 3 indicated that participants relied on both digital social media and more traditional outlets to access and share information: Digital platforms such as WeChat have become the primary communication tool for staying in touch with family and friends, and for exchanging videos and articles. Video platforms such as YouTube and TikTok/Kuaishou were also repeatedly mentioned, primarily due to their engaging and easy-to-understand content. Traditional media outlets such as television, Chinese newspapers, and radio retain considerable credibility, especially among those less familiar with digital devices. These sources are generally considered more reliable than the fragmented information found on social media. This divergence highlights a potential tension between accessibility and trustworthiness, suggesting that different media sources may shape perceptions in distinct—and at times conflicting—ways within the UK context.

Message Formats and Trust: Matching Preferences to Literacy and Context

The participants expressed clear preferences regarding the format of climate information, revealing how literacy, personal habits, and emotional connection shape message effectiveness. Videos were widely favored for their clarity, relevance, and ease of sharing. The participants found videos more engaging and suitable for communicating complex topics like climate change. Additionally, audience-specific content is crucial. Participants noted that the format should be tailored to the target audience. For those with lower education levels or limited English proficiency, images

and short videos are more appropriate. In contrast, those with higher literacy levels are more receptive to text-based content, including articles and research summaries.

5.4.2 Comparison with Existing Literature

Migration Studies and Social Networks

These findings align with scholarship that highlights the importance of social networks and community identity in shaping migrants' daily behaviours (Curran & Saguy, 2001). Compared with older adults in general, older migrants often rely more on ethnic ties and family bonds, and are less dependent on government websites or English-language media. Instead, they place greater trust in community activities and personal connections. As a result, any low-carbon or environmental campaigns that focus solely on 'official messaging' may fail to reach this group if they overlook the networks operating within Chinese communities.

Additionally, some participants expressed a desire to influence policymakers, suggesting that older Chinese migrants were not merely passive recipients of information. Rather, they sought to use their experience or professional expertise to shape wider social change. This perspective reflected recent calls for "immigrant empowerment," where migrant groups become not only consumers of information but also producers and transmitters of knowledge (Abbasian & Bildt, 2009; Brodsky et al., 2022; Zou, 2002).

Co-design in Environmental Contexts

The collaborative design approach adopted in this study aligns with Ceschin and Gaziulusoy's (2016) arguments on sustainable design, which posit that addressing complex social and environmental challenges requires collective input from designers, target users, and community stakeholders. Through the workshops, older Chinese migrants were invited to map their daily routines, share personal values, and identify information preferences. This process not only provided the researcher with direct, first-hand insights but also sparked the participants' interest in low-carbon topics, with many noting that they had previously been less familiar with concepts like climate change or net-zero. The workshops helped them recognise the connection between their everyday activities and wider environmental concerns.

These findings highlighted the value of co-design as a powerful tool for community empowerment, giving traditionally underrepresented groups a chance to voice their perspectives and take practical action. Furthermore, they offered policymakers, service

designers, and community leaders evidence to craft more inclusive and culturally responsive strategies for climate-related interventions.

Unintentional vs. Intentional Sustainability

A critical distinction emerged between the participants' deliberate engagement with climate topics (e.g., attending workshops or watching educational videos) and their habitual practices that nonetheless support sustainability—such as reusing containers, conserving electricity, or avoiding food waste. These behaviours were often motivated by economic prudence or cultural upbringing rather than environmental awareness (Gifford & Nilsson, 2014; Kollmuss & Agyeman, 2002). This latent form of sustainability highlights the importance of recognising diverse motivations behind climate-positive actions, especially within older migrant groups. It also suggested that future communication strategies might benefit from acknowledging and validating these habitual, culturally-rooted practices, instead of solely focusing on overt environmental messaging (Shove, 2010; Southerton et al., 2011; Spaargaren, 2011).

5.4.3 Future Work and Potential Interventions

Drawing on the findings of Study C, several avenues emerge for future research and practical design interventions aimed at enhancing older Chinese migrants' engagement with low-carbon behaviours.

1）Community-Centred Approaches

Community centres and religious sites can serve as reliable venues for promoting low-carbon awareness. Partnering with churches and local associations to regularly organise workshops, demonstrations, and intergenerational events can normalise sustainable practices in everyday community life. In the home setting, simple interactive tools or fun activities can encourage older people and their families to set shared environmental goals, strengthening communication and collective responsibility.

2）Mixed-Media Strategies

Given the dual reliance on traditional media and digital platforms, future work should explore integrated communication strategies that combine the credibility of television and newspapers with the accessibility of social media platforms like WeChat. Visual storytelling, videos, and bilingual materials, particularly those linking climate action to health and family well-being, can enhance inclusion and resonance across cultural levels.

3）Intergenerational Collaboration

Intergenerational collaboration offers a crucial opportunity to bridge cultural wisdom and digital innovation within immigrant families. Older people often possess rich life experience and cultural knowledge, while younger relatives bring technological skills and awareness of sustainability practices. Future research could explore "family pairing" models to enable cross-generational learning.

Building on a co-design framework, intergenerational workshops could further encourage collaborative planning and shared environmental action. In this context, older migrants might offer practical insights into thriftiness and resourcefulness, while younger participants could introduce digital tools for behaviour tracking and advocacy.

4）Community Advocacy and Policy Integration

At the community level, close collaboration with local authorities, nonprofit organisations, and environmental organisations can support the development and distribution of bilingual resources such as brochures, workshops, and promotional events. These partnerships can help make climate communication more inclusive and accessible.

Beyond outreach, empowering older migrants to participate in public discourse can further expand their influence. The participants in this study expressed a strong interest in promoting social change and suggested that future projects could provide platforms for dialogue with local policymakers, opportunities to share low-carbon success stories, and pathways to collaboratively develop climate policies that are responsive to migrants.

The climate-related opportunities mentioned in the findings and recommendations of this section are summarised in Figure 5.9.

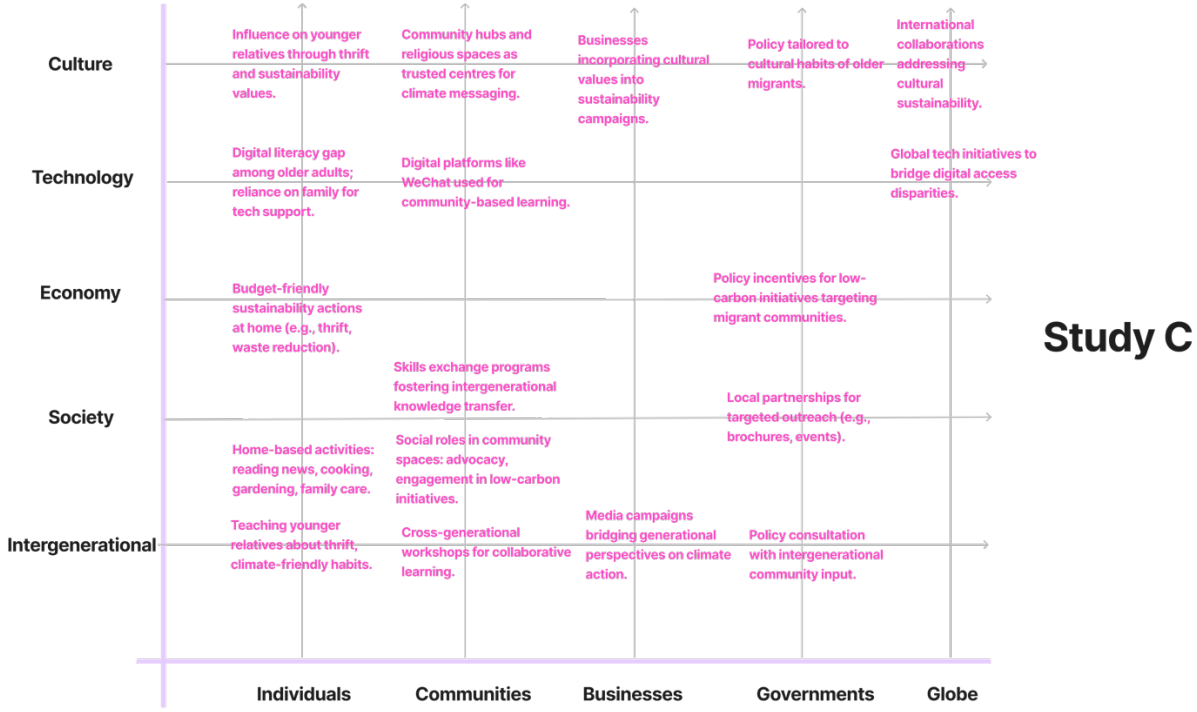


Figure 5.9 Climate-related opportunities (Study C).

5.4.4 Research limitation

Study C recruited participants primarily from two Chinese communities in London, which may not fully represent older Chinese migrants in other regions. Even within London, there could be significant variations in the needs and preferences of older adults with different ages, educational backgrounds, or economic circumstances.

5.5 Summary

Study C investigated how older Chinese migrants in the UK acquire and share information about climate change and low-carbon behaviours, focusing on their day-to-day routines, social roles, and communication channels. The study gained first-hand insights into the participants' daily habits, values, and preferences.

Findings from Study C indicated that older Chinese migrants split their daily routines between home, local community venues, and broader public spaces. Their media usage patterns combined traditional channels, such as television and newspapers, with digital platforms like WeChat, and they tended to trust messages endorsed by community leaders and peers. Additionally, these older Chinese migrants occupied three primary roles, including family member, worker/professional, and community member, each involving distinct responsibilities and stakeholders, thus providing multiple avenues for

targeted interventions. Community networks, including faith-based groups, cultural associations, and peer support circles, could function as key touchpoints for promoting broader environmental awareness.

Moving forward, **Chapter 6 (Study D)** runs in parallel with Studies A and B, delving into the practices and attitudes of local older adults. It offers valuable insights and recommendations for how older Chinese migrants might enhance their understanding of net-zero goals and climate change.

Chapter 6: Investigating Local Older Adults' Advice on Climate Change

6.1 Introduction

Chapter 4 explores the low-carbon practices and perceptions of "net zero" among older Chinese migrants in London, alongside the motivations driving their low-carbon behaviours. The study identifies several influencing factors, including demographic characteristics, acculturation experiences, and access to information, all of which shape their understanding of net zero. Despite their efforts to adopt sustainable practices, older Chinese migrants face significant barriers in accessing information about net zero. Understanding the perspectives of older adults residing in the UK on net zero and climate change can provide valuable insights for designing interventions tailored to the local context. Their experiences of engaging with policy-related information and navigating the UK information environment may offer useful points of reference for supporting Chinese migrant older adults.

Peer education is another potentially valuable approach. It facilitates the transfer of information, skills, and values between individuals with shared characteristics, such as age or common experiences (Simoni et al., 2011). Peer educators and participants interact as equals, with peer educators acting as positive role models can build participants' confidence (Peel and Warburton, 2009). Older adults, in particular, benefit from this reciprocal learning model, where the exchange of knowledge, ideas, and experiences enhances their ability to learn and adapt (Peel & Warburton, 2009). In this context, local older adults could serve as peer educators, sharing their experiences of acquiring climate change information to support Chinese migrant older adults in overcoming barriers and engaging more actively in climate action.

This chapter also introduces Study D, a parallel investigation to the research presented in Chapter 4. Study D examines how local older adults perceive net zero and climate change and presents their recommendations for empowering Chinese migrant older adults to participate in climate action.

6.1.1 Research Stage Overview

Studies A and B are part of the Research Clarification (RC) stage of the DRM framework, focusing on the low-carbon practices, perceptions of net zero, and

motivations of older Chinese migrants in London. They addressed the following research questions:

Study A:

- Question 1: What are the current low-carbon practices of older Chinese migrants?
- Question 2: What are their perceptions of net zero?

Study B:

- Question 1: What are the motivations of older Chinese migrants to engage in low-carbon behaviour?

Study D was designed as part of the DS1 (Descriptive Study 1) phase in the DRM framework. The aim of this stage was to explore the perspectives of local older adults on net zero and their related practices, paying special attention to their learning processes and motivations. The primary objective was to understand how local older people acquire knowledge about net zero policies and their advice for achieving net zero goals.

Study D addresses the following research questions:

Study D:

- **Question 1:** How do British seniors understand net zero, and what advice would they offer to migrant seniors?

By situating Study D within the broader research framework, this phase builds on the findings from Studies A and B and focuses on leveraging the experiences of local older adults to provide actionable insights for Chinese older migrants in London (Fig 6.1).

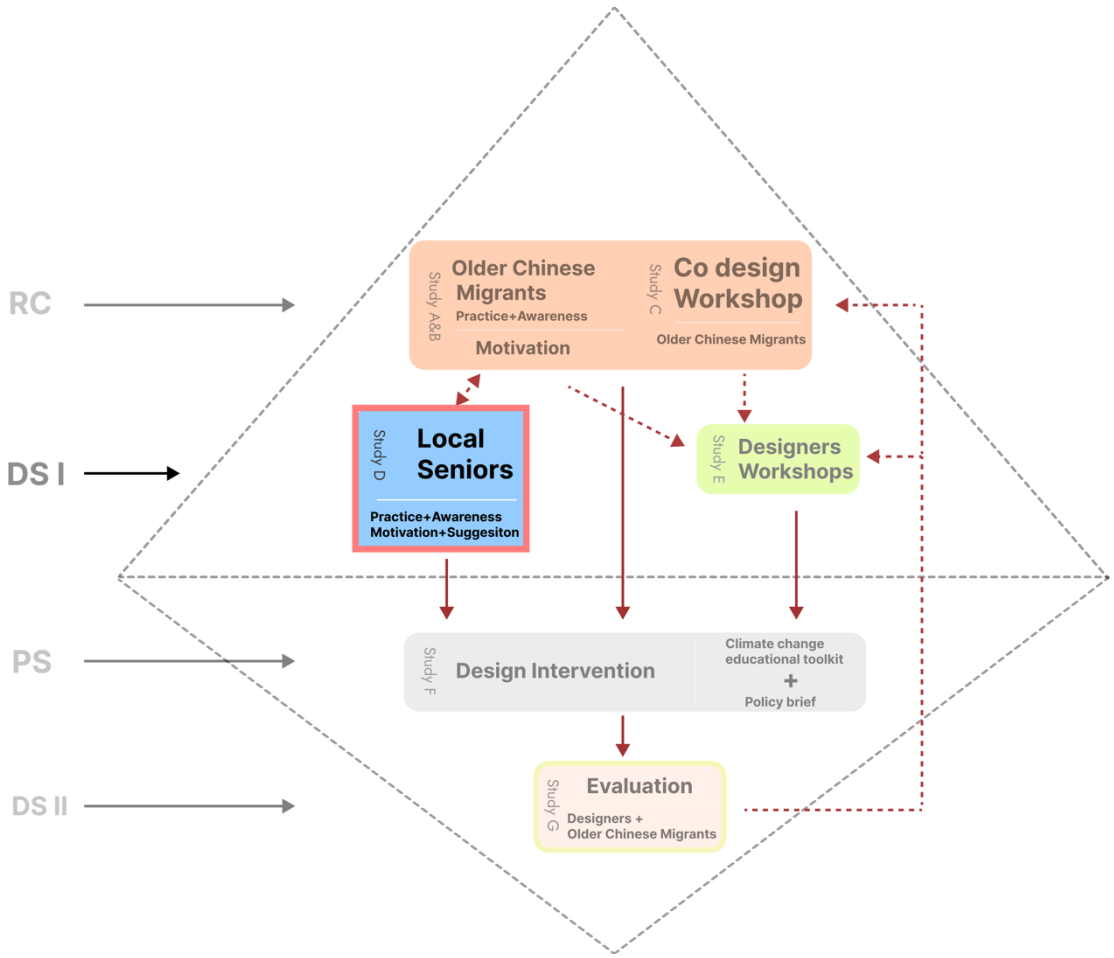


Figure 6.1 Study D as part of Descriptive Study I.

6.1.2 Research Background

The UK has committed to achieving net-zero emissions by 2050, a goal that requires widespread public understanding and engagement (Government, 2021; Sasse et al., 2020b). Older adults represent a significant demographic, contributing both to carbon emissions and holding the potential to drive meaningful change (Fan et al., 2021; Pais-Magalhães et al., 2022).

Having witnessed decades of environmental and societal shifts, older adults bring unique and valuable insights into sustainable practices (Peel & Warburton, 2009) . However, they are often underrepresented in climate-related discussions (Wagenet, 2010), and their understanding of key concepts like net zero remains underexplored (Ayalon & Tesch-Römer, 2018). Research also suggests a generational divide in perceptions of net zero. Younger people are generally more optimistic about achieving net-zero goals, while older adults are less frequently seen as direct beneficiaries of such policies (Poortinga, Whitmarsh, et al., 2023).

Net zero refers to the balance between greenhouse gas emissions produced and those removed from the atmosphere (An, 2018). Achieving this balance depends on individuals adopting low-carbon lifestyles, making it essential to enhance public awareness and participation (Hickman et al., 2021). In the UK, older adults are directly affected by net-zero policies, such as initiatives to improve energy efficiency, shifts in transportation practices, and reform waste management (Committee, 2020). Their willingness and capacity to participate in these measures will play a critical role in the nation's progress toward its climate targets (Clarke et al., 2014).

Research Gap

Existing research primarily focuses on the health impacts of climate change on older adults, highlighting their vulnerability during extreme events such as heatwaves (Huang et al., 2013). However, limited attention has been paid to their understanding of net zero and their engagement in climate action. While much of the emphasis on climate education is placed on younger generations, there is a lack of research on how older adults perceive and participate in net-zero policies and practices (Muhonja et al., 2024). Moreover, their strategies for learning about climate initiatives, as well as their potential role as influencers within their communities, remain insufficiently studied (Peel & Warburton, 2009).

Understanding older adults' perspectives on net-zero emissions and related practices can provide valuable insights for targeted interventions. Identifying their knowledge gaps, motivations, and barriers will enable policymakers and designers to create more inclusive strategies that encourage their participation.

Study D investigates how older adults in the UK perceive net zero and engage with climate-related practices. It focused on their learning experiences, barriers to participation, and suggestions for fostering greater involvement. The research also aimed to provide actionable recommendations for older Chinese migrants in the UK, drawing from the experiences of local older adults.

By exploring the perceptions and practices of local older adults regarding net zero, Study D sought to address several critical gaps:

1) Learn about the low-carbon practices already undertaken by local older adults;
2) Identify the motivations and barriers older adults face in adopting low-carbon behaviours;
3) Summarise their strategies in learning and adapting to climate change and net-zero policies;

4) Offer practical advice for immigrant groups, such as older Chinese migrants in the UK, to enhance their understanding and participation in climate action efforts.

6.2 Methods

6.2.1 Recruitment and Procedure

This study took place between August 2023 and January 2024, recruiting 30 older participants across seven focus groups. These older adults were from West London, with some participants recruited through the Brunel University Older People's Reference Group. Other participants were recruited from Uxbridge Library and churches in west London. The participation rate for this study was 100%, with all 30 individuals completing the focus groups. Participants were recruited on a rolling basis, and recruitment continued until data saturation was reached, that is, when no new themes were identified from the discussions.

Focus groups are a qualitative research method aimed at gathering in-depth views and opinions on a specific topic (Akyıldız & Ahmed, 2021; Rosenthal, 2016). Typically, a focus group consists of a moderator and six or more participants. By combining participant dynamics, body language, and responses to questions, this method can provide rich insights into future products (Kitzinger, 1995), services, and system features (Hennink, 2013). In this study, focus groups created a safe and open environment where older adults could freely express their views, helping to reduce participant anxiety. The discussions enabled participants to inspire one another, leading to new ideas or perspectives. The group setting facilitated dynamic interactions, less likely to occur in one-on-one settings. While individual interviews were not conducted in this study, the focus group discussions allowed the researcher to observe commonalities and differences among participants, to comprehensively understand their thoughts and motivations.

6.2.2 Sampling Strategy

A purposive sampling strategy was used to recruit older participants, which is suitable for situations requiring an in-depth understanding of a specific group's views, experiences, or behaviours (Campbell et al., 2020). This approach focuses on selecting information-rich cases to provide deeper insights into the phenomenon under study, rather than aiming for statistical representativeness. The recruitment criteria did not require participants to have extensive knowledge of climate change; an interest in the

topic was sufficient. This ensured a range of perspectives and contributed to data diversity. However, some older adults did not take part in the study, as they declined the invitation to participate.

The main participants were recruited from the Brunel Older People's Reference Group (BORG), a database of local adults aged over 50 who have expressed an interest in research activities at Brunel University London. Members of this group receive periodic invitations to participate in research and public engagement activities, but participation is entirely voluntary. Invitations were sent to BORG members via email, explaining the purpose of the study and inviting them to participate in focus group discussions. BORG members were also encouraged to share these invitations with their networks. Additionally, recruitment efforts extended to Uxbridge Library and churches in west London, where posters were displayed on community boards and informational cards were distributed to older adults visiting these locations. Interested participants were asked to express their interest to participate by emailing or text the researcher, allowing the researcher to schedule sessions at mutually convenient times.

Inclusion criteria for Study D involved age and willingness to participate. The participants were screened with the question, "Are you willing to discuss climate change and net zero?" and needed to be aged between 60 and 85, able to move independently, and communicate fluently. Those who met the inclusion criteria were invited to the study.

The aim of this study was to explore older adults' perceptions and behaviours regarding climate change and net zero, focusing on a group capable of engaging in in-depth discussions. This approach sought to provide a detailed understanding of the low-carbon behaviours and climate change perceptions of this specific group, laying the groundwork for future research.

Given that the workshops were held at Brunel University and were highly interactive, the participants needed to travel to a designated location and actively contribute to discussions. As such, selecting individuals with mobility and effective communication skills was essential to ensure data quality and facilitate smooth interactions. The sample size of 30 participants was chosen to ensure a balance between obtaining diverse perspectives and achieving data saturation, where no new themes emerge from additional data collection.

The demographic characteristics of the participants are summarised in Table 6.1.

Table 6.1 Demographic characteristics of participants (N=30 participants).

Category	Subcategory	Sample (%)
Gender	Female	60%
	Male	40%
Age	60-70	33%
	71-80	53%
	81-85	13%
Race	White	83%
	Asian	13%
	Black	3%
Climate-related Knowledge	No Knowledge	3%
	Basic Knowledge	40%
	Moderate Knowledge	46%
	Advanced Knowledge	10%

6.2.3 Materials Used in Focus Groups

The semi-structured questionnaire used in Study D was designed based on established theoretical frameworks and a comprehensive literature review to ensure relevance and comprehensive coverage of the topics.

Prior to conducting the formal focus groups, the semi-structured questionnaire underwent pretesting and validation. The first round of pretesting involved four researchers from Brunel University's Design School, who provided feedback on the focus group process and materials. This led to improvements, such as offering clearer explanations for technical terms (e.g., "net-zero" or "carbon footprint") and optimising the session duration to 120 minutes, while ensuring refreshments were provided. The second round of pretesting involved three participants from the target demographic in a simulated interview setting. Based on their feedback, adjustments were made to the questionnaire, including increasing font size for readability. Finally, the questionnaire was validated through a pilot test with seven participants, confirming its logical consistency and measurement reliability for use in the main study. Before assigning the participants to focus groups, the researcher recorded everyone’s level of climate change awareness in an information form. Each focus group, consisting of 4–5 participants,

was carefully balanced to include both men and women, and participants with varying levels of climate engagement, ensuring a well-rounded and diverse discussion dynamic.

The materials used during the focus groups included printed or digital questionnaires, participant information sheets, and informed consent forms. The printed and digital materials contained identical content, with the digital version accessible on participants' mobile devices. Participants were able to sign the consent forms electronically and return them to the researchers by email. Before the discussion began, participants were asked to review the information sheet and provide informed consent. The researcher then introduced the project background and explained the procedure, after which the semi-structured focus groups commenced.

Ethical approval was obtained before the focus groups were conducted. Given the age of the participants and the potentially sensitive nature of discussions around climate change, health, housing, and future uncertainty, participants were reminded that they could pause, skip questions, or withdraw at any time. All recordings and transcripts were anonymised, and the relevant ethics approval documents, information sheet, consent form, and focus group materials are provided in Appendix Study D.

Based on the semi-structured questionnaire, the participants engaged in semi-structured discussions during the focus groups. Two researchers facilitated the sessions: the PhD researcher managed the flow, posed questions, and ensured all participants had equal opportunities to speak, while the other researcher helped record audio and noted non-verbal cues, stepping in to redirect discussions or address participant discomfort if necessary. Researchers are particularly interested in emotional signals, given that the topic of climate change can raise concerns about life safety, health threats, or future uncertainty, potentially leading to anxiety, sadness, or anger. They encouraged the participants to express their emotions freely without fear of judgment. Questions about financial or housing situations were avoided, with indirect or open-ended questions used instead to prevent feelings of blame or guilt among participants.

The following topics were covered in the focus groups:

Awareness and Perception of Climate Change

- The role of perception in understanding climate change
- Awareness of terms such as "net zero," "global warming," and "climate change"

Low-Carbon Practices and Motivation

- Experiences with low-carbon practices
- Motivations for adopting low-carbon behaviours

Access to and Sharing of Climate Change Information

- Preferred channels and methods for accessing climate change information
- Strategies for sharing climate change information
- Advice for older Chinese migrants to learn about net zero and climate change

Expectations and Challenges for the Future

- Personal challenges and aspirations regarding climate change
- Expectations of society, government, and businesses in addressing climate change

Each focus-group interview lasted approximately 90-120 minutes. A 10-minute break was provided every 60 minutes, allowing the participants to drink water, move around, or temporarily step away from the discussion. The participants were given no incentive to participate, but tea, water, and light snacks were offered during the breaks to help them recharge. Additionally, the participants were given the option to pause or withdraw from the discussion at any point if they felt fatigued, ensuring their comfort and avoiding any sense of obligation to continue. The interviews from focus group sessions were audio-recorded and transcribed by the researcher. To protect participant confidentiality, the data was anonymised.

6.2.4 Data Analysis

The interview data was analysed using thematic analysis with the support of NVivo software for coding. Data was securely stored on Brunel University's cloud drive. Transcription and initial coding were carried out by the PhD researcher to ensure consistency in data preparation. This study employed Investigator Triangulation and Data Source Triangulation. For investigator triangulation, one researcher reviewed and analysed the data, followed by team discussions to consolidate themes and minimize potential biases. Data source triangulation was achieved by recruiting participants from diverse settings, including libraries, churches, and older people's reference groups, ensuring a range of climate knowledge levels and backgrounds.

The data analysis followed Braun and Clarke's six-phase framework: familiarising with the data, generating initial codes, searching for themes, discussing and validating themes with co-researchers, defining and naming the themes, and producing the final report (Terry et al., 2017). The analysis began with an in-depth review of the transcribed focus group discussions to gain familiarity with participants' insights and interactions. From this, initial codes were generated to capture recurring ideas and patterns within the data. For instance, "frugality" was coded based on participants frequently

referencing resource-saving habits shaped by past economic hardships. Similarly, “intergenerational dialogue” was mentioned in discussions about sharing climate-related knowledge with younger family members.

Initial codes were generated by the PhD researcher and reviewed by another researcher. Disagreements in coding, such as whether “low trust in government policies” should form a separate theme or be included under "systemic barriers," were resolved through discussions. This collaborative approach helped ensure that diverse perspectives were considered and potential biases were minimised.

The preliminary findings and themes were shared with older adults during Brunel University’s Older People’s Day event. This engagement allowed the participants to provide feedback and validate key themes.

6.3 Results

Study D revealed how local older adults perceive and understand climate change. In particular, it highlighted how they described the impact of climate change on their lives within today’s information-rich society, as well as how they access and interpret climate-related information and knowledge. The participants also discussed their low-carbon practices and the motivations driving these behaviours. Additionally, they shared the challenges they currently face in relation to climate change and their hopes and expectations for the future. Figure 6.2 is a frame diagram that shows the classification of subthemes and themes of the codes.

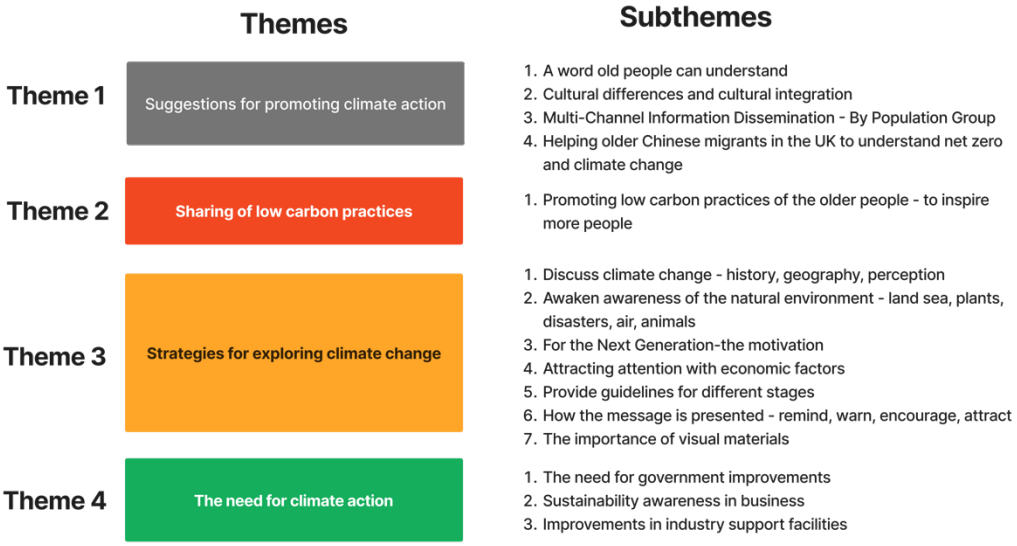


Figure 6.2 Themes & Subthemes.

6.3.1 Suggestions

1) Terminology Old People Can Understand

In the focus groups, the participants explored various terminologies used to describe climate issues, such as "net zero," "climate change," and "global warming." Initially, many older adults were more familiar with the term "global warming." One participant explained, *"We use that very often...when you look at a problem like flooding, we always say it's related to global warming. People don't believe it's global warming, but it is"* (Female, 72). However, as some regions experienced shifts that were not exclusively warming, the term "climate change" became more appropriate. As another participant noted, *"There are parts of the world where it's cooling...by describing it as climate change, it's more inclusive"* (Male, 65). This shift from "global warming" to "climate change" resonated with the participants as a more accurate reflection of the broad environmental changes they were witnessing.

While the term "net zero" was recognised as a useful concept for balancing greenhouse gas emissions, it was met with some hesitation. Many participants found the term abstract and felt it lacked clarity. One participant expressed, *"It's a strange term...it seems to be central to government policy...for most people, maybe it's easier to understand 'climate change'"* (Male, 68). This reflected a preference for simpler, more familiar language that feels more grounded in everyday understanding.

Moreover, the participants' aversion to "net zero" stemmed from their perception that it was primarily a governmental term, one that carried a sense of obligation and pressure. *"When you say zero emissions, I think of cars...it feels like trying to fake information,"* one participant explained (Male, 68). Another added, *"I feel a lot of pressure when you say, 'net zero'. I don't know about net zero"* (Female, 81), highlighting how the technical terminology can feel inaccessible or even alienating to this demographic.

To enhance understanding, "net zero" could be explained through relatable examples, such as households using renewable energy to offset emissions from daily activities. This approach ensures the terminology remains accessible while preserving its conceptual depth.

2) Cultural Differences and Cultural Integration

In the focus groups, older participants also discussed the role of cultural inclusivity and integration in relation to climate change. The UK is home to immigrants from diverse backgrounds, including many older adults who have come from different parts of the world. One participant emphasised the importance of multicultural environments. Her home was a guesthouse, receiving visitors from different countries and she talked with everyone, she said *"It really helps if you live in a multicultural house... there will often be enough people in the same situation"* (Female, 63). This highlighted how cultural exchange provided an opportunity for mutual learning between people from different ethnic backgrounds.

Older adults from developing countries, for instance, often practise low-carbon behaviours due to different economic and social systems. As one Indian participant explained, *"In India, we have learned to think about the future... you have to save... planning for a rainy day is for emergencies"* (Female, 78). This emphasis on future planning and saving contributes to lower household carbon emissions, contrasting with the participant's perception of Western consumption patterns.

Additionally, some participants expressed the need for immigrant seniors in the UK to better engage with local environmental efforts. One participant noted, *" if you don't understand climate change in the UK... you can't participate in community activities"* (Male, 65). This reflects the challenges immigrant older adults face in integrating into climate-related community activities due to language barriers and cultural isolation.

Study D underscored the importance of cultural inclusivity in climate communication and action, as well as the need to provide older migrants with more accessible information to enhance their participation in environmental initiatives.

3) Multi-Channel Information Dissemination

In the focus groups, the older people shared their views on reliable sources of information and where they typically obtained knowledge about climate change. The BBC, as a long-established media outlet in the UK, was highly regarded by the participants as a trusted source. One participant commented, *"The BBC has improved a lot. There were many climate deniers until the BBC spread the word... public awareness has increased, and you don't hear counterarguments in the media anymore."* (Male, 74). This reflected the role of traditional media in shaping public discourse on climate change.

Newspapers and radio were also integral parts of daily life for many older adults, and they were considered reliable sources of information. One participant explained, *"Newspapers, and radio. It can convince the mass. It has accelerated public awareness of climate change."* (Female, 62). This demonstrated the importance of familiar, accessible media platforms in informing older generations.

While some older adults had started using computers, many found reading reports on websites tedious and exhausting. Television, particularly for documentaries and news, remained a trusted source for many: *"TV can provide you with some good documentaries, so I believe this is the one."* (Female, 75). The reliance on these traditional forms of media highlights the accessibility challenges older adults face when engaging with digital platforms.

In contrast, many older adults expressed distrust in social media, viewing the information as unreliable and unsuitable for their needs. As one participant put it, "*I'm not a fanatic who needs to search for anything. If there's something on social media,I don't read it."* (Female, 78). This points to a significant digital divide in how older generations engage with information compared to younger audiences.

Moreover, advice from friends and family was seen as highly valuable. The participants emphasised the importance of intergenerational dialogue: *"Certain family members are more interested in climate change... My daughter-in-law is very concerned about it, and my son is very passionate about it."* (Female, 70). The quote underscored the significance of trusted personal relationships in shaping views on climate change.

Communities and social groups also emerged as reliable sources of information, with discussions often sparked by interactions with friends and family. One participant mentioned, *"I joined a lot of groups... maybe I will join one on climate change to gain more knowledge and then do more."* (Female, 78). This highlighted the potential of community-based networks to foster greater climate awareness and action among older adults.

The complex relationship between older adults and the sources of information they trust was revealed, with traditional media and personal networks playing pivotal roles in shaping their understanding of climate change. However, significant gaps remained in the use of digital media among older adults.

4) Helping Older Chinese Migrants in the UK to Understand Net Zero and Climate Change

This section explores advice from local older adults aimed at helping Chinese older migrants and ethnic minorities in the UK understand net zero and climate change. Several practical suggestions were proposed during the focus group discussions:

- **Utilising Translation Tools**

The participants suggested that Chinese older migrants could use translation tools, such as mobile apps, to convert local information into Chinese. This would enable them to access critical information without language barriers. For example, one participant stated:

" You know, there's automatic translation. Someone spoke Spanish, I heard it translated into English. Technically, it is possible." (Male, 63)

- **Simplifying Information**

Another suggestion involved making information more digestible by simplifying complex concepts and incorporating visuals. The participants highlighted the effectiveness of using materials like children's books:

" I suggest they read the climate change information from children's books. The pictures are good and easy to understand." (Male, 75)

- **Overcoming Language Barriers**

Local older adults encouraged Chinese older migrants to be bold and proactive in overcoming language barriers when discussing climate change: *"I think you've got to be bold and put it out there and not be embarrassed about trying to explain things."* (Female, 76)

- **Collaborating with Local Councils and Communities**

The participants emphasised the importance of collaboration between net zero organisations and local councils or ethnic minority groups to ensure effective communication. They suggested working with Chinese community organisations to make information more accessible:

"We will translate to the best of our ability. I'm better off working with the church or the council because they can open channels for the Chinese, so it's better to go to the Chinese community." (Male, 72)

"Find groups that Chinese people like. Find the Chinese group. It's like the BBC News, with a translator." (Male, 69)

- **Engaging Trusted Community Leaders**

Reaching older migrants through trusted community leaders was seen as an effective strategy for building trust and encouraging participation:

"I guess they need to find people they trust who can act as leaders in their community

or who can convey information to them, reassure them and encourage them to come forward and put their point of view forward." (Male, 72)

- **Leveraging Social Media and Digital Platforms**

The participants highlighted the potential of digital tools and social media to facilitate learning and engagement. For example, joining Facebook or WhatsApp groups, or following reliable sources on platforms like Twitter, was seen as a practical way to stay informed:

"In fact, I find Twitter very useful for research. You follow Bill Maguire's work on hydrogen. I got on Twitter because financial people in that era liked to take in a lot of things on Twitter, and it turned out to be very, very useful for getting good, reliable, valid information." (Male, 75)

" We can talk freely. We always let people in for a chat. Maybe you can do that. So anyone has a chance to read some of the group's news. You're either online or you're not." (Female, 66)

- **Providing Practical and Relevant Information**

Participants stressed that climate change and net zero information shared with older migrants must be practical and directly relevant to their lives. This would motivate them to learn and take action:

"Think about how you can use that useful information. The answer to this question must be practical, not just climate change. We need to give them practical information about what they can do." (Female, 74)

6.3.2 Sharing of Low-carbon Practices

1) Promoting Low-Carbon Practices of Older People - to Inspire More People

Study D, all 30 participants shared their low-carbon practices, which encompassed areas such as food, housing, transportation, education, and social responsibility. Some participants mentioned that health issues had limited their ability to engage in certain actions, but overall, they demonstrated a range of sustainable behaviours.

The older adults highlighted efforts to reduce food waste. One participant shared, *"We try not to throw away food. We respect the people who grow our food, and that's important. I compost the vegetable peels and return them to the soil."* (Male, 79). This illustrated a common practice of composting to reduce waste and grow plants, reflecting a respect for the food production process. The participants were also aware of the higher carbon emissions associated with red meat compared to vegetables, with many reducing their consumption of meat as they aged due to both health concerns and environmental

awareness. As one participant noted, *"They should cut down on meat; it takes a lot of the world to break down meat. We need to talk about consumption."* (Female, 62).

In terms of transportation, many participants mentioned that they had reduced their use of private cars and increasingly relied on public transport, particularly in London, where it was readily available. One participant stated, "*I live in London, so public transport is very convenient for me. I always take the bus or the subway."* (Female, 65). Mobility challenges due to age were acknowledged, but older adults continued to prioritise public transportation whenever possible. Many participants had also reduced long-distance travel, a trend that was accelerated by the COVID-19 pandemic. *"During the last three years of the pandemic, I have reduced my travel."* one participant shared (Male, 74). Changes in family structure, such as the loss of a spouse, also contributed to a reduction in long-distance travel among older adults living alone.

Recycling was another area where the participants shared practical knowledge. Older adults discussed collecting rainwater for plants, composting, donating old clothes, and turning off lights to conserve energy. They also emphasised the importance of recycling plastics due to the environmental harm caused by their slow degradation. One participant explained, *"When I buy goods, I reuse plastic bottles rather than throw them away after one use. Buying refill packs is more cost-effective and eco-friendlier."* (Female, 63).

Energy-saving practices during winter were particularly significant due to rising energy costs. Many older adults reported using products like electric blankets or hot water bottles to reduce heating bills while staying warm. Others mentioned turning off heating at appropriate times or lowering the thermostat to save energy. *"I turn down the heat. I go around calculating my electricity and gas bills,"* one participant shared (Female, 69). Additionally, some participants had installed insulation systems or smart meters to improve energy efficiency and further reduce costs. The energy crisis had prompted some participants to save energy.

Several participants attributed their low-carbon behaviours to values of frugality instilled during their upbringing, particularly those who had lived through the post-World War II era or periods of food rationing. *"We were very frugal. We saved things, and my friends are still the same today."* one participant recalled (Male, 84). These experiences shaped a long-term approach to resource use and environmental responsibility. For others, a sense of social responsibility motivated their actions. One participant

emphasised the broader perspective of climate action, stating, *"Reusing clothes is important for sustainability."* (Male, 68).

These low-carbon behaviours, such as reducing food waste, using public transportation, and recycling, showed that older adults were actively engaged in sustainable practices. These actions were often guided by personal values like frugality and supported by policies and social structures.

6.3.3 Strategies for Exploring Climate Change

1) Discuss Climate Change - History, Geography, Perception

It is noteworthy that, as long-term residents of the UK, older adults shared their perceptions of climate change by recounting changes in temperature, smells, and air quality. Their reflections were deeply rooted in personal experiences and memories from various periods, almost as if they were assembling scenes from past films. These vivid recollections enhanced the discussion and evoked emotional resonance, inviting others to relate to their own memories.

One participant recalled, *"I remember the heatwave in 1976, the first one. The weather was beautiful. We went boating on the sea between Ireland. I remember dipping my toes in the water, and it was freezing, absolutely freezing. I couldn't believe it—so cold, and yet, there were turtles swimming around."* (Male, 77).

Older adults described their understanding of climate change from a geographical perspective. While climate change is a global issue, they were particularly attuned to the changes in their local environments. In discussing such a vast topic, personal experiences often resonate more strongly, particularly when these experiences are tied to visible environmental shifts. These specific and localised details make climate change feel less abstract and more tangible, emphasising its direct impact on individual lives.

Older adults often draw on personal historical experiences to understand climate change, linking it to specific events such as heatwaves or changes in air quality. This localised way of understanding makes climate change more tangible and relatable.

2) Awaken Awareness of the Natural Environment – Land, Sea, Plants, Disasters, Air, Animals

The older participants also discussed nature's warnings to humanity, citing phenomena such as glacier melting, deforestation, wildfires, and heatwaves. Their concerns went beyond the increasing frequency and intensity of natural disasters, focusing on the long-term implications these changes may have on the survival of both humans and animals. Whether the information came from friends or television news, the older adults vividly recalled numerous details, expressing profound regret and worry about the current state of the environment.

"It wasn't until April of this year that people started to really worry about the 5°C rise in ocean temperatures in Ireland. In Antarctica, we've reached the limit of how much carbon dioxide the ocean can absorb, and that's why we're having these massive heatwaves. The snow is melting, and polar bears have nowhere else to go." (Female, 69).

Older adults bring personal reflections, memories, and concerns about the future into discussions on climate change. This personal approach not only enriches the dialogue but also adds emotional depth. Their lived experiences serve as powerful evidence in the climate change conversation, demanding greater attention and reflection on this global issue.

3) For the Next Generation-The Motivation

Older adults also discussed their motivations for caring about climate change, with a common concern being the well-being of their children and grandchildren. The most frequently cited motivation was the desire to leave a better environment for future generations. Participants emphasised that this concern is likely shared across the older population, as most older adults, regardless of their background, care deeply about the quality of life for the next generation.

"You want your children and grandchildren to have a truly liveable earth, too. I think that's true for everyone, no matter where they come from. If they have a family, if they have grandchildren, it's a shared motivation in the older community." (Female, 82)

"We talk about it all the time for the future of the planet, for the children's children. When you worry about the next generation or consider it a responsibility, you feel you have something to contribute." (Female, 63)

Leveraging older adults' motivation to safeguard the future of their children and grandchildren can be an extremely effective strategy for promoting climate change action. This motivation transcends cultural, national, and background differences, making it a powerful and universally resonant approach.

4) Attracting Attention with Economic Factors

Economic factors emerged as a critical concern for older adults, serving as a primary motivator for adopting low-carbon practices. The drive to "save money" was frequently mentioned as a reason for exploring new energy technologies. As one participant remarked, *"Everyone is motivated to save money, which is why things like insulating your house actually save money in the long run. This will not only reduce the impact on the climate, but also save money"* (Female, 82). This highlights how financial considerations intertwine with environmental consciousness, driving low-carbon practices among older individuals. In practical terms, many participants reported reducing their heating usage or adopting cost-saving technologies like electric blankets to stay warm during the winter. This demonstrates a practical response to the increasing costs of energy. Moreover, the participants discussed how a system of rewards and penalties could further encourage such behaviour. One participant highlighted the importance of financial incentives for switching to new energy vehicles: *"They reward owners with a £100 grant and the ability to rent an electric car for a month. I think if they offered more incentives, it would encourage more people"* (Male, 65). This suggests that financial incentives could play a significant role in fostering environmentally friendly behaviour, particularly when they are directly linked to tangible benefits like cost savings. Conversely, the participants also mentioned how penalties related to older vehicles, such as additional fees, act as a deterrent and nudge towards sustainable alternatives. As one participant noted, *"Now, if you have an old car, you have to pay the fee every day. It's all about protecting the environment and making people aware of it"* (Male, 68). These statements reflect a broader understanding among older adults of how financial incentives and penalties can regulate environmental behaviour.

However, several participants expressed frustration over the high costs of implementing energy-efficient measures such as solar panels, which they felt were prohibitive. One participant lamented, *"Some of our houses don't have solar panels... the cost of installing solar panels is high. At our age, it's just too expensive"* (Female, 82). Another added, *"I did the maths. If I fitted the house with solar panels, it would cost about pounds 15,000. I might die before I make any money. It's too expensive"* (Female, 78).

This reveals a significant barrier to the adoption of low-carbon technologies, particularly among older adults who may have financial limitations and shorter time horizons for recouping the investment. When encouraging older adults to adopt low-carbon practices, economic factors are clearly a crucial consideration. Saving money is another key motivator for this group, and both rewards and penalties are viewed as effective mechanisms for regulating behaviour. However, the financial realities faced by older people, such as the high costs of home renovations or electric vehicles, mean that "saving money" alone may not be enough to address the challenges. Therefore, in designing low-carbon policies and initiatives, it is essential to take older people's economic circumstances into account and offer more flexible and affordable options.

In addition to economic incentives, emotional appeals and social influences can significantly motivate behaviour change. For instance, emphasising the emotional satisfaction of contributing to a better future for grandchildren or showcasing community leaders engaging in low-carbon practices can inspire collective action.

5) Provide Guidelines for Different Stages Learners

To address the varying levels of understanding and engagement with climate change among older adults, it is crucial to acknowledge their diverse motivations and needs. Some participants in the study were at the early stages of awareness, showing a desire for more information and guidance to take meaningful action. While certain individuals have already adopted low-carbon practices, they often expressed a need for additional resources to continue making progress. This reflects a broader challenge in climate change communication, ensuring that those who are already taking steps toward sustainability have access to the necessary knowledge and support to do more.

However, for some older people, age plays a significant role in their level of motivation. As one participant noted, their advanced age made them feel less inclined to act, as they may not live long enough to witness the long-term effects of climate change: *"I don't have the motivation to do it anymore. I'm very old"* (Female, 78). This sentiment highlights a potential barrier for engaging older populations in climate action, as personal relevance and future-oriented concerns maybe diminished with age.

Scepticism about climate change was also evident among the participants. Some voiced doubts about current sustainability practices, particularly with regards to the integrity of waste management systems. For instance, one participant questioned the credibility of European countries' approach to waste management, particularly the practice of

exporting plastic waste: *"Have you heard the one about European countries exporting their plastic waste to other places? How ridiculous do you think that is?"* (Male, 60). This critique reflects concerns about the ethical implications of waste disposal and the perception of ineffective global solutions to environmental issues.

Additionally, scepticism extended to the broader sustainability movement, with doubts about individual actions, such as dietary changes, making a real impact on the climate crisis. These reflections suggest that some older adults are not fully convinced of the effectiveness of widely promoted sustainability efforts, particularly when such efforts seem disconnected from broader, systemic environmental challenges.

By recognising the diverse attitudes toward climate change, ranging from motivation to scepticism. This study underscores the need for tailored communication and engagement strategies. To address apathy and cognitive dissonance, communication strategies should emphasise personal relevance by linking climate change to local environmental impacts, such as rising energy costs or extreme weather events. And highlighting collective benefits can also foster a sense of agency and reduce feelings of helplessness.

6) How the Message is Presented - Remind, Warn, Encourage, Attract

In the focus groups, the participants discussed various methods to remind people about the impact of their actions and motivate them to engage in more environmentally responsible behaviour. Older adults frequently mentioned reward and penalty systems as formal mechanisms that can regulate behaviour. These systems not only influence individuals through incentives and sanctions but also provide information that evaluates specific actions. Such information serves as a subtle reminder to reflect on whether their behaviour aligns with environmental standards. For example, older adults referred to news reports showing images of the destruction of the Amazon rainforest or homeless animals, which served as "soft nudges," helping them realise the environmental consequences of their daily choices. One participant remarked, *"When I see those pictures of animals losing their habitats, it makes me think what have I done today that could be hurting the planet?"* (Female, 68). Rather than delivering an emotionally charged message, these reminders gently prompted individuals to reconsider their behaviour, fostering self-awareness in a non-intrusive way.

Beyond reminders, the participants highlighted the importance of warnings that emphasise the potential consequences of inaction. Warnings, compared to gentle

nudges, deliver a more serious message aimed at capturing attention and informing individuals of the risks associated with their current behaviour. These warnings can evoke stronger emotional responses and create a sense of urgency or responsibility. For instance, one participant stated, *"If you tell people about fines for leaving the heating on too high, they'll listen. But just saying it's about saving the planet? Not everyone cares as much"* (Male, 72). This reflects the perception that monetary penalties may be more effective than moral appeals in motivating behavioural changes.

In contrast to warnings, rewards offer positive reinforcement. Older adults expressed interest in financial incentives, such as subsidies for switching to renewable energy sources. These tangible rewards could help encourage environmentally conscious behaviour. However, rewards need not always be financial. Verbal encouragement and positive reinforcement, such as acknowledging good practices or providing feedback through informational cues, can serve as powerful motivators. One participant shared, *"Even if it's just a thank-you letter for participating in a recycling programme, I'd feel good about it. It makes you want to do more"* (Female, 74). Another noted, *"When someone says, 'You've saved energy this month,' it feels like you've achieved something. That's encouragement enough"* (Male, 65). Encouragement builds a supportive environment by praising positive actions, which helps sustain long-term engagement with low-carbon practices.

Finally, the participants discussed the role of attraction as a motivational strategy, with the goal of drawing attention through visually engaging or creatively designed content. Rather than directly prompting action, attraction works by sparking curiosity and stimulating exploration, encouraging individuals to learn more about climate change. One participant noted, *"I love those colourful infographics that show you how small actions add up to big changes, they're so much easier to understand than just numbers"* (Female, 71). Another added, *"If it's a documentary with a good story, I'll watch it. But if it's too technical, I lose interest"* (Male, 67). By engaging people through appealing visuals or compelling stories, attraction can lead to greater awareness and, ultimately, more sustained involvement in climate action.

7) The Importance of Visual Materials

Simplifying information and presenting it in a format that is easily understandable for older adults is essential for effective communication on climate change. One participant explained, *"I think whatever channel of information you want to get the message across, you need to make the message very easy to understand, and that's one of the reasons I think climate change is better than net zero. All these people must understand what is*

necessary... It doesn't matter which channel you use, what matters is that it doesn't work. Otherwise, people won't be motivated to download a lengthy, boring report" (Female, 82). This emphasises the need for straightforward language and strong visual elements when communicating climate issues to older adults.

Visual materials, such as images and videos, are often more effective in conveying messages, particularly for older individuals who may experience vision impairments or difficulties with reading. Visual communication has the power to evoke empathy and emotional resonance, making it a useful tool for raising awareness about climate change. One participant mentioned, *"Perhaps visual material is easier to understand"* (Female, 70), while another echoed this sentiment, stating, *"The pictures are good. This is universal"* (Female, 69).

The participants also stressed the importance of keeping the message simple and accessible. As one older adult advised, *"Keep it simple, silly. Have you ever heard that phrase? Keep it simple, stupid, and don't be stupid enough to make things unnecessarily complicated. Keep it simple. I like simple information"* (Male, 70). This reinforces the idea that straightforward, visually engaging communication is likely to be more effective in motivating older adults to engage with climate-related content.

6.3.4 The Need of Climate Action

1) The Need for Government Improvements

Older adults, having lived in the UK for many years or even generations, are particularly attuned to shifts in local government policies, often noticing contradictions in government climate initiatives. They pointed out inconsistencies, such as allowing polluting businesses to operate while simultaneously promoting climate awareness. One participant noted the irony of climate change demonstrations turning violent, undermining the very cause they were advocating. Additionally, a retired town hall employee high-lighted flaws in the recycling system, observing that waste sent to main recycling stations was often not properly processed: *"It's really not separated... not all of it gets recycled"* (Female, 63). This reflects broader concerns among older adults about the gaps between government policies and their implementation. Many older participants called on the government to refine its messaging and management strategies, suggesting that current efforts lack coherence and effectiveness. They expressed a need for the government to be more consistent and transparent in its approach to promoting and executing climate change initiatives. As one participant

explained, *"I think the government has to invest, the government has to do something. It helps us tell the people. Hopefully they will accept and learn"* (Female, 81). Another voiced concerns about the integrity of political leaders, stating, *"People are very worried about the honesty of the politicians who lead us. We are concerned about the honesty of the information we are getting from British politicians"* (Male, 62).

The older adults also highlighted a lack of transparency and openness in how the government implements and reports on climate policies. This has left many feeling frustrated, with limited channels for communicating their concerns. Furthermore, the absence of a clear system of rewards and penalties for low-carbon actions has resulted in a lack of public motivation to engage in environmentally friendly practices. This underscores the need for more structured incentives and improved communication to foster greater participation in climate action. While participants criticized government inconsistencies, they also recognized the potential for collaboration. For example, establishing local advisory panels with older adults or hosting public consultations could enhance policy transparency and inclusivity.

Beyond individual efforts, systemic change is necessary to address structural barriers to sustainability. Policies that support renewable energy transitions, such as community-level solar projects or subsidies for electric vehicles, create enabling environments for low-carbon lifestyles. Additionally, businesses can play a pivotal role by adopting circular economy principles, which reduce waste and encourage sustainable consumption patterns.

2) Sustainability Awareness in Business

Older adults emphasised that addressing climate change is a collective responsibility, extending beyond individuals to include various industries and businesses. They suggested that shifting from non-sustainable to sustainable consumption patterns can be effectively encouraged through innovative marketing strategies. For example, when products clearly communicate their sustainability credentials, consumers are more likely to engage in sustainable behaviours through their purchasing decisions. This indirect approach can be highly effective in fostering environmentally conscious habits. As one participant noted, *"Reusing clothes is important for sustainability. So one area I talked about was branding. Brands like Patagonia...they encourage people to mend clothes and not throw them away. They gave away repair tools. So there are sustainable behaviours in some brands"* (Male, 65).

Some participants also highlighted the potential of sustainable business models, such as incentivising the recycling of plastic bottles. They suggested that such initiatives could be driven by creative marketing strategies, which align economic incentives with environ-mental goals: *"Some people say that if you pay people to recycle plastic bottles, you can look at who makes this marketing model and make money in this way"* (Female, 72). This perspective underscores the role businesses can play in shaping consumer behaviour towards more sustainable practices, aligning individual actions with broader environmental objectives through subtle yet impactful marketing tactics.

3) Improvements in Industry Support Facilities

In the focus group discussions, older participants highlighted specific challenges regarding the promotion of electric vehicles, particularly the lack of adequate infrastructure. While the UK has made significant efforts to promote electric vehicles, the participants noted that supporting infrastructure, such as charging stations, remains underdeveloped, making it difficult for them to transition to electric vehicles. One participant emphasised the perceived inconvenience, stating, *"I don't think I want an electric car. It's too much trouble. It needs to be recharged"* (Male, 60). This concern reflects the broader need for more accessible and user-friendly infrastructure to support electric vehicle adoption, especially for older individuals who may be less familiar with new technologies.

Additionally, the participants raised concerns about the challenges that public transport presents, particularly due to age-related health conditions. Long distances and the physical demands of using public transport were frequently mentioned as barriers. One participant reflected on their daily efforts to stay active but noted, *"Walking is difficult in winter. The cold weather made walking a great challenge"* (Female, 78). Another participant pointed out the importance of living near transport facilities, stating, *"As you get older, transportation gets harder, and it's really important to live near a bus stop or something"* (Male, 84). These comments underline the importance of incorporating age-friendly designs into public transport systems and improving infrastructure to meet the needs of an ageing population.

6.4 Discussion

Study D sheds light on the important role older adults can play in climate action. It highlights their potential as active contributors and advocates for sustainable practices,

rather than passive recipients of climate policies. The research explores their views and behaviours toward climate change, providing valuable insights into their motivations and the challenges they face.

6.4.1 The Findings

Theme 1 shows that older adults prefer familiar terms like "climate change" over abstract ideas such as "net zero." This finding emphasises the need for clear and simple language to encourage participation. The study also highlights the role of cultural integration, which helps share knowledge and influence behaviours. Participants from developing countries demonstrated strong habits of saving energy, showing the value of cross-cultural experiences in shaping global climate strategies. Traditional media like the BBC, newspapers, and television remain key sources of information for older adults. In contrast, digital platforms and social media are used less often, partly due to trust issues. Family and friends play an important role in shaping their understanding of climate issues, showing the value of intergenerational conversations in driving climate action.

Local older adults offered valuable insights into how to engage Chinese older migrants and ethnic minorities in understanding net zero and climate change. The suggestions emphasised practical solutions, such as translation tools, simplified materials, trusted community leaders, and digital platforms.

Theme 2 highlights established low-carbon habits among older adults, such as reducing food waste, using public transport, and eating less meat. These actions are driven by both cost-saving and a strong sense of responsibility. However, financial barriers, such as the high cost of solar panels or electric vehicles, limit their ability to adopt more sustainable technologies. Policymakers should address these barriers by offering more affordable and flexible solutions.

Theme 3 reveals how older adults make climate discussions more relatable by sharing personal stories and emotional reflections. Their lived experiences help others connect to the real impacts of climate change. Nature is another factor that motivates people to take action, and the plight of animals and plants can gain people's sympathy. Moreover, the participants mentioned the motivation of protecting the earth for the next generation. Intergenerational dialogue was also identified as a powerful tool, with older adults sharing stories and practical advice with family members.

To improve climate communication, the study suggests simplifying information, using visuals, and tailoring messages to older adults. These strategies include practical reminders for daily actions, warnings about risks, and sharing success stories to inspire change.

The participants expressed frustration with unclear government policies, calling for more transparency in reward and penalty systems. They also emphasised the need for businesses to take a more active role in promoting sustainability by driving eco friendly behaviours from within.

Figure 5.3 shows the opportunity points mentioned in the analysis of this study. They summarise the corresponding points mentioned in the themes.

Figure 6.3 Opportunity points identified in Study D.

Current literature predominantly addresses the health and psychological impacts of climate change on older adults, emphasising their vulnerability to climate-related risks, such as heat-induced illnesses during heatwaves (Haines et al., 2006), due to limited adaptive capacities stemming from physical, economic, and social constraints. Despite varying levels of climate change awareness, older adults' participation in climate action, especially in policy development and implementation, remains minimal (Adger et al., 2013).

However, an important gap lies in understanding how to support older migrants, such as Older Chinese migrants, in learning about net zero policies and climate change. The unique challenges faced by minority ethnic groups, including language barriers and limited access to culturally tailored information, have not been sufficiently explored. Advice from local older adults on effective strategies to support minority elders in navigating and engaging with climate policies presents an under-researched area. Filling this gap could provide crucial insights into fostering inclusivity and participation among diverse older populations, ensuring that all groups have the opportunity to contribute meaningfully to climate action.

6.4.2 How the Study Addressed Its Research Objectives

Based on the findings presented above, this study successfully achieved its initial research objectives. The next section summarizes how each objective was achieved and highlights the key insights gained during the research process.

1) Understanding Existing Low-Carbon Practices.

The study first investigated the low-carbon behaviours that older people already adopt, such as reducing food waste, saving energy, choosing sustainable transportation, and recycling or reusing materials.

2) Identify Motivations and Barriers.

It explored the motivations that drive older people to engage in sustainable practices, including intergenerational concerns, economic benefits, social responsibility, and traditional thrift education. While also recognising barriers such as financial constraints, health and mobility issues, lack of accessible information, and distrust of government and corporate initiatives.

3) Analysing Learning and Adaptation Strategies.

The study summarised how older people learn about and adapt to climate and net zero policies, often through trusted media sources, personal networks, and community-based

initiatives. Strategies such as simplifying complex policies and leveraging cultural integration proved particularly effective.

4) Providing Practical Guidance for Migrant Communities.

Finally, the study provides practical insights for migrant groups, including older Chinese migrants in the UK, to enhance their understanding and participation in climate action. Key approaches include using translation tools, simplifying communication, cross-cultural exchanges, and engaging trusted community leaders to build support networks.

6.4.3 Future Work Plan

While the initial research objectives outlined the study's focus, the findings extend well beyond these goals. The results revealed opportunities spanning cultural, technological, economic, societal, and intergenerational dimensions. Furthermore, the study identified layers of potential impact from the individual to global levels, including individuals, community, business, government, and global contributions to climate action.

Figure 6.4 illustrates the multifaceted nature of the findings and climate-related future opportunities.

There will be further opportunities to strengthen older adult's involvement in climate change and fill gaps in existing research. Building on the findings of this study, several key areas emerge for strengthening older adults' engagement in climate action. These include addressing economic barriers, enhancing intergenerational dialogue, improving communication strategies, fostering community integration, and supporting broader systemic and cultural changes.

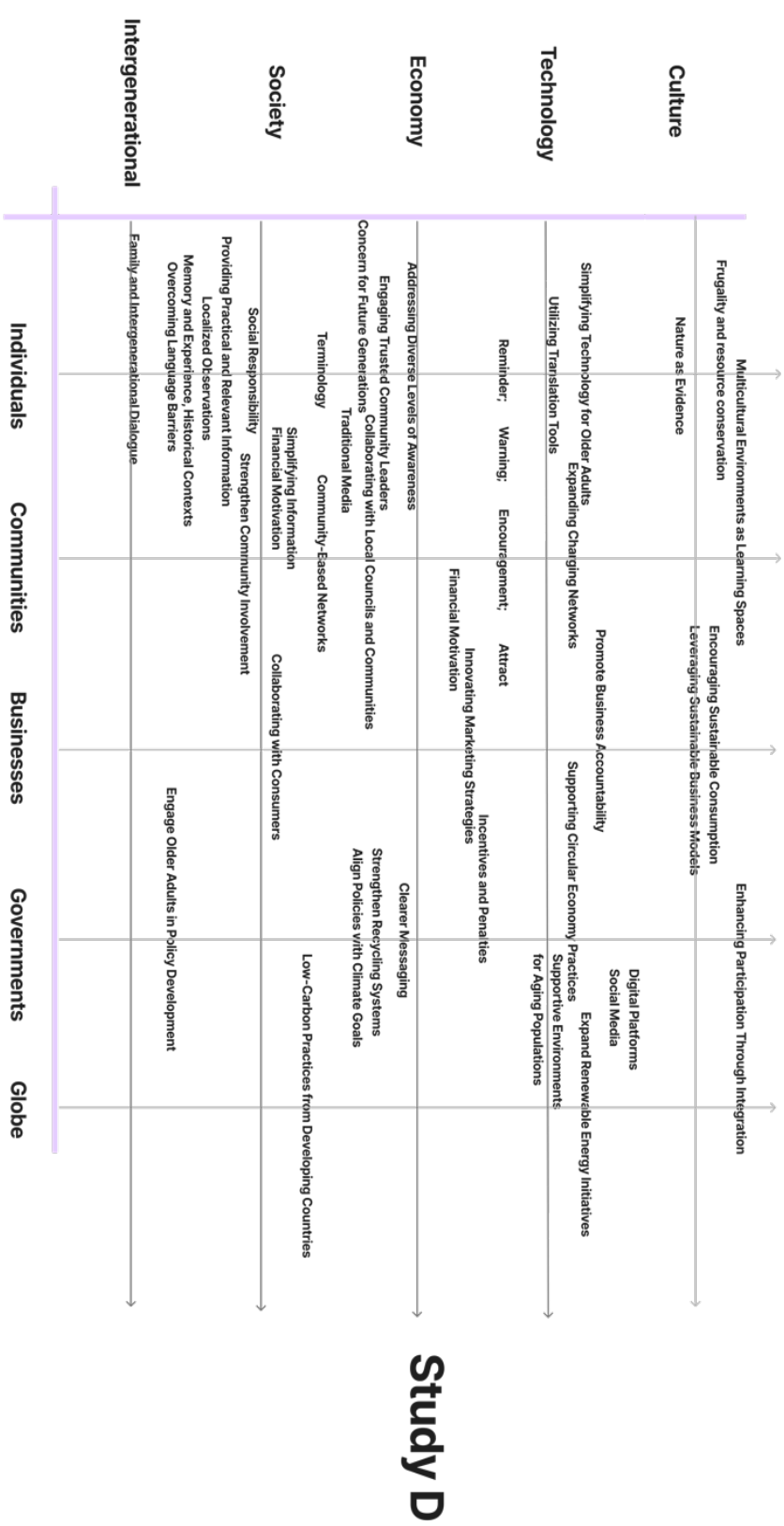


Figure 6.4 Study D Climate-related opportunities.

Economic Incentives and Accessibility: Older people face financial barriers to adopting low-carbon technologies, such as solar panels and electric vehicles. Future research should investigate which economic incentives, such as subsidies, tax rebates, or utility discounts are most effective in encouraging sustainable practices among this demographic (Borenstein, 2017). Additionally, addressing cost barriers associated with green technologies could show the pathways to make these options more accessible for individuals on fixed incomes. Tailored solutions should focus on reducing upfront costs for individuals on fixed incomes, ensuring that financial constraints do not limit their participation in climate action. These incentives could also be paired with educational initiatives to help older adults better understand and adopt green technologies.

Intergenerational Dialogue: Older people play a critical role as climate communicators within their families and communities. Their lived experiences and personal narratives can inspire younger generations to take meaningful action, while younger individuals often provide insights into new technologies and energy solutions. This two ways exchange creates opportunities for mutual learning and collective action (Ayalon et al., 2023). Future studies could explore how to empower older adults as advocates for sustainable practices, provide them with the tools and platforms to effectively share their knowledge and experiences.

Tailored Communication Strategies: Given older peoples' reliance on traditional media, climate communication strategies should integrate traditional and digital platforms to maximize outreach. Simplified, visually appealing materials, such as infographics for beginners or interactive guides for more experienced individuals, can address different levels of climate knowledge. Also alongside audio formats like podcasts or narrated videos, can cater to a wide range of learning preferences. Hybrid platforms that combine the accessibility of traditional media with the interactivity of digital tools would enable more inclusive and effective engagement with older populations.

Community Integration: Governments and community organisations should actively involve older adults in local climate initiatives. Hosting interactive events, such as exhibitions or community sustainability days, can create opportunities for peer-to-peer knowledge sharing and intergenerational collaboration. These activities foster a sense of belonging and encourage collective participation in climate action. Furthermore, integrating climate-focused programmes into older adults' daily routines can help

normalise sustainable behaviours and enhance their contribution to community-level efforts.

Systemic Changes and Cultural Integration: To create a supportive environment for older adults' climate engagement, systemic changes are essential. Investments in green infrastructure, incentives for sustainable business practices, and community-level programmes can enable older adults to adopt low-carbon lifestyles more easily. Linking individual actions, such as conserving energy or reducing waste, to broader societal benefits can help older people recognise their contributions as part of a collective solution to climate change. This sense of shared purpose inspires ongoing participation and highlights the cumulative impact of small, everyday actions.

Cultural Integration also provides opportunities to promote knowledge sharing and behavioural influence across ethnic and cultural groups. By providing tailored resources, such as language support and culturally relevant information, older people from migrant backgrounds can more effectively participate in climate initiatives. By combining knowledge and practices from diverse backgrounds, inculturation fosters creativity and adaptability in climate strategies, ultimately strengthening collective climate resilience.

6.4.4 Limitations

Study D has certain limitations that should be acknowledged. First, the sample size was limited to 30 participants, all residing in West London. While this provided valuable perspectives and rich data, the findings may not fully capture the diversity of older adults' views and behaviours across different regions or socioeconomic contexts.

6.5 Summary

This chapter presents local older adults' understanding of net zero and climate change. Thirty older people shared their perspectives on strategies for communicating climate change, proposed approaches to addressing its challenges, and highlighted ongoing low-carbon practices. Additionally, they emphasised the need for improvements in government policies, business initiatives, and public infrastructure to better support sustainable behaviours.

The findings of **Study D** addressed gaps left by **Studies A and B**, particularly in exploring older people's attitudes toward business, government, technology, and

economic factors. By framing the participants' insights as opportunity points within a matrix (Figure 6.4) during the discussion phase, this study provided a reference for future design interventions.

Chapter 7 will build on these findings through a co-creation study that incorporates feedback from designers. By integrating older people's and designers' recommendations, the researcher aims to further expand on the identified design opportunities and propose actionable solutions for engaging older adults in climate action.

Chapter 7: Older Adults Co-Producing Climate Strategies and Tactics with Designers

The previous chapter examined local seniors' understanding of net zero and climate change, as well as their recommendations for older Chinese migrants engaging in climate action in the UK. Both local seniors and older Chinese migrants demonstrated good low-carbon practices and shared a general understanding of net zero. Notably, neither group preferred to use the term "net zero" to discuss climate change.

7.1 Introduction

Compared to older Chinese migrants, local seniors demonstrated a deeper understanding of climate knowledge and net-zero policies. While older Chinese migrants primarily focused on language barriers and their unfamiliarity with net zero concepts, local seniors actively voiced their demands to governments, businesses, and public institutions. Additionally, their motivations for driving climate action varied. For older Chinese migrants, these were rooted in "frugality as virtue," a desire to "save money for the next generation," and a sense of "social responsibility." On the other hand, local seniors had a broader range of motivations, including "social responsibility," ensuring a "better environment for future generations," "economic benefits," and "frugality as virtue." These differences suggest that cultural backgrounds and lived experiences significantly shape the understanding and behavioural patterns of seniors from different countries. Table 7.1 illustrates the similarities and differences between the two groups.

Table 7.1 Comparison of Low-Carbon Practices and Net Zero Perceptions Between Older Chinese Migrants and Local Seniors.

Category	Similarities	Differences
Low-Carbon Practices	Both groups demonstrate good low-carbon practices, focusing on resource conservation and waste reduction	Local seniors have a higher level of knowledge about climate change and net zero policies.
Attitude Toward 'Net Zero'	Both groups dislike using the term 'net-zero' to discuss climate change.	**Older Chinese migrants:** Focus more on language barriers and unfamiliarity with net zero policies.

		Local seniors: Raise more demands for government, businesses, and public facilities.
Motivations for Climate Action	Both groups emphasize "Next generation" and “social responsibility” as a key motivation.	**Older Chinese migrants:** Motivations mainly include "frugality education","saving money for the next generation", "social responsibility." **Local seniors:** Broader motivations including "social responsibility" ,"ensuring a good environment for the next generation" , "economic benefits" , "frugality as virtue."
Information Channels	All gravitate towards reliable sources of information, pictures and data.	**Older Chinese migrants:** Depend more on Chinese-language media, community activities, and Chinese popular social media. Language barriers limit access to local policies or technologies. **Local seniors:** Access more diverse information sources, including government websites, digital platforms, and local news outlets. More rely on traditional media (e.g., TV, radio)
Social Networks and Community Support	Community activities as social interaction and support can help them.	**Older Chinese migrants:** Check social media and ask for online help. Rely on ethnic community support (e.g., Chinese associations, migrant mutual-aid groups) and participate less in broader local social activities. **Local seniors:** Engage in broader community activities, such as local organisations and retirement clubs, community events, with higher involvement in public affairs.
Role in Intergenerational Interaction	Both groups care deeply about the well-being of future generations, with intergenerational responsibility as a core motivation.	**Older Chinese migrants:** Tend to influence their children and grandchildren through “frugality as virtue” within the family, focusing on household-level actions. **Local seniors:** Advocate for climate action

		at both family and societal levels, with more focus on the future of nature.

While Chapters 4 and 6 explored the attitudes, low-carbon practices, and challenges faced by older Chinese migrants and local seniors in relation to net zero and climate change, the research as a whole has yet to provide concrete guidelines or intervention strategies for helping older Chinese migrants learn about net zero and enhance their climate awareness. Although local seniors offered advice (Chapter 6) based on their lived experiences, their suggestions remain insufficient as a foundation for designing effective intervention strategies. Moreover, the study revealed that local seniors also face significant challenges and hold expectations regarding climate action, particularly in terms of support from governments, society, and businesses.

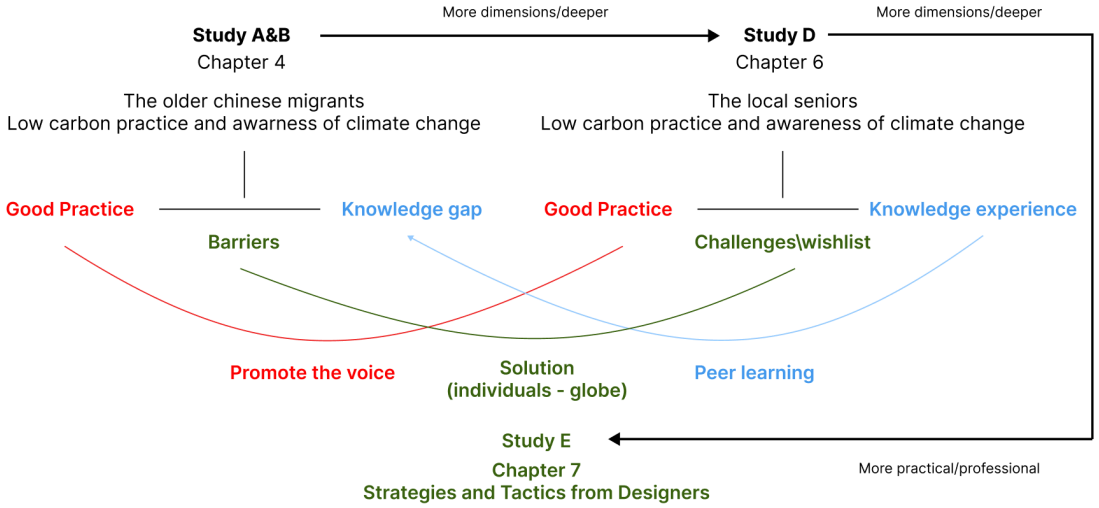


Figure 7.1 The connection between Studies A&B, D and E.

This chapter explores collaborative efforts between seniors and designers. Based on the findings from Chapters 4 and 6 (Study A&B and Study D), designers contributed their creative thinking and design expertise to propose a wide range of solutions to address climate change. These recommendations spanned both **vertical dimensions**, such as intergenerational, social, economic, technological, and cultural factors, and **horizontal dimensions**, including individuals, communities, businesses, institutions, governments, and nations.

7.1.1 Research Stage Overview

Study E was designed as the second part of the Descriptive Study 1 (DS1) phase within the Design Research Methodology (DRM) framework. This study took the form of an

online workshop for design professionals, where the researcher summarised insights provided by seniors from Study A to Study D and invited design researchers to offer feedback and propose future directions.

The primary aim of Study E was to encourage designers to provide professional insights, guiding improvements in products, services, and systems involved in climate change advocacy and climate action from a design perspective.

Study E addresses the following research questions:

Study E:

- **Question 1:** How can designers translate insights from seniors into inclusive intervention strategies?

By situating Study E within the broader research framework, this phase builds on the findings from Studies A, B, C and D, focusing on the collaborative exploration between designers and older people. This phase emphasised the role of co-producing, integrating the lived experiences of seniors with the expertise of designers to propose practical and multidimensional solutions. Figure 7.2 illustrates the positioning of this study within the overall research framework.

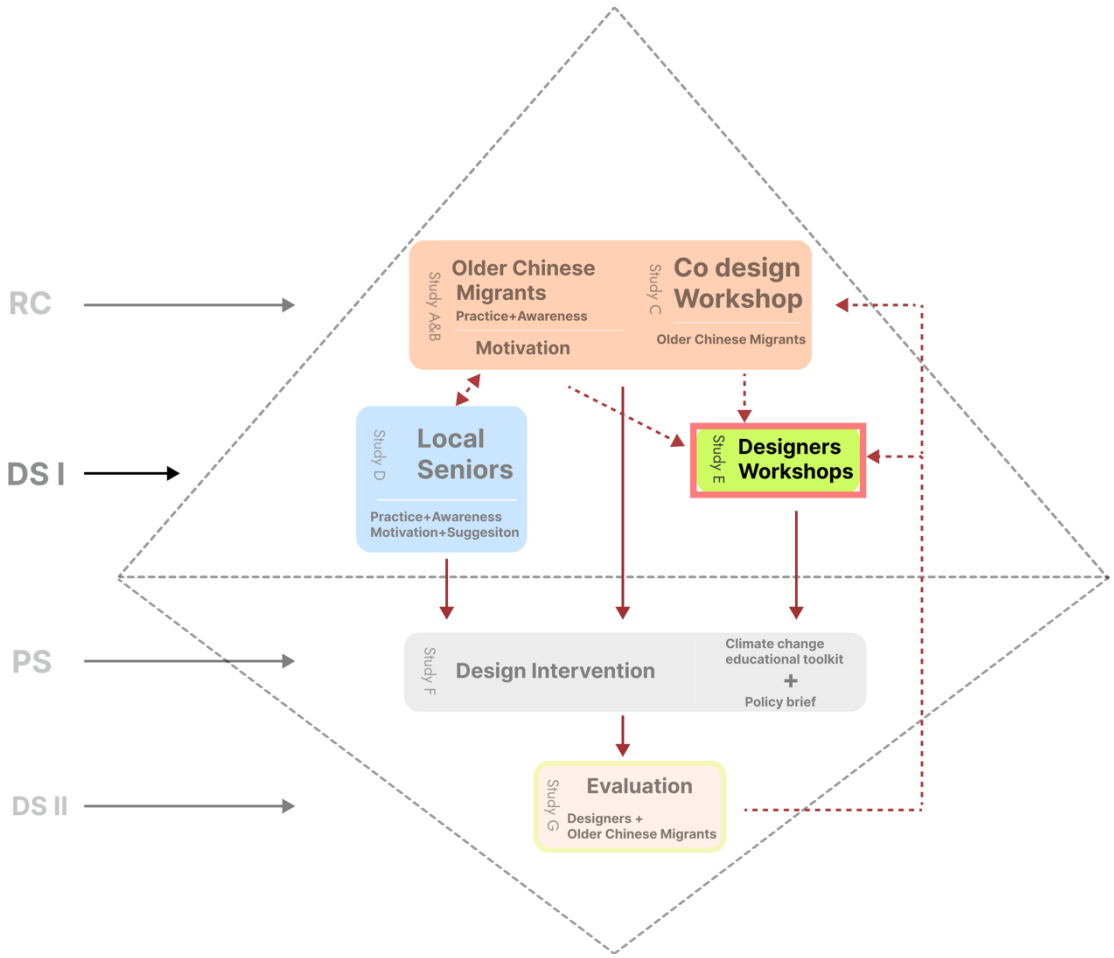


Figure 7.2 Study E as part of Descriptive Study (DS) I.

7.1.2 Research Background

The Role of Co-Production in Design for Climate Change: Engaging Older Adults

The relationship between design and climate change is becoming increasingly interconnected (Svihla & Linn, 2012). Designers play a pivotal role in addressing climate challenges by making sustainable material choices, optimising manufacturing processes, and promoting low-carbon consumption habits (De los Rios & Charnley, 2017). However, much of the existing research rarely considers older adults as key participants in these efforts.

In contemporary design practice, the role of designers is evolving, particularly in advocating for user involvement through co-production processes. This shift stems from the recognition that users add significant value through their interactions with services, and that organisers and designers can collaboratively generate value with them (Ostrom & Lacobucci, 1995; Sanders & Stappers, 2008). Designers now adopt multiple roles, working collaboratively with users and stakeholders as equal partners rather than

merely directing the design process (Pahl et al., 1996). They act as intermediaries, integrating diverse perspectives and needs (Manzini, 2015), and as synthesisers, translating abstract ideas into tangible, user-centered solutions (Brown, 2009).

This inclusive approach is particularly critical when designing for older adults, a demographic often impacted by ageism (Katz, 2005). Engaging older adults in the design process enables designers to better understand their unique needs, eliminate biases, and create solutions that are inclusive, equitable, and aligned with societal goals (Bennett & Rosner, 2019; Farage et al., 2012). As societies and technologies evolve alongside environmental challenges, the needs of older adults also shift (Wild et al., 2013). Co-production with older adults ensures that designs remain adaptive and relevant—an essential consideration in addressing long-term objectives such as climate action and sustainable development (Ceschin & Gaziulusoy, 2016; Manzini, 2014).

Existing literature on designer collaboration with older adults primarily focuses on age-friendly and universal design (van Hoof & Marston, 2021) . However, studies specifically exploring co-production between designers and older adults in the context of climate change remain scarce.

Understanding Co-Production and its Value in Engaging Older Adults

Co-production is a collaborative process where diverse stakeholders—communities, service users, professionals, and policymakers—work together to design, develop, and implement solutions or services (Bovaird & Loeffler, 2013). Unlike top-down decision-making by experts or authorities, co-production actively involves all stakeholders at every stage, incorporating their insights, needs, and knowledge into the final outcome (Bracci & Sicilia, 2016). Scholars such as Osborne et al. (2016) and Sorrentino et al. (2018) highlight co-production's role in enabling participatory policymaking.

While co-production is related to co-design, they differ in scope and emphasis. Co-design is often seen as a specific method within the broader framework of co-production (Robert et al., 2022). In co-design, designers typically lead the project using experience-based methods, with the primary focus on achieving a design outcome. Conversely, co-production emphasises equitable power-sharing, where all participants hold decision-making authority at different project stages. Designers in a co-production framework are not sole decision-makers but collaborators who co-manage and co-direct projects alongside users, professionals, and other stakeholders.

Co-production is particularly valuable in amplifying the voices of marginalised groups and fostering inclusivity and equity. It has been successfully applied to explore complex social and health issues faced by older adults (Agwu et al., 2021), such as housing, care, and well-being (Terkelsen et al., 2022). However, limited research has examined co-production with older adults in the context of climate change.

Why Co-Production with Older Adults Matters in Climate Action

Older adults possess a wealth of lived experience and knowledge (Glück, 2023). Many have been directly affected by climate change and are deeply concerned about its impacts on future generations (Page, 2007). Including older adults in climate action is not only ethical but also necessary to ensure their voices and insights contribute to meaningful solutions. Co-production provides an effective platform for engaging older adults in climate initiatives, enabling their perspectives to inform and shape sustainable strategies.

Few studies document collaboration between designers and older adults to address climate change. Designers can play a crucial role in helping older adults navigate the complexities of climate issues, integrate resources from various fields, and co-create solutions that benefit multiple stakeholders. By fostering co-production, designers can move beyond the traditional top-down approach, creating innovative and practical solutions that address both the immediate and long-term challenges of climate change.

7.2 Methods

7.2.1 Recruitment and Procedure

Study E employed the online collaboration platforms **Miro** and **Microsoft Teams** to conduct participatory design workshops with designers. These workshops were held between September and October 2024, with a total of 16 participants divided into five workshops.

The participants were recruited through two methods:

1) Poster Recruitment: Posters were displayed within the Design School at Brunel University to attract interested designers.
2) Snowball Sampling: The participants were encouraged to recommend other suitable design professionals or scholars involved in design-related research for the workshops.

Interested individuals were asked to express their willingness to participate by contacting the researcher via email or text message. Participants were expected to contribute their insights and professional expertise during the workshops to generate potential solutions.

There were no restrictions on participants' design specialisations or educational backgrounds to ensure diverse perspectives were represented in the results, enriching the study's findings. The workshops were conducted online to accommodate remote participation. Miro was used to facilitate online data collection. The research maintained anonymity, with participants' identities replaced by codes.

Table 7.2 summarises the demographic and professional profiles of the designer participants.

Table 7.2 Designer participant information sheet.

Number	Gender	Age	Profession
WS101	Female	26-30	PhD researcher in Product Design
WS102	Male	26-30	PhD researcher in Inclusive Design
WS103	Male	31-35	VR experience Designer
WS204	Male	26-30	Vehicle designer
WS205	Female	26-30	Designer, Illustrator
WS206	Female	21-25	Design management
WS307	Male	36-40	Vehicle designer
WS308	Female	31-35	Lecturer in communication
WS309	Female	26-30	Lecture in communicate design
WS410	Male	31-35	User experience designer
WS411	Female	26-30	PhD researcher in Sustainable Design
WS412	Female	26-30	PhD researcher in Design management
WS513	Female	21-25	Product designer
WS514	Male	31-35	Senior product service designer
WS515	Female	26-30	Product designer
WS516	Male	31-35	Lecturer in gerontology

Note: The lecturer in gerontology was invited because of his collaborations with design academics in product, healthcare, and communication design.

7.2.2 Pilot study

On 31st August 2024, a pilot study was conducted to evaluate the feasibility and timing of the planned workshops. Two participants were involved in this pilot. The findings

indicated that the pilot workshop lacked time restrictions, leading to extended discussions and delays in concluding the sessions.

Based on the pilot study results, the following measures were implemented to improve the workshop design:

1) Introduction of Background Information: At the beginning of the workshop, participants were briefed on the research background and process to help them understand the significance of their contributions.

2) Pre-Workshop Preparation: Participants were required to familiarise themselves with the workshop schedule and the tools to be used before the session.

3) Facilitator Preparation: The facilitator ensured they arrived early to set up the Miro platform and collaborated with Teams to streamline the hosting process.

4) Time Management: Specific time limits were introduced for answering questions with sticky notes, and overall discussion times were restricted to ensure sessions concluded on time.

5) Note-Taking and Participant Feedback: The facilitator took real-time notes during the workshop. For participants who verbally expressed their ideas, keywords were also added to sticky notes for better documentation.

7.2.3 Workshop Process

Ethical approval was obtained before the designer workshops were conducted. Participants who agreed to take part received the participant information sheet and consent form before the online session. They were informed how their Miro contributions, discussion notes, and audio recordings would be used. The workshop link was also sent before the workshop, allowing participants to familiarise themselves with the context and schedule. During the workshop, instructions were provided before each activity, clearly briefing the key steps and the required timeframe for workshop exercises (see Figure 7.3).

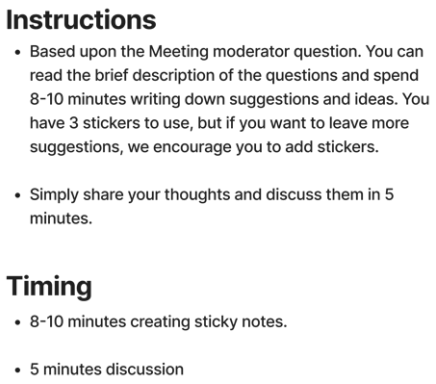


Figure 7.3 Workshop instructions embedded in the Miro platform.

At the start of the workshop, the facilitator spent five minutes introducing the research background. This included a short educational video on net zero and climate change - The Royal Society, “What is Net Zero? ”(Society, 2023), along with an overview of individual low-carbon behaviours. These materials were designed to help participants understand the context and motivations driving the study *(See Figure 7.4)* .

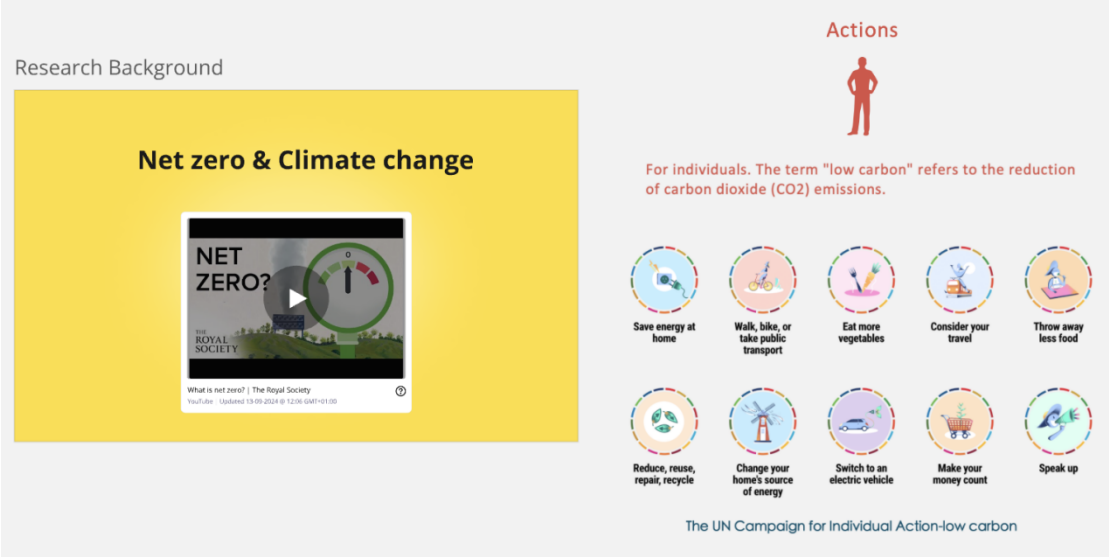


Figure 7.4 Research background embedded in the Miro platform.

Next, the facilitator spent three minutes explaining the overview of Studies A, B, C, &D, as well as the objectives of Study E. This was to help the participants understand the position of this study within the overall research framework and to clarify how their contributions would add value.

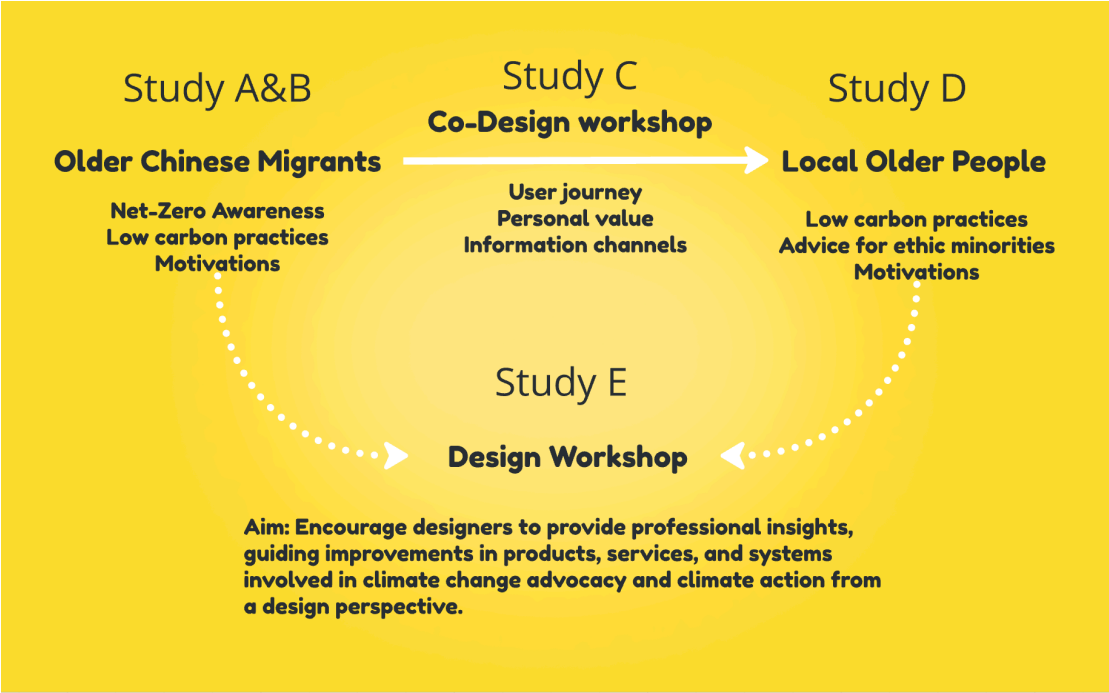


Figure 7.5 Research process embedded in the Miro platform.

The researcher then officially began the workshop discussions. As shown in Figure 7.6, each question was presented in separate, colour-coded text boxes, allowing the participants to read the content in advance. During the workshop, the facilitator also introduced each topic in detail. The framework for these questions was derived from the findings of Study D, which provided a more multidimensional and comprehensive understanding of older adults' perspectives on climate change compared to Studies A and B.

Building on the results of Study D served several purposes: it helped address the barriers faced by older Chinese migrants in participating in climate action, refined strategies for older adults to explore and promote climate initiatives, and offered design-oriented suggestions for governments, businesses, and society.

Suggestions for promoting climate change

Terminology old people can understand

Although net zero is a short way of describing the situation, there are still some older people who are not used to using the term 'net zero'. In the first study, the older Chinese migrants were also unfamiliar with net zero. However, the native British older people were more aware of it. The older people also mentioned that the term **'net zero'** could be simplified to make it easier to understand. So it is best to use different strategies to communicate net zero to different groups of people. If the elderly tend to use **global warming** or **climate change**, they can be labelled as sources to explain net zero.

Please give your suggestions:



Cultural differences and cultural integration

In Study A&B, many older Chinese people mentioned that their motivation for saving was to save money for the next generation. In this study, two South Asian seniors shared the same reason. She said that different countries have different social systems and cultures. In developing countries, education, healthcare, and marriage all require a large amount of money. So people from those countries develop the habit of saving money. These seniors agree that Western culture should include saving for the future, or saving for their children. **If these seniors had the opportunity to share their motivation for saving and their stories and backgrounds, it might inspire a lot of other people.**

Please give your suggestions:



Multi-Channel Information Dissemination - By Population Group

In Study A, older Chinese migrants are already using **social media** to communicate with others and to receive news and information. The local seniors preferred **traditional media** such as BBC, TV, and newspapers. Communicating net zero or climate change to different groups of people can be done by working with information channels that they are familiar with.

Older people also like to chat **face-to-face** with their friends, or with their **family and children**. So how does this offline communication need to incorporate net zero knowledge.

Please give your suggestions:



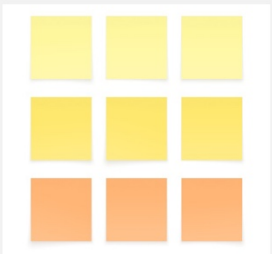
Sharing of low carbon practices

Promoting low carbon practices of the older people - to inspire more people

Like the data obtained from Study B, local older people have a wealth of experience of going low carbon. **These include reducing food waste, composting, growing vegetables; how to save energy and reduce bills in winter; using greener transport and trying new energy sources; recycling and recovery methods; eating more vegetables is better for your health and so on.** These good experiences can be shared with more people.

The **next generation** should be more worried about the planet, but young people tend to consume more. Even though young people are more motivated by climate change, they can ignore it or lack concrete action because of their busy lives. That's why the older people think that sometimes young people should learn from the older people. Many good experiences and behaviours need to be shared so that more people can be motivated.

Please give your suggestions:



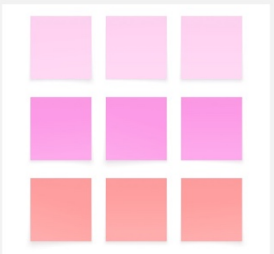
Strategies for exploring climate change

How to discuss climate change - history, geography, perception

The older person has **memories**, standards by which to judge life, values, and different goals at different stages of life. All these factors affect the answers an elderly person gives to our questions. In the low carbon practice session, when the old man talked about his mother who used to save food, the distribution system he experienced after World War II, and the climate disaster in his grandfather's memory.

In this study, participants volunteered to mention their feelings and impressions of climate change. This included **memories of history**, **feelings of temperature**, **smells** of odours, and climate change felt in different **geographical locations**. So when people talk about global warming and climate change, they often overlook their personal feelings about climate.

Please give your suggestions:



Awaken awareness of the natural environment - land sea, plants, disasters, air, animals

In the course of the interviews, the older people mentioned nature several times. Concerns about **nature** are also one of the main motivations for climate change. They mentioned plants - such as the destruction of the Amazon rainforest, glaciers - glaciers have started to split, **animals** - penguins and fish are in a worrying situation, oceans - oceans are absorbing too much carbon dioxide, **heatwaves and floods** - Thames and will spread to the city of London. These are the kind of messages that may be seen by older people from TV news, newspapers, documentaries and other places. But messages about nature are easy to follow and resonate with. Because everyone still lives on the earth, the natural environment has something to do with everyone.

Please give your suggestions:



"For the Next Generation" the motivation

Protecting the earth for the next generation is the motivation mentioned by most of the Older people. As people in their later years, they want to leave a better nature for their children and grandchildren. However, the seniors worry that they are not capable of doing more, so they also hope that the young people can be aware of the need to protect the environment at an early age. Therefore, **"for the next generation"** is a good topic and motivation to inspire more people to protect the environment.

Please give your suggestions:



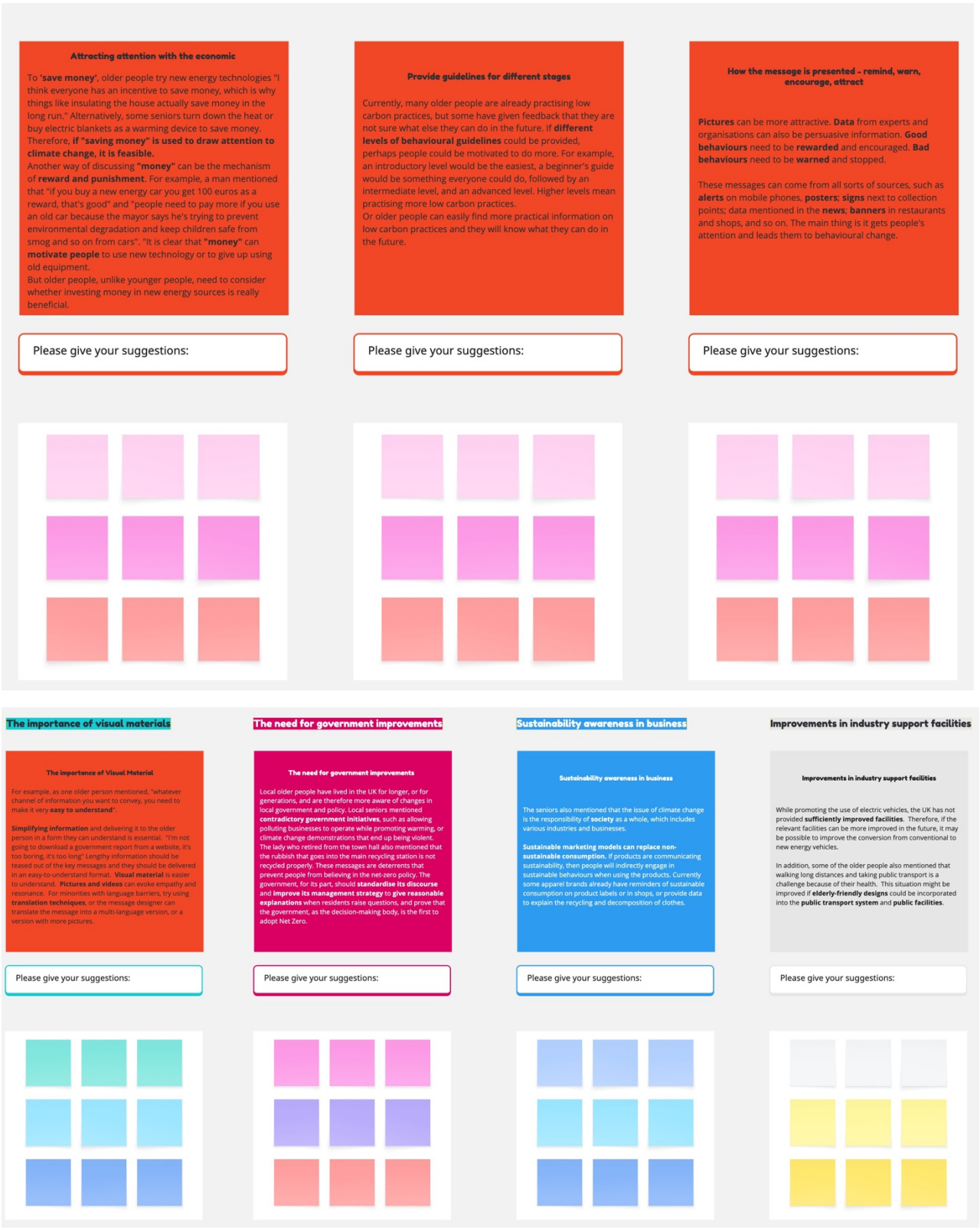


Figure 7.6 Interactive panel on the Miro platform.

After introducing the content in each text box, the researcher posed questions to the participants. The participants were given 8 minutes to write their ideas on virtual sticky

notes. While each participant was initially allocated 3 sticky notes on the interactive board, they could add additional notes if they had more suggestions to share.

Once the participants completed their contributions, each question was followed by a 5-minute discussion and sharing session. This phase was included to allow the participants to explain their ideas from their professional or personal perspectives, often resulting in spontaneous insights. The discussions also helped the researcher interpret the keywords and abbreviations that some participants used on their notes. The researcher recorded these explanations in real-time to aid in the later data analysis, ensuring a clear understanding of each participant's contributions.
The outline of the discussion questions is presented in Table 7.3:

Table 7.3 Research questions based on themes descriptions.

Theme	Sub-themes and Questions
Suggestions for Promoting Climate Change	Terminology old people can understand Q: What terminology is more effective for promoting climate change? Cultural differences and cultural integration Q: How can cultural integration be promoted to promote climate action? Multi-Channel Information Dissemination for Climate Change- By Population Group (How to help Older Chinese migrants in the UK) Q: What channels are most effective for promoting climate change awareness?
Sharing of Low-carbon Practices	Promoting low-carbon practices of older people - to inspire more people Q: How can we promote good low-carbon behaviour and motivate people to adopt better practices?
Strategies for Exploring Climate Change	Discuss climate change - history, geography, perception Q: How to use personal experiences and perceptions to explore climate strategies? Awaken awareness of the natural environment – land, sea, plants, disasters, air, animals Q: How to use empathy from nature to explore climate strategies?

	For the Next Generation – the motivation Q: What can be inspired by this motivation? Attracting attention with economic factors Q: How can economic benefits be used to encourage climate action? Provide guidelines for different stages Q: How can these guidance be provided? How the message is presented - remind, warn, encourage, attract Q: How can economic benefits be used to encourage climate action? The importance of Visual Material Q: How can visual tools help older adults learn about climate change?
The Need for Climate Action	The need for government improvements Q: What improvement suggestion can you provide to the government? Sustainability awareness in business Q: What do you think businesses should do? Improvements in industry support facilities Q: What do you think businesses should do?

Each workshop lasted approximately 120–150 minutes. The sample size of 16 participants was carefully chosen to strike a balance between capturing diverse perspectives and achieving data saturation, ensuring no new themes would emerge from additional data collection. This study did not involve any material incentives; all participants voluntarily contributed their personal experiences and professional insights. The audio recordings from the five workshops were securely stored on the university-provided OneDrive for later review during data analysis. Contributions made on the Miro platform were transcribed into Word documents after all the workshops were completed and stored on OneDrive.

To ensure anonymity, participants' identities were replaced with codes such as WS101. Audio recordings and Miro contributions were securely stored on Brunel University OneDrive, and Miro outputs were transcribed into Word documents after the workshops

for analysis. In compliance with the ethical guidelines approved by Brunel University, participants were informed that they could request the deletion of their data within the approved period. The relevant ethics approval documents, information sheet, consent form, and workshop materials are provided in Appendix E.

7.2.4 Data Analysis

The analysis for **Study E** employed a multi-level approach, integrating first-order (participant-centred) and second-order (theory-centred) data analysis (Gioia et al., 2013). This is a widely used and well-established method, particularly suited to design research, social sciences, and action research. The first-order process of categorisation and theme extraction draws on the principles of Thematic Analysis (Braun & Clarke, 2006), while the second-order conceptualisation and theoretical development closely align with the core ideas of Grounded Theory, especially its emphasis on theory generation from data (Charmaz, 2014).

First-Order Analysis

This stage focused on extracting insights directly from the participants' perspectives and experiences. Data from the workshops were systematically categorised and summarised, with the original statements organised into thematic categories. This bottom-up approach ensured that the analysis remained grounded in the participants' contributions.

Second-Order Analysis

Building on the first-order findings, the second-order analysis elevated the data to a higher conceptual level. This process involved identifying overarching themes, theoretical frameworks, or recurring patterns that could explain the observed phenomena. By linking the participants' practical insights to a broader theoretical structure, this level of analysis aims to provide theoretical support and guidance for future climate action and design strategies. By combining these two levels of analysis, the study effectively captured both the practical insights offered by participants and their theoretical implications, situating the findings within the broader context of design, climate action, and co-production.

After the data analysis, the researcher employed a triangulation method to ensure the reliability of the results. This was achieved by comparing the first-order and second-order analysis findings with existing literature and theoretical models. Additionally, one of the design researchers who participated in the workshops was invited to review

and discuss the findings during an internal feedback session. This collaborative process further enhanced the logical coherence and consistency of the analysis.

7.3 Results

This section presents the findings of the study, which have been further enriched by suggestions from the participating designers. These suggestions build on the insights gathered from interviews with older adults and offer practical and creative strategies. The results are grouped into key themes, focusing on ways to raise awareness of climate change, encourage collaboration between institutions and communities, and support older adults' involvement in sustainable practices.

7.3.1 Strategies for Promoting Climate Awareness

Raising climate change awareness among older people requires targeted strategies that consider their cognitive preferences, lifestyle habits, and information consumption patterns.
Table 7.4 summarises the strategies identified in this study, grouped into key themes to address the specific needs and preferences of this demographic group.

Simplified and visually supported communication is crucial for making complex environmental concepts more accessible. Providing information in multiple languages ensures inclusiveness and fosters understanding among linguistically diverse communities.

Community-based activities and intergenerational initiatives further enhance participation, enabling older people to engage in climate action with their families and peers.

Social connections also play a key role: peer learning and group influence encourage behavioural change through shared experiences and discussions. Incentive mechanisms, such as small rewards or participation in activities, can effectively motivate participation.

Furthermore, digital platforms complement traditional media channels such as television, newspapers, and radio as tools for education and outreach.

Government-led initiatives enhance credibility and ensure the wider dissemination of accurate information. Meanwhile, key opinion leaders (KOLs) serve as trusted communicators, bridging the gap between official information and everyday community discourse.

Table 7.4 Design Strategies about Promote Climate Change.

Themes	Codes
Simplify Information	Simplify information to focus on key points (WS204). Use image-related concepts to enhance understanding for older adults (WS515). Organize workshops to explain "climate change" using simple and popular terms (WS309).
Multilingual Advocacy	Provide multilingual or native language interpretations to improve accessibility (WS307).
Advertising and Memory Aids	Create catchy slogans tailored for older adults to aid memory retention (WS101). Develop visual, intuitive displays, such as cards, videos, or live interviews (WS204). Offer feedback opportunities via conversations, newspaper articles, or online platforms (WS205).
Government Initiatives	Governments should take the lead in producing text, video, and news interviews to enhance urgency and credibility (WS309).
Demographic-Specific Approaches	Tailor activities to specific community groups or nursing homes based on demographic needs (WS514). Use traditional methods like brochures, flyers, and visualizations to explain concepts to less-educated seniors (WS205). Incorporate low-carbon information into daily touchpoints, such as product packaging and public transport (WS411). Promote low-carbon knowledge directly on grocery packaging (WS206).
Community Promotion	Conduct community activities to demonstrate low-carbon living scenarios (WS410). Collaborate with local governments or publicity departments to increase credibility (WS309).

	Create virtual communities for older adults unable to travel (WS515).
Intergenerational Influence	Emphasize the benefits of climate action for future generations to inspire older adults (WS412). Leverage children's understanding of climate change, as their influence on older adults may be stronger (WS309, WS516).
Social Media and Digital Promotion	Utilize social media, educational websites, promotional videos, and animations to spread awareness (WS205). Incorporate climate change concepts into care community service processes (WS205). Create online activities with prizes and interactive features to engage participants (WS309). Use traditional media, such as films, television, radio, and newspapers, for wider reach (WS410, WS516).
Incentive Mechanisms	Motivate participation by distributing prizes (e.g., eggs, oil) for engagement in low-carbon activities (WS309).
Key Opinion Leaders (KOLs)	Leverage the influence of KOLs for both offline community communication and online advocacy (WS308, WS516).
Peer Learning and Group Effect	Encourage behavioural shifts through peer influence and group discussions (WS204). Highlight how older adults are influenced by friends who discuss and adopt climate-friendly behaviours (WS204). Gather environmentally conscious seniors to set examples for others in their community (WS515).

7.3.2 Collaborative Institutions and Activities

Institutions such as care homes, nursing homes, hospitals, and community groups play an important role in helping older adults understand and act on climate change. By combining their influence with well-designed activities, these organisations can promote awareness and encourage sustainable practices. The following strategies were suggested by designers:

1) Institutional Leadership

Nursing homes, hospitals, and religious organisations can serve as important platforms for disseminating climate-related information. For example, nursing homes and retirement homes can incorporate simple environmental information into daily life or organize themed activities promoting sustainable practices (WS204, WS513, WS205). Healthcare institutions, particularly the National Health Service, have the potential to connect health and sustainability by demonstrating how environmentally friendly behaviours (such as energy conservation or active transportation) support individual well-being. Community-based groups, including women's associations and community organizations, can facilitate two-way communication by gathering feedback and tailoring interventions to the needs of older people (WS205).

2) Cultural and Religious Activities

Culturally and faith-based activities offer accessible and meaningful entry points for environmental engagement. Religious institutions, such as churches, can integrate messages of stewardship and intergenerational responsibility into sermons and community gatherings (WS101, WS205, WS412). Similarly, cultural celebrations and community festivals can embed low-carbon messages within familiar traditions, making sustainable development education more relevant and contextualised.

3) Charitable and Educational Activities

Charitable organisations and lifelong learning centers also have great potential to promote climate literacy. Educational programs, such as workshops and short courses offered by community colleges like u3A, can introduce the basic principles of sustainable living in an accessible way (WS309). Furthermore, encouraging older people to share their personal experiences and stories through public exhibitions, printed brochures, or community presentations can foster a sense of pride and intergenerational learning (WS411).

4) Activities Tailored for Older Adults

Activities designed around the interests and abilities of older people are more likely to sustain participation. For example, skill-sharing sessions can integrate traditional practices like gardening, mending, or crafting with discussions about environmental issues (WS309). Seasonal or themed group activities, such as local trips focused on nature conservation or recycling, can transform climate education into enjoyable social experiences.

5) The Role of Volunteers and Local Leaders

Volunteers and respected community leaders can serve as facilitators and role models in these initiatives. Volunteers can also assist with event coordination, provide accessible information, and encourage peer participation (WS309). Senior representatives, in particular, can leverage their social status to advocate for local initiatives, mobilize community support, and legitimize environmental projects (WS204).

7.3.3 Raising Awareness and Fostering Experience of Climate Change

Through focus group discussions, it became evident that integrating historical, geographical, and perceptual perspectives can enhance older peoples' understanding of climate change. Drawing on natural signs and intergenerational connections fosters empathy and collaboration in addressing climate issues. Based on these insights, the following strategies were designed to promote awareness and engagement:

1) Historical Perspective: Reflection and Identity

Encouraging older people to revisit their personal histories allows them to connect life experiences with environmental change. Participants suggested that reflecting on environmental change during youth can enhance awareness of climate impacts:
"Older people can recall the environmental changes they witnessed in their youth, helping them understand the long-term impact of climate change by comparing past and present conditions" (WS515).

Personal storytelling was also seen as an effective approach to raise awareness. Combining personal stories, family histories, or memoirs with climate themes can foster engagement. Publishing books or brochures conveying these narratives with a sustainable message can leave a lasting impact:
"Publishing books such as memoirs or histories with a sustainable message resonates with readers and raises awareness" (WS101).

Visual storytelling through documentaries capturing older adults' memories and comparing past and current climates effectively conveys the urgency of climate action:
"Visualising personal experiences evokes empathy and enhances awareness" (WS513).

2) Geographical Perspective: Observing Environmental Change

Revisiting familiar surroundings can help older people directly experience the impact of environmental changes. Participants suggested organised trips to places they

previously lived:
"Returning to former places of residence, whether in the UK or in participants' countries of origin, enables older adults to compare past and present environments, prompting reflection and the sharing of experiences with family members" (WS102).

Museums and immersive exhibitions were viewed as powerful tools to illustrate geographical and temporal changes:
"Visual and sensory museum displays showcase environmental changes over time, leaving a strong impression" (WS204).

Participants also recognised the potential of new technologies such as AR/VR for visualising change:
"AR/VR apps vividly display how climate change has altered lives, encouraging positive behaviours" (WS103).

3) Perceptual Perspective: Multi-Sensory Experiences and Future Outlook

Multisensory engagement was identified as key to deepening emotional understanding. Participants suggested leveraging tactile and visual experiences:
"Sensory experiences, such as visuals of landfills or tactile comparisons between traditional and modern materials, foster environmental awareness" (WS204).

AI technology is also considered a tool for simulating future climate:
"AI-generated videos illustrating potential futures if waste remains unsorted can educate audiences effectively" (WS103).

4) Awakening Environmental Awareness: Nature and Phenomena

Nature documentaries and wildlife stories were mentioned repeatedly as emotionally resonant ways to inspire climate awareness:
"Stories of endangered species and their struggles evoke compassion and awareness" (WS412).

Participants also supported the use of data visualisation and public displays to make climate information easily accessible:
"Dynamic visuals in public areas make environmental data relatable and memorable" (WS514).

Personal relationships with animals are considered another entry point for empathy:

"Older adults' affection for pets can be harnessed to raise awareness about endangered species" (WS102).

5) Building Connections: Community Collaboration

Promoting storytelling strengthens intergenerational connections and enables the transmission of climate knowledge and values. Participants highlighted the value of storytelling:

"Community events focused on reminiscing can promote intergenerational learning" (WS103).

They also recommend family-oriented initiatives that connect environmental protection with shared values:

"Family gatherings provide a platform for older adults to share life stories, instilling values in the younger generation" (WS308, WS516).

7.3.4 Incentive and Penalty Mechanisms

Previous research has shown that financial rewards can effectively encourage people to participate in climate action. Building on this idea, designers explored both reward and penalty mechanisms, offering practical examples. Whether through virtual incentives, community competitions, or schemes led by governments and businesses, these approaches aim to motivate individuals to adopt low-carbon lifestyles.

However, some participants highlighted a critical point: while economic incentives can drive short-term behavioural change, they may not necessarily lead to sustained, long-term commitment to climate-friendly actions. This suggested the need for a more balanced approach, combining financial rewards with strategies that promote intrinsic motivation, such as education, community engagement, and fostering a sense of environmental responsibility.

1) Data-Driven Sharing and Virtual Rewards

Participants emphasised the importance of making environmental benefits visible through data. Simple, relatable examples, such as an older people demonstrating how they saved £XX in a year by reducing electricity and water use, were seen as an effective way to convey the tangible impact of behavioural change.

A recurring idea was the "Ant Forest" model, a virtual incentive system where users accumulate points through environmental activities to contribute to real-world tree

planting efforts (WS515). While these rewards are non-monetary, participants noted their emotional appeal and the sense of accomplishment that comes from contributing to collective environmental goals. This suggests that gamification and data-driven approaches can increase engagement, especially among younger and older adults who are familiar with digital tools.

2) Corporate Rewards and Point Systems

Businesses are seen as key drivers of support for climate-friendly lifestyles. Participants suggested mechanisms such as off-peak electricity discounts (WS102) and point-based reward systems operated by utility companies or supermarkets (WS205). These programs allow households to accumulate points for measurable energy savings and redeem them for environmentally friendly products or community projects.

Partnerships between private businesses and retailers were also suggested as a means of encouraging recycling, such as by rewarding shopping points for recycled plastic or glass containers (WS514). Such corporate partnerships can normalise sustainable behaviour by integrating environmental action into everyday consumption patterns.

3) Government Incentives and Public Rewards

Government-led intervention was considered key to ensuring credibility and widespread adoption. Communities could introduce programs where households receive vouchers or household items, such as bottles or clothing, based on the amount of waste they correctly recycle (WS206, WS411).

The workshop also discussed tax-based incentives as an effective mechanism to support renewable energy investment and household sustainability. Households that install solar panels or engage in recycling could receive tax breaks. For example, businesses that generate renewable energy could pay lower property taxes (WS514).

4) Community Competitions and Reward Systems

At the community level, friendly competition is considered an effective way to motivate participation through social comparison and public recognition. For example, community competitions for reducing water or energy consumption can award small prizes or certificates to the best performing households (WS411).

Other strategies, such as incentives for waste sorting (e.g., free trash bags, vouchers, or public recognition), have also been suggested to strengthen community participation.

Regularly publishing results and recognising active participants can also enhance motivation (WS513, WS309).

5) Education and Behavioural Guidance

Beyond material incentives, participants emphasised the need for educational reinforcement and behavioural guidance. Communities could introduce systems that reward individuals for eco-friendly actions, such as walking or reducing waste, while issuing warnings or penalties for harmful behaviours like littering. Volunteers could visit homes to praise good practices and offer guidance on improvements (WS204, WS309).

6) Support from Financial Institutions

Finally, participants identified financial institutions as potential facilitators of sustainable behaviour. Banks and financial institutions could promote green investment funds or sustainable bonds, encouraging eco-friendly consumption. For instance, platforms like Alipay or WeChat could introduce step-tracking mechanisms to reward low-carbon behaviours (WS205).

Financial institutions could offer reduced loan rates for owners of environmentally friendly vehicles or homeowners who invest in renewable energy solutions (WS515).

7.3.5 Tailored Communication Strategies for Different Groups

People have different levels of awareness and attitudes about climate change, so it is important to tailor communication strategies to suit different groups. Based on the findings, designers proposed specific ideas for three types of individuals: beginners, experienced practitioners, and skeptics or opponents.

1) Beginners: Introducing Basic Concepts

For those who are new to low carbon practices, simple and accessible resources are essential. Suggested strategies include:

Basic Materials: Provide easy-to-read leaflets, articles, and visual aids like cartoons or short videos. These can explain low-carbon behaviours in an engaging way (WS204, WS514).

Community Support: Volunteers can share simple climate facts during casual conversations. This approach can be especially helpful for beginners who might feel overwhelmed by technical details (WS204, WS516).

Language Assistance: For people who face language barriers, multilingual guides can help ensure they understand and accept the ideas being shared (WS206).

2) Experienced Practitioners: Encouraging Leadership

People already involved in low-carbon practices may benefit from strategies that deepen their knowledge and empower them to become leaders:

Workshops and Case Studies: Provide training sessions and share success stories. These can inspire individuals to become advocates and lead by example in their communities (WS205, WS513).

Online Platforms: Create a website or app offering detailed climate information and spaces to share experiences. This allows people to learn and connect with others who share their interest (WS101).

Local Media: Collaborate with local TV and radio stations to broadcast programmes on climate change. Invite experts and businesses to share practical low-carbon solutions (WS204).

Practical Tools: Develop simple tools that make it easier for people to find energy-saving tips or adopt sustainable habits. This is particularly useful for older adults who may find technology challenging (WS102).

3) Skeptics or Opponents: Building Trust

For individuals who are unsure about or resistant to climate change ideas, the focus should be on gradual engagement and trust-building:

Open Conversations: Organise events where people can freely discuss their concerns. This can help skeptics understand the benefits of low-carbon behaviours without feeling pressured (WS205, WS513).

Personal Connections: Older individuals who already practice sustainability can share their experiences with skeptics. This peer-to-peer approach often feels less confrontational (WS204, WS309).

Family Influence: Younger family members can encourage climate-friendly behaviours during family conversations. Many people are more willing to listen to their loved ones (WS309).

7.3.6 Government Needs and Measures for Improving Climate Action

During the focus group discussions in Study D, older people expressed their views on government initiatives related to climate change. Their feedback provided valuable

insights to Study E, where designers translated into actionable recommendations for improving environmental policies and fostering public trust and participation.

1) Establish a Supervision Department and Promote Transparency

Participants consistently emphasised the importance of institutional accountability. Several suggested that the government could create a dedicated body to monitor and publicly share the progress, data, and outcomes of low-carbon policies. Regular updates would enable public oversight and build trust (WS101, WS412).

Complementary to this, participants suggested that conducting regular surveys or sentiment analysis could help identify public challenges in adopting climate-friendly practices, allowing the government to develop targeted solutions (WS309).

2) Transparency and Open Data

Transparency was identified as a cornerstone of effective climate governance. Participants recommended that governments regularly publish updates on emissions reduction progress and environmental performance through official websites and media channels (WS411, WS513).

Some participants further recommended live demonstrations of recycling processes, such as broadcasts or live streams showing how waste is sorted, processed, and reused (WS102, WS410, WS412). These measures were considered practical ways to enhance public confidence and make environmental systems visible, traceable, and understandable to ordinary citizens.

3) Engage with Communities and Gather Feedback

Focus group participants also emphasised the need for closer government engagement with local communities. They recommended that government representatives regularly visit communities to observe real challenges and gather suggestions for improvement (WS103, WS513).

Furthermore, face-to-face dialogue events, such as community lunches or town hall meetings, were suggested as opportunities for direct communication between citizens and officials (WS309).

4) Promote and Clarify Policies

Participants emphasised the need for clear, credible, and visible communication of government climate policies. They suggested that producing videos and media content highlighting government efforts on climate action could enhance public trust. Involving

trusted public figures, such as members of the British royal family or respected community leaders, could amplify these messages (WS103, WS206).

Furthermore, personal engagement of political leaders in sustainable practices can inspire the public and reinforce the importance of environmental policies (WS206, WS515).

Finally, regularly publishing progress reports and summaries of achievements on official websites (WS309) was considered crucial for maintaining transparency and encouraging informed public scrutiny.

7.3.7 Awareness of Sustainable Development in Business

The findings from Study E also underscored the crucial role of businesses in shaping sustainable consumption patterns. Designers emphasised that by adapting their business models, improving product design, ensuring transparency in packaging, enhancing recycling systems, and engaging with communities, companies can not only boost their own growth but also influence consumers to adopt more sustainable behaviours.

1) Extending Product Life Cycles

Participants emphasised the importance of reducing product disposables and promoting a circular economy. Apple's trade-in program encourages consumers to trade in old products for new ones, thereby extending the product lifecycle. This reduces the prevalence of disposable goods and promotes recycling (WS101, WS410).

Furthermore, companies can reduce overproduction through accurate market demand analysis, thereby avoiding waste and excess inventory (WS410).

2) Transparency in Packaging Information

Concurrently, providing clear information on packaging about a product's environmental impact helps consumers make informed choices. For example, labels explaining a product's contribution to environmentally friendly agricultural practices are effective in raising awareness (WS206, WS307).

3) Improvement of Business Models

A recurring theme among designers was the need to integrate sustainability directly into corporate strategy, rather than treating it as a secondary objective. Companies can integrate sustainability into their business strategies, aligning social responsibility with market objectives. This approach encourages innovation, improves energy efficiency, and reduces emissions, while also enhancing corporate image (WS205, WS308).

Participants also emphasised the importance of industry leadership, with large companies setting a standard for others in their industry by demonstrating sustainable practices (WS309).

4) New Materials and Recycling

Materials innovation is seen as a core driver of sustainable development. Participants recommended that companies prioritise the use of recyclable and biodegradable materials to reduce reliance on unsustainable resources. Encouraging collaboration between industry and academia and collaborating with university research teams to develop environmentally friendly materials, can support this goal (WS205, WS410).

Furthermore, companies can promote a circular economy by establishing effective recycling mechanisms and encouraging consumers to recycle used items (WS412).

5) Consumer Engagement and Experience

Finally, participants emphasised that consumer engagement is crucial for bridging the gap between awareness and action. One proposed strategy is to organize factory tours or behind-the-scenes visits, allowing consumers to observe the production process and understand the tangible differences between sustainable and conventional materials (WS103). This type of experiential learning is seen as a powerful means of fostering awareness of environmental responsibility.

Furthermore, market research and user feedback are considered important tools for understanding consumer sustainability preferences (WS204, WS513). These insights can guide future product innovation and help companies design marketing strategies.

7.3.8 Improvements in Industry Support Facilities

Older people have emphasised the need for improved support facilities to enhance their mobility and quality of life, which also play a crucial role in fostering sustainable and climate-friendly behaviours. By improving public transport and related infrastructure, governments and communities can not only make travel more accessible, Such as through age-friendly design (e.g. step-free access and seating), affordable pricing, clearer information, and practical improvements such as sheltered bus stops and community-based transport options, but also encourage the adoption of low-carbon transport options. Age-friendly services, enhanced transport systems, and shared

mobility solutions can significantly reduce carbon footprints while promoting convenience and comfort for older adults in their daily lives.

1) Encouraging the Use of Public Transport

Participants considered public transportation a sustainable mode of transportation that is both economical and environmentally friendly. To increase accessibility, they recommended expanding senior travel card programs to offer free or discounted bus and subway rides to encourage regular use by older people (WS101, WS514).

Furthermore, the introduction of community shuttle buses was seen as a practical means of improving local connectivity. These fixed-route services could connect residential areas, supermarkets, and hospitals, specifically cater to seniors and be certified by senior citizens (WS309, WS514).

2) Improving Support Services for Older People and Public Awareness

A consistent theme throughout the workshop was the need to integrate age-friendly principles into public transportation design and management. Participants recommended public campaigns to promote courtesy and helpfulness toward older passengers, encouraging passengers to offer their seats and assisting seniors when needed (WS102, WS410).

They further emphasised the importance of inclusive transportation design, suggesting that buses should include age-friendly features such as priority seating and wheelchair access as standard. Improving layout and accessibility could make commuting more comfortable for older people (WS204, WS513).

Upgrading bus and subway stations, such as installing safety barriers, handrails, and improved ventilation systems at subway and bus stops, and increasing priority seating and dedicated platforms for seniors (WS206).

Furthermore, strengthening pedestrian infrastructure, such as escalators, ramps, and personnel assistance points at major transportation hubs, would make travel more convenient for people with limited mobility (WS412, WS514).

3) Enhancing Support Facilities in Remote Areas

Participants expressed concern about limited transportation and retail infrastructure in remote areas, which limits convenient and sustainable travel options. They suggested

expanding bus routes and local supermarkets to reduce the need for seniors to travel long distances (WS101, wss514).

Another recurring suggestion was the development of electric vehicle charging stations and safety facilities (WS206, WS309). Participants believed that collaboration between local governments and auto companies is crucial to ensuring that these facilities are affordable, safe, and evenly distributed, especially in underserved areas.

4) Delivery and Shared Services

Advances in shared and on-demand services were identified as key enablers of sustainable mobility for older people. Participants recommended establishing dedicated delivery points to serve seniors and individuals with limited mobility, ensuring the rapid delivery of essential goods (WS205, WS410).

They also envisioned shared transportation solutions, including autonomous shuttles and electric taxis that can be booked through simple digital interfaces (WS102, WS410).

7.4 Discussion

This section reflects on the key findings of Study E, linking them to broader theoretical frameworks and practical implications. It provides an in-depth analysis of the new themes, connects the findings to relevant theories, and highlights their potential to guide future research and actionable strategies for climate action.

7.4.1 Key Themes Emerging from the Results

1) The Role of Co-Production in Engaging Older Adults and Designers. This study underscored the value of co-production as a collaborative approach to engaging older adults in addressing climate change challenges. Rather than involving all stakeholders simultaneously, co-production in this research was enacted through a staged process. Insights gathered from interviews with older Chinese migrants, alongside comparative data from local older adults, were synthesised and brought into a design workshop with professional designers.

In this way, the lived experiences and practical knowledge of older participants informed the design process indirectly, shaping the perspectives and decisions of designers. This mediated form of co-production enabled the integration of diverse viewpoints, resulting in solutions that were both inclusive and contextually grounded.

This approach challenges traditional top-down strategies often employed in climate initiatives, where older adults are treated as passive recipients. Instead, the co-

productive model fostered a sense of agency by ensuring that participants' experiences were embedded in the design process, even when they were not physically present in the workshop.

These findings are consistent with prior research emphasising the benefits of participatory methods in addressing marginalisation and improving policy implementation (Bovaird & Loeffler, 2013; Minkiewicz et al., 2016).

2) Designing Targeted Strategies for Climate Awareness. The results revealed that raising climate awareness among older adults required tailored strategies that align with their cognitive and cultural contexts. For instance, simplified messaging, visual aids, and multilingual advocacy were identified as effective tools to overcome barriers related to comprehension and accessibility. Additionally, the study highlighted the importance of community-based and intergenerational activities in fostering engagement.

3) Institutional and Community Collaboration Institutions such as care homes, churches, and community organisations were identified as crucial facilitators in promoting sustainable practices. These entities serve as trusted intermediaries capable of disseminating climate-related information and organising initiatives tailored to older adults' preferences and routines.

Furthermore, cultural and religious activities were identified as effective avenues for integrating environmental messages into familiar and meaningful contexts. For instance, hosting climate-themed talks in religious settings connects environmental stewardship with moral and spiritual values, fostering a sense of collective responsibility.

The study's emphasis on the role of volunteers and Key Opinion Leaders (KOLs) further illustrated the potential of leveraging existing social networks and community leadership to amplify the impact of climate initiatives.

4) Incentives and Systemic Support The findings also emphasised the importance of economic incentives and systemic support in motivating older adults to adopt low-carbon practices. Examples such as tax benefits for sustainable behaviours, rewards for recycling, and point-based systems highlight the dual role of financial motivation and institutional backing.

5) Addressing Barriers and Ensuring Inclusivity The study helped to solve problems on specific barriers faced by older adults, particularly among older Chinese migrants. These include language barriers, cultural unfamiliarity, and limited access to resources.

By proposing strategies such as multilingual advocacy, culturally sensitive activities, and targeted support systems, the study contributed to a more inclusive approach to climate action.

The involvement of government, businesses, and industries highlighted the necessity of establishing a holistic ecosystem. In this ecosystem, the transparency and fairness of the government influence citizens' motivation to participate in climate action.

Figure 7.7 presents an updated diagram, modified from Figure 6.3, incorporating new recommendations proposed by the designers in this study. The designers' suggestions have further enriched the framework. This diagram also illustrates how, following the conclusion of this study, the recommendations for climate action have become increasingly specific and practical.

	Themes	Subthemes
Theme 1	Suggestions for promoting climate action	1. Terminology old people can understand 2. Cultural differences and cultural integration 3. Multi-Channel Information Dissemination - By Population Group 4. Helping older Chinese migrants in the UK to understand net zero and climate change
Theme 2	Sharing of low carbon practices	1. Promoting low carbon practices of the older people - to inspire more people
Theme 3	Strategies for exploring climate change	1. Discuss climate change - history, geography, perception 2. Awaken awareness of the natural environment - land sea, plants, disasters, air, animals 3. For the Next Generation-the motivation 4. Attracting attention with economic factors 5. Provide guidelines for different stages 6. How the message is presented - remind, warn, encourage, attract 7. The importance of visual materials
Theme 4	The need for climate action	1. The need for government improvements 2. Sustainability awareness in business 3. Improvements in industry support facilities

Figure 7.7 Added Designer Suggestions (adapted from Figure 6.3).

7.4.2 Relevant Theoretical Support and Application

This section explores the theoretical frameworks that underpin the findings from the design workshops. The application of theory offered a dual benefit: it enhanced the interpretation of findings and provided a foundation for generalising insights to guide future research and design strategies (Collins & Stockton, 2018). Table 7.5 summarises design suggestions and their theoretical underpinnings:

Table 7.5 Linking Design Suggestions to Theoretical Foundations.

Theme	Design Suggestion/Observation	Relevant Theory	Theory Description
Multisensory Experiences	Use AR/VR technology and multisensory stimuli (touch, smell, vision) to create immersive learning environments for older adults to better understand the impacts of climate change.	Multisensory Experience Theory (Spence, 2020) Affective Priming Theory (Klauer, 1997) Situated Learning Theory (binti Pengiran & Besar, 2018)	Multisensory stimuli enhance information retention and create emotional resonance, inspiring positive behaviour.
Empathy and Emotional Triggers	Leverage disaster films, endangered species footage, or simulated future scenarios to evoke urgency and emotional connection through visual and auditory stimuli.	Empathy Theory (Hoffman, 1996) Appeal to Fear Theory (Williams, 2012)	Empathy fosters protection for vulnerable subjects; fear appeals create a sense of urgency through strong emotional triggers.
Intergenerational Responsibility	Highlight the role of climate action in protecting future generations, encouraging older adults to act out of concern for their descendants.	Prosocial Behaviour Theory (Penner et al., 2005)	Prosocial behaviour motivates individuals to contribute positively to society, often through altruistic actions.
Peer Influence and Social Learning	Promote low-carbon behaviour through community-based peer influence. Older adults tend to	Social Learning Theory (Akers & Jennings, 2015)	Behavioural learning occurs through observation and

	adopt behaviours observed in friends or neighbours.		imitation of credible or influential role models in social groups.
Incentives and Behavioural Reinforcement	Use rewards (e.g., subsidies, vouchers) to encourage low-carbon behaviours, while employing penalties (e.g., fines) to discourage undesirable behaviours.	Behaviourism Theory (Moore, 2011)	Positive reinforcement increases the likelihood of repeated desirable behaviour; punishment deters negative actions.
Opinion Leaders and Knowledge Dissemination	Engage KOLs via social media or community events to spread climate-related knowledge and influence older adults.	Two-Step Flow of Communication Theory (Choi, 2015) Diffusion of Innovations Theory (Dearing & Cox, 2018)	Opinion leaders mediate information flow and persuade communities to adopt innovations or behaviours.
Advertising and Cognitive Strategies	Create memorable slogans and visually appealing materials to reinforce climate change awareness.	Heuristic Processing (Frimodig, 2023) Availability Heuristic (Schwarz et al., 1991)	People rely on intuitive rules and accessible information to process complex issues and make decisions.
Circular and Sharing Economy	Develop comprehensive recycling systems, support sustainable material innovation, and introduce shared mobility solutions to reduce emissions.	Circular Economy Theory (Negrei & Istudor, 2018) Sharing Economy Theory (Parente et al., 2018)	Circular economy focuses on reducing waste and maximising resource efficiency; sharing economy promotes resource-sharing for low-carbon living.

7.4.3 Future Research

This Study incorporated designers' suggestions, making future climate action strategies more practical and actionable. As shown in Figure 7.8.

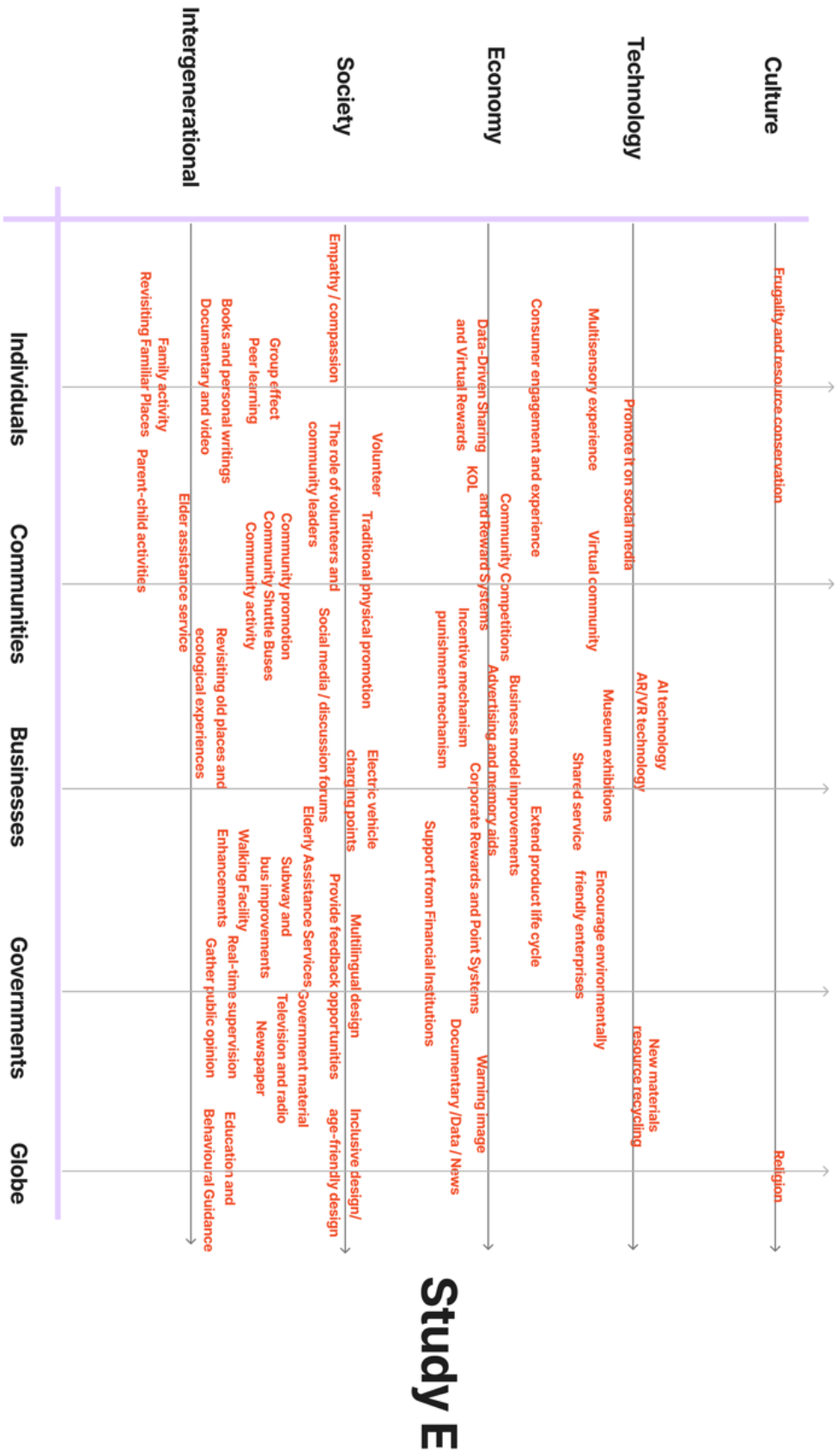


Figure 7.8 Climate-related opportunity points from designers.

Figure 7.9 illustrates a comparative analysis of climate-related opportunities identified in **Study D (Local older people)** and **Study E (Designers)**. Their results reveal distinct emphases shaped by participant backgrounds and methodological orientations.

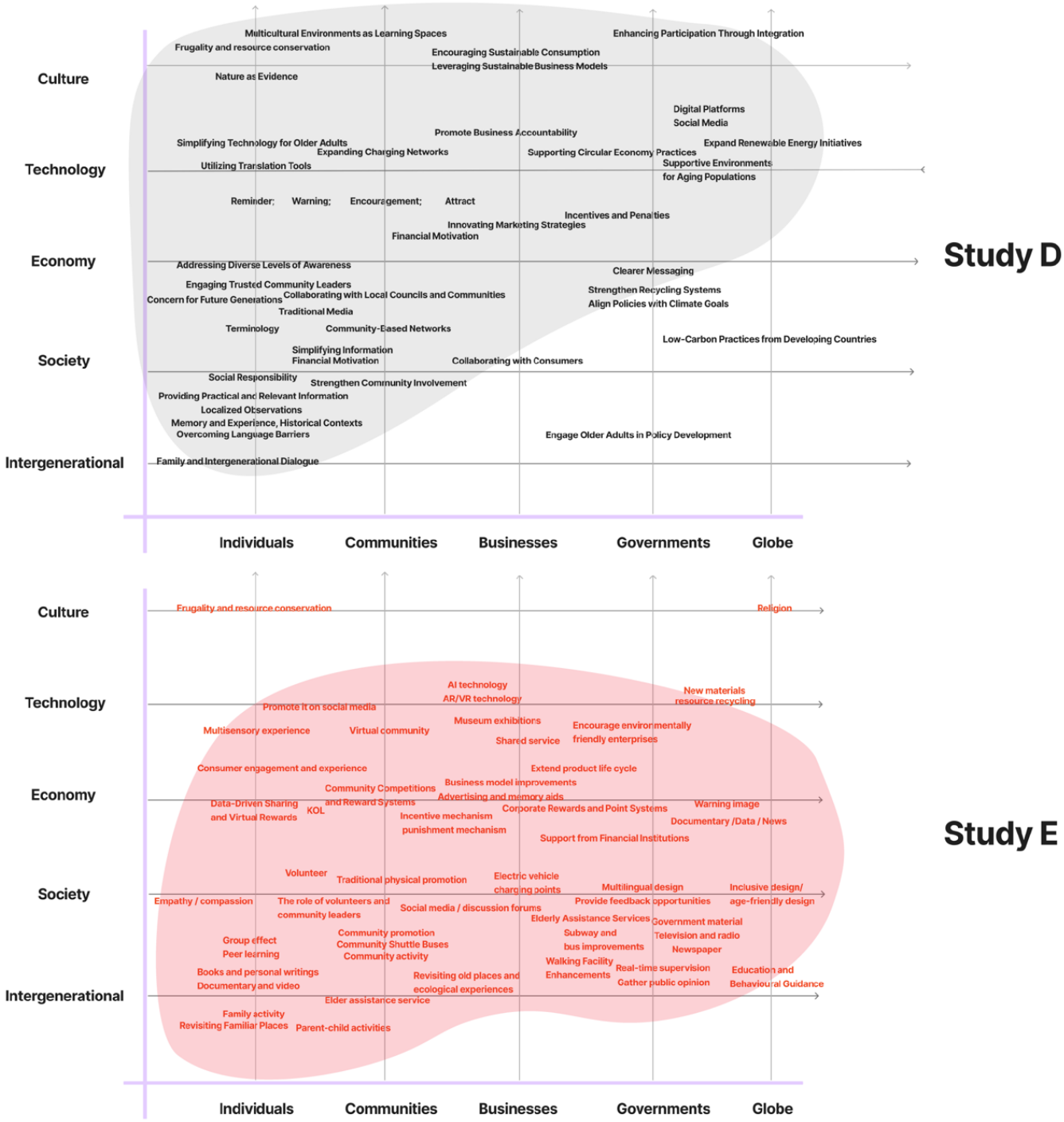


Figure 7.9 Climate-related opportunity comparison.

1) Thematic Orientation and Emphasis

Study D reflects insights from older people's lived experiences and practices. The identified opportunities are primarily concentrated within the *societal* and *intergenerational* dimensions, such as "Community-based networks," "Family and intergenerational dialogue," and "Simplifying information." These findings highlight the importance of trust, social connectedness, and generational learning in promoting engagement with sustainability among older populations.

In contrast, Study E demonstrates a shift towards *technological* and *economic* themes, exemplified by interventions such as "AI/VR technology," "Data-driven sharing," and "Reward systems." As the outcomes emerged from a professional co-design setting, participants proposed system-level and innovation-oriented interventions, positioning technology and incentives as enablers of behavioural change.

2) Actor-Level Distribution

Study D's design opportunities are predominantly located at the *individual* and *community* levels, revealing a **bottom-up perspective** that foregrounds personal motivation, local networks, and community participation. This aligns with the focus group participants' proximity to lived experience and practical concerns in daily low-carbon actions.

Study E, conversely, demonstrates a **multi-level and cross-sectoral orientation**. The inclusion of interventions targeting *businesses* and *governments*, such as "Corporate rewards and point systems," "Policy alignment," and "Government material design" which reflects designers' inclination to envision systemic, top-down strategies that complement individual behaviour change.

3) Cultural and Intergenerational Dynamics

Both studies emphasise intergenerational engagement but differ in intent. Study D frames it as a means of knowledge inheritance and cultural continuity, whereas Study E reframes it as a design strategy, which leveragies shared family experiences or educational activities to foster cross-generational environmental awareness. The shift from relational empathy to structured intervention reflects the transition from *user insight* to *design conceptualisation*.

Building upon the findings of Studies D and E, several future opportunities emerge for advancing climate engagement among this findings.

First of all, effective climate action requires moving beyond the individual level to strengthen collaboration among families, communities, organisations, and policy institutions. It suggested that social connectedness and trust play a crucial role in

motivating older adults and migrant communities to participate in sustainability initiatives. Future interventions could therefore focus on co-designed community events, intergenerational learning activities, and culturally inclusive communication materials that translate complex climate information into relatable, daily terms. Designers can play a significant role in this process by constructing interventions suitable for the particularities of ageing and migration, ensuring that the information of sustainable development is not only understood but also embedded in daily life.

Secondly, from an economic perspective, the studies point to the need for aligning environmental goals with social and financial incentives. While participants in Study D emphasised affordability and practicality, Study E, conducted as a design workshop, explored designers' more speculative and forward-looking ideas, demonstrating their interest in systemic solutions such as circular economy models, low-carbon technologies, and green innovation platforms. In the future, designers and researchers across diverse disciplines may further investigate these economic mechanisms, including community-based reward systems, applications of consumer psychology, and incentives for sustainable business models, with particular attention to their adaptability to varying demographic groups and cultural contexts. However, these ideas were not always directly grounded in the lived experiences of older migrants, and therefore highlight potential directions rather than immediately applicable solutions.

7.5 Summary

This study explored insights and strategies for promoting climate action and encouraging low-carbon behaviours, drawing on older adults' lived experiences and designers' interpretations developed through a staged co-production process. It expanded on the quadrant framework established in **Chapter 6 (Study D)** and extracted theoretical frameworks (Table 7.5) from key themes to guide the development of practical and innovative solutions to overcome barriers to climate participation.
The Study highlighted community-driven approaches, intergenerational collaboration, and the use of technologies to create immersive learning experiences. It also advocated for economic incentives, such as reward and punishment mechanisms, and leveraging opinion leaders to raise climate awareness. The recommendations emphasised fostering cultural sensitivity, promoting systemic sustainable practices, and utilising shared resources for effective collaborative services.

Chapter 8: Design Intervention - A Climate Toolkit and a Policy Brief for Older Chinese migrants

8.1 Introduction

This chapter presents the design intervention developed based on the findings from previous studies (Studies A–E). The intervention consists of **a climate toolkit** and **a policy brief**, specifically designed to enhance older Chinese migrants' understanding of net zero policies and the awareness of climate change.

8.1.1 Research Overview

Study F was informed by insights gathered from a series of studies (A-E) among older Chinese migrants, local Older seniors and designers in the UK.

Study A: Questionnaire and Semi-Structured Interviews explored the fundamental challenges faced by older Chinese migrants in understanding and adopting net zero policies.

Study B: Walking Interviews provided an observational and context-based perspective on how low-carbon behaviours were practised by older Chinese migrants.

Study C: Co-Design Workshop focused on how older Chinese migrants engaged with information, their personal values, and preferences for climate communication.

Study D: Focus groups with Older British Adults served as a comparative study to explore how cultural and policy differences influenced older adults' understanding and response to climate change, and their suggestions on engage in net zero for Older Chinese migrants.

Study E: The Designer Workshop facilitated the development of creative interventions, gathering suggestions from designers to provide intervention strategies for climate action, generate engaging and practical tools tailored to the needs of older Chinese migrants.

Drawing from these insights, this chapter introduces a culturally tailored climate toolkit designed to address language barriers, information accessibility, and engagement gaps among older Chinese migrants. In addition, a policy brief was developed to recommend broader climate interventions and strategies.

Figure 8.1 shows the position of Chapter 8 in the doctoral research.

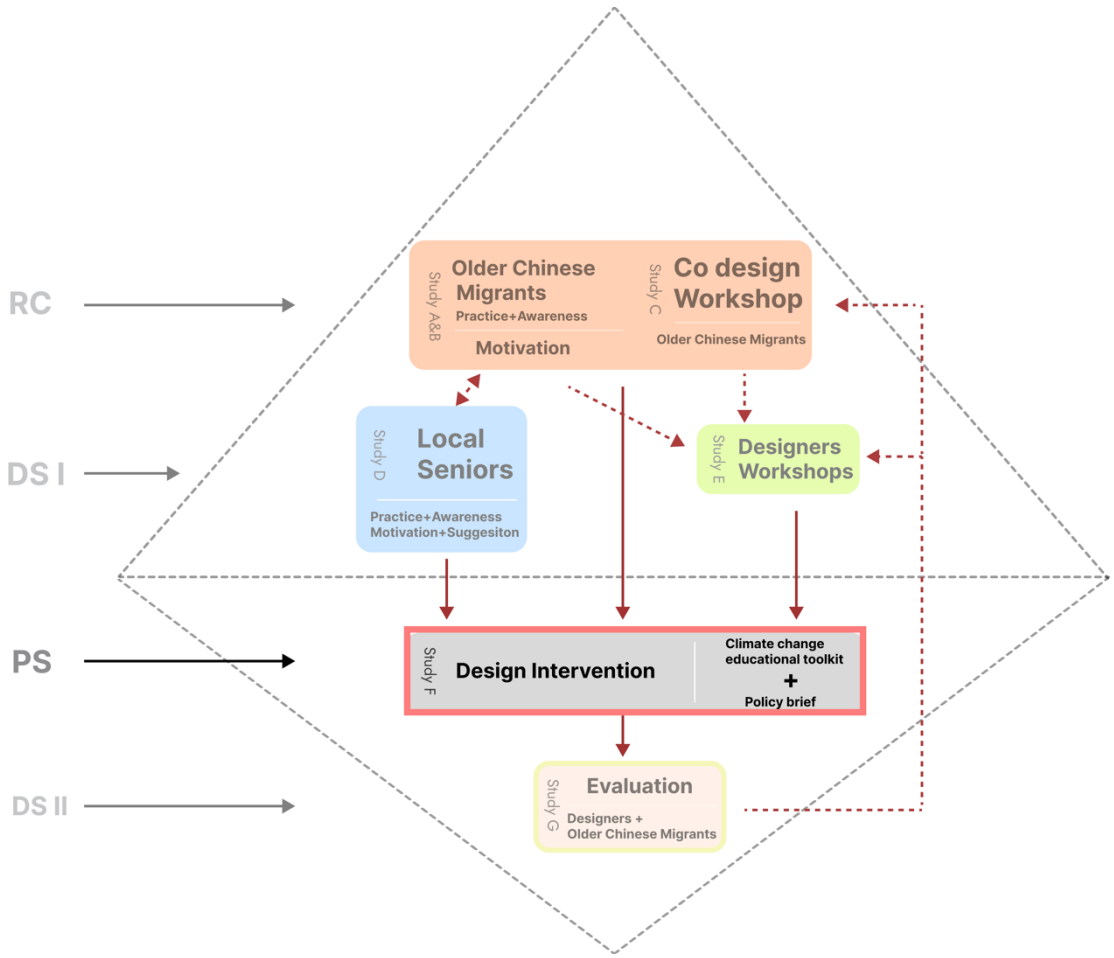


Figure 8.1 Study F as Prescriptive Study (PS).

8.2 Research Background

8.2.1 Climate Change Education and Theoretical Foundations

Traditional educational approaches, such as lectures, brochures, and policy documents, have shown limited success in driving pro-environmental behaviours (Moser & Dilling, 2011b). In response, gamification and serious games have emerged as innovative educational tools that enhance engagement, improve knowledge retention, and encourage sustainable practices (Reckien & Eisenack, 2013; Wu & Lee, 2015).

Theoretical Foundations of Climate Change Education

The primary goal of climate change education is not only to communicate scientific knowledge but also to develop environmental awareness, critical thinking, and behavioural competencies (Monroe et al., 2015). Several key learning theories provided a framework for integrating interactive and game-based approaches into climate education, as shown in Table 8.1.

Table 8.1 Learning theories in climate education.

Theory	Core Concept	Application in Climate Change Education
Constructivist Learning Theory (Waite-Stupiansky, 2022)	Knowledge is actively constructed through experience and interaction, rather than passively received.	Climate games and simulations enable learners to explore climate change impacts through hands-on activities.
Behaviour Change Theory (Ajzen, 1991)	Behavioural change is influenced by attitudes, subjective norms, and perceived behavioural control.	Game mechanics such as **reward systems** and **social influence** can incentivise low-carbon behaviours.
Social Learning Theory (Bandura & Walters, 1977)	Learning occurs through observation, imitation, and social interaction.	Players engage in **role-playing scenarios** that reinforce sustainable behaviours through social dynamics.
Situated Learning Theory (Lave & Wenger, 1991)	Learning is context-dependent and occurs through participation in social environments.	Walking interviews and immersive games provide real-world contexts for understanding climate change.

The Role of Game-Based Approaches in Climate Education

Studies indicate that interactive and gamified learning experiences enhance climate literacy, encourage pro-environmental attitudes, and cultivate empathy towards climate issues (Ahn et al., 2014; Ouariachi et al., 2018). Games offer a structured yet engaging way to bridge the knowledge-action gap by making climate change more relatable, actionable, and participatory (Satyagraha et al., 2025; Sillanpää et al., 2024).

Key game-based elements in climate change education include:

Table 8.2 Game-based elements in climate change education.

Gamification Element	Role in Climate Education
Immersive Experience	Role in Climate Education.
Interactive Learning	Utilises tasks, challenges, and feedback mechanisms to simplify complex climate concepts.
Instant Feedback	Reinforces **positive low-carbon behaviours** through points, rewards, and progress tracking.
Social Influence	Facilitates **intergenerational dialogue** and community engagement, reinforcing collective climate responsibility.

This study developed game-based interventions, incorporating interactive learning, social engagement, and instant feedback into a climate toolkit. The interactive games within the toolkit provided practical, engaging, and culturally relevant means for older Chinese migrants to understand and adopt sustainable behaviours.

8.2.2 Policy Briefs in Climate Communication and Policy Engagement

Policy briefs are widely recognised as effective tools for bridging the gap between academic research and policy implementation. They serve as concise, evidence-based documents that inform decision-makers about pressing issues, providing clear recommendations for action (Cairney & Oliver, 2017).

1) The Role of Policy Briefs in Climate Governance

Effective climate governance requires coordinated efforts across multiple levels, from international agreements to local community actions. Policy briefs help facilitate this process by condensing complex scientific insights into actionable knowledge.

First, they simplify technical findings into accessible, key messages that resonate with policymakers and practitioners (Cairney, 2016).

Second, they help identify policy gaps, drawing attention to areas where current frameworks fall short in addressing changing environmental or societal challenges (Newig et al., 2016).

Third, policy briefs support evidence-based decision-making, grounding public strategies in scientific research rather than short-term political or economic considerations (Haas, 2004).

2) Policy Briefs and Migrant Communities

Migrant communities, particularly older adults, are often overlooked in climate policies despite their unique vulnerabilities and potential contributions to sustainability efforts. Culturally inclusive policy briefs can give migrants a voice and enhance their participation.

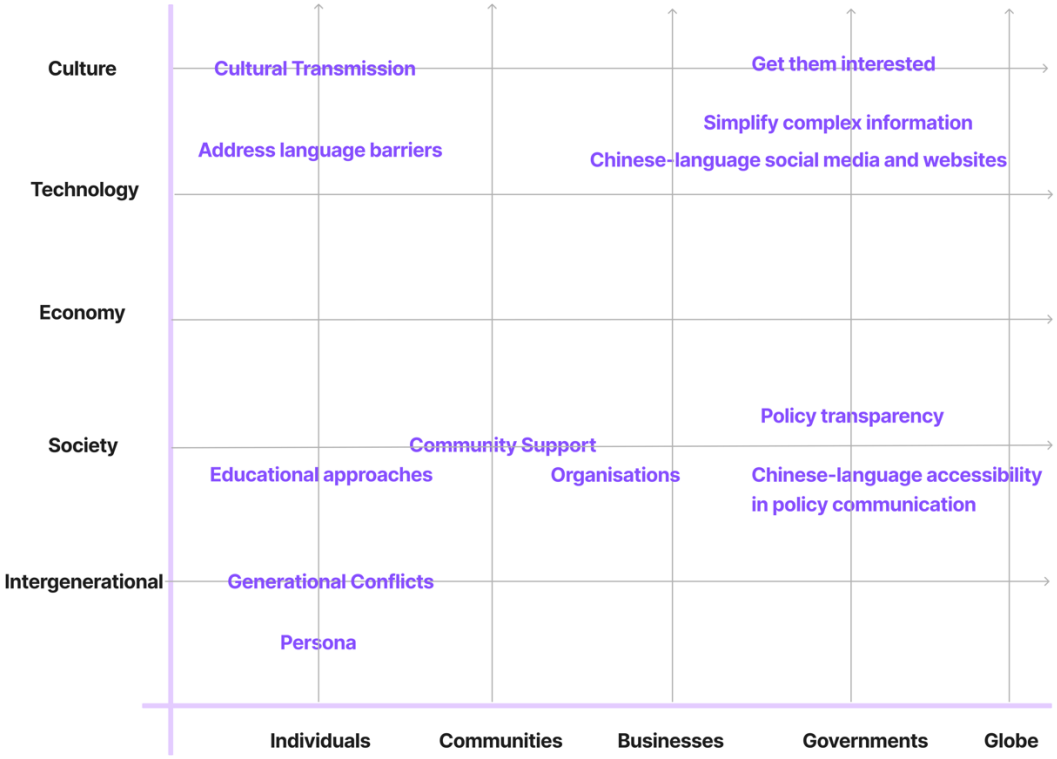
3) Policy Briefs as a Tool for Localised Climate Action

Climate action must be tailored to local contexts, making policy briefs an essential mechanism for advocating place-based strategies. In particular, policy briefs targeting local governments can foster community-led initiatives, ensuring that policies support grassroots sustainability efforts (Bulkeley & Betsill, 2013). They can also encourage intergenerational knowledge sharing (Bjursell, 2015), leveraging older migrants' resource-conscious behaviours to inform climate strategies. They can also strengthen

collaboration among policymakers, businesses, and community groups, ensuring a holistic approach to sustainable development (Meadowcroft, 2009).

8.3 Design reasoning

Figure 8.2 illustrates the findings from Studies A to E and the corresponding intervention recommendations. It demonstrates how initial insights, which were relatively limited, gradually expanded and became more comprehensive, ultimately forming a more systematic intervention strategy map. A large version of Figure 8.2 is available in Appendix (Study F).



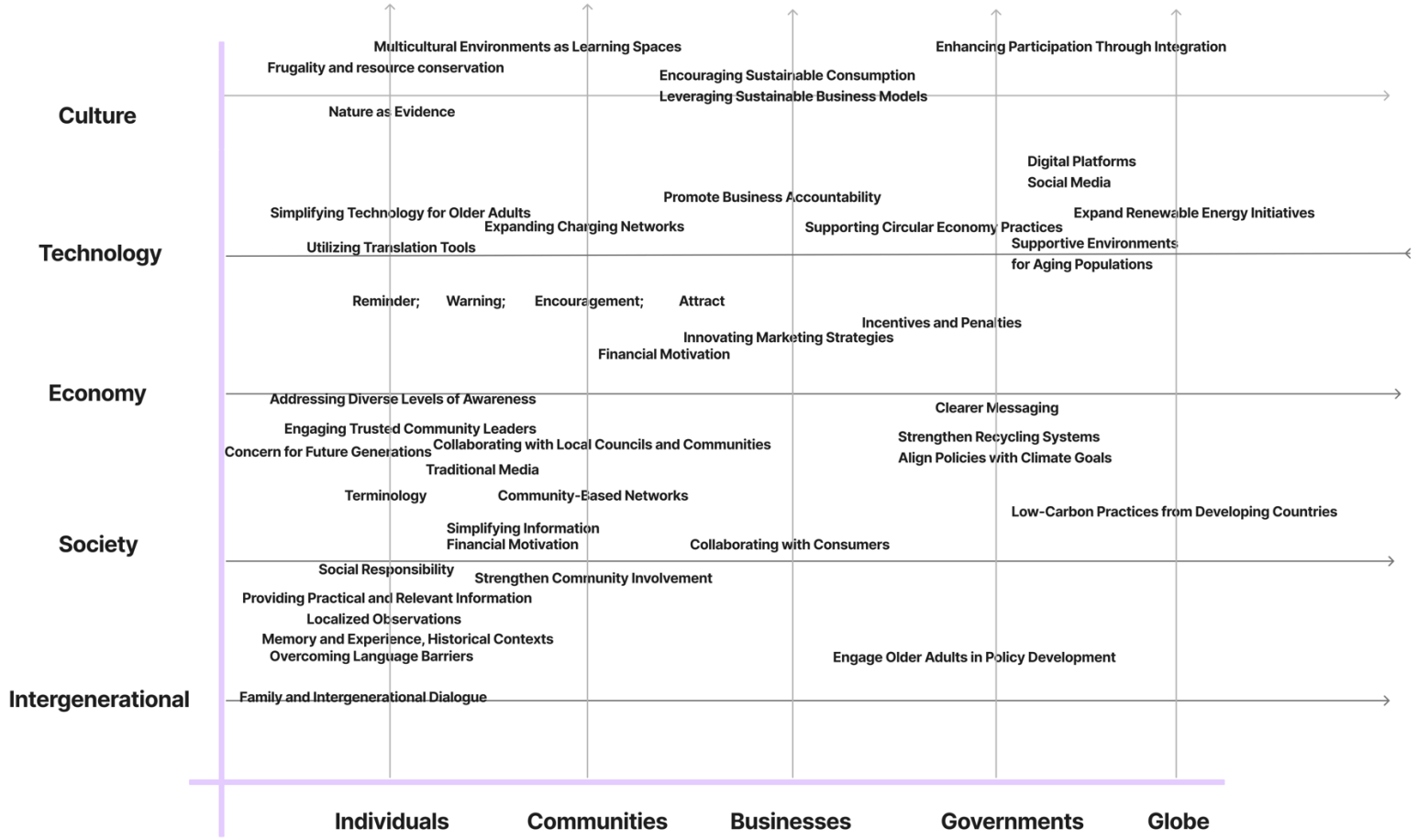
Study A


Culture
Technology
Economy
Society
Intergenerational
Encouraging collective responsibility for environmental sustainability
Promote community-led low-carbon initiatives that align with the cultural values of frugality as sustainability.
Ensure bilingual accessibility of policy information, using culturally relevant messaging that resonates with older Chinese audiences.
Environmental information can be disseminated through Chinese social media platforms (e.g., WeChat, Red) and ethnic media outlets.
Incentive Mechanisms - Highlight practical benefits
Develop targeted campaigns in locations frequented by older Chinese migrants.
Provide easy-to-implement environmental tips tailored to their daily routines and cultural habits.
Strengthen the link between low-carbon behaviours and migrant identity
Behaviour Reinforcement-social recognition
Share personal stories of resourcefulness and conservation to inspire broader participation in sustainability efforts.
Governments should collaborate with Chinese community organisations and media to deliver clear, transparent messages on net zero policies.
Intergenerational Communication and Family-Based Environmental Education
Individuals
Communities
Businesses
Governments
Globe

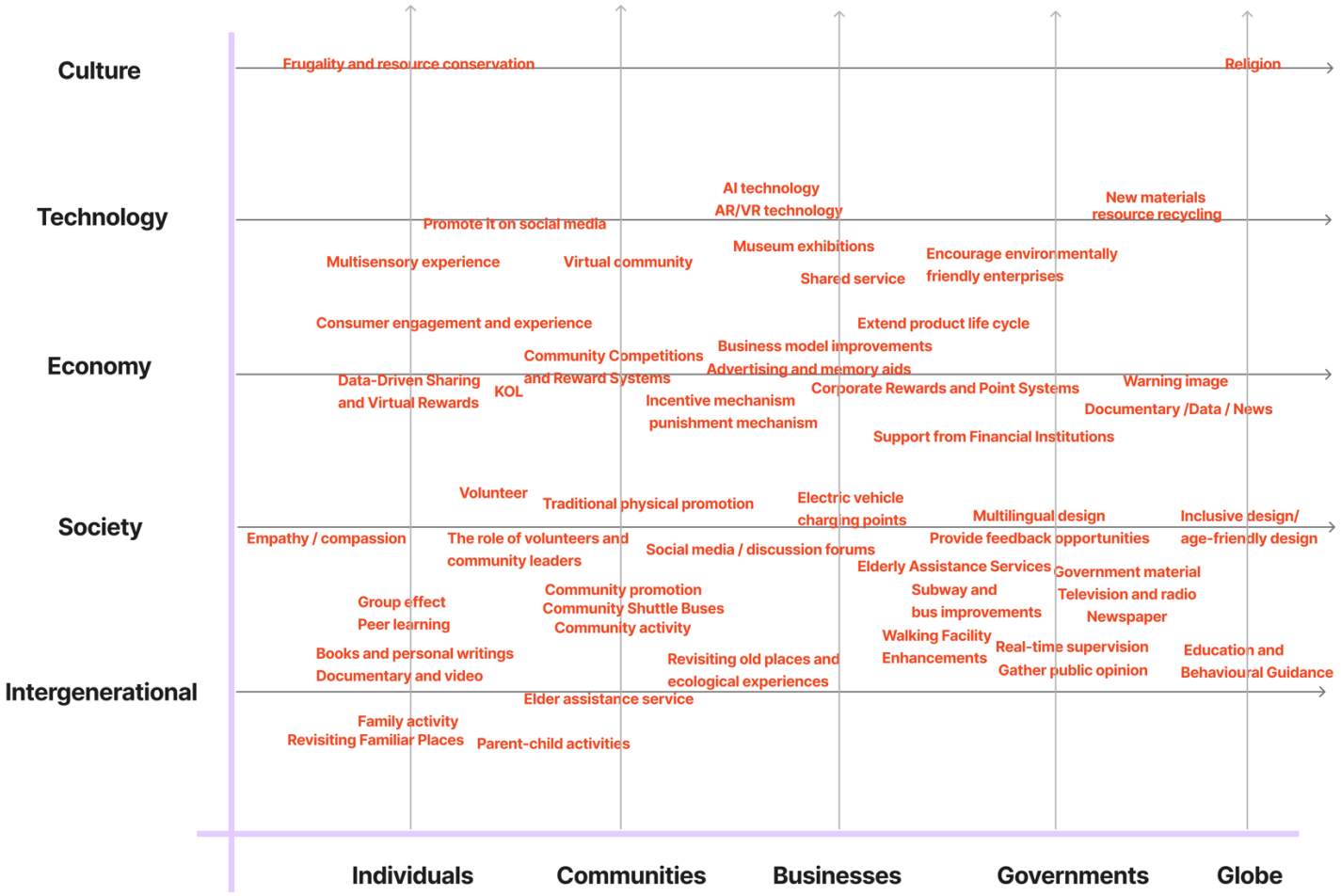
Study B


Culture
Technology
Economy
Society
Intergenerational
Influence on younger relatives through thrift and sustainability values.
Community hubs and religious spaces as trusted centres for climate messaging.
Businesses incorporating cultural values into sustainability campaigns.
Policy tailored to cultural habits of older migrants.
International collaborations addressing cultural sustainability.
Digital literacy gap among older adults; reliance on family for tech support.
Digital platforms like WeChat used for community-based learning.
Global tech initiatives to bridge digital access disparities.
Budget-friendly sustainability actions at home (e.g., thrift, waste reduction).
Policy incentives for low-carbon initiatives targeting migrant communities.
Skills exchange programs fostering intergenerational knowledge transfer.
Local partnerships for targeted outreach (e.g., brochures, events).
Home-based activities: reading news, cooking, gardening, family care.
Social roles in community spaces: advocacy, engagement in low-carbon initiatives.
Teaching younger relatives about thrift, climate-friendly habits.
Cross-generational workshops for collaborative learning.
Media campaigns bridging generational perspectives on climate action.
Policy consultation with intergenerational community input.
Individuals
Communities
Businesses
Governments
Globe

Study C


Culture
Technology
Economy
Society
Intergenerational
Individuals
Communities
Businesses
Governments
Globe
Multicultural Environments as Learning Spaces
Enhancing Participation Through Integration
Frugality and resource conservation
Encouraging Sustainable Consumption
Leveraging Sustainable Business Models
Nature as Evidence
Digital Platforms
Social Media
Promote Business Accountability
Simplifying Technology for Older Adults
Expand Renewable Energy Initiatives
Expanding Charging Networks
Supporting Circular Economy Practices
Supportive Environments
Utilizing Translation Tools
for Aging Populations
Reminder;
Warning;
Encouragement;
Attract
Incentives and Penalties
Innovating Marketing Strategies
Financial Motivation
Addressing Diverse Levels of Awareness
Clearer Messaging
Engaging Trusted Community Leaders
Strengthen Recycling Systems
Concern for Future Generations
Collaborating with Local Councils and Communities
Align Policies with Climate Goals
Traditional Media
Terminology
Community-Based Networks
Low-Carbon Practices from Developing Countries
Simplifying Information
Financial Motivation
Collaborating with Consumers
Social Responsibility
Strengthen Community Involvement
Providing Practical and Relevant Information
Localized Observations
Memory and Experience, Historical Contexts
Overcoming Language Barriers
Engage Older Adults in Policy Development
Family and Intergenerational Dialogue

Study D



Study E

Figure 8.2 Building up the Intervention Strategy.

In various studies, certain perspectives overlap. To gain a more systematic understanding of their respective roles and priorities, these climate-related opportunities were categorised. Two methods were considered in compiling all the suggestions from studies A-E.

Classification Method 1: Thematic Organisation (e.g. culture, economic, community)

1) Cultural Adaptation and Information Dissemination

- Cultural Transmission
- Address Language Barriers
- Simplify Complex Information
- Chinese-Language Social Media and Websites
- Terminology
- Use of Traditional Media
- AI and Translation Tools
- Multilingual, Inclusive, and Age-Friendly Design

2) Community Support and Policy Communication

- Community Hubs and Religious Spaces as Trusted Centres for Climate Messaging
- Chinese-Language Accessibility in Policy Communication
- Community Promotion
- Policy Transparency
- Local Partnerships for Targeted Outreach
- Engaging Trusted Community Leaders (KOLs)
- Opportunities for Feedback
- Engaging Older Adults in Policy Development

3) Intergenerational Interaction and Family Education

- Generational Conflicts
- Influence on Younger Relatives
- Family and Intergenerational Dialogue
- Passing on Low-Carbon Lifestyles to Younger Generations
- Skills Exchange Programmes for Intergenerational Knowledge Transfer
- Cross-Generational Workshops for Collaborative Learning
- Media Campaigns Bridging Generational Perspectives on Climate Action

4) Low-Carbon Behaviour Incentives and Interventions

- Encouraging Sustainable Consumption
- Reinforcing Pro-Environmental Behaviours via Social Recognition
- Incentive Mechanisms (Corporate Rewards, Points Systems)
- Financial Motivations, Incentives, and Penalties

- Highlighting Practical Benefits
- Community Competitions and Reward Systems
- Shared Services and Circular Economy Practices
- Resource Recycling
- Promoting Low-Carbon Initiatives Aligned with Frugality as a Cultural Value

5) Digital Engagement and Technological Innovation

- Digital Literacy Gap among Older Adults
- Reliance on Family for Tech Support
- Social Media and Digital Platforms (WeChat, Discussion Forums)
- Gamification, AR/VR Technology, Multisensory Experience, Virtual Communities
- Online Educational Resources (Community-Based Learning, Museum Exhibitions)
- Data-Driven Sharing and Virtual Rewards

6) Sustainable Mobility and Infrastructure

- Improvements to Walking Facilities
- Enhancements to Subways and Buses
- Community Shuttle Buses
- Expanding Networks for Electric Vehicle Charging Points

7) Climate Education and Social Responsibility

- Enhancing Climate Awareness through Stories and Personal Experience
- Using the Natural Environment as Tangible Evidence
- Global Exchanges of Low-Carbon Practices
- Corporate Sustainability Responsibility
- Raising Awareness via Volunteering, Traditional Physical Promotion, and Community Activities
- Documentaries, Books, Data, News, and Personal Writings
- Gathering Public Opinion
- Parent-Child Environmental Activities

Classification Method 2: By Time Frame (Short-Term vs. Long-Term)

In addition to thematic organisation, the findings from Studies A–E are also categorised by implementation timeframe, distinguishing between short-term (1–2 years) and long-term (3–5 years and beyond) goals. This categorisation highlights the temporal dynamics of design and policy interventions. The classification method by the frames is illustrated by Table 8.3.

Table 8.3 Short-term and Long-term Goals for Promoting Net-Zero Engagement Among Older Chinese Migrants.

Category	Short-term Goals (1–2 years)	Long-term Goals (3–5 years and beyond)
Cultural Adaptation & Information Dissemination	Provide policy information in Chinese and improve the readability of climate content on social media (e.g., WeChat, traditional media).	Foster cross-cultural dialogue to enhance older migrants' understanding of policies.
Community Support & Policy Outreach	Establish community-based environmental awareness points and provide low-carbon lifestyle guides.	Develop long-term collaboration mechanisms among the government, Chinese communities, and businesses.
Intergenerational Interaction & Family Education	Organise intergenerational exchange activities to facilitate knowledge-sharing on environmental issues between older and younger generations.	Establish ongoing environmental education programs in schools and community projects.
Low-Carbon Behaviour Incentives & Interventions	Launch small-scale incentive programs (e.g., eco-points, discount vouchers).	Develop culturally-driven low-carbon communities where sustainable consumption becomes a daily habit.
Digital Engagement & Technological Inclusion	Provide digital literacy training to help older adults adapt to social media and mobile applications.	Promote technological inclusivity and enhance older migrants' ability to use smart technologies.
Sustainable Mobility & Infrastructure	Offer walking guides and community shuttle services to improve public transport accessibility.	Expand sustainable transport infrastructure, such as shared mobility options and EV charging stations.
Climate Education & Social Responsibility	Increase environmental awareness through documentaries, books, and social media.	Influence policy-making and position Chinese communities as pioneers in sustainable development.

Short-term objectives can be realised through educational interventions and collaboration with media outlets and community groups. By contrast, long-term

goals require broader societal and governmental direction, incorporating public opinion and ultimately bringing about a shift in social norms.

8.3.1 Selecting and Developing the Design Interventions: From Concept to Practice

In the process of designing interventions for this study, multiple potential approaches were evaluated and refined. Ultimately, an Intervention Toolkit and a Policy Brief were chosen as the key vehicles of intervention. This selection was informed by a feasibility assessment carried out over the course of the doctoral research, a needs analysis focusing on the target population, theoretical underpinnings, and an in-depth understanding of low-carbon behavioural patterns among older Chinese migrants. This section addresses three primary questions:

Study F:

- How are design options prioritised?

8.3.2 Selecting the Most Feasible Interventions

During the initial phases of the design research, a variety of potential pathways for intervention were explored.

Criteria for Selecting Feasible Interventions are illustrated in Figure 8.3:

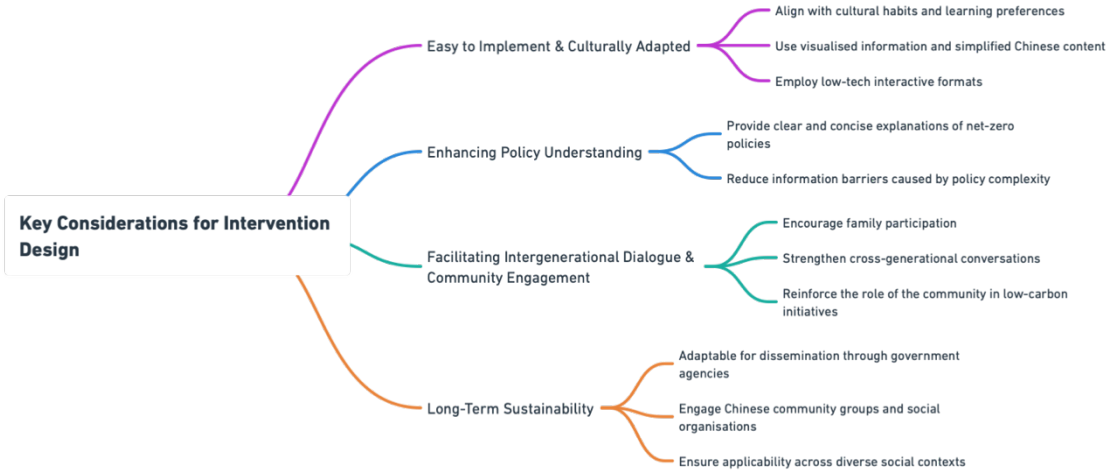


Figure 8.3 Key Considerations for Intervention Design.

8.3.3 Selecting the "Design Intervention Toolkit" and the "Policy Brief"

As this research progressed, a systematic set of interventions and policy recommendations was gradually developed to enhance older Chinese migrants' understanding of net zero policies and to empower their voice in climate action. Based

on Studies A–E, two complementary outputs – a design intervention toolkit and a policy brief were selected as final deliverables.

Studies A & B: Enhancing Awareness

Key Findings:

1) Many older migrants had limited comprehension of "net zero," being more familiar with the term "climate change."
2) Their low-carbon practices often arose from a culture of frugality rather than from policy-driven environmental awareness.
3) Language barriers and restricted access to information channels inhibited their understanding of climate policies.

These findings underscored the need for multi-level actions on climate change, both top-down government policies and bottom-up community engagement. However, older Chinese migrants are frequently overlooked in mainstream environmental policies due to language barriers, cultural differences, and limited communication pathways.

Study C: Strengthening Older Migrants' Contribution in the Home, Community, and Policy Arenas

Key Findings:

1) Many older Chinese migrants wished to participate in climate action but lacked suitable channels of communication.
2) Family and community networks played a crucial role in their information-sharing and environmental behaviours.
3) Intergenerational communication barriers persisted, with older and younger generations having differing priorities and approaches to sustainability.

Corresponding Interventions:

1) Interactive Games (puzzles, conversation cards, turntables, origami exercises): to encourage family members to learn together in a more enjoyable and engaging way.
2) Storytelling & Real-Life Examples: linking climate action to personal migration experiences, thereby making low-carbon choices more relatable.

Studies D & E: Using the Policy Brief to Advance Climate Action and Policy Reform among Older Migrants

Key Findings:

1) Inadequate Policy Adaptation: Current climate policies lacked language and cultural considerations, rendering them inaccessible to older migrants.

2) Mismatch in Communication Channels: Government campaigns mostly relied on mainstream media and digital platforms, whereas older migrants depend on community networks, word-of-mouth, Chinese newspapers, and radio broadcasts. This led to a disconnect in outreach.
3) Older Migrants Already Practice Low-Carbon Lifestyles: Habits of thrift and reusing resources were deeply ingrained, but not recognised or harnessed in mainstream policies. The government could leverage these cultural strengths, promoting more inclusive low-carbon policies within migrant communities and reinforcing grassroots climate action.
4) Policy Transparency: Gaps in policy implementation and monitoring mechanisms could undermine trust and efficacy.

Proposed Policy Actions:

1) Improve Policy Communication: Ensure multilingual accessibility of climate policies and collaborate with Chinese community groups to optimise message delivery.
2) Foster Intergenerational Environmental Education: Incorporate family-focused learning models, enabling older adults and younger generations to jointly explore sustainability concepts.
3) Enhance Policy Transparency: Strengthen oversight and feedback mechanisms to translate policy intentions into real-world impact.
4) Create Co-Creation Platforms: Invite older migrants directly into policy formulation processes, ensuring culturally appropriate solutions.

Through a series of design-led interventions, this study offered two complementary strategies to foster the better integration of Chinese migrant communities into the UK's net zero initiatives. As illustrated later, both the **Design Intervention** and the **Policy Brief** were deployed in the final stage of the research to influence behaviour change and amplify impact. Figure 8.4 shows the expected interventions at this stage.

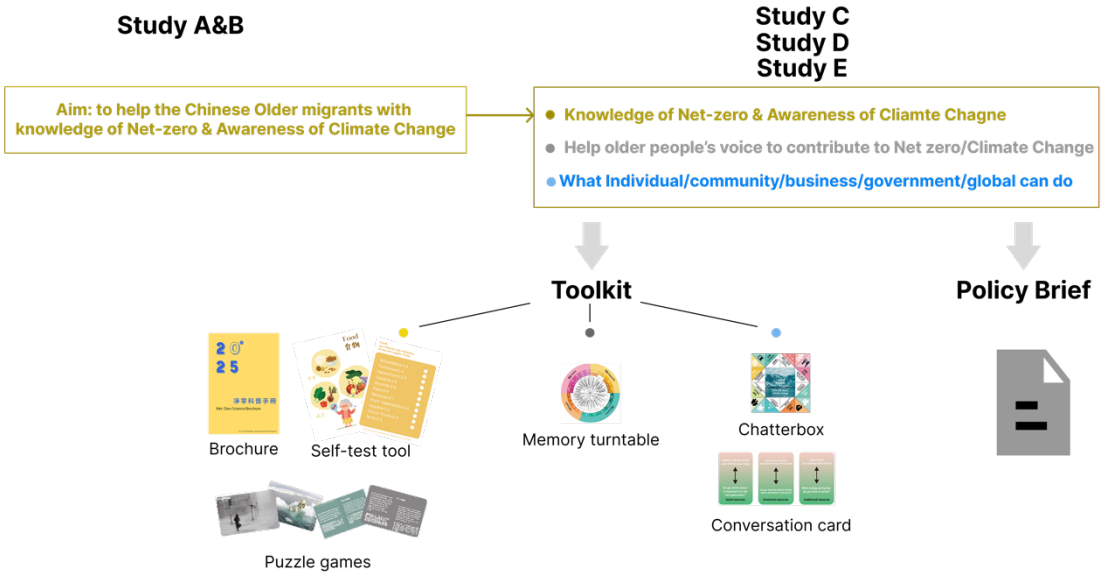


Figure 8.4 Design interventions based on Studies A-E.

1) Climate Toolkit Key Design Principles

This Climate toolkit aimed to help older Chinese migrants comprehend climate policies and enhance environmental engagement through interactive methods.

Straightforward and Accessible

Older Chinese migrants often have limited acceptance of purely text-based materials. Hence, the toolkit utilised games, interactive cards, and visually engaging manuals, making the learning process more interactive and enjoyable.

Intergenerational Interaction

By incorporating conversations, puzzles, and turntable games, the toolkit fosters communication between grandparents and grandchildren. Younger family members become conduits for knowledge transfer, thereby raising older adults' environmental awareness.

Cultural Alignment

Drawing on traditional values such as frugality, family obligations, and community support, the toolkit integrated low-carbon actions with existing migrant lifestyles to boost acceptance and relevance.

Cross-Context Application

Designed for use in domestic settings, community events, or study groups, the toolkit had a broad social reach.

Toolkit Contents

- **Bilingual Brochures**: Simplify policy concepts through visual aids and case studies, enabling migrants to grasp net zero more accessible.

- **Carbon Footprint Self-Assessment Card**: Links daily habits (e.g., energy saving, water conservation, and transport choices) to climate impact, enabling users to gauge their personal carbon emissions.
- **Interactive Games**: Through puzzles, chatterbox, turntable activities, and intergenerational conversation cards, participants could discuss climate challenges and their own low-carbon practices in familial and social settings.

Modes of Implementation

- **Individual Level**: Used at home for learning and discussing environmental topics; self-assessment cards and games encourage users to become aware of their carbon footprint.
- **Community Activities**: Applied in Chinese cultural centres, religious gatherings, and social events, enhancing group-based learning and mutual exchange.
- **Social Media Outreach**: Promoted via WeChat and other Chinese-language media channels to increase coverage.
- **Policy Level**: Government entities can integrate these tools to improve older migrants' acceptance and uptake of net zero policies.

Despite its focus on personal, familial, and community interactions, the toolkit alone cannot fully address policy gaps. Therefore, a policy brief was also developed.

2) Policy Brief

The policy brief was directed at local governments and city councils, presenting research-driven policy recommendations to optimise policy outreach and strengthen environmental participation among migrant communities. By advocating bilingual policy dissemination and culturally adapted environmental campaigns, the brief suggested dedicating resources towards initiatives that involve older migrants.

Grounded in findings from Studies A–E, it offered evidence-based recommendations to refine climate measures, ensuring they reflect the needs of Chinese migrants.

8.3.4 Core Design Principles

Building on the insights gleaned from earlier stages, this study's intervention framework incorporated seven key principles, includes cultural adaptability (Adger et al., 2013; Marcus et al., 2000), relevance (Corner & Clarke, 2016; Lave & Wenger, 1991), interactivity (Barker, 1994), collaboration (Cumbo & Selwyn, 2022), operability (Issa & Isaias, 2022), shareability (Bruno et al., 2023), and reflexivity (Visser, 2010), to create climate education and policy communication tools that catered specifically to older Chinese migrants.

Table 8.4 outlines how these core principles were embedded into specific design features and how they address corresponding challenges.

Core Element	Specific Design Strategies	Challenges Addressed
Cultural Adaptability	Use of Chinese-language content (Simplified/Traditional). Incorporation of traditional Chinese values (e.g., frugality, family, and intergenerational support).	Language barriers and low English proficiency. Cultural differences leading to low uptake of mainstream climate information.
Relevance	Leveraging cultural identity, personal experience (e.g., from the past), and future aspirations to situate climate action in a meaningful context.	Ensuring that climate messaging resonates with older migrants' lived experiences, thereby bridging abstract policies with personal and cultural significance.
Interactivity	Chatterbox, puzzles, turntables, and other low-carbon learning tools. Conversation cards to promote cross-generational dialogue.	Traditional environmental education can be perceived as dull. Lack of intergenerational engagement in low-carbon behaviour.
Collaboration	Promoting playful, creative thinking (e.g., group tasks that spark imagination). Facilitating collective idea generation through co-design or workshop activities.	Engaging older adults often requires inclusive, hands-on collaboration. Encouraging creative synergy in climate-related discussions and initiatives.
Operability	Carbon Footprint Self-Assessment Card to help individuals evaluate their environmental behaviour Community guides offering practical low-carbon tips.	Difficulty in comprehending policy texts. Lack of clear guidance on how to adopt more sustainable lifestyles.
Shareability	Designing materials that are easy to distribute (e.g., small, printed leaflets, digital versions on social media), enabling widespread dissemination across families and communities.	Ensuring that tools and resources can be circulated within migrant networks for broader impact, particularly among those less engaged with mainstream channels.

Reflexivity	Cultivating empathy and curiosity. Encouraging participants to explore and question different stances on climate change.	Allowing room for personal reflection on climate impacts. Encouraging older migrants to reconsider their own habits in light of changing environmental realities.

8.4 Methods

This study was informed by inclusive design principles, supplemented by gamification strategies and interdisciplinary collaboration, to develop a climate toolkit tailored for older Chinese migrants. A policy brief was also developed to translate the design insights into policy recommendations for local governments. Study F did not involve a new formal participant sample. The development of the toolkit and policy brief drew on anonymised findings from earlier ethically approved studies. Ethical considerations in this phase focused on the responsible translation of participant insights into design materials, avoiding stereotypical representations of older Chinese migrants, and ensuring that the toolkit materials were accessible, respectful, and culturally appropriate.

1) Inclusive Design

Inclusive Design emphasises meeting the needs of diverse user groups during product and service development, thereby minimising social exclusion (Coleman et al., 2016). In this study, its application manifested in the following ways:

- **Linguistic and Cultural Adaptation**: All toolkit materials are bilingual and incorporate culturally resonant values such as thriftiness and family care, enhancing readability and context.
- **Low Technological Barriers**: Recognising that many older migrants experience barriers related to language, platform familiarity, and information accessibility (Dijk van Jan, 2006; Norris, 2003), the toolkit relies on physical games, printed materials, and community-based activities rather than solely digital platforms. While participants actively use familiar platforms such as WeChat for short videos, information sharing, and discussion, they are less likely to engage with English-language websites or text-heavy digital resources. This approach therefore reduces reliance on less accessible digital formats while aligning with participants' existing communication practices.

- **Cost-Effectiveness**: Most resources were delivered in print form, reducing acquisition and learning costs.
- **Intergenerational Interaction and Reduced Ageism**: The toolkit promoted interaction between older adults and younger generations, encouraged knowledge exchange across age groups, and fostered community-based environmental dialogue. The interactive games allowed participants of different backgrounds and ages to engage on an equal footing rather than placing older people in a passive learning role.

2) Gamification

Gamification entails the application of game elements and mechanisms in non-gaming contexts, thereby enhancing user engagement and the overall learning experience (Deterding et al., 2011). This study utilised gamification strategies to stimulate older migrants' interest in net zero policies and low carbon living, specifically through:

- **Interactive Learning**:
  By designing puzzle games, chatterbox, and turntable discussions, older adults can learn about low-carbon practices in an engaging and unintimidating setting, mitigating challenges posed by complex policy terminology.
- **Instant Feedback**:
  Tools like the Carbon Footprint Self-Assessment Card provide a direct visual representation of the environmental impact of daily activities, motivating behavioural adjustments from a "see-your-impact" perspective.
- **Social Influence**:
  Group-based games foster communication among peers, family members, and community groups, promoting the spread of sustainable practices through social interaction.
- **Storytelling**:
  Many of the game themes and personal narratives used in the toolkit allow older migrants to link climate change to their own life stories. For instance, the "topic turntable" activity draws on childhood memories of thrift, prompting reflection on the real-world significance of low-carbon behaviours.
- **Empathy Induction**:
  Discussions involving multiple sensory experiences (images, sounds, recollections) help participants recognise the effects of climate change on themselves and future generations. In the Climate Change Conversation Cards, for example, both older and younger participants ask questions from a position of mutual respect, enhancing emotional investment and a sense of responsibility.

- **Behavioural Nudging**:
  Through mechanisms such as community competitions, rewards, and public recognition, older people are encouraged to incorporate low-carbon actions into their daily lives. Sharing sustainable practices via WeChat groups or at community centres can further reinforce these behaviours.

3) Interdisciplinary Collaboration

This approach employed an interdisciplinary collaborative model, bringing together experts in design and policy research to create interventions that were not only engaging but also institutionally relevant. For example, they collaborated with policymakers to ensure that the content of the policy brief was effectively communicated to local councils and other relevant departments. Secondly, they could partner with community organisations, such as Chinese community associations and religious institutions, to encourage adoption of the toolkit in settings where older people already have trust. Alternatively, they could collaborate with designers. Design professionals could refine the gamification toolkit based on identified user needs to enhance its appeal and usefulness.

Moreover, Human-Centred Design (HCD) serves as a foundational principle for these interventions (Norman & Draper, 1986; Sanders & Stappers, 2008), bridging the gap often found in climate communication, which tends to rely heavily on scientific language rather than personal experience. By placing user needs and experiences at the core, the toolkit and policy brief were not only suitable for individual learners but also well-suited to community centres, family gatherings, and wider Chinese social events, so it amplifies group motivation. In doing so, older people progress from merely being "learners" to becoming active stewards of cultural knowledge, family mentors, and engaged contributors to community climate initiatives, thus reinforcing their sense of belonging and self-worth.

8.5 Design Intervention Outcome

8.5.1 Net Zero Brochure

The **Net Zero Brochure** (Figure 8.5) is one of the key design interventions developed to support older Chinese migrants in understanding net zero policies and climate change. The brochure served as an accessible, culturally relevant, and visually

engaging educational tool that simplified complex environmental concepts and promoted sustainable practices.

1) Design Rationale

The brochure was designed to address key challenges faced by older Chinese migrants when engaging with climate policies:

- Language Barriers: Many older migrants struggle with English-language policy documents. The brochure provided simplified Chinese translations to improve accessibility.
- Information Complexity: Climate change policies often involve technical jargon. The brochure broke down key concepts using plain language, visuals, and real-life examples.
- Trust and Credibility: Older migrants rely on trusted community sources for information. The brochure included references to familiar Chinese-language sources to enhance credibility.
- Cultural Relevance: The content connected low-carbon behaviours with traditional values such as frugality, resourcefulness, and community well-being, making sustainability personally meaningful.

2) Key Content Features

- Clear and Concise Explanation of Net Zero

The brochure explained the concept of net zero emissions using simple, non-technical language. It provided real-life examples of how climate change was affecting daily life, making the issue more tangible and personally relevant.

- Actionable Low-Carbon Tips for Everyday Life

It included practical suggestions on energy saving, waste reduction, sustainable shopping, and transportation choices. The recommendations align with existing behaviours of older Chinese migrants, such as reusing materials, reducing food waste, and saving electricity.

- Resources and Community Support Information

The brochure directs readers to Chinese-language support networks, government initiatives, and local community programmes. This ensures that older migrants can access further assistance and engage in community-led sustainability efforts.

- Visual and Interactive Design

The layout featured icons, infographics, and visual cues to make information easier to navigate. Large fonts and high-contrast colours catered to older people' reading needs.



Figure 8.5 Net Zero Brochure (example pages).

8.5.2 Carbon Footprint Self-Assessment Tool

The Carbon Footprint Self-Assessment Tool (Fig 8.6)is part of the design intervention. It aimed to help older Chinese migrants measure the environmental impact of their daily activities and provided data to encourage low-carbon lifestyles. By using data visualisation, behavioural feedback, and personalised assessment, this self-assessment tool made it easier for the target group to understand and modify their own environmental actions.



Figure 8.6 Carbon Footprint Self-Assessment Tool.

1) Design Rationale

The rationale behind the tool stems from earlier findings that older migrants often lack a clear understanding of the concept of "carbon footprint" and are instead motivated by tangible, data-driven evidence of their personal impact.

- Raise Awareness of Carbon Emissions: By showing specific emission numbers for different foods, transport modes, and housing types, users can see how their everyday choices affect the environment.
- Promote Behavioural Change: Backed by data, this tool nudges users towards more sustainable options, such as eating less high-carbon food or choosing low-carbon travel.
- Increase Understanding of Carbon Footprints: Some Chinese migrants may be unfamiliar with the idea of a carbon footprint. With simple explanations and calculations, they can realise how their personal emissions contribute to overall environmental impact.

2) Content

- Food: Lists the greenhouse gas emissions (kg CO_2e per kilogram of food) for common foods. Compares high-emission items (e.g., beef at 60 kg CO_2e/kg, lamb at 24 kg CO_2e/kg, cheese at 21 kg CO_2e/kg) with low-emission foods (e.g., fruits at 0.4 kg CO_2e/kg, nuts at 0.3 kg CO_2e/kg, beans at 0.9 kg CO_2e/kg). By showing this contrast, users become more aware of how different foods contribute to carbon emissions and can adjust their diets (e.g., reducing red meat and increasing plant-based meals).
- Transport: Presents CO_2e per person per kilometre for various transport modes. Highlights high-emission options (e.g., short-haul flights at 255 g CO_2e/km, medium petrol cars at 192 g CO_2e/km) versus low-emission ones (e.g., Eurostar rail at 6 g CO_2e/km, walking at 0 g CO_2e/km). Encourages older migrants to limit high-carbon travel, promoting public transport, walking, or cycling instead.
- Home: Home: Helps users estimate the carbon impact of their current living conditions (e.g. flats or detached houses) based on energy use. Rather than encouraging users to change housing types, this feature supports awareness by showing how everyday consumption (e.g. heating, electricity, and water use) contributes to emissions, enabling users to reflect on their habits and identify practical ways to reduce energy use within their existing homes.

3) Key Features

- Data Visualisation: Uses clear numbers and charts to simplify complex carbon data. Let users assess their high-emission habits (food, transport, home) and identify areas for change.

- Instant Feedback: Offers direct comparisons (e.g., beef vs. nuts, short-haul flights vs. high-speed rail) so users can immediately see the impact of their choices. This immediate feedback can boost environmental awareness and encourage low-carbon behaviour.

4) Research Significance

The Carbon Footprint Self-Assessment Card focused on gamified learning and behaviour change. Through interactive learning, older migrants could explore their own carbon footprints rather than merely absorbing facts. The instant feedback then helped users recognise the environmental consequences of their actions and fostered greater motivation to adopt low-carbon practices.

8.5.3 Climate Change Puzzle

The Climate Change Puzzle was designed as an interactive, printable toolkit to support older Chinese migrants in understanding climate change and net-zero concepts. Rather than functioning as a static visual, the puzzle consists of individual cards that can be printed, cut out, and physically arranged, enabling hands-on and collaborative learning. This intervention draws on gamification and interactive learning strategies to enhance engagement, understanding, and knowledge retention.

1) Design Rationale

- Educational Goal: To provide a visually engaging way to understand the causes and effects of climate change.
- Interactive Engagement: By encouraging participants to match different components (images and text) correctly, the game fosters active learning.
- Cognitive Stimulation: Designed for older adults, the puzzle encourages problem-solving, memory recall, and information processing.
- Social Interaction: The activity can be completed collaboratively, promoting discussion and knowledge-sharing within families and communities.

2) Content

The puzzle consisted of two thematic categories:

- Causes of Climate Change: Factors like urban pollution, fossil fuel consumption, deforestation, and industrial manufacturing.
- Effects of Climate Change: Phenomena such as global warming, extreme weather, water shortages, biodiversity loss, and poverty.

Each puzzle piece contains real-world images illustrating the environmental issue, and scientific statistics and figures explaining the impact. Also bilingual Explanation, such

as Chinese and English text to ensure accessibility for older Chinese migrants.Chinese migrants.

3) Gamification Elements

- Immersive Learning: Participants physically engage with the puzzle, reinforcing their understanding through hands-on experience.
- Social Learning: Encourages intergenerational learning as younger family members can help explain concepts to older adults.
- Immediate Feedback: Players can quickly recognise correct and incorrect matches, reinforcing learning in real-time.

4) Broader intervention strategies

This puzzle complements the Net Zero brochure by providing a more interactive alternative to text-based materials. It is suitable for use in workshops, family discussions, and community learning settings, supporting dialogue and collective reflection on climate issues.

The toolkit comprises individual printable cards designed to be cut out and used interactively; text is not intended to be read at this scale.

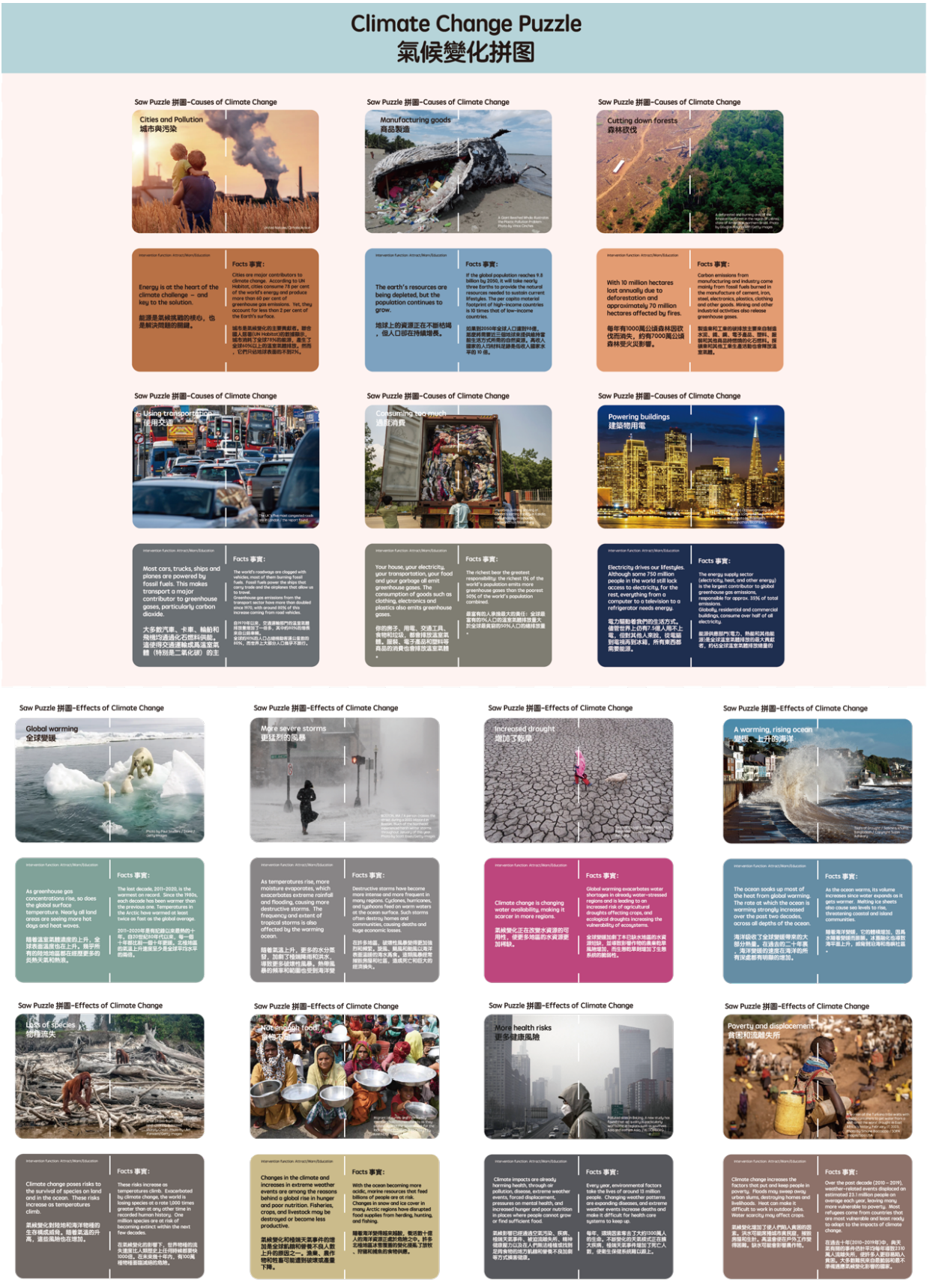


Figure 8.7 Overview of the Climate Change Puzzle in its assembled form.

8.5.4 Climate Change Memory Turntable

The Climate Change Memory Turntable (Fig 8.8) to help older Chinese migrants understand climate change on a more personal level and to encourage family and community dialogue. Many older migrants approach environmental issues by drawing on personal experiences, family values, and cultural traditions, rather than focusing on large-scale climate data or policies. This design therefore guided users to reflect on personal memories, sensory experiences, family interactions, and historical shifts, helping them build an emotional understanding of climate change while offering topics for intergenerational exchange.

1) Design Rationale

Gamified learning and situated learning were used to boost user engagement. Sensemaking Theory (Weick, 1995) offers a framework explaining how people interpret new information through past experiences and social interactions. For older migrants, climate change can be an abstract idea; however, by recalling childhood memories and contrasting past and present lifestyles, they can perceive environmental changes more directly.

In addition, research on intergenerational learning indicates that interactions between older adults and younger generations regarding sustainable behaviour help transmit knowledge and values. Consequently, the turntable was designed not just as a personal memory tool; it also encouraged grandparents, parents, and grandchildren to discuss low-carbon behaviours from everyday perspectives.

2) Content

The turntable is structured into four primary thematic domains—Feeling, People, Geography, and History—each represented by a distinct colour and organised into sub-categories that guide different types of reflection. Within each segment, participants encounter open-ended questions designed to prompt personal narratives and experiential recall.

• Feeling (Sensory Experiences)

This domain focuses on embodied and sensory memories, including vision, auditory experience, smell, temperature, humidity, and food-related perceptions. Example prompts include: “Were winters colder in the past?”, “Is our air moist enough? ”, “What do the flowers or trees smell like? ”, and “Is the food different from when you were young? ”. These questions encourage participants to reflect on climate through lived, sensory experience, grounding abstract environmental changes in everyday perception.

• People (Social Relationships)

This category explores interpersonal and intergenerational relationships, including grandparents, parents, friends, colleagues, children, and partners. Example prompts include: “What was your grandparents’ life like in the past?”, “Do you remember your parents’ cooking?”, “Did your friends talk about climate change?”, and “Does your child care about climate change?”. By situating climate-related reflection within social contexts, this domain facilitates the sharing of memories and values across generations.

• Geography (Spatial Contexts)

This domain focuses on spatial awareness and place-based comparison, including references to China, the UK, Europe, Asia, and other regions. Questions such as “Is your hometown beautiful? Do you visit it often?”, “Where have you travelled? ”, and “How does the climate in other countries compare with the UK?” encourage participants to reflect on environmental differences across locations. This spatial perspective supports an understanding of climate change as a geographically situated phenomenon.

• History (Temporal Reflection)

This category structures reflection across the life course, including childhood, adolescence, adulthood, and recent experiences. Example prompts include: “What was the climate like in your childhood?”, “Can you describe your most memorable day?”, and “What climate-related disasters do you remember?”. These questions position climate change within personal timelines, enabling participants to compare past and present environmental conditions.

The turntable combined randomness and open-ended discussion in a relaxed setting, encouraging users to share from their own experiences rather than passively absorbing information. The tool can be used on its own or in conjunction with other design interventions (e.g., puzzle games or the Carbon Footprint Self-Assessment Card) for deeper exploration. For instance, a question from the turntable may prompt users to calculate their carbon footprint or link the puzzle game’s causes and effects of climate change to their own life stories.

This Turntable helped older Chinese migrants form a profound understanding of climate change. By revisiting personal memories, they can connect climate change with their own lives, strengthening their motivation to engage in sustainable action.

At the same time, this Turntable facilitated family and community dialogue. Older adults can discuss these questions with their children or grandchildren, allowing younger generations to appreciate how past lifestyles affect today’s environment and helping older adults see the new challenges younger people face. This intergenerational

exchange would not only heighten climate awareness but also foster deeper mutual understanding and value transmission across generations.

At the community level, the Turntable may be used as a tool for public discussions in Chinese community centres, cultural events, or low-carbon education programmes. It could encourage members of migrant communities to engage with environmental topics and promotes the spread of environmental awareness on a collective scale.

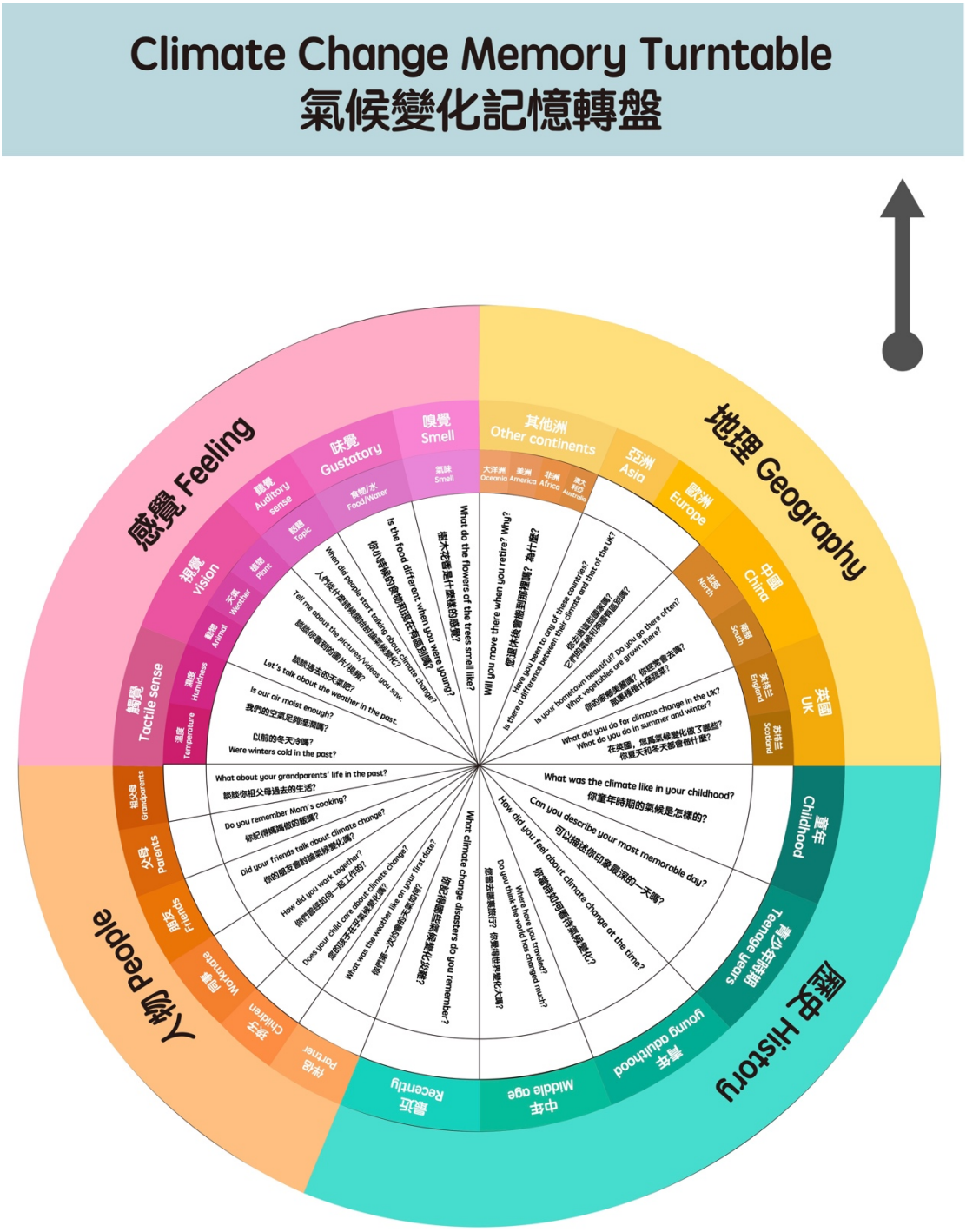


Figure 8.8 Climate Change Memory Turntable.

8.5.5 Climate Change Chatterbox

The Climate Change Chatterbox (Fig 8.9) is an interactive, paper-based engagement tool designed to facilitate climate-related discussions among older Chinese migrants. Inspired by the traditional "chatterbox" or origami fortune teller, this tool integrated gamification, storytelling, and social interaction to foster deeper engagement with sustainability topics. By addressing key themes such as transport, economy, health, home, food, and intergenerational dialogue, the tool encouraged participants to reflect on their environmental impact through an accessible and culturally familiar format.

1) Design Rationale

- Remind, Encourage, Enlighten: The chatterbox serves as a gentle intervention to remind users of climate-related actions, encourage sustainable choices, and enlighten them on environmental issues.
- Facilitate Intergenerational Conversations: The tool included prompts that encourage older users to share experiences with younger family members, reinforcing the transfer of sustainability values across generations.
- Make Climate Change Tangible: By integrating personal and everyday topics (e.g., food choices, energy consumption, transportation habits), the chatterbox helps older migrants relate climate issues to their daily lives.
- Enhance Social Interaction: The tool is designed to be used in group settings, community centres, or family gatherings, making climate conversations more engaging.

2) Content

The Climate Change Chatterbox incorporated several game-based elements to enhance participation and knowledge retention:

- Interactive Learning: The foldable paper structure required physical engagement, keeping participants actively involved in the learning process.
- Storytelling and Personal Reflection: Prompts such as *"What do you want to say to the next generation?"* encouraged users to connect climate change with their own experiences and values.
- Social Reinforcement: Designed for peer-to-peer interaction, the tool encouraged discussion and collective learning within the community.
- Cultural Adaptation: Bilingual design (Chinese & English) ensured accessibility for older migrants, reducing language barriers to participating in climate discourse.

The Climate Change Chatterbox illustrated how culturally adapted, low-tech interventions could make climate discussions more accessible, offering valuable insights for several areas. Policy-makers can integrate interactive, low-barrier communication tools into public campaigns. Community organisations may

employ simple yet engaging formats to improve climate literacy among older migrant populations. Finally, intergenerational learning programmes can use this approach to foster knowledge exchange between older and younger generations regarding sustainable living practices.

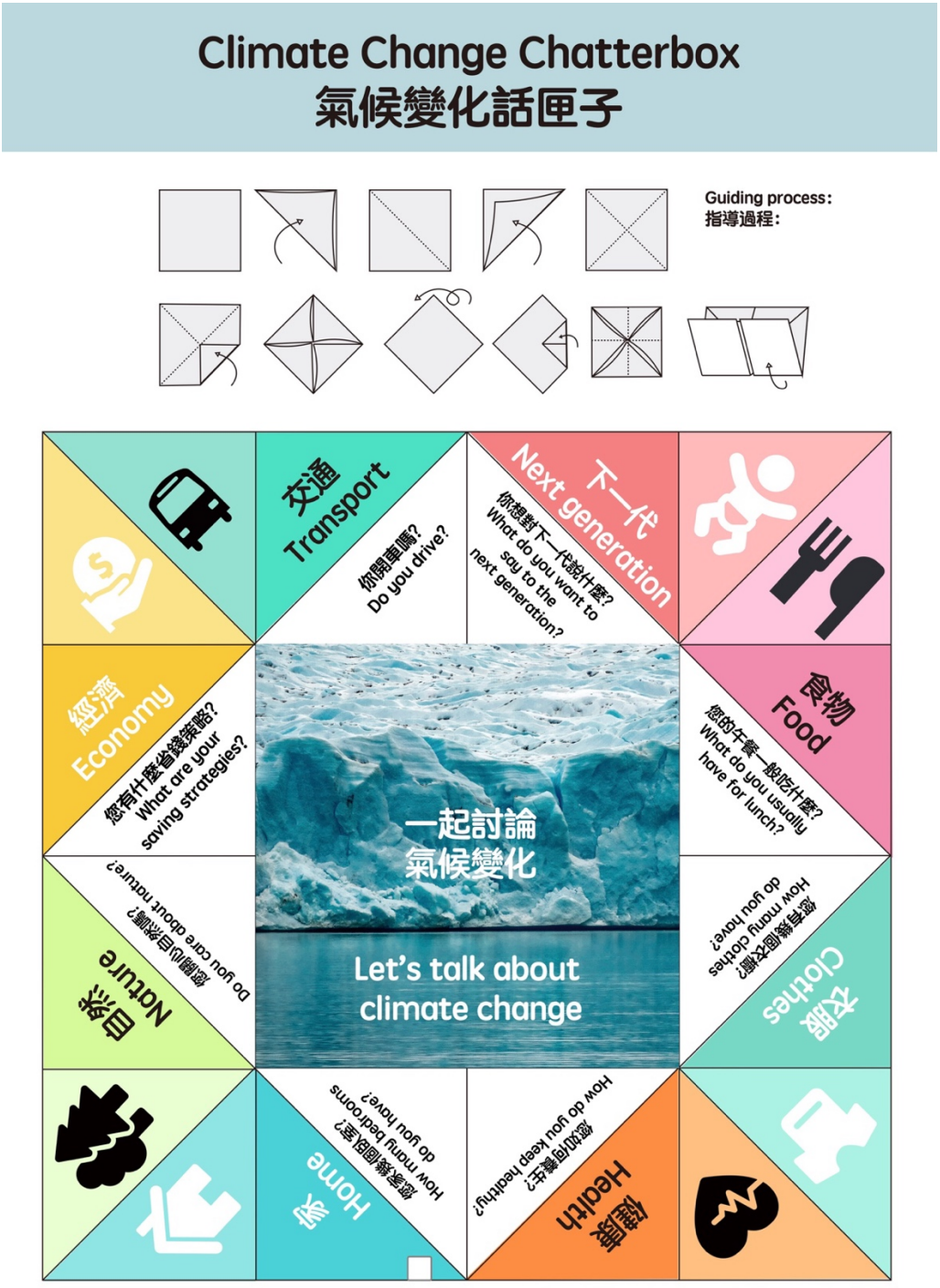


Figure 8.9 Climate Change Chatterbox.

8.5.6 Climate Change Conversation Cards

The Climate Change Conversation Cards were designed to encourage intergenerational exchange between older Chinese migrants and younger generations, using this

interaction to explore climate change, sustainable lifestyles, and the transmission of cultural values.

1) Design Rationale

The cards used a two-way questioning mechanism, prompting older and younger participants to ask each other questions and share experiences, insights, and skills.

Guided by Inclusive Design principles, this intervention establishes a balanced dialogue, ensuring that older adults and younger people interact as equals, rather than following the traditional model of "elder teaching" or "youth leading." Building on situated learning, it created opportunities for intergenerational co-learning, where participants share personal experiences and co-construct a sense of environmental responsibility.

Additionally, gamification underpins the design of the cards:

- Interactive Learning: By posing and answering questions, participants explore low-carbon practices in everyday life, rather than receiving information passively.
- Instant Feedback: Real-time conversation encourages both older and younger participants to reflect on their actions immediately, potentially inspiring adjustments in daily routines.

2) Content

Each card revolves around one of five resource categories, inspiring discussion on multiple levels:

- Practical Resources: Skills and know-how applied in daily life (e.g., sewing, cooking, repairing) that promote sustainable living through hands-on practices.

e.g., older adults ask: "Do you know any sewing skills? What practical crafts do you have?" *Younger people ask*: "What do you do with your old clothes?"

These cards encourage younger individuals to learn from older adults' practical skills and discuss sustainable lifestyles (e.g., reusing and repurposing items).

- Intellectual Resources: Knowledge, reasoning abilities, and problem-solving strategies that enable informed decisions about energy use, budgeting, and other climate-related actions.

e.g., older adults ask: "Have you ever paid attention to winter energy bills?"

Younger people ask: "What are your tips for saving energy in winter?"

These cards used discussions about financial management and energy-saving strategies to raise awareness of resource conservation among younger generations.

- Cultural Resources: Traditions, values, and heritage that shape perspectives on family, community, and the environment, offering guidance for intergenerational learning.

e.g., older adults ask: "Which of your skills can be passed on to the next generation?"
Younger people ask: "What could you teach your elders?"
These cards strengthened cultural transmission and social responsibility through intergenerational learning.

- Emotional Resources: Feelings, attitudes, and motivations that drive concern for the future of the planet and inspire meaningful dialogue about climate change.

e.g., older adults ask: "Do you think the climate will improve in the future?"
Younger people ask: "What do you think our planet will be like in the coming years?"
These cards encouraged participants to consider the future, fostering environmental responsibility and prompting reflection on the long-term impact of personal actions.

- Social Resources: Networks, relationships, and shared responsibilities that influence how communities mobilise and collaborate on climate action.

e.g., older adults ask: "Do you believe the natural environment is important for the next generation?"
Younger people ask: "When did you first start caring about climate change?"
These cards prompted the discussion on social responsibility and how individual actions can shape the wider community.

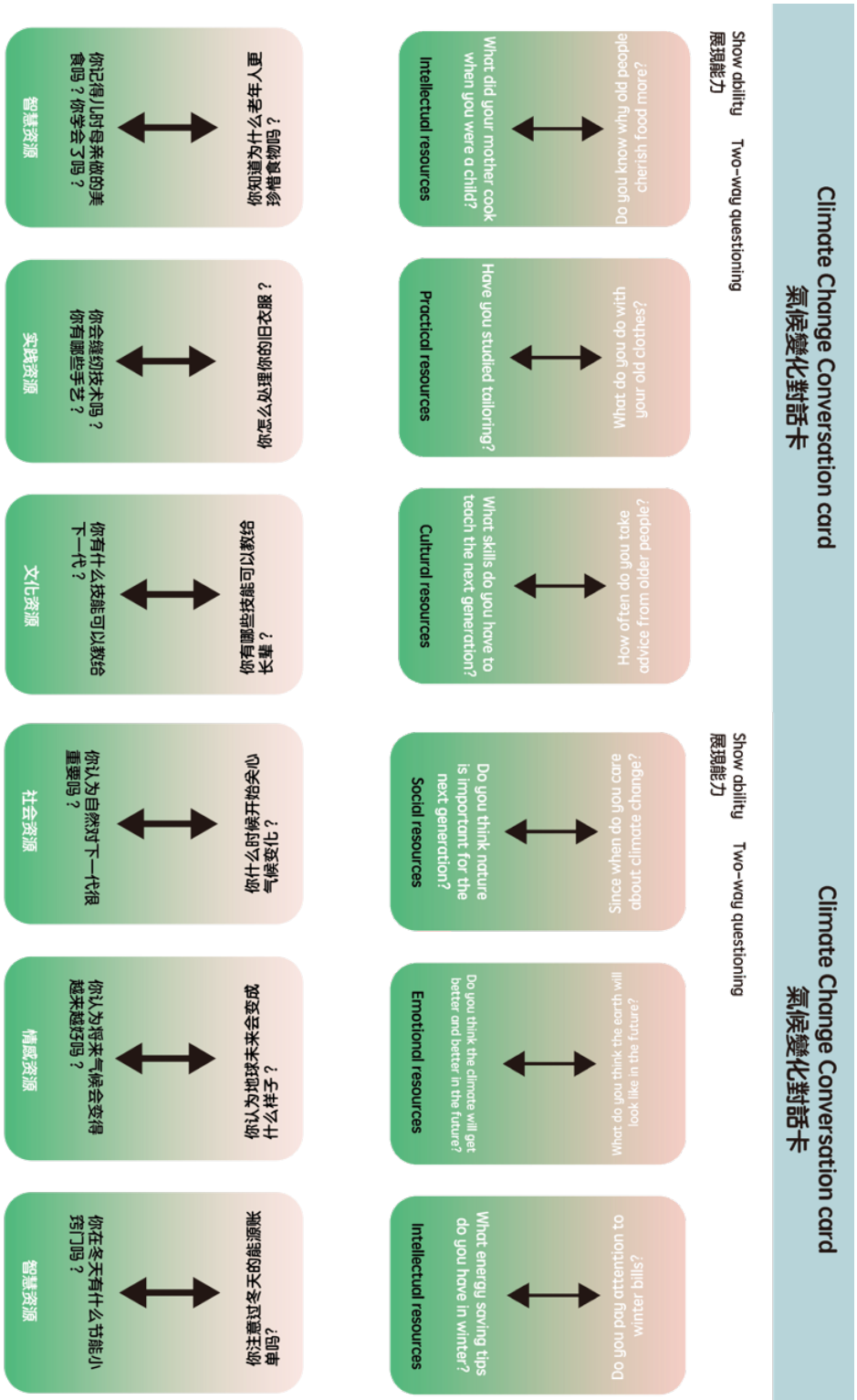


Figure 8.10 Climate Change Conversation Cards.

8.6 Policy Brief

This policy brief highlighted that older adults are not only vulnerable to climate change but can also be active agents of sustainable living. In particular, older migrants often

carry low-carbon habits formed in their home countries, rooted in frugality. However, due to language barriers and limited social integration, their knowledge and potential remain largely unrecognised in mainstream climate policy.

1) Rationale

Research shows that older adults find "climate change" more understandable than the more abstract term "net zero." Therefore, policy communication should employ familiar, straightforward language rather than overly technical vocabulary.

Although older migrants bring valuable low-carbon practices, linguistic barriers and cultural isolation often prevent these skills from being fully utilised or integrated into local climate initiatives.

Studies suggest that migrant communities from diverse cultural backgrounds frequently demonstrate unique sustainable behaviours, yet their capacity to engage depends on how well they adapt to mainstream society (Adger et al., 2013).

The insights gained from the PhD research were summarised in a Policy Brief, with advice from the Brunel Policy Unit, to inform policy-making.

2) Content

The policy brief puts forward five specific recommendations:

Simplify Climate Communication

- Avoid technical jargon and provide clear, relatable explanations of key concepts (e.g., explaining "net zero" as balancing the amount of greenhouse gases emitted and removed, using everyday examples).
- Develop visually oriented materials (infographics, videos, podcasts) to make information more accessible.

Strengthen Cultural and Community Integration

- Provide multilingual climate resources in Mandarin, Cantonese, and other relevant languages.
- Collaborate with leaders in Chinese migrant communities to improve message outreach and build trust.

Foster Intergenerational Collaboration

- Design cross-generational programmes that support mutual learning, where younger people contribute knowledge of emerging technologies and low-carbon solutions, while older adults share their experience of resource-saving practices and everyday sustainability.
- Encourage family dialogue to strengthen shared understanding and collective motivation for climate action across generations.

Invest in Infrastructure

- Offer age-friendly green public facilities, such as accessible public transport and electric vehicle charging points.

Build Trust Through Transparent Policies

- Ensure policy stability, avoiding frequent changes that can undermine public confidence.
- Involve older adults in policy consultations to increase policy acceptance.
- Climate action research indicates that stability, transparency, and inclusivity in policy-making are crucial for building public trust (Collins et al., 2017).

Finally, the brief calls on governments, community organisations, and businesses to undertake concrete measures that broaden policy inclusiveness, reduce barriers to participation, and strengthen community collaboration—thus enabling older adults to play a more active role in climate action.

The Policy Brief was submitted to the UK Department for Energy Security and Net Zero (DESNZ) and informed by insights gathered through community engagement and workshop discussions with older Chinese migrants and design practitioners. While formal evaluation by policy stakeholders remains ongoing, the brief reflects empirically grounded perspectives and identifies practical directions for future collaboration and implementation.

The full Policy Brief can be found in Appendix (Study F).

8.7 Discussion

This chapter focused on the interventions, the Climate Toolkit (including the Net Zero Brochure, Carbon Footprint Self-Assessment tool, the puzzle game, Memory Turntable, chatterbox, and conversation cards) and the Policy Brief—and examined how older Chinese migrants can be empowered to better understand and participate in the UK's climate initiatives and net zero policies at multiple levels (individual, family, community, society, and government). Drawing on the empirical research from Studies A–E, this chapter integrated inclusive design, gamified learning, and interdisciplinary collaboration to propose a multi-layered intervention framework targeting individuals, communities, and policymakers.

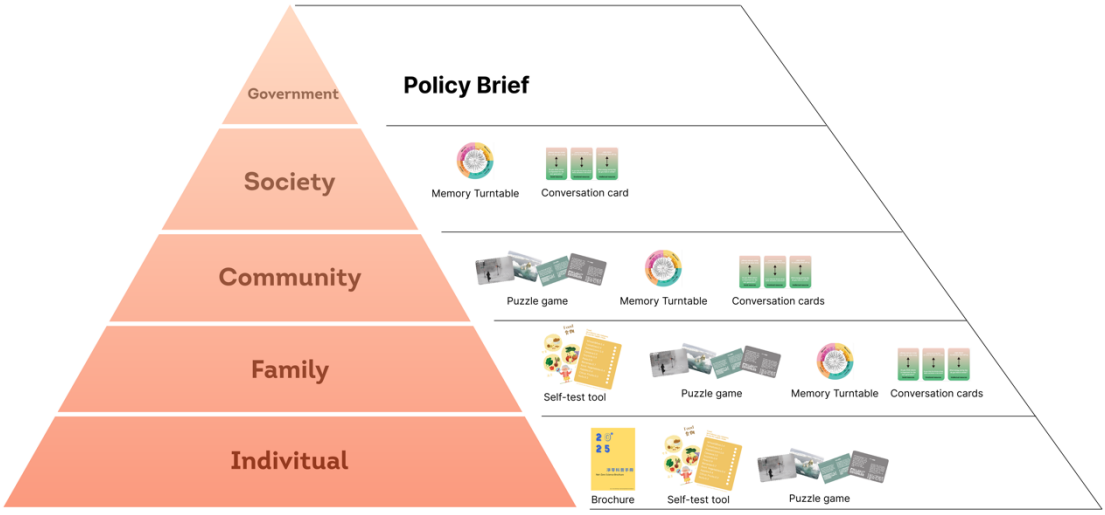


Figure 8.11 Design intervention from micro to macro.

As shown in Figure 8.10, each design intervention addressed a different application context and intervention level:

- **Individual Level**: The Net Zero Brochure presented the concept of "net zero" in a simplified, visually appealing format; the Carbon Footprint Self-Assessment Tool used data visualisation to help individuals recognise and reflect on the carbon emissions of their daily habits; and the Puzzle offered an interactive approach to understanding the causes and impacts of climate change.
- **Family Level**: The Puzzle and Self-Assessment Tool can be used at family gatherings, reinforcing intergenerational dialogue and sparking discussions about sustainable lifestyles.
- **Community Level**: In Chinese community centres, special-interest groups, or workshops, the Puzzle games and Memory Turntable facilitate collaborative learning, while the Conversation Cards encourages deeper exchanges of experiences and insights.
- **Society Level**: The Conversation Cards and Memory Turntable can be applied in broader social activities, such as cross-community gatherings or cultural festivals, helping different groups engage in intergenerational, cross-cultural discussions about climate topics and experiences—building a broader societal consensus.
- **Government Level**: Informed by the findings of Studies A-E, the Policy Brief highlighted older adults' needs, policy fairness, and cultural sensitivities among migrant groups. It recommended targeted policy improvements and resource allocation to foster older migrants' involvement in climate action, offering them greater institutional support and a stronger voice in low-carbon initiatives.

8.7.1 Implications for Policy and Society

1) Policy Brief: Filling the 'Missing Voice' of Older Migrants in Mainstream Climate Policy

The Policy Brief is aimed at government bodies and city councils. Findings from earlier interviews and questionnaires (Studies A and D) showed that mainstream policies often overlook older migrants' potential for environmental action. By presenting research insights and concrete recommendations, the Policy Brief urged the government to adopt principles of "cultural adaptation," "intergenerational collaboration," "policy transparency," and "multi-stakeholder cooperation" in net zero policy making. Recognising language barriers, improving community feedback mechanisms, and validating older migrants' low-carbon lifestyles can significantly increase trust and engagement between policymakers and this demographic.

2) Synergy between the Climate Toolkit and the Policy Brief

At the "micro" level, the toolkit provided methods and practical guides for behaviour change in individuals and families. At the "macro" level, the Policy Brief informed resource distribution and institutional improvements. Together, they could help older migrants become more integrated and engaged in daily sustainability practices and public policy domains.

Because Chinese migrants often rely heavily on community networks and trusted associations, government partnerships with these local groups to develop and promote bilingual campaigns can rapidly improve policy comprehension.

8.7.2 Limitations and Future Outlook

The label "older Chinese migrants" encompasses a group with varied characteristics, including differences in educational background, language ability, year of migration, place of origin, and religious beliefs. Although the interventions developed in this study incorporated Chinese-language texts and cultural values, they may not meet the needs of every subgroup. Future efforts could create more specialised materials or digital aids for those with lower speaking proficiency, less digital literacy, or particular dialect requirements.

8.8 Summary

Through a series of empirical investigations—questionnaires, interviews, walking interviews, co-design workshops, focus groups, and designer workshops—this research explored the linguistic, cultural, informational, and policy-related challenges faced by older Chinese migrants in the UK. Although many older Chinese migrants already

practise low-carbon behaviours such as frugality and reusing resources, they often struggle to align these habits with government-led climate initiatives because they lack easy-to-understand bilingual information and face a high threshold for engaging with mainstream policies.

In response, **Study F** proposed two main interventions:

1) Climate Toolkit

- Brochure: Used Chinese-language explanations and visual aids to lower the barriers posed by technical policy documents.
- Self-test Tool: Employed numerical data and clear graphics to show the carbon impact of daily activities, such as diet, transport, and energy use.
- Puzzle games / Memory Turntable / Conversation Cards / Chatterbox: Combined game-based learning with intergenerational discussion, making the learning process more engaging and encouraging deeper family and community conversations about climate action.

2) Policy Brief

Aimed at government departments and local councils, it consolidated research findings and evidence, recommending simpler policy communication, cultural adaptation, community support, and intergenerational collaboration. This would help policymakers include older Chinese migrants more effectively in mainstream climate efforts.

The interventions make three key contributions:

- Addressing a Gap in Both Research and Practice
  Existing climate interventions rarely provide culturally and linguistically tailored designs for older migrant groups. This work offers targeted solutions in that space.
- Highlighting the Value of Inclusive Design and Gamified Learning
  By adopting interactive, low-tech, and culturally sensitive methods, climate communication becomes more accessible for the target group. This approach helps them grasp abstract decarbonisation concepts.
- Promoting Collaboration across Multiple Levels
  The Climate toolkit empowers individuals and families so that older migrants shift from being passive “information receivers” to active agents in environmental action. Meanwhile, the policy brief encourages top-down institutional support, fostering partnerships among government and communities to realise comprehensive climate engagement.

Chapter 9: Evaluation of the Interventions

9.1 Introduction

Climate change education is essential for fostering public awareness and encouraging sustainable behaviours (Adebayo & Longe, 2024). However, traditional methods of climate communication often fail to engage diverse communities, particularly older migrants who may face language barriers, cultural differences, and accessibility challenges. In response, this research developed a climate toolkit, integrating interactive design interventions to enhance older Chinese migrants' understanding of net zero policies and climate action.

This chapter explores how effectively the previously developed interventions (e.g., **Climate Toolkit** and **Policy Brief**) address the needs of older Chinese migrants in engaging with net zero actions. It aimed to assess both the usability and impact of the interventions, as well as to gather feedback for further refinement.

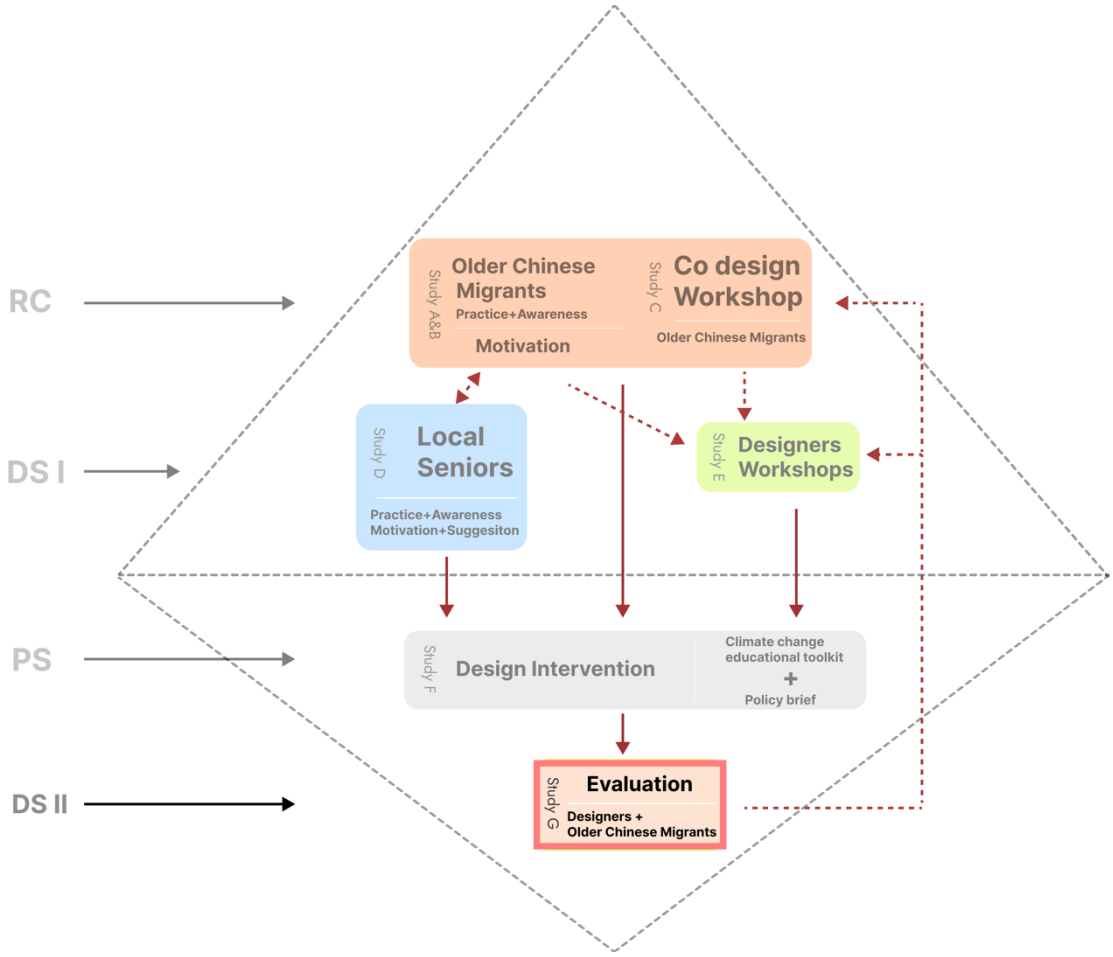


Figure 9.1 Study G as Descriptive Study II.

As shown in Figure 9.1, **Study G** is in the stage of DS II (Design Study II), and its core task is Evaluation.

The Research question of **Study G** is:

1) What are the impacts of the intervention on Knowledge, engagement, and behaviour?
2) What are the lessons for improving climate communication for ethnic minorities?

The main objective of this evaluation Study G was to assess:

- User Reactions: How do older Chinese migrants and design professionals perceive the interventions?
- Learning Outcomes: What knowledge and skills do participants gain?
- Behavioural Impact: Are participants motivated to apply what they learned in real-life contexts?
- Potential Beneficiaries: Who else could benefit from using the interventions?
- Areas for Improvement: What modifications can enhance the effectiveness of the interventions?

The study employed **Kirkpatrick's Four-Level Model** (Reaction, Learning, Behaviour, and Results) as the **evaluation framework** to systematically analyse participant feedback (Kirkpatrick & Kirkpatrick, 2006). Kirkpatrick's model provides a multidimensional approach that aligns with the objectives of this study — not only assessing the usability and reception of the intervention toolkit, but also examining its capacity to enhance awareness, motivation, and low-carbon engagement among older Chinese migrants. A mixed-method approach was used, combining qualitative thematic analysis (open-ended feedback) and quantitative data (Likert scale ratings) to derive insights into the toolkit's strengths and areas for refinement.

9.2 Methods

Prior to formal research recruitment, the researcher conducted a pilot study at the 2024 Research Festival in Brunel. During the pilot study, the researcher invited 10 older people to use the prototype Climate toolkit. The following are the suggestions received:

1) Increase the contrast of background and text. Highlight key information.
2) Control the interaction time to prevent the process from taking too long.
3) Explain and introduce the toolkit.

These comments were addressed to refine the climate toolkit.

9.2.1 Recruitment

The evaluation study was conducted from November to December 2024. The aim was to gather diverse insights on the usability and effectiveness of the toolkit from both

the end-users (older Chinese migrants) and experts (design researchers and professionals in related fields).

Older Chinese migrants were recruited through two well-established community organisations: Kingston Chinese Association and Mandarin Evangelical Church London. These locations were chosen due to their active engagement with the older Chinese community and their role as trusted spaces where participants would feel comfortable interacting with the research team. Recruitment was conducted through on-site visits, posters, and word-of-mouth referrals. The researcher introduced the study during community gatherings and provided printed information sheets in Chinese, ensuring that all potential participants clearly understood the study's purpose. Snowball sampling further helped in reaching a broader audience, as early participants encouraged their peers to join. The selection criteria required participants to be between 55 and 85 years old. Individuals with severe cognitive impairments were excluded, as the study required active participation in evaluation. The sample comprised a combination of returning participants from earlier phases of the research and newly recruited individuals. Although some participants had prior exposure to related studies, the temporal gap between phases, along with the inclusion of new participants, helped to mitigate potential bias while maintaining continuity in community engagement.

For design researchers and related professionals, recruitment took place through Brunel University's Design School and the researcher's professional networks. Email invitations, LinkedIn outreach, and departmental flyers were used to target postgraduate students, faculty members, and industry professionals with expertise in user-centered design, gamification, education, climate change communication, or older adult care. To ensure a diverse range of professional perspectives, the study aimed to recruit individuals working in design research, journalism, social work, and community-based environmental initiatives. Similar to the recruitment of older Chinese migrants, a snowball sampling approach was also applied, allowing participants to refer colleagues who might provide valuable insights. Ethical approval was obtained before the toolkit evaluation study was conducted. All participants received a participant information sheet and consent form before taking part. Older Chinese migrant participants were provided with Chinese-language explanations where appropriate, and all participants were informed that their feedback, observation notes, photographs, and questionnaire responses would be anonymised and used for research purposes only. Participants could decline to answer questions, stop using any toolkit component, or withdraw from the study at any point. The relevant ethics approval documents,

information sheet, consent form, and evaluation materials are provided in Appendix Study G.

9.2.2 Participant Information

This study involved **two main groups** of participants:

1) Older Chinese Migrants which represented the primary target users of the Climate Toolkit.

2) Designers & Related Professionals who providing expert evaluation based on their knowledge in design, education, media, older adult care, and community engagement.

A total of 26 participants were recruited:12 older Chinese migrants from London-based Chinese community organisations. 14 design researchers and professionals from Brunel University and relevant industries. Figure 9.1 shows the demographics information of the participants.

Table 9.1 Participant Demographics.

Number	Age	Gender	Occupation
Older Chinese migrant participants			
P1	65	Male	Doctor
P2	59	Male	Finance Industry
P3	55	Male	Consultant
P4	64	Male	Nurse
P5	70	Female	Chef
P6	57	Female	Chinese Teacher
P7	62	Male	Factory Worker
P8	72	Female	Former Civil Servant
P9	60	Female	Teacher
P10	65	Female	Nursery Worker
P11	57	Female	Teacher
P12	75	Female	Housewife
Design researchers and professionals participants			
P13	27	Female	PhD Design Student
P14	31	Male	PhD Design Student
P15	31	Male	Municipal Officer
P16	29	Male	AR Technician
P17	26	Female	Illustrator
P18	24	Female	Marketing Manager

P19	36	Male	Assistant Director of Chinese Institution
P20	34	Female	University Lecturer
P21	30	Female	Journalist
P22	28	Female	PhD Design Student
P23	32	Male	Designer
P24	25	Female	Newspaper Journalist
P25	31	Female	Chinese Church Volunteer
P26	30	Male	Older Adult Care Nurse

9.2.3 Materials and Data Collection

The study was divided into two phases for engaging with older Chinese migrants and design researchers/related professionals. The methodology combined observational studies, and user feedback forms, following the Kirkpatrick Model of Evaluation (Kirkpatrick & Kirkpatrick, 2006) to assess participants' reactions, learning, behaviour changes, and potential results.

Phase 1: Data Collection from Older Chinese Migrants

The first phase focused on observing and collecting feedback from older Chinese migrants as they interacted with the Climate Toolkit. The process took place at two Chinese community centers. At the beginning of each session, the participants were provided with a Participant Information Sheet explaining the purpose, procedures, and ethical considerations of the study. Then a Consent Form which they were required to sign before participation. A brief verbal introduction also provided by the researcher, explaining the structure of the session and how to use the toolkit.

After the introduction, the participants were invited to explore and engage with the toolkit, which included: Net Zero Brochure, Carbon Footprint Self-Assessment Tool, Puzzle Games, Memory Turntable and Conversation Cards.

The researcher rented a table in the Chinese community restaurant place to facilitate interactions with older participants and secured a meeting room in a Chinese church for similar engagement. During the data collection process, the researcher first introduced the *Net Zero* brochure, which was printed in full-colour A4 format. The *Carbon Footprint Self-Assessment Tool* was printed as a card, followed by the introduction of other games. Each participant was allowed to take home any materials of interest. To better simulate the use of the *Conversation Cards*, the researcher invited a research assistant (a master's student) to engage with older Chinese migrants, while also actively participating in the interaction.

Each participant was observed as they interacted with the toolkit. The observation focused on:

- Ease of use (Did the participant struggle with understanding instructions?)
- Engagement level (Which tools generated the most discussion or excitement?)
- Social interactions (How did the participant communicate with others while using the tools?)

The researcher took field notes and photographs (with consent) to capture real-time reactions.

After engaging with the toolkit, the participants completed a structured feedback form, which included Likert scale ratings (1-5) and open-ended questions covering:

- Reaction: How do you feel about these tools? Which one do you like best? What can be improved?
- Learning: What knowledge do you learn from using these tools?
- Behaviour: Are you going to use these tools? Can you give an example of use?
- Results: Who else do you think would benefit from using these tools? Who do you think will benefit from it? Will you recommend it to other people?

The combination of observational data, feedback forms ensured a rich, multi-dimensional dataset, capturing both quantitative insights (satisfaction ratings) and qualitative reflections (personal experiences and suggestions).

Phase 2: Data Collection from Design Researchers & Related Professionals

The second phase targeted design researchers and professionals.

The participants had to take part in the group evaluation workshops. Sessions were held at Brunel University's Design School in a controlled environment, where the participants were introduced to the entire Climate Toolkit and encouraged to test each component. They were asked to: 1) Engage with each tool in the toolkit. 2) Critically evaluate the usability, effectiveness, and engagement levels of each component. 3) Provide feedback based on their professional knowledge. Following their engagement with the toolkit, the participants completed feedback forms similar to those used for older Chinese migrants but with additional expert-focused questions:

1) How effective is the toolkit for climate change education?
2) How well does it engage older users?
3) What recommendations do you have for improvement?

The participants were encouraged to stay after the workshop for a semi-structured interview to further explore their professional perspectives. The questions focused on:

1) The design quality of the toolkit
2) Cultural relevance for older Chinese migrants
3) Potential real-world applications in education, policymaking, and community engagement.

9.2.4 Data Analysis

The study employed a mixed-methods approach, combining thematic analysis for qualitative data and descriptive statistical analysis for quantitative data. The analysis framework was structured using Kirkpatrick's Four-Level Model (Reaction, Learning, Behaviour, and Results) to systematically assess participant engagement, knowledge acquisition, behavioural intent, and perceived impact.

1) Qualitative Data Analysis: Thematic Analysis

Data Sources: The qualitative data was derived from Participant Observation Notes, detailed field notes taken during toolkit evaluation sessions, capturing participant interactions, engagement levels, and notable reactions. Open-Ended Survey Responses, the responses to questions such as *"What did you learn?"* and *"How would you use these tools in the future?"* Also Verbal Feedback and Discussions , the insights from informal conversations with the participants about their experiences with the toolkit.

A thematic analysis (Braun & Clarke, 2006) was used to identify key patterns across the data. Codes were clustered into broader themes aligned with Kirkpatrick's Model. Example themes under each evaluation level included:

Reaction: Engagement with interactive elements, usability of materials, preferences for component tools.

Learning: Awareness of climate issues, new insights gained, recognition of personal responsibility.

Behaviour: Intent to apply the toolkit, perceived usefulness in real-life scenarios.

Results: Anticipated long-term impact, potential for intergenerational knowledge transfer.

Themes were reviewed to ensure clarity, coherence, and relevance to the research objectives. Direct participant quotes were extracted to illustrate key findings.

2) Quantitative Data Analysis: Descriptive Statistics

Quantitative data was collected through a structured questionnaire, where the participants rated aspects of the toolkit on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Responses were recorded and analysed in Microsoft Excel.

To ensure the rigour of the data analysis process. Findings were cross-validated across multiple data sources (questionnaire, observations, interviews) to strengthen reliability.

9.3 Results

This section presents the findings from the evaluation of the Climate Toolkit. The results are based on qualitative feedback from 26 participants, including 12 older Chinese migrants (aged 55–75) and 14 younger professionals (aged 24–38), who engaged with the toolkit in a workshop setting.

Table 9.2 summaries the main findings according to the four levels (Kirkpatrick & Kirkpatrick, 2006).

Table 9.2 Integration of Qualitative and Quantitative findings.

Evaluation Level	Qualitative Themes (Thematic Analysis)	Quantitative Trends (Descriptive Stats)
Reaction	Interactive tools enhanced engagement; text-heavy materials less effective	High engagement scores (Mean = 4.5, SD = 0.7); lowest rating for Net-Zero Handbook
Learning	Increased climate awareness, stronger sense of responsibility	87% of participants agreed the toolkit improved their understanding of climate issues
Behaviour	Participants plan to introduce the toolkit in family and community settings	92% of respondents intend to use the toolkit beyond the study
Results	Anticipated intergenerational impact, potential for community adoption	100% recommendation rate from participants

9.3.1 Observational Findings

1) Ease of Use & Understanding

Net Zero Brochure: While informative, some participants found it overwhelming. One Older participant (P3) noted, "*It's useful, but compared with videos, I prefer something more visual.*"

Climate Change Puzzle games: Initially, some participants were unsure of how to play the games, but after seeing others engage, they quickly caught on. Those with higher literacy levels took the lead in explaining the games.
Conversation Cards: Some participants were hesitant at first, as they were unsure how to initiate discussions. However, after observing others, they became more engaged.

2) Engagement & Interaction

Engagement levels varied across different tools. Gamified elements (e.g., the puzzle, turntable, and chatterbox) elicited the highest engagement, while text-heavy materials required more prompting.
High Engagement Tools: Climate Change Puzzle games encouraged collaborative problem-solving and memory recall. The participants helped each other, discussing personal experiences related to the puzzle's themes. Climate Change Chatterbox triggered nostalgic memory for many. An older participant in her 60s commented, "*This reminds me of the games we used to play as children.*" Older participants were drawn to the experience, eager for the opportunity to engage in conversations with younger individuals using Conversation Cards. Some even moved beyond the topics on the cards, asking the young research assistant about artificial intelligence (AI) and related subjects. Figure 9.2 illustrates a scene of intergenerational dialogue between older participants and younger individuals.
Lower Engagement Tools: Net Zero Brochure – Though informative, the participants struggled to remain engaged with it, particularly those without prior knowledge of climate policies.



Figure 9.2 Conversation Cards used by older participants and younger individuals.

3) Social Interactions & Group Dynamics

The participants gravitated toward group-based interactions, with the tools serving as conversation starters.

Older participants preferred engaging in activities as a group, particularly when playing the climate change puzzle games. They naturally formed teams and turned the activity into a friendly competition. Given the variations in age and cognitive abilities, instances of mutual assistance also emerged among them (Figure 9.3). During the Memory Turntable activity, the participants collectively reminisced about their childhood experiences and the hardships of the past, reflecting on how quickly time had passed.



Figure 9.3 Team competition in playing climate change puzzle games.

During their engagement with the intervention tools, discussions frequently shifted towards family and the next generation. Older participants not only gained a better understanding of climate change themselves but also used the process as an opportunity to strengthen their connections with younger individuals.

4) Emotional Reactions & Attitudes Toward Climate Change

Reactions ranged from enthusiasm and curiosity to skepticism about climate policies.

Positive Reactions:

Many participants were curious about climate change. One (P2, aged 60) commented, "*I never thought about how my habits impact the planet. This is eye-opening.*"

The turntable sparked nostalgia and personal reflections about environmental changes over time.

Skepticism & Concerns:

Some participants questioned the effectiveness of individual action, particularly regarding government policies.

One older participant stated, "*Even if we reduce waste, big companies still pollute. What can we really do?*"

5) Behavioural Intent & Real-World Application

Many participants indicated they would use the tools again, particularly in social and family settings.

Where Participants Plan to Use the Toolkit: 1) At home with family 2) At community gatherings 3) As an educational tool for caregivers and teachers.

They suggested that the tools had strong potential for long-term engagement, particularly within families and community groups.

9.3.2 Kirkpatrick's Four-Level Evaluation Results

Level 1: Reaction – Participant Engagement and Perceptions

Overall Enjoyment and Engagement

The participants responded very positively to the toolkit. On a 5-point scale rating their overall feeling about the tools, almost all gave the highest marks ("5 – loved it"), with a few rating "4". This indicated strong enthusiasm and enjoyment across the board. Many described the activities as "*fun,*" "*engaging,*" and "*meaningful.*" There was a general sense of excitement in interacting with the diverse tools, suggesting the design intervention successfully captured the participants' interest. Notably, both older and younger participants were laughing, collaborating, and actively discussing while using the toolkit, reflecting a high level of engagement (as reported in their feedback).

Favourite Tools: When asked which specific tool they liked best and why, the participants' preferences varied, often influenced by their age group and personal interests. Their preferences were classified by key themes, as follows:

1) **Intergenerational Conversation: Conversation Cards** were a clear favourite among many older Chinese participants. They appreciated that the cards facilitated dialogue with others, especially with the younger generation. For example, several older adults mentioned that the conversation prompts gave them an opportunity to "*share my experiences and memories with young people*" and "*show my concern for the next generation.*" This tool tapped into older participants' desire for connection and storytelling. In contrast, only a few younger professionals chose the conversation cards as their top pick. Those who did noted the cards' interactivity and how they "*spark meaningful discussions about environmental*

habits within the family." However, most younger participants tended to gravitate toward the more game-like tools for their favourites.

2) **Interactive Games and Nostalgia:** Younger professionals frequently cited the "Chatterbox" and the Climate Change Memory Turntable as their favourites. They found these tools "*fun and playful*" and praised their ability to break the ice in group settings. A number of younger respondents mentioned the *nostalgia* factor of the chatterbox: "*It reminded me of my childhood,*" noted one participant, referring to the familiar origami game format. They felt this nostalgia made the learning experience enjoyable and approachable. The climate change Memory Turntable was seen as "*lively and full of variety,*" helping to create a cheerful atmosphere. Younger participants liked that these tools could "*quickly get everyone talking and laughing,*" making the topic of climate change less intimidating. A couple of older participants also chose the turntable as their favourite, specifically those who enjoyed puzzles and challenges. For instance, one older participant said, "*I like the complex patterns on the climate change turntable; it feels challenging and I enjoy learning new things like this.*" The chatterbox and turntable were more popular among the younger cohort, who valued their game-like, icebreaker qualities.

3) **Climate Change Puzzle games:** Both age groups appreciated the Climate Change Puzzle games, which was a matching or jigsaw game illustrating climate facts. Older participants who favoured the puzzle noted that it was "*very meaningful and engaging*". It tested their observation and memory in a fun way. One older adult explained that through assembling the puzzle, they could "*learn about the impact on our planet while having the satisfaction of solving a puzzle.*" Another mentioned it "*exercised my brain and was very interesting, especially if played in a team competition, it requires teamwork and quick thinking.*" Younger participants also enjoyed the puzzle, often mentioning its flexibility to be played alone or with others: "*It's like a card-matching game; you can play it by yourself or with a group. Either way it's entertaining,*" said one younger respondent. A few younger professionals highlighted that the puzzle "*allows the user space to think and connect ideas,*" making it a favourite because it subtly encouraged reflection on climate information while remaining playful.

4) **Educational Materials:** The Net Zero Brochure and the Carbon Footprint Self Assessment Tool had a more mixed reception, generally split by participants'

backgrounds. Some older participants loved the brochure, saying it "*introduced new concepts to us older folks in a simple way*", for those who rarely follow climate policy, the brochure was a valuable source of information. An older participant noted, "*This booklet is great for people like me with no basic knowledge; it gave me a chance to understand what the UK is doing about climate change.*" Younger design-oriented participants were less likely to name the brochure as most enjoyable, though a couple still appreciated its visual design and potential to "*spread information widely in the community.*" The carbon footprint self-test tool (which allows users to assess their own carbon emissions from daily activities) appealed to the participants who were already environmentally conscious. For instance, one younger participant who was a fitness enthusiast liked this tool, saying "*it's a great tool for someone like me who cares about my lifestyle impact, it's a good reflection on my carbon footprint.*" An older participant who liked gardening mentioned she "*had heard of carbon footprints before*" and enjoyed having a tangible way to measure and discuss it. These tools were often mentioned as secondary favourites or tied with other tools, rather than the top pick, but they added an educational depth to the toolkit that certain participants valued highly.

Design Improvement Suggestions: The participants also provided feedback on what could be improved, revealing differences in perspective between the two groups. Older participants generally offered minimal suggestions for improvement, with many indicating they were satisfied with the tools as presented. Only a few older participants suggested changes: for example, one older adult who enjoyed the puzzle wanted "*even more pieces or a more complex version to increase the challenge,*" demonstrating that some in this group were open to deeper complexity. Another older participant felt that the conversation cards could cover a broader range of topics; she noted the topics were somewhat limited and suggested "*including more in-depth questions to spark deeper discussions.*" Interestingly, one of the oldest participants admitted that some tools contained a lot of information, she found the puzzle "*had too many tiny details*" and the turntable "*had so much content I might not remember it all,*" implying that, simplifying content might be helpful for very old participants.

In contrast, **younger professionals provided a wealth of detailed suggestions** for refining the toolkit. Their design and facilitation expertise showed through these constructive critiques. Common improvement themes from younger participants included:

1) **Visual Design Tweaks:** Several younger participants noticed that text size and clarity could be an issue for older users. For instance, one commented that on the puzzle games, "*the font is a bit small and there are too many, which might be hard for older people to read even with glasses.*" Another suggested simplifying the graphics on the turntable, as "*the diagram felt a bit complex, it could be cleaner with fewer options to choose from.*" These observations highlight an awareness of accessibility and the need to tailor visuals to the senior audience.

2) **Increasing Interactivity and Fun:** Younger participants had creative ideas to make the games even more engaging. One design researcher proposed adding a scoring or points system to the puzzle: "*If we turn it into a friendly competition, for example, awarding a point for each correct match, it might increase excitement and motivation to play,*" he said. Another suggested transforming the puzzle into playing cards or dominoes, which could "*add familiarity and greater replay value*" for participants who enjoy traditional games like poker or mahjong. For the chatterbox, a participant suggested designing "*more origami shapes or even practical folded objects (like a little paper trash bin) to tie in the theme and keep it interesting.*" These ideas indicated that younger users were imagining ways to extend the toolkit's playfulness and replayability.

3) **Content Depth and Variety:** Some younger professionals wanted either more content or more targeted content. A couple of participants felt the conversation topics overlapped between the turntable and the chatterbox, noting that both tools had similar questions. One volunteer remarked that the chatterbox felt "*repetitive given the turntable already covers many topics, perhaps the chatterbox could have entirely different questions or fewer but more unique prompts.*" Meanwhile, a journalist participant in the group suggested that the Net Zero Brochure could provide links to videos or additional resources: "*If someone is intrigued by a topic in the brouchure, it'll be great to point them to where they can learn more or watch a short video explanation,*" she said. This reflected a desire to connect the toolkit with further learning opportunities for those interested.

4) **Relevance and Meaning:** A few of the younger participants evaluated the meaningfulness of each tool critically. For example, one participant felt that "*the chatterbox, while fun, wasn't especially meaningful in content*" and that its role somewhat overlapped with the turntable's function as a conversation starter. Another participant (a city council staff member) observed that two of the tools

could be used in sequence: “The second game and the first game seem like one could naturally lead into the other, almost as an extension.” This suggests that the tools could be more clearly structured either as a progressive sequence or as an integrated system. For example, by designing them as a set of interconnected cards or modules that guide users through different stages of engagement.

Level 2: Learning – Knowledge and Insights Gained

All the participants demonstrated increased awareness and understanding of climate change concepts after engaging with the toolkit. Thematic analysis identified four primary learning outcomes:

1) **Increased Climate Change Awareness:** Nearly all the participants, across both demographics, mentioned that using the toolkit raised their awareness of climate change issues. Many explicitly stated they became “*more aware of climate change*” or gained “*a better understanding of environmental issues.*” This was often the first point participants listed when asked what they learned. The interactive nature of the tools appeared to reinforce important facts and concepts; for example, matching pieces in the climate puzzle or reading the Q&A on the conversation cards helped the participants recall information about climate impacts and solutions. An elder participant summed it up: “*I have more awareness of climate change now; I didn’t realise how certain everyday actions are connected to the climate.*” For the younger professionals, even those who already had some background knowledge found their awareness sharpened. One design PhD student noted that the toolkit gave her “*more awareness of climate change from different angles,*” suggesting that the variety of tools introduced her to aspects she had not considered before.

2) **Sense of Responsibility and Urgency:** A strong theme, especially among older Chinese participants, was the development of a heightened sense of responsibility toward addressing climate change. Many older respondents expressed that the toolkit made them feel “*a sense of responsibility for climate change.*” This often came alongside statements of awareness, indicating that as they learned new information, they also internalised an ethical or personal duty to act. For instance, one older participant wrote that she learned “*we each have a responsibility to protect the environment*” and even added that she now believes in “*leading by example to protect the planet.*” This shows that the intervention not only delivered facts but also resonated on an emotional and moral level, motivating older adults to consider their own role. Younger participants also mentioned responsibility, though slightly less frequently than the older group. A community volunteer in her

30s shared that the experience gave her "*a sense of mission about climate change,*" implying that she felt more compelled to incorporate climate action into her work and life after using the toolkit.

3) **Increased Interest in Climate Action:** Another learning outcome was a greater personal interest in the topic of climate change, noted more prominently by the younger professionals. Several younger participants commented that the toolkit sparked their curiosity and interest. For example, one AR technology specialist (in his late 20s) said the intervention "*piqued my interest in climate change, I want to learn more now.*" Similarly, an illustrator in her 20s mentioned she discovered "*an interest in climate change*" through the games, whereas before it was not a subject she actively followed. This was an important result: by framing climate education in a fun, social format, the toolkit managed to engage people who might not otherwise seek out information on climate, effectively drawing them into the topic. Older participants were generally interested as well, though they tended to frame their responses in terms of responsibility or awareness rather than personal interest. Still, a couple of the more active older learners did mention they were "*more curious about climate issues now*" and intend to keep learning.

4) **New Climate Knowledge and Perspectives:** Beyond general awareness, the participants picked up specific knowledge and broadened their perspectives on climate action. The content of the toolkit provided multi-faceted insights:

Some participants learned concrete facts (for example, through the quiz questions on the turntable or the content of the net zero brochure). A journalist participant in her 30s noted, "*I gained knowledge about climate change, including perspectives from multiple disciplines.*" She elaborated that the toolkit incorporated scientific viewpoints, policy information (through the brochure), and personal lifestyle tips, giving her a more holistic understanding.

For some older adults, the knowledge gain was more foundational. One retiree happily reported that it was her "*first time learning about these climate concepts in the UK,*" and it helped her understand how climate change was relevant to her community and daily life. Even a simple awareness of terms like "carbon footprint" or understanding why climate change matters could be a significant learning milestone for the participants who were previously not engaged with the topic.

Communication and discussion skills were also mentioned by the participants. An implicit skill gained was improved confidence in discussing climate change and

connecting with others on the topic. While not all participants explicitly stated this, it was reflected in answers like one given by a designer (P23) who responded to the learning question with a reflective note: "*I learned from what various aspects we can discuss climate change.*" This suggested that through using the toolkit, she discovered different angles or approaches to talk about climate issues (for instance, via personal stories using the conversation cards, fun facts via the turntable, or tangible examples via the carbon footprint tool). The toolkit essentially provided a kit of narratives and entry points for climate conversations. The participants were better equipped to initiate and engage in discussions about climate action after using the toolkit. For example, one older teacher mentioned she learned ways to "*inspire others*" and realised that talking about climate can be woven into everyday social activities (like replacing small talks or card games with climate games).

Level 3: Behaviour – Intended Behaviour Change and Application

The third level of the Kirkpatrick evaluation examined whether participants planned to change their behaviour or take action after using the toolkit, particularly in relation to climate-friendly practices or continued engagement with the toolkit. The results were generally encouraging, indicating a strong intention to apply what was learned.

Intention to Use the Toolkit: All participants (100%) indicated that they intended to continue using the toolkit or its components in the future. When asked "Are you going to use these tools? ", every participant, both older and younger, responded positively (or in Chinese, "会," meaning "will do"). Notably, none of the participants dismissed the tools as irrelevant, and even those who reported slightly lower enjoyment ratings (4 out of 5) still expressed willingness to continue using them. This suggests that the toolkit was broadly aligned with participants' interests and perceived needs.

However, this finding should be interpreted with caution. As responses were collected immediately after the workshop, participants' expressed intentions may have been influenced by the interactive setting or by social desirability bias. Therefore, it remains uncertain to what extent these intentions would translate into sustained engagement or behavioural change in everyday contexts.

Planned Usage Scenarios: Through an open-ended question, participants provided examples of how and where they envisioned using the toolkit in the future. A clear theme was that participants perceived the toolkit as a social instrument, enabling them to engage others in climate-related conversations through informal and enjoyable activities. The specific scenarios varied across demographic groups:

Older Chinese Migrants

1) **Family and Community Focus:** Older participants described using the tools in family or community social gatherings. A majority mentioned *family get-togethers* as prime opportunities. Many said they would bring the toolkit out during family gatherings or holiday celebrations (such as Lunar New Year dinners or weekend family visits). One older gentleman said he would use it "*at our New Year gathering as an after-dinner entertainment game.*" Another older lady mentioned doing the activities "*with my grandchildren when we spend time together, as a game that also teaches them something.*" This indicated the toolkit would likely facilitate intergenerational interaction in these families, with grandparents actively initiating climate-related games with their children and grandchildren.

2) **Community Events:** Several older participants were involved in local community groups (e.g. senior centers, cultural associations, hobby clubs). They saw those as perfect venues. One retiree suggested using the toolkit at her singing group and dancing club meetups, noting "*when the community seniors gather, we can play these games instead of just cards or mahjong, it would be a fun change and we can learn about climate while we play.*" Another participant mentioned she volunteered at a local elder care facility and would bring the toolkit "*when I do activities at the nursing home to interact with the seniors there in a more engaging way.*" In fact, one enthusiastic older teacher outlined multiple contexts: "*1) at group events, 2) when interacting with kids or students, 3) when volunteering with seniors, and 4) since Chinese people like to play poker together, I can introduce these games as a more interesting alternative that sparks memories and imagination.*"

3) **Educational Uses:** A few older participants also saw the toolkit as a teaching tool. For example, one mentioned using it "*as a science learning tool*" to educate others about climate change during gatherings. Another said she would use it "*to gently influence more people in daily life to care about the environment,*" suggesting she might informally share tidbits or encourage climate-friendly habits as a result of what she learned. The core message was that older people intended to embed the toolkit's activities into their social routines, such as family nights, festive celebrations, and community club meetings, using fun and conversation to spread awareness among their peers and younger family members.

Younger Professionals – Workshops, Outreach, and Creative Adaptation: The younger cohort described an even broader array of use scenarios, often extending beyond family into professional or public realms, e.g.:

1) **Family Engagement with Older People:** Many younger participants echoed the idea of using the toolkit with their own older relatives. For instance, one design student said he planned to "*play the chatterbox game with my grandparents to have a sustainable conversation, letting them share stories from their youth while we also talk about climate.*" This showed the toolkit inspiring younger people to initiate climate dialogues with the elder generation, effectively reversing the usual direction of teaching (younger teaching older in this case, but through a respectful, story-sharing approach). Another young professional mentioned bringing the turntable or conversation cards home "*to open up topics with my parents about how we can all live a healthier, more climate-friendly life.*" These examples demonstrate the toolkit's potential to foster two-way learning between generations, as younger individuals use it to learn about their elders' experiences and elders learn about climate from the youth.

2) **Professional and Educational Workshops:** Several younger professionals saw relevance to their work or volunteer activities. A couple of design researchers and social workers stated they would integrate the toolkit into workshops or community programmes. For example, one participant who worked in municipal services said he might use the tools "*as a reference in other related design research, or apply them in workshops with people with disabilities.*" His idea was that the tactile, visual nature of the games could engage audiences who have different learning needs, suggesting the toolkit could be inclusive and adaptable. Another participant involved in a Chinese community organisation considered using the toolkit for "*community outreach and education sessions,*" possibly to engage local Chinese diaspora members in sustainability discussions. Additionally, a volunteer in eldercare noted his could use the games "*when I visit nursing homes or community centres, it's a fun way to get seniors talking, much better than just chatting about the weather.*" In fact, she cleverly noted that "*Brits love to talk about the weather with these tools we can turn that small talk into a deeper conversation about climate!*"

3) **Social Gatherings and Public Spaces:** The younger participants did not limit usage to formal settings; some mentioned casual social contexts. A participant in

her mid-20s imagined using the toolkit "*at a pub*" or during friend gatherings as a fun activity to do together, indicating the tools were enjoyable enough to become party games among peers. Another young participant mentioned bringing out the turntable "*at parties to lighten the mood and get people sharing their experiences and opinions on climate issues,*" highlighting its role in social bonding. The fact that a climate toolkit could be seen as *party entertainment* by young adults was a testament to its engaging design.

4) **Creative Adaptation:** One particularly innovative application came from a 30-year-old nursing home nurse. He described using the toolkit at family parties with younger generations who were British-born Filipinos (an interesting cross-cultural scenario). He suggested "*we can change the language to cater to their needs and teach them not only some Filipino words but at the same time climate change and net zero concepts. The game format will make it fun for them at their age.*" This example showed the younger professionals viewing the toolkit as a flexible template that could be adapted for different cultural or language contexts, effectively combining language learning with climate education. It underscored a broader point: the toolkit design is versatile and can be customised, which could amplify its reach to various communities beyond the original Chinese migrant context.

Level 4: Results – Broader Community Impact on Individuals, Families, and Community

At the highest level of Kirkpatrick's model, the researcher examined the broader outcomes and potential long-term impact of the design intervention. Although the evaluation took place shortly after the intervention (mostly capturing perceived impact and intentions), the participants provided insight into who they believed would benefit and what the overall effects might be. Several significant themes emerged:

1) **Broader Beneficiaries – "Everyone is Involved":** A common sentiment was that climate change affected *everyone*, so the benefits of the toolkit could extend to almost anyone in the community. Many participants, both older and younger, stated that "*everyone*" could benefit from these climate tools in one way or another. For example, one older respondent wrote, "*Climate change relates to every single person, so it's important for everyone.*" A younger participant similarly noted that "*anyone who plays these games will learn something useful from them.*" These responses indicate that participants perceived the toolkit as broadly relevant, rather than limited to a specific demographic group. This suggests a potential for

inclusive design; however, this perception should be interpreted with caution, as the actual accessibility and effectiveness of the toolkit may still vary across different user groups.

2) **Impact on Older Adults' Well-Being and Engagement:** Several younger professionals highlighted that the toolkit could have positive benefits for older adults in particular, not only just climate knowledge. One design researcher in her observed that "*it's of great benefit to older people: it gives them topics to talk about with others and brings more interest to their life.*" This comment encapsulated a powerful outcome: the toolkit could help reduce social isolation among seniors by providing fresh conversation topics and stimulating activities. By engaging older people in storytelling (through conversation cards) and cooperative play (through puzzles or quizzes), it could enhance their social interactions and mental engagement. An older participant indirectly affirmed this by saying the toolkit was "*very suitable for people like me who had no prior knowledge. It gave me an opportunity to learn and also to connect with society (British society) on this issue.*" Thus, the result was not only climate education but also a sense of inclusion and participation for older migrants who might otherwise feel left out of contemporary discussions. Younger participants also imagined secondary benefits like improved intergenerational relationships: "*gave them a topic of conversation and something enjoyable to do with us,*" implying it could strengthen family bonds and mutual understanding.

3) **Empowering the Younger Generation and Next Generation:** Many older participants, when asked who would benefit, immediately pointed to the younger generation such as their children and grandchildren. They felt that by using these tools, they could educate and influence youth. For instance, an older participant said the toolkit was "*useful for the next generation; it promotes intergenerational dialogue.*" Another mentioned that "*my family members and friends*" would benefit, emphasising that her children could learn about climate change in a fun way. This indicated a role reversal from the typical parent-child teaching dynamic: older people saw themselves as conduits of climate knowledge to the young, using the toolkit as the medium. The benefit to youth, as perceived by these older people, was twofold: gaining environmental awareness and also strengthening family communication (since doing these activities together bridges their worlds). Younger participants also agreed that children and teens could benefit. Some explicitly included "the next generation"and "students" among the beneficiaries.

4) **Community and Niche Groups:** Especially among the younger professionals, there was a recognition that certain community groups or niche audiences could particularly benefit from the toolkit: A city official noted that persons with disabilities or those who might not typically be included in climate discussions could find value in the toolkit. He believed simplifying the concepts into games "*can help them discover their own value in contributing to low-carbon awareness.*"

Several younger participants thought about **organisations and institutions**: one listed beneficiaries to include "*government agencies, community centers, families of seniors, and even businesses,*" reasoning that an overall rise in public awareness (sparked by these tools) would support the goals of those entities (for example, a more climate-aware public could drive demand for greener business practices or support government climate initiatives).

One participant pointed out that even people who are *not* already interested in climate could benefit because the toolkit "*can be treated as a fun little game for those who don't care about climate change.*" In other words, it could hook in the disengaged by being enjoyable first; the benefit was that those individuals might absorb some information or at least start thinking about climate where they previously would not.

1) **Cultural Communities:** Given that this project focused on Chinese migrants, one result was the empowerment of that community with a tailored resource. The participants saw that other cultural communities could adapt it (as evidenced by the example of British-born Filipinos mentioned by one participant). So the broader impact could include migrant communities using culturally adapted versions of the toolkit to engage their members in climate conversations, thereby increasing inclusivity in climate action dialogues.

2) **Intergenerational Dialogue and Relationship Building:** A significant result that emerged across responses was the strengthening of intergenerational connections as both a means and an end. By using the toolkit, older and younger people came together to play and discuss, which resulted in:

- **Knowledge Transfer:** Older adults can share life experiences and contextualise climate issues in stories, while younger people can share new information and digital-era perspectives. One younger participant noted beneficiaries would include "*stakeholders and practitioners*" as well as "*young and old people understanding each other.*" This hinted that not only was climate knowledge being

transferred, but mutual understanding between ages was improved. A likely long-term benefit is that families and communities become more cohesive in tackling problems like climate change when generations communicate better.

- **Empathy and Respect:** The toolkit also has the potential to enhance social cohesion. When an older person sees a grandchild engaged in learning about climate, or a youth hears grandparents relate to environmental changes over decades, it builds empathy.

Finally, an immediate outcome at the result level was that all participants said they would recommend the toolkit to others. This was an important result because it indicated a high level of satisfaction and confidence in the value of the intervention. If every participant followed through, the toolkit's reach could expand.

9.3.3 Comparative Analysis of Older vs. Younger Participants' Responses

Overall, feedback to the toolkit was positive from both groups, but differences were observed between the two age groups:

1) Engagement and Emotional Response

Older adults mainly enjoyed the social interaction and learning aspects, often expressing joy in connecting with family or learning something new. Younger adults highlighted the playful nature of the tools, describing them as "fun", "cool", and "nostalgic". For example, younger participants liked the chatterbox because it reminded them of childhood, while older participants found it interesting and challenging as a new activity.

2) Preferred Tools

Participants' favourite tools differed notably by age:

Older Chinese Migrants tended to favour the Conversation Cards and Climate Puzzle. These tools allowed them to engage at a comfortable pace and leverage their strengths. The conversation cards, in particular, appealed to their desire for meaningful exchange and sharing of wisdom with younger people. The puzzle was liked for combining learning with a familiar game format. Tools that had a straightforward educational payoff (like the net zero brochure were also appreciated by some older individuals who were eager to educate themselves on climate issues).

While Younger Professionals Showed a stronger preference for interactive, game-like tools such as the Chatterbox and Turntable, and also enjoyed the Puzzle but often with an eye toward its social play aspect (e.g., competition or group play). The younger group enjoyed elements that were lively, competitive, or could serve as ice-breakers in

gatherings. They were less drawn to the handbook or simple Q&A cards, possibly because these felt too static or informational; instead, they liked tools that introduced information through play. Interestingly, the conversation cards were not top-ranked by most younger participants, possibly because as facilitators or knowledgeable individuals, they might have already been comfortable with conversation and craved something more novel.

3) Feedback and Critique

When it came to critiquing the toolkit or suggesting improvements, younger professionals were far more vocal and detailed. Many of them offered concrete design suggestions (changing formats, adding features, improving visuals), reflecting either their design background or their comfort with providing feedback. In comparison, older participants gave relatively sparse critique. The majority either said nothing needed improvement or gave a single simple suggestion. This could be due to several factors:

The older generation's cultural/personal tendency is to be polite and not overly critical of the programs offered; they are also less familiar with possible designs (while younger design researchers can easily imagine alternative versions).

Nevertheless, some of the suggestions given by the older generation did offer insights into their user experience (e.g., wanting larger text or noticing when something was too easy or too difficult). In short, younger participants viewed themselves not only as users but also as co-designers, readily identifying flaws or improvements, while older participants mostly viewed themselves as recipients, focused on enjoying and learning from the experience rather than on how to tweak it. Younger users offered creative criticism, while older users revealed comfort levels and potential pain points (such as information overload or difficulty).

4) Learning Emphases

Both groups reported increases in awareness and knowledge, but older participants emphasised affective learning (responsibility, personal resolve) more, whereas younger participants emphasised cognitive expansion (new perspectives, interest) more:

Many older Chinese migrants came away feeling *responsible* and wanting to set an example. This may tie into cultural values of being elders who guide younger generations, now extended to guiding them in climate responsibility. It might also reflect that climate change was a relatively new topic for them, and learning about it triggered a strong moral response ("*We should do our part; I must change my habits and encourage others*").

Younger professionals certainly acknowledged responsibility too, but a number of them talked about how their *interest was sparked* or how they *learned something unexpected*. Because many in this group already accepted the importance of climate change (some work in related fields or are generally aware), the new outcome for them was more about *how* to engage or specific insights (for example, learning about community engagement strategies or seeing climate action from older people's perspective).

5) Perception of Toolkit's Purpose

Older participants seemed to see the toolkit as an educational empowerment tool for themselves and their peers or family. They frequently mentioned how it helped them or would help others learn about climate change. Education and awareness-raising were top-of-mind results for them, along with the enjoyment factor. In their eyes, the toolkit's value lay in simplifying a complex issue (climate change) into tangible, discussable pieces.

Younger participants valued the toolkit as an engagement and communication tool. They talked about it as a way to get people talking ("open up topics", "break the ice", "suitable for interaction"). They likely already accept the importance of climate action, so for them the toolkit's special value was in how it facilitates conversation and involvement. Their focus was on the toolkit's ability to bring people together and catalyse discussions that might not happen otherwise. This is why they thought about stakeholders, or using it in workshops.

9.4 Discussion

The evaluation showed that the Climate Toolkit achieved positive outcomes across all four levels of the Kirkpatrick Model. Both young and older participants enjoyed the toolkit, learned important concepts, planned to change their behaviours (especially regarding social interactions), and expected widespread benefits. This section discusses what these results mean for future design interventions, community climate action, and engaging older migrants in sustainability.

1) Improving User Engagement through Co-design

The overwhelmingly positive response from older Chinese migrants and young professionals confirmed the effectiveness of using co-design (involving users in the design process). Participants enjoyed culturally relevant elements such as conversation cards in Chinese and interactive puzzle games. They expressed a desire to continue

using and sharing the toolkit, demonstrating that its design successfully meets their needs.

Similar participatory design approaches could be used in the future to create educational tools in other fields or for other communities. When users see their culture, language, and interests reflected in the materials (as was the case with the older Chinese community here), they are more likely to adopt and spread the word.

2) Bridging Generations through Design

This toolkit helped bridge the generational gap. Older participants learned about climate change and connected better with younger people, while younger participants gained new insights on engaging with older adults. The toolkit allowed everyone to participate equally through storytelling and games.

By using creative tools, climate action (and other social issues) can be transformed into intergenerational action. Families and communities are untapped resources in climate communication.

3) Empowering Older Adults

In our literature review, we found that the capacity of older people to contribute to climate action is often overlooked. While this research demonstrated their numerous opportunities to participate in climate action, real-world practice and research remain underrepresented. In this study, older Chinese migrants enthusiastically embraced the toolkit and even considered themselves advocates for climate action. They felt a sense of responsibility and wanted to lead by example. Thus, empowering older generations with the knowledge and tools to address climate change is of great value. Not only can they adopt more environmentally friendly behaviours, but they can also influence others within their families and cultural communities (as many reported educating their children or using the toolkit within their social groups). Organisations working with older people (such as senior care centres and cultural associations) can integrate climate education into their programs, adopting an approach that respects older people's wisdom and desire to contribute.

4) Iterative Design and Accessibility

Participants suggested improvements such as larger text, simpler visuals, and clearer instructions, particularly helpful for older people.

Future iterations of the toolkit are necessary to further enhance its accessibility, engagement, and relevance. Building on user feedback from the evaluation, the next version will incorporate several targeted improvements.

First, to address issues of readability identified during testing, all text-based materials will be redesigned to be more age-friendly, including the use of larger font sizes, higher contrast, and simplified layouts.

Second, to accommodate varying levels of confidence and prior knowledge among users, the toolkit will introduce multiple levels of difficulty within interactive elements such as the puzzle. This would allow participants to engage at their own pace, offering both simplified entry points and more challenging tasks for sustained interest.

Third, the content will be expanded and refined based on participants' preferences, particularly by incorporating additional conversation prompts and contextually relevant examples. This aims to strengthen the toolkit's role as a social and discussion-based intervention.

In addition, a digital version of the toolkit has been developed, allowing users to access the games through a shared link. This format extends the toolkit beyond physical settings, enabling remote participation, easier dissemination, and intergenerational engagement across locations. It also responds to the observed behaviour that some participants, particularly younger users, were comfortable sharing and interacting with content through digital platforms.

5) Broader Application and Scaling

Many older Chinese migrants mentioned their hope that the toolkit "would benefit everyone."

Future expansion of this approach could include both horizontal scaling (adapting the toolkit to other communities or languages) and vertical scaling (integrating it into larger programs or policies).

6) Behaviour Change through Communication

This evaluation demonstrated the importance of behaviour change communication strategies in climate action—leveraging fun, interactive communications to shift attitudes and intentions. Traditional climate communication often struggles to engage the public due to fear-based messaging or technical jargon. Here, we see an alternative: positive, game-based user engagement leads to a willingness to act and advocate.

This provides insights that policymakers and environmental advocates can learn from this approach. If the goal is to get households to save energy or communities to support climate policy, incorporating game elements and personal conversations may be more effective than just a brochure. The success of this toolkit suggests that sometimes

emotional engagement (through games and personal connection) can drive cognitive and behavioural change.

7) Limitations and Future Considerations

Older participants might have shown positivity bias. While initial feedback is positive, future evaluations should observe actual behaviour changes over time. Using quantitative measures alongside qualitative feedback could give clearer insights into the toolkit's real-world impact.

The evaluation study only focused on the Climate Toolkit, not the Policy Brief. The Policy Brief was received by a policy expert and received positive feedback. It was submitted to the Department for Energy Security and Net Zero (DESNZ) Strategy team.

9.5 Summary

This chapter has presented the findings from the evaluation of the toolkit. Structured according to Kirkpatrick's four-level model, Study G provided insights into how older Chinese migrants and younger professionals engaged with the climate toolkit and its effectiveness in facilitating discussions on climate-related topics.

At the Reaction level, the participants responded very positively, with interactive and game-based elements, such as the climate change puzzle, conversation cards, and turntable eliciting the highest levels of engagement. Older participants particularly valued tools that encouraged storytelling and intergenerational dialogue, whereas younger professionals preferred dynamic, game-like activities.

At the Learning level, the toolkit proved effective in increasing the participants' awareness of climate change, their sense of personal responsibility, and their understanding of practical climate actions. Many older participants linked climate issues to their past experiences, while younger professionals developed a broader perspective on sustainability communication.

At the Behaviour level, the participants expressed a strong intention to continue using the toolkit. Older participants planned to incorporate the materials into family discussions and community gatherings, while younger professionals saw opportunities to apply them in educational and outreach contexts.

At the Results level, the study highlighted the toolkit's potential for wider social impact, fostering intergenerational dialogue and strengthening community engagement in

climate action. Notably, all participants stated they would recommend the toolkit to others, suggesting a multiplier effect in the dissemination of climate knowledge.

Chapter 10: Discussion & Conclusion

This chapter brings together the core findings of the dissertation and interprets them in relation to the research questions, theoretical framework and wider academic debates outlined in the previous chapters.

10.1 Bringing the Thesis Together

This thesis set out to investigate how older Chinese migrants in the UK perceive, practise, and engage with low-carbon living, and how inclusive design interventions can support their understanding of, motivation for, and participation in the UK's net-zero transition. Rather than treating net zero as a purely technical or policy-driven agenda, the thesis has approached it as a social, cultural, and communicative challenge. It has examined how climate action is understood and enacted through everyday routines, migration experiences, family relationships, community networks, language access, and culturally embedded values.

Across the seven studies, the thesis demonstrates that older Chinese migrants are not outside the net-zero transition. Many participants already practised forms of low-carbon living through thrift, reuse, moderation, careful consumption, public transport use, food saving, and energy saving. However, these practices were often not articulated through the language of "net zero" or formal climate policy. Instead, they were shaped by cultural memory, economic prudence, health concerns, family responsibility, and intergenerational care. This finding challenges the assumption that limited familiarity with climate terminology necessarily indicates disengagement from sustainable practice. It also highlights a gap between mainstream net-zero communication and the lived realities of older migrants.

The research programme was deliberately staged to move from understanding everyday practices to translating them into design and policy-relevant interventions. Studies A and B established the empirical foundation by examining older Chinese migrants' existing low-carbon behaviours, perceptions of net zero, motivations, and barriers to information access. Study C then used co-design workshops to explore participants' daily routines, social roles, trusted information channels, and preferences for climate communication. Study D introduced a comparative perspective through local older adults in the UK, showing both shared concerns and differences in policy familiarity, institutional trust, and forms of climate engagement. Study E brought designers into the process, enabling insights from older participants to be interpreted and translated into

potential intervention strategies. Study F developed these insights into a bilingual climate toolkit and policy brief, while Study G evaluated the toolkit with older Chinese migrants and design-related professionals.

These studies show that climate engagement among older Chinese migrants cannot be understood through awareness, attitude, or behaviour change alone. Their engagement is better understood as a process of sensemaking, in which people connect unfamiliar policy concepts to familiar practices, values, relationships, and material circumstances. The thesis therefore argues that inclusive climate communication should not simply attempt to "educate" older migrants about net zero from the top down. Instead, it should recognise the low-carbon meanings already present in their lives and create culturally relevant pathways through which these practices can be named, shared, strengthened, and connected to wider climate action.

This chapter draws these threads together. It first discusses the thesis's core findings in relation to the literature on climate communication, ageing, migration, practice, and behaviour change. It then reflects on the diversity of older Chinese migrants and the structural conditions that make some participants appear "hard to reach". The chapter also considers the salience and limitations of co-design and designer translation, before reflecting on the usefulness of the toolkit within the evaluation sample. Finally, it outlines the theoretical, methodological, and practical contributions of the thesis, its limitations, and directions for future research.

10.2 Culturally Embedded Low-Carbon Practice: Reframing Older Chinese Migrants' Climate Engagement

A central finding of this thesis is that older Chinese migrants' engagement with climate action is often embedded in everyday practices rather than expressed through formal climate terminology. Across the empirical studies, many participants demonstrated low-carbon behaviours such as thrift, reuse, careful consumption, energy saving, food saving, walking, public transport use, and passing items on within families or communities. However, these practices were not usually described by participants as "climate action" or "net-zero behaviour". Instead, they were commonly understood through cultural values, economic prudence, personal habits, health, family responsibilities, and memories of material scarcity (Hobson, 2003; Liang et al., 2024; Shove, 2010; Yan, 2020).

This finding complicates conventional assumptions in the climate communication and behaviour-change literature, where a lack of awareness or unfamiliarity with policy terminology may be interpreted as limited engagement. In this research, limited knowledge of the term "net zero" did not necessarily mean an absence of low-carbon practice. Rather, it revealed a disconnection between participants' existing everyday sustainability and the dominant language of UK climate policy. Older Chinese migrants were often already practising forms of sustainability, but these practices remained largely invisible because they were not framed through institutional climate discourse (Kollmuss & Agyeman, 2002; Southerton et al., 2011; Spaargaren, 2011).

Frugality was particularly significant. For many participants, saving energy, avoiding waste, repairing items, reusing containers, reducing unnecessary consumption, or saving food were not new behaviours introduced by environmental campaigns. They were long-standing habits shaped by Chinese cultural traditions, life-course experience, migration histories, and economic adaptation (Ma, 2019; Tu, 1996; Yan, 2020). These findings resonate with practice-based approaches to sustainability, which argue that environmentally significant behaviours are often embedded in routines, materials, meanings, and social norms rather than produced solely by individual attitudes or policy awareness (Reckwitz, 2002; Shove, 2010; Southerton et al., 2011).

The research therefore reframes older Chinese migrants not as a group lacking climate engagement, but as a group whose climate-relevant practices are culturally embedded and under-recognised. Their everyday low-carbon behaviours represent what might be understood as a form of tacit or quiet sustainability: practices that contribute to resource conservation without necessarily being labelled as environmental action (Hards, 2011; Head et al., 2021; Hobson, 2003). This is particularly important because mainstream net-zero communication often privileges technical terminology, policy targets, new technologies, and future-oriented transition narratives. Such framings may overlook older migrants' existing forms of low-carbon knowledge, especially when these are expressed through thrift, care, moderation, and family-based responsibility (Climate Outreach, 2025; Moser & Dilling, 2011b; United Nations, n.d.).

At the same time, the thesis does not romanticise frugality or assume that culturally embedded low-carbon practices are sufficient on their own. Some behaviours were driven by financial constraint rather than environmental choice, and some participants associated net-zero policy with cost, taxation, inconvenience, or institutional distance. This indicates that everyday sustainability may coexist with limited policy trust, low

climate literacy, and exclusion from formal participation (Middlemiss et al., 2023; OECD, 2025; Stern, 2000). The point, therefore, is not that older Chinese migrants are automatically climate actors, but that climate engagement must begin from the meanings, constraints, and values already present in their lives.

This has important implications for inclusive climate communication. Instead of asking older migrants to abandon their existing understandings and adopt abstract policy language, communication strategies should connect net-zero concepts to familiar practices and values. For example, messages about reducing emissions can be linked to saving energy, avoiding waste, protecting family wellbeing, caring for future generations, and maintaining practical wisdom across generations (Barras, 2021; Moser & Dilling, 2011b; United Nations, n.d.). In this sense, climate communication becomes a process of translation: translating policy language into everyday meaning, and translating participants' lived practices into recognised forms of climate contribution.

By foregrounding culturally embedded low-carbon practice, this thesis contributes to a more inclusive understanding of public engagement with net zero. It suggests that climate participation should not be measured only by explicit awareness, stated concern, or adoption of new technologies, but also by the ways people already organise everyday life around resourcefulness, care, and restraint (Barr et al., 2011; Mees, 2022; Whitmarsh et al., 2011). For older Chinese migrants, the challenge is not simply to create new low-carbon behaviours, but to recognise, support, and extend existing practices in ways that are meaningful within their cultural, linguistic, and social contexts.

10.3 From Vulnerability to Agency: Older Adults as Contributors to Climate Action

Much of the literature on ageing and climate change emphasises older adults' vulnerability to climate-related risks, including heatwaves, health impacts, mobility constraints, social isolation, and limited adaptive capacity (Arbuthnott & Hajat, 2017; Filiberto et al., 2009; Haines et al., 2006). These concerns are important, particularly as older adults may face heightened physical, economic, and social risks in the context of extreme weather and wider environmental change. However, a vulnerability-focused framing can also narrow how older people are understood within climate discourse. It may position them primarily as recipients of protection rather than as holders of

knowledge, everyday practitioners of sustainability, and potential contributors to climate action.

The findings of this thesis support a more balanced interpretation. Older Chinese migrants in this research did experience forms of exclusion, including language barriers, digital difficulties, limited access to official policy information, unfamiliarity with UK climate terminology, and varying levels of social isolation. Some participants were also cautious about institutional communication, particularly when net-zero policies were associated with cost, taxation, or unclear government responsibility. These findings confirm that older migrants can be structurally marginalised within mainstream climate communication and public engagement processes.

At the same time, the research shows that vulnerability does not preclude agency. Participants across the studies demonstrated practical knowledge, resourcefulness, and moral motivation that are highly relevant to climate action. Their low-carbon practices were often embedded in everyday acts of thrift, care, reuse, saving, repair, and moderation. Many participants also expressed a strong sense of responsibility towards children and grandchildren, suggesting that intergenerational concern can be a significant motivation for climate engagement (Ayalon et al., 2023; Frumkin et al., 2012; Pillemer et al., 2021b). In this sense, older Chinese migrants should not be understood only as a “hard-to-reach” group, but also as a group whose knowledge and participation have been insufficiently recognised by existing climate communication systems.

Study D reinforced this broader point by showing that local older adults in the UK also possess climate-relevant knowledge and practical suggestions. Participants discussed the importance of clearer language, trusted media, community-based communication, intergenerational dialogue, and more transparent government and business action. This comparative perspective suggests that older adults more generally can contribute to climate communication not only as learners, but also as advisers, storytellers, community connectors, and advocates (Pillemer et al., 2021b; Pillemer et al., 2022). The issue, therefore, is not simply whether older people are willing to engage, but whether climate institutions create accessible and meaningful opportunities for their engagement.

This shift from vulnerability to agency is particularly important in the case of older migrants. The term “hard to reach” can be misleading if it implies that the problem

lies mainly with the participants themselves. In this thesis, participants were not inherently unreachable. Rather, they were often made difficult to reach by language exclusion, reliance on English-only information, digital-first communication, limited institutional trust, unfamiliarity with participation channels, and the absence of culturally meaningful climate narratives (Climate Outreach, 2025; Gutterman, 2022; Middlemiss et al., 2023). Once engagement took place through trusted community spaces, bilingual materials, visual prompts, familiar topics, and respectful conversation, many participants were willing to share their experiences and reflect on climate-related issues.

The research also revealed considerable diversity within the category of "older Chinese migrants". Participants differed in migration route, language repertoire, education, social networks, length of residence, digital confidence, family role, and degree of cultural adaptation. Some participants were highly educated and relatively confident in navigating UK systems; others relied heavily on Chinese-language networks and family members. Some were environmentally curious and policy-aware, while others engaged in low-carbon practices mainly through frugality, household responsibility, or financial necessity. This diversity cautions against treating older Chinese migrants as a single homogeneous group and supports the need for differentiated communication strategies (Berry, 1997; Caidi et al., 2020; Victor et al., 2021).

Reframing older adults as contributors does not mean ignoring their needs or barriers. Rather, it means recognising that support and agency can coexist. Older Chinese migrants may require accessible information, translation, trusted intermediaries, and age-friendly engagement formats, while also bringing cultural knowledge, everyday sustainable practices, family influence, and community trust into climate action. This dual understanding is central to inclusive design: those often positioned at the margins may reveal problems in existing systems and generate insights that benefit wider publics (Clarkson & Coleman, 2010; Coleman et al., 2016).

10.4 Exclusion, Diversity and the Meaning of 'Hard-to-Reach'

The findings of this thesis suggest that the label "hard to reach" requires careful reflection. Older Chinese migrants in this research were not inherently unwilling to participate in climate-related discussions. Rather, they were often made difficult to reach by the ways in which climate communication, public engagement, and research

recruitment are commonly organised. English-language policy materials, digital-first communication, technical terminology, unfamiliar institutional channels, and limited cultural representation can all create barriers that exclude older migrants from mainstream net-zero discourse (Caidi et al., 2020; Gutterman, 2022; Middlemiss et al., 2023).

This is important because the term "hard to reach" can unintentionally shift responsibility onto the participants themselves. It may imply that older migrants are passive, disengaged, hidden, or resistant. However, the empirical studies in this thesis showed a more complex picture. When engagement took place through trusted community organisations, Chinese-language communication, face-to-face interaction, familiar social settings, and visual or participatory methods, many participants were willing to share detailed reflections on everyday sustainability, family responsibility, cultural memory, and climate-related concerns. In this sense, the research suggests that older Chinese migrants are not simply "hard to reach"; rather, they are often underserved by conventional engagement infrastructures.

The recruitment process itself revealed this dynamic. Participants recruited through Chinese community centres, churches, cultural associations, WeChat groups, and snowball sampling were reached through relational trust rather than formal institutional channels. These routes were especially important because many participants relied on Chinese-language social networks for information and support (Caidi et al., 2020; Du et al., 2019; Sun & Yu, 2022). Some were more comfortable engaging in familiar community spaces than responding to university-style or government-style invitations. This indicates that access depends not only on the availability of participants, but also on the cultural and relational appropriateness of the invitation.

The thesis also revealed considerable diversity within the category of older Chinese migrants. Participants differed in migration history, region of origin, language repertoire, education, occupation, length of residence, family role, digital confidence, and level of social integration. Some were former international students or professionals with relatively strong English skills and higher confidence in navigating UK institutions. Others were labour migrants, marriage migrants, or dependent grandparents whose social lives were more strongly centred on Chinese-speaking networks. Some participants showed interest in net-zero policy, while others understood low-carbon behaviour primarily through thrift, household responsibility, health, or economic

necessity. This diversity means that older Chinese migrants should not be treated as a homogeneous community (Berry, 1997; Pan et al., 2021; Wei & Hua, 2010).

The idea of "hard to reach" also intersected with age. Some older participants experienced barriers related to mobility, digital confidence, eyesight, fatigue, or unfamiliarity with formal research settings. These barriers shaped both recruitment and participation. For example, longer sessions, text-heavy materials, online-only platforms, or abstract policy language could have discouraged participation. The use of larger print materials, bilingual explanations, short activities, visual prompts, familiar examples, and breaks helped reduce these barriers. This suggests that age-friendly and culturally responsive research design is not an optional addition, but a condition for meaningful participation (Gutterman, 2022; Pillemer et al., 2021b; Woolrych et al., 2023).

At the same time, the research process revealed that community-based recruitment can produce its own limitations. Participants who were already connected to churches, community organisations, or WeChat groups were easier to reach than those who were more socially isolated. As a result, the most excluded individuals may still remain underrepresented. This limitation is important. The study accessed both visible community participants and some less visible participants through online and snowball routes, but it cannot claim to fully represent older Chinese migrants who are isolated, digitally excluded, undocumented, in poor health, or disconnected from community networks.

Therefore, this thesis understands "hard to reach" as a relational and structural condition rather than a fixed characteristic of a group. Participants become easier or harder to reach depending on the language, medium, location, trust relationship, timing, and cultural framing of engagement. For climate communication, this means that inclusion requires more than translating existing messages. It requires redesigning engagement pathways around trusted intermediaries, community spaces, bilingual and visual formats, and recognition of the diverse life circumstances within migrant communities.

This reflection also has implications beyond older Chinese migrants. Groups described as marginal, hidden, or hard to reach may reveal the limitations of mainstream communication systems. From an inclusive design perspective, working with participants at the edge of existing systems can expose barriers that affect many others, including older people, migrants, low-income communities, digitally excluded groups,

and people unfamiliar with policy language (Clarkson & Coleman, 2010; Coleman et al., 2016). In this sense, the experiences of older Chinese migrants are not peripheral to net-zero communication; they illuminate how climate engagement can become more inclusive, accessible, and socially grounded.

10.5 From Awareness to Sensemaking: Rethinking Behaviour Change through Practice, Culture and Migration

This thesis challenges a simple awareness-based model of climate behaviour change. In many climate communication approaches, limited engagement is often treated as a knowledge deficit: if people do not act, they are assumed not to know enough or not to understand the issue (Kollmuss & Agyeman, 2002; Moloney et al., 2010). However, the findings of this research suggest that this explanation is insufficient for older Chinese migrants. Many participants already practised low-carbon behaviours, including saving energy, reusing materials, reducing waste, walking, using public transport, and careful consumption, but these actions were usually connected to thrift, health, family responsibility, and economic prudence rather than explicit climate awareness.

This indicates that the problem is not simply a lack of behaviour, but a gap between existing sustainable practices and formal net-zero discourse. Participants' everyday actions often aligned with low-carbon principles, yet they were not always recognised by participants themselves, policymakers, or mainstream climate communication as climate-relevant. Therefore, the role of design intervention is not only to provide information, but also to help participants reinterpret familiar practices within the language of climate action.

Sensemaking is useful here because it explains how people interpret new information through existing experiences, identities, and social relationships (Weick, 1995). For older Chinese migrants, net zero became more meaningful when linked to familiar concerns such as saving money, avoiding waste, protecting health, caring for grandchildren, and remembering past experiences of scarcity. Migration also shaped this process, as participants negotiated between Chinese cultural values and the policy language, infrastructures, and expectations of life in the UK.

This thesis therefore, argues that behaviour change among older migrants should be understood as a situated and relational process (Berry, 1997; Reckwitz, 2002; Shove,

2010). It is shaped by everyday routines, cultural memory, family roles, language access, community trust, and institutional conditions. The Climate Toolkit supported this process by using bilingual, visual, tactile, and discussion-based formats to connect abstract climate concepts with participants' lived experience. In this sense, the toolkit functioned not simply as an educational resource, but as a bridge between existing low-carbon practices and formal net-zero engagement (Harper, 2002; Pink, 2013; Sanders & Stappers, 2008).

This research suggests a shift from awareness-led communication to sensemaking-oriented climate engagement. Older Chinese migrants should not be approached as blank recipients of climate information, but as people who already hold climate-relevant practices, values, and knowledge. The task is to recognise these practices, make their environmental relevance visible, and connect them to wider net-zero goals.

10.6 The Role and Limits of Co-design and Design Translation

Co-design played an important role in this thesis, but its role needs to be understood carefully (Blessing & Chakrabarti, 2009; Sanders & Stappers, 2008). The research did not treat co-design as a single workshop method or as a guarantee of empowerment. Instead, co-design was used as part of a staged design research process in which participant insights were gradually elicited, interpreted, translated, developed, and evaluated across the DRM phases (Ceschin & Gaziulusoy, 2016).

In Study C, older Chinese migrants were directly involved in co-design activities through journey mapping, role mapping, communication preference exercises, and visual message creation. These activities helped reveal aspects of everyday life that may have been difficult to capture through interviews alone, including routine-based touchpoints, trusted community spaces, family roles, and preferred formats for receiving climate information. In this sense, co-design was valuable because it gave participants opportunities to express tacit knowledge through visual and participatory methods, rather than relying only on abstract verbal explanation (Harper, 2002; Pink, 2013).

However, the research also shows that co-design has limits. Older participants did not always have the language, confidence, time, or design vocabulary to translate their experiences directly into intervention concepts. Some participants were more comfortable sharing stories, routines, and preferences than proposing formal design

solutions. This is particularly important in research involving older migrants, where language barriers, unfamiliarity with design processes, and power differences between researcher and participants can shape the extent of participation (Bovaird & Loeffler, 2013; Minkiewicz et al., 2016).

For this reason, Study E introduced a process of design translation. Designers worked with synthesised findings from earlier studies and translated older adults' experiences into possible communication strategies, visual formats, and intervention ideas. This stage was valuable because designers could identify patterns, imagine formats, and connect participant needs to practical design possibilities. The resulting toolkit was therefore not produced by older migrants alone, nor imposed by designers alone. It emerged through a mediated process between lived experience and design expertise.

At the same time, this mediated process also created limitations. Because designers interpreted findings indirectly, there was a risk that older migrants' voices could be simplified, aestheticised, or reframed through professional assumptions. The research attempted to reduce this risk by grounding the design brief in empirical findings from Studies A – D and by evaluating the resulting toolkit with older Chinese migrants in Study G. Nevertheless, the thesis recognises that design translation always involves interpretation, selection, and reduction.

The contribution of co-design in this thesis therefore lies not in claiming full participant control over the design process, but in showing how participatory insight, designer interpretation, and evaluation can be connected transparently and iteratively. Co-design helped surface lived experience; design translation helped turn this experience into tangible interventions; and evaluation tested whether these interventions were meaningful to the intended users.

This reflection is important for inclusive climate communication. Working with marginalised or underrepresented groups does not mean expecting participants to become designers. Rather, it means creating accessible ways for them to contribute their knowledge, ensuring that designers remain accountable to that knowledge, and returning to users to assess whether the design outcomes are understandable, respectful, and useful.

10.7 Usefulness and Limitations of the Climate Toolkit

The Climate Toolkit was developed as a practical response to the barriers identified across the thesis, particularly language barriers, unfamiliarity with net-zero terminology, limited access to trusted information, and the need for culturally meaningful forms of climate communication. Its usefulness was evaluated in Study G with a specific sample of 26 participants, including 12 older Chinese migrants and 14 designers or related professionals. This sample allowed the toolkit to be assessed both by its intended users and by participants with relevant expertise in design, education, media, community work, and older adult care.

The evaluation suggested that the toolkit was useful in three main ways. First, it helped translate abstract net-zero concepts into accessible everyday language. Older Chinese migrant participants often found technical climate terminology difficult to understand, but the bilingual brochure, visual explanations, carbon footprint self-assessment card, and games helped connect net zero with familiar practices such as saving energy, reducing waste, public transport use, food choices, and careful consumption. This indicates that the toolkit worked not only as an information resource, but also as a translation device between policy language and everyday practice.

Second, the toolkit supported engagement through tactile, visual, and playful formats. Participants responded positively to interactive components such as the puzzle, memory turntable, chatterbox, and conversation cards. These tools reduced the formality of climate communication and made discussion less intimidating. Rather than presenting climate change as a distant or technical issue, the toolkit encouraged participants to explore it through memory, storytelling, daily routines, and practical choices.

Third, the toolkit created opportunities for intergenerational and community-based dialogue. Older Chinese migrants in the evaluation suggested that the materials could be used with family members, friends, community groups, and Chinese-speaking organisations. This is important because earlier studies showed that older migrants often rely on family members, community organisations, WeChat groups, churches, and Chinese-language networks for information and support. The toolkit therefore appears most useful when embedded in relational settings, rather than used as a stand-alone educational product.

However, the usefulness of the toolkit should not be overstated. The evaluation sample was small and purposively selected. Many participants were recruited through community organisations or professional networks, meaning they may have been more socially connected, motivated, or open to participation than more isolated older migrants. Therefore, the positive responses in Study G cannot be generalised to all older Chinese migrants in the UK.

There are also limitations in the type of impact that was measured. The evaluation captured immediate reactions, perceived learning, intended behaviour change, and anticipated wider benefits, but it did not measure long-term behavioural change. Participants stated that they would use or recommend the toolkit, but future research would need to examine whether the toolkit leads to sustained changes in household practices, family conversations, or community engagement over time.

Accessibility also remains an area for improvement. Although the toolkit was designed to be bilingual, visual, and low-tech, participants still suggested improvements such as larger text, clearer contrast, simplified instructions, and different levels of difficulty. This indicates that inclusive design is an iterative process rather than a one-time solution. Future versions would need to be adapted for participants with lower literacy, poorer eyesight, limited mobility, dialect differences, or limited confidence in group activities.

Finally, the toolkit cannot solve structural barriers on its own. It can improve understanding, support discussion, and validate existing low-carbon practices, but it cannot directly remove wider constraints such as energy costs, housing conditions, access to subsidies, distrust of institutions, or exclusion from policymaking. For this reason, the toolkit should be understood as one part of a wider engagement strategy, alongside community partnerships, translated policy information, institutional support, and more inclusive public engagement.

10.8 Researcher Reflexivity and the PhD Journey

At the beginning of the research, I was still unfamiliar with the everyday lives and experiences of older Chinese migrants in the UK. Although I am also a Chinese migrant, this research continually reminded me that migration is not a single or uniform experience. In many ways, the participants represented multiple possible versions of migrant life: different from me, but also connected to my own reflections on migration,

belonging, language, family, and adaptation. Helping older Chinese migrants to voice their experiences and understand the UK's net-zero agenda also became a process of self-education, through which I explored, together with participants, what forms of participation and recognition might be possible.

My partial insider position helped me build trust with older Chinese migrant participants. When discussing familiar topics such as thrift, family responsibility, food practices, migration, and community life, we often shared cultural references and a common language. At times, I also saw traces of my own family members in their stories. This made the research personally meaningful, but it also required careful reflexivity. My insider position was limited, as I did not share the same age, migration history, class background, or life stage as many participants. Therefore, I had to avoid assuming that shared language or cultural background meant complete understanding. Throughout the research, I treated cultural familiarity as a starting point for dialogue, rather than as evidence that I already understood participants' experiences.

My understanding of the research problem also changed during the PhD. I initially approached the study as a problem of climate communication: how could older Chinese migrants be supported to understand net zero? However, the empirical studies showed that many participants were already practising low-carbon behaviours, although their motivations were far more complex than I had expected. Their actions were connected to personal histories, cultural memory, economic conditions, family responsibilities, health, and experiences of migration. This shifted the focus of the thesis from simply increasing awareness to recognising, interpreting, and translating existing practices. It also encouraged me to ask not only what participants do, but why these practices matter within their lives, and what designers and researchers can responsibly do with this knowledge.

Working with older migrants also required continuous ethical reflection. Some participants faced language barriers, limited digital confidence, health considerations, and varying levels of trust in formal institutions. I also encountered practical challenges, including refusals, less active interviews, and the complexity of analysing a large amount of qualitative data. These challenges led me to adapt the research process through bilingual materials, larger printed formats, flexible language use, less intrusive questions, and opportunities for participants to pause, skip questions, or withdraw. Respecting participants, lowering the power distance, building rapport, offering

feedback, and ensuring data security and research rigour became essential parts of the research process.

Older Chinese migrants are both a small group within the UK and part of a much wider landscape of migration, ageing, and social participation. Although this PhD represents only a limited exploration over three years, it offers practical insights into inclusive climate communication and the recognition of marginalised voices in net-zero transitions. This reflexive journey has helped me understand research not only as a process of collecting data, but also as a process of listening, translating, learning, and imagining more inclusive possibilities for the future.

10.9 Contributions to Knowledge

This research contributes to the interdisciplinary fields of ageing, migration, climate engagement, and inclusive design. By focusing on older Chinese migrants in the UK, a group often overlooked in environmental discourse and net-zero policy communication, the thesis challenges dominant assumptions about who participates in climate action and how such participation should be understood.

1) Theoretical Contributions

This research contributes to a paradigm shift in how older adults are represented in the climate discourse. Contrary to depictions of older people as disengaged, static, or resistant to change, this study revealed older people as agents of sustainability, albeit in culturally specific and often invisible ways.

Building on Agyeman's concept of "just sustainabilities (Agyeman, 2013)", the findings highlight the need for intergenerational and intercultural justice in climate engagement strategies. Older Chinese migrants are not only caregivers and cultural transmitters, but also everyday practitioners of low-carbon living. Recognising their contributions reframes them from passive recipients to active co-producers of climate knowledge. See the Figure 10.1, which visualises the intersection of thematic domains (culture, technology, economy, society, and intergenerational dimensions) and levels of social actors (from individuals to global systems). Throughout the different stages of this research, both older Chinese migrants and local older adults in the UK contributed to enriching and refining this framework.

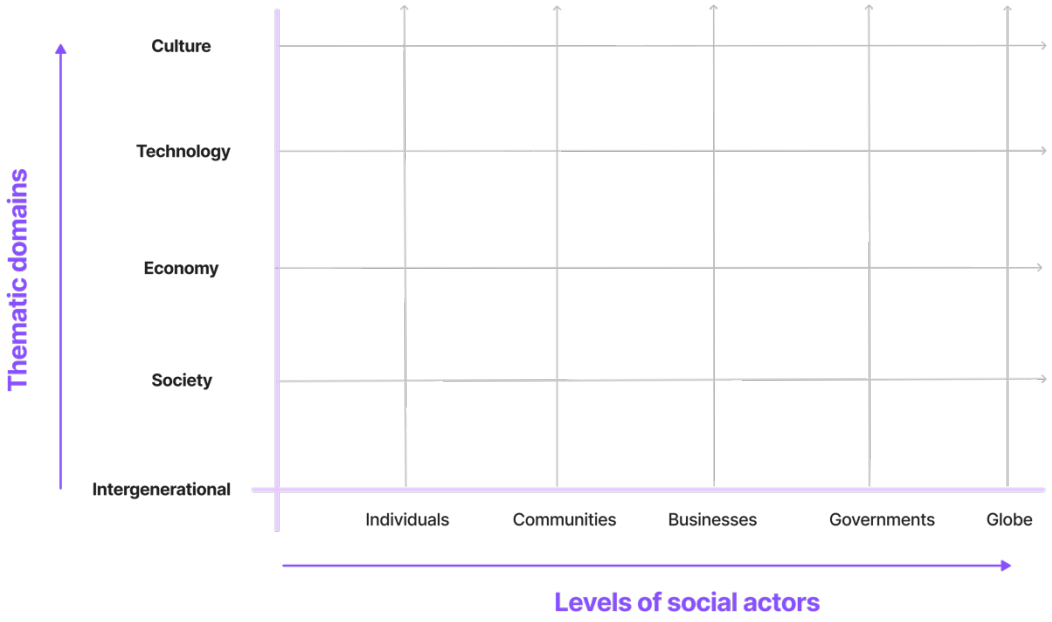


Figure 10.1 Multi-level integration framework (drawn by the author).

This research extends the concept of inclusive design beyond its traditional applications (e.g., accessibility, product design) to net-zero policies and climate change communication. It highlights how design thinking can be applied to improve policy accessibility, climate engagement, and low-carbon behaviour adoption among marginalised communities.

2) Methodological Contributions

This study proposes a bottom-up communication model, starting with a specific ethnic minority group and scaling insights to wider communities, policymakers, and businesses. Instead of relying solely on top-down policy dissemination, it adopts a participatory and staged approach that integrates multiple forms of engagement across the research process.

In particular, participatory design and co-design practices were incorporated in selected stages of the research (Study C), where older Chinese migrants actively contributed to shaping communication content and formats. These insights were further developed through subsequent stages, including designer-led workshops and research-through-design processes, allowing participant knowledge to be translated into practical interventions.

The study also contributes to design research for sustainability by demonstrating that design can function as both methodology and intervention. Through visual storytelling, gamified elements, participatory workshops, and iterative prototyping, the research positions design not merely as a communication tool but as a practice that incorporates and represents marginalised voices within the development of climate-related interventions.

3) Practical Implications

This research sheds light on the often-overlooked low-carbon behaviours of older Chinese migrants in the UK. While they naturally engage in sustainable practices (e.g., frugality, waste reduction), language barriers, policy inaccessibility, and limited digital literacy prevent them from aligning with the UK's net-zero agenda.

The bilingual climate toolkit developed in this project exemplifies how design can serve as a culturally sensitive medium, translating abstract climate policy into familiar, contextually meaningful practices. The preference for tactile, visual, and narrative-based formats emphasizes the need to move away from digital-only or text-heavy interventions. The toolkit was also found to stimulate intergenerational dialogue, particularly through its game- and story-based formats.

The study also highlights the importance of intergenerational dynamics in shaping climate understanding and action among older Chinese migrants. Many participants were caregivers to grandchildren or were supported by adult children in navigating information and services. This positions them as both influencers and recipients in familial sustainability decision-making.

Policy briefs developed through this study offer replicable templates for how to:

- Localise net-zero policy language into accessible, culturally relevant narratives;
- Employ non-digital, bilingual, and low-literacy formats;
- Centre the expertise of older migrants as contributors, not just targets;

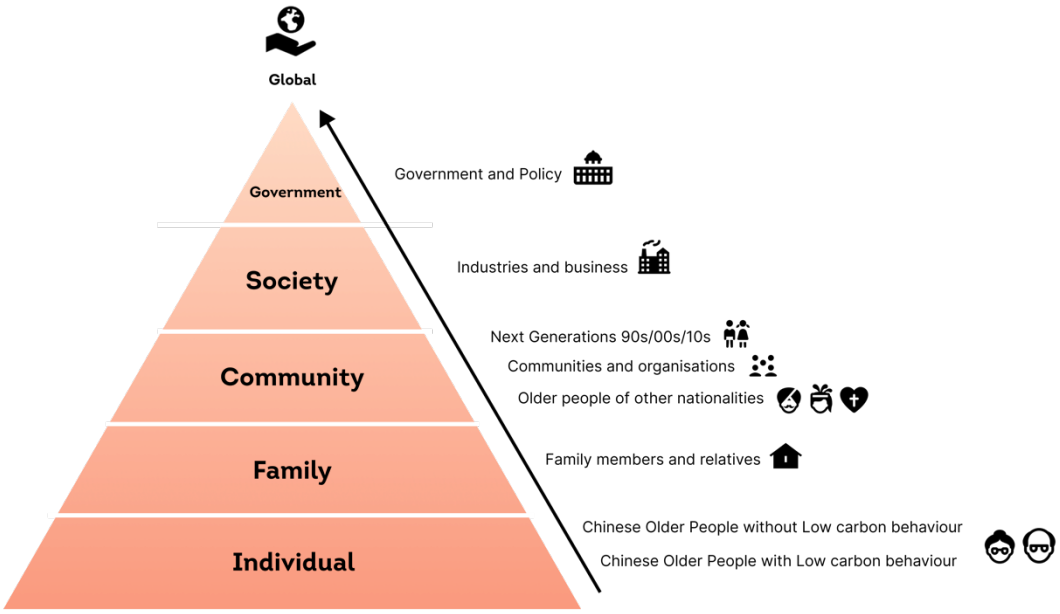


Figure 10.2 Multi-level engagement strategy (drawn by the author).

These impacts extend beyond the Chinese community. They touch upon broader issues such as climate justice, equity in policy participation, and the need for design approaches that prioritise voice, participation, and collaboration.

Figure 10.2 illustrates the multi-level engagement strategies mentioned in Chapter 1. Beyond individual use, the toolkit demonstrates potential for broader application across multiple social strata. It is not merely a set of educational tools but a bottom-up communication strategy that begins with individual awareness and extends outward through social, intergenerational, and cultural networks. By leveraging its social, playful, and educational nature, the toolkit can foster dialogue, strengthen collective learning, and inspire broader behavioural change across diverse contexts. This adaptability makes it a scalable model for participatory climate communication and inclusive sustainable development education.

10.10 Limitations of the Study

While this research offers contributions to climate engagement, ageing, migration, and inclusive design, several limitations should be acknowledged. These limitations relate to the study's scope, recruitment, participant continuity, design process, evaluation, and transferability.

First, the study was based on a relatively small, purposively selected sample. Most older Chinese migrant participants were recruited from London-based or nearby community contexts, including Chinese community organisations, churches, social networks, and online platforms. Although efforts were made to include variation in age, gender, migration pathway, language background, and levels of community participation, the sample cannot represent the full diversity of older Chinese migrants in the UK. Older migrants living in rural areas, those with weaker community ties, those with poorer health, and those experiencing more severe social isolation may have different experiences.

Second, the recruitment strategy may have excluded some of the most "hard-to-reach" participants. Community-based and snowball recruitment helped build trust and access participants who might not respond to formal university recruitment. However, these methods also relied on existing social networks. Participants who were already connected to community organisations, churches, WeChat groups, or family networks were more likely to be reached. By contrast, older migrants who were socially isolated, digitally excluded, undocumented, distrustful of institutions, or less confident in participating in research may remain underrepresented. This limitation is important because the barriers faced by these groups may be more severe than those identified in this thesis.

Third, some participants took part in more than one stage of the research, while others were newly recruited at later stages. This partial participant continuity had advantages, as it supported trust, deeper engagement, and an iterative understanding of participants' experiences. However, it may also have influenced the findings. Returning participants may have become more familiar with the research topic, more confident in discussing climate issues, or more positive towards the toolkit. Therefore, the sample should be understood as a mixed and partially overlapping research population, rather than a fully independent sample at each stage or a longitudinal cohort.

Fourth, the co-design process had methodological limits. Although older Chinese migrants contributed directly through interviews, walking interviews, and co-design activities, not all stages involved equal levels of participant control. In particular, the designer workshops and Research-through-Design phase involved a process of design translation, where participant insights were interpreted and transformed into intervention concepts by the researcher and designers. This made the design process

more feasible and professionally grounded, but it also introduced the risk of simplification or reinterpretation of participants' voices.

Fifth, the evaluation of the Climate Toolkit was limited in scope. Study G assessed immediate reactions, perceived learning, intended behaviour change, and anticipated wider benefits. However, it did not measure long-term behavioural change or sustained community use. Participants' positive responses indicate that the toolkit was understandable, engaging, and potentially useful, but future research is needed to examine whether it leads to lasting changes in household practices, intergenerational conversations, or community climate participation.

Finally, the transferability of the findings requires caution. The focus on older Chinese migrants provides cultural depth and allows the thesis to examine migration, language, family responsibility, frugality, and community trust in detail. However, other migrant or ethnic minority groups may have different histories, values, information channels, and relationships with climate policy. The findings and design principles may therefore be transferable only if adapted carefully to different cultural and social contexts.

10.11 Future Directions

Building on the findings and limitations of this study, several pathways for future research are proposed. These directions aim to further understand and enhance climate engagement among marginalised communities, and to refine the role of inclusive design in environmental communication.

1) Longitudinal Evaluation and Real-World Implementation of the Toolkit

Future research should examine the long-term usefulness and impact of the Climate Toolkit beyond the immediate evaluation conducted in Study G. While the evaluation showed positive responses in terms of engagement, perceived learning, and intended behaviour change, it did not measure sustained behavioural change over time. Future studies could therefore follow participants over several months to examine whether the toolkit supports continued family conversations, community sharing, changes in household practices, or increased confidence in engaging with net-zero information.

Further research could also test the toolkit in real-world community settings, such as Chinese community centres, churches, libraries, older people's groups, and intergenerational family events. This would help identify how the toolkit functions

outside a research setting, what forms of facilitation are needed, and which components are most useful for different subgroups

2) Intergenerational and Family-Centred Climate Engagement

This research shed light on the role of intergenerational relationships in shaping the environmental behaviours of older migrants. Future research could further explore how family-based interventions, including co-designed games, energy-saving challenges, or storytelling exercises, can foster shared climate practices across generations.

Design researchers could also explore intergenerational co-design workshops, creating opportunities for older and younger family members to jointly define what sustainability means within their family or cultural context.

3) Comparative Research with Other Migrant and Ethnic Minority Groups

Although this thesis focused on older Chinese migrants, future research could examine whether the findings and design principles are transferable to other migrant and ethnic minority communities. Different groups may have different languages, faith traditions, migration histories, household structures, information channels, and relationships with climate policy. Comparative studies with, for example, South Asian, Black African, Eastern European, Middle Eastern, or other East and Southeast Asian older migrant communities could help identify which aspects of the approach are broadly applicable and which require cultural adaptation.

4) Methodological Innovation in Inclusive Design Research in the future

Future research can push methodological boundaries by further exploring multimodal, sensorial, and emotion-based approaches to climate communication. The use of visual metaphors, tactile games, audio storytelling, and participatory mapping all hold promise for engaging underrepresented groups.

5) Institutional Integration and Policy Partnerships

Future studies should move beyond prototyping and testing, toward investigating how inclusive toolkits and participatory processes can be used in policy ecosystems. This may include:

- Embedding toolkits into local authority climate action plans;
- Co-producing communication strategies with municipal departments;
- Piloting training-of-trainers models (ToT) within migrant-led organisations.

The ToT approach is a cascading model in which key individuals are trained to pass on knowledge and skills within their own communities. It has been widely adopted in public health, education, and community development to promote sustainable, bottom-up capacity building (Poitras et al., 2022; Swanepoel, 1991; Wexler et al., 2017).

Such integration would not only enhance the real-world applicability of research outputs, but also contribute to the development of systemic, equity-focused engagement infrastructures for older adults and other marginalised populations.

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Appendices：

Appendix Study A

Sample questions for the interview

Understanding the perceptions of net zero among older Chinese migrants

This question should take an answer for 60 minutes.

Part 1

- **Basic information**

1. How old are you? (please circle one)

A：50-59

B：60-69

C：70-79

D：Over 80

2. What is your gender? (please circle one)

A: Male

B: Female

C: Prefer not to say

3. Where did you migrate from? (please circle one)

A: Hong Kong

B: Mainland China

C: Taiwan

D: Singapore

E: Malaysia

F: Other (Please specify) _____

4. How long have you lived in the UK? (please circle one)

A: 0-6 months

B: More than 6 months and less than 1 year

C: More than 1 year and less than 3 years

D: More than 3 years and less than 5 years

E: More than 5 years and less than10 years

F: More than 10 years

5. What are the reasons for your migration? （Multiple choice）

A: Reunion with family

B: Job opportunities

C: Better living conditions

D: Political and/or religious

E: Education

F: Better medical care

J: Security

6. How many times have you migrated or relocated?

A：0-1

B：2-3

C：4-5

D： More than 5 times

7. What language do you usually use? (please circle one or more)

A: English

B: Mandarin

C: Cantonese

D: Other (Please specify) _____

8. What is your level of proficiency in English?

Poor 1 2 3 4 5 Excellent

9. Do you think there is a gap between your own culture and the culture here?

Strongly disagree 1 2 3 4 5 strongly agree

10. What do you think are the differences between your home country and your host country?

(*Such as social environment, political background, economic factors, and cultural differences.)

_____

11. Are you always interacting with people from different cultures?

Never 1 2 3 4 5 Very often

12. Did you take training after migration to help you adapt to life here? If yes, what is it? Is it useful?

13. Do you have any coping strategies when you experience culture shock?

(*Many symptoms of culture shock are physical illnesses such as social isolation, homesickness, loneliness, low self-esteem, and more. Also, many external factors, such as weather and food differences, accommodation, language, discrimination, and different education systems, can also do.)

_____

14: Have you benefited or are you benefiting from social support?

(*It may be from the government, community, family, friends, or media .....)

_____

15. How do you understand Chinese thoughts and habits? Have they changed since you experienced the migration?

_____

16. Please describe your personality.

A: Openness (High to Low)

(*Example: A1 If you move to a new city, do you prefer to explore the new things in the city or do you prefer to stay at home; A2 with smart devices, do you prefer to explore them or do you prefer to use your old ones?)

B: Conscientiousness (High to Low)

(*Example: If you are planning a trip, do you prefer to spend time preparing the itinerary and details, or do you prefer to enjoy your free time?)

C: Extraversion (High to Low)

(*Example: Are you an extrovert or an introvert? For example, do you like to be the centre of attention and meet new people, or do you prefer to be alone and have your own space?)

D: Agreeableness (High to Low)

(*Example: Do you often help others? Or do you consider your own things to be more important?)

E: Neuroticism (High to Low)

(*Example: If you are unhappy, do you tend to talk to friends and family and express your emotions, or do you tend to keep quiet and self-regulate?)

17. Have you heard about net-zero? (please circle one or more)

A: Climate change

B: Increasing Energy bills

C: Rising temperatures

D: Food waste

E: Other (Please specify) _____

18. Net zero has been discussed a lot nowadays. Please tell me where you sit on the scale below.

0	1	2	3	4	5
No awareness at all	A little awareness	Moderate awareness	Good awareness, with actions	Very good awareness, Doing as much	Extremely aware and active on Net Zero

Part 2

- **Introduction to the study**
- Definition of Net Zero
- Document handbook
- Short Videos about Net Zero

- **Questions about Net Zero (4 aspects)**

- **Home**

1. Choose the type of house you are living in. What are the main differences between living in your home country and in London?
2. How to keep your home warm in cold days? What changes may you consider for this winter?
3. Do energy prices affect how much and how often you use your heating?
4. Facing the increasing energy bill, what is your coping strategy?

- **Food**

1. What diet changes have you experienced since you migrated to the UK?
2. How often do you eat meat and dairy products on a weekly basis?
3. Have you considered eating more vegetable? Why?
4. Do you grow vegetable or fruits by yourself?
5. Do you know the source of your food? Are they local or imported? Do you care? Why?

- **Waste**

1. How do you treat your home waste? Such as general waste; food waste; paper waste.
2. Do you bring your own bag when shopping?
3. Plastic bags are charged by supermarkets, do you support this?
4. What else do you think should be done to reduce waste? What can you contribute?

- **Clothes**

1. How many pieces of clothing do you have in your wardrobe?

A：10-20

B：21-50

C：51-100

D：100+

2. How many new clothes have you bought in the last 12 months？
3. If there are some rips in your clothes, do you have a habit of repairing them?

- **Travel**

1. What is your preferred means of transportation? Is it different from when you were in your home country?
2. If you could use public transport to reach your destination, would you choose to drive? Why?
3. Do you choose walking/cycling instead of public transport in your daily life?
4. Do you travel by flight? How often?
5. Did you fly back to your home country before COVID？ Do you have any plans to fly back to your home country in the future?
6. Did you have any long-distance travel in the last 12 months? How did you travel? How did you make your decisions?

- **Perspectives**

1. Please give us good examples of what you have done to reduce carbon emissions.

2. How do you get information about net zero emissions?

3. What channels do you think can help you obtain Information? (please choose one or more)

A: Family and friends

B: TV

C: Social media (such as WeChat, Facebook, Twitter, etc.)

D: Newspapers

E: Communities and Organizations

F: Other (Please specify) _____

4. What barriers hinder your access to relevant knowledge and information?

5. Could you please tell me what you would like to do to help achieve net zero emissions in the future?

PARTICIPANT INFORMATION SHEET

Understanding the perceptions of net zero among older Chinese migrants

Invitation Paragraph

You are invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with your family and friends if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the purpose of the study?

This research (Nov 2022-Nov 2023) will target mainly Chinese older migrants in London. The aim is to help older Chinese migrants understand low-carbon policies and the 2050 net-zero goal; understand their perspectives on the personal and social aspects of achieving net-zero goals and understand their current practices.

Why have I been invited to participate?

You are invited because we think you may be able to offer insights into this PhD research topic from the Chinese older migrant perspectives. We aim to include 30+ healthy Chinese older people (aged between 50-85), based on a voluntary basis.

Do I have to take part?

As participation is entirely voluntary, it is up to you to decide whether or not to take part. If you do decide to take part, you will be given in this information sheet to keep and you may be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time up until 30th June 2023 and without having to give a reason.

What will happen to me if I take part?

The research will be conducted through interviews and questionnaires, online or in person(if in person, a location will be chosen to ensure safety and convenience for you and the PhD researcher, with appropriate risk assessment in advance. The PhD researcher will wear a mask throughout to ensure social distancing and all COVID-19 safety measures are followed). Each session will be between 60-90 minutes. the PhD researcher will introduce

you to the background of her research, after which you will be asked questions and given sufficient time to answer and/or discuss these questions and make suggestions/comments.

Are there any lifestyle restrictions?

There are not any lifestyle restrictions.

What are the possible disadvantages and risks of taking part?

Please be aware that while every effort is made to ensure your safety, vaccination is proven to decrease the risk of transmission of Covid-19 and to reduce the likelihood of severe illness. Face coverings should be worn wherever possible for in-person interviews. You should wash or sanitise your hands regularly.

What are the possible benefits of taking part?

You will receive a small 'thank you' gift of appreciation(Eco bags for shopping); you may find out some tips to reduce your energy bills.

What if something goes wrong?

If something goes wrong and you wish to complain about the experience, you can contact the Chair of the Research Ethics Committee of College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Will my taking part in this study be kept confidential?

All information that is collected about you during the course of the research will be kept strictly confidential (for three years, between Nov 2022-Nov 2025). Any information about you which leaves the University will have all your identifying information removed. With your permission, anonymized data will be stored (On Brunel Onedrive only accessible to the research team) and may be used in future research – you can indicate whether or not you give permission for this by the Consent Form.

Will I be recorded, and how will the recording be used?

We intend to audio or video record the interviews as we plan to transcribe the data. The research team will use a Brunel-own laptop (password protected) or an audio/video recorder to do the recording. Your permission will be sought in advance, and the research team will clearly indicate it before the recording starts. The recording data will be transferred to a GDPR-compliant platform (e.g., a Brunel-owned computer) within three days of the

data collection, and cleared from the recording device so no other people will accidentally access it. The data will be destroyed once the transcription is completed, before the 31st of November 2023.

What will happen to the results of the research study?

The results will be written up as part of a research dissertation and associated publications. The participants will not be identified in any report or publication unless you specifically request it.

Who is organising and funding the research?

The research team (Miss Qing Ni, Prof Hua Dong, Dr. Antonios Kaniadakis) are organizing the research.

What are the indemnity arrangements?

Brunel University London provides appropriate insurance cover for research that has received ethical approval.

Who has reviewed the study?

The Research Ethics Committee of the College of Engineering, Design and Physical Science Research Ethics Committee has reviewed the study.

Research Integrity

Brunel University London is committed to compliance with the Universities UK Research Integrity Concordat. You are entitled to expect the highest level of integrity from the researchers during the course of this research

Contact for further information and complaints

Researcher name and details: Qing Ni, Brunel Design School, 2105826@brunel.ac.uk

Supervisor name and details: Prof Hua Dong, Brunel Design School, hua.dong@brunel.ac.uk

For complaints, Chair of the Research Ethics Committee:

Chair of the Research Ethics Committee, College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Please note: Research ethics approval has been obtained for this study from the Research Ethics Committee of the College of Engineering, Design and Physical Sciences

CONSENT FORM

Understanding the perceptions of net zero among older Chinese migrants

Principal Investigator: Qing Ni

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 30/11/2022 AND 30/11/2023

Please complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☐	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☐	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☐	☐
Who have you spoken to about the study?		
Do you understand that you will not be referred to by name in any report concerning this study?	☐	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☐	☐
• You don't have to give any reason for withdrawing	☐	☐
• Choosing not to participate or withdrawing will not affect your rights?	☐	☐
• You can withdraw your data any time up to 30/06/2023	☐	☐
I agree to my interview being audio and video recorded	☐	☐
I agree to the use of non-attributable quotes when the study is written up or published	☐	☐

The procedures regarding confidentiality have been explained to me	☐	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☐	☐
I agree to take part in this study.	☐	☐

Signature of research participant:	
Print name:	Date:
Witness Statement	
I am satisfied that the above-named has given informed consent.	
Witness signature:	
Print name:	Date:

Online Consent Form Template

Uunderstanding of low carbon decision making and the awareness of net-zero policies of older Chinese migrants in London

Principal Investigator: Qing Ni

Please confirm the following:

	Yes	No
• I have read the Participant Information Sheet included with this questionnaire		
• I am over the age of 18		
• I understand that no personal identifying data is collected in this study, therefore I know that once I have submitted my answers I am unable to withdraw my data from the study		
• I agree that my data can be anonymised, stored and used in future research in line with Brunel University's data retention policies		
• I agree to take part in this study		

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

21 November 2022

LETTER OF APPROVAL (Conditional)

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 22/11/2022 AND 31/10/2023

Applicant (s): Miss Qing Ni

Project Title: Understanding and perceptions of net zero among older Chinese migrants

Reference: 38537-LR-Nov/2022- 42215-2

Dear Miss Qing Ni

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- **Please ensure that you monitor and adhere to all up-to-date local and national Government health advice for the duration of your project.**
- **You must give your participants a Consent Form depending on the type of your research activity. For interviews (in person or vis skype etc.), Focus Groups, observations etc., you will need to give your participants the 'Consent Form Template' to complete/sign prior to commencing your testing.**
- **For the purposes of safety, we recommend that you remove your personal phone number from the questionnaire.**
- **As you are intending to conduct this research over a prolonged period; please be mindful that when you get the Final Ethical Approval, you will need to ensure that you follow the agreed protocol to conduct this research. Any changes to the agreed protocol will require you to either submit an 'Amendment' or a new Ethics Application.**

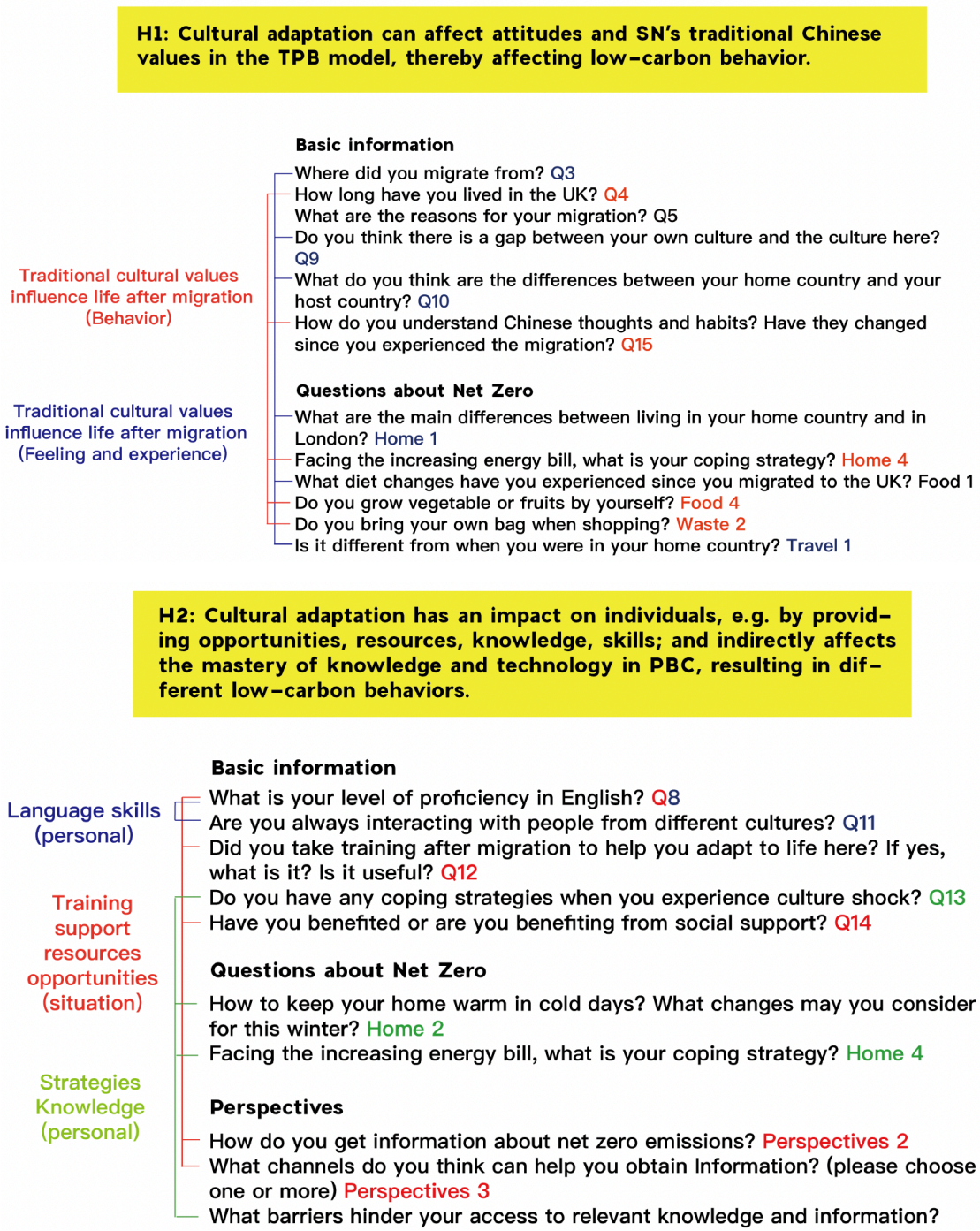
Above points can be addressed outside of the BREO system.

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- If your project has been approved to run for a duration longer than 12 months, you will be required to submit an annual progress report to the Research Ethics Committee. You will be contacted about submission of this report before it becomes due.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.



Classification of research questions



H3: The new environment provides external factors, such as economy, policy, culture, society, which are potential influencers of low carbon behavior change.

Basic information

Social support
- Did you take training after migration to help you adapt to life here? If yes, what is it? Is it useful? Q12
- Do you have any coping strategies when you experience culture shock? Q13
- Have you benefited or are you benefiting from social support? Q14

Society
- How do you understand Chinese thoughts and habits? Have they changed since you experienced the migration? Q15

Questions about Net Zero

Energy Policy
- What are the main differences between living in your home country and in London? Home 1
- How to keep your home warm in cold days? What changes may you consider for this winter? Home 2
- Do energy prices affect how much and how often you use your heating? Home 3

Society
- What diet changes have you experienced since you migrated to the UK? Food 1
- Do you know the source of your food? Are they local or imported? Food 5
- Plastic bags are charged by supermarkets, do you support this? Waste 3

Covid
- Is it different from when you were in your home country? Travel 1
- Did you fly back to your home country before COVID? Do you have any plans to fly back to your home country in the future Travel 5

Perspectives

Media
- What channels do you think can help you obtain Information? (please choose one or more) Perspectives 3

H4: There are significant differences in LCB among older migrants due to different personal characteristics.

Basic information

Personal information
- How old are you? Q1
- What is your gender? Q2
- Where did you migrate from? Q3
- How long have you lived in the UK? Q4
- What are the reasons for your migration? Q5
- How many times have you migrated or relocated? Q6
- What language do you usually use? Q7
- What is your level of proficiency in English? Q8
- Please describe your personality. Q16

Low-carbon awareness
- Have you heard about net-zero? Q17
- Net zero has been discussed a lot nowadays. Please tell me where you sit on the scale below. Q18

Questions about Net Zero

Eating habits
- How often do you eat meat and dairy products on a weekly basis? Food 2
- Have you considered eating more vegetable? Why? Food 3
- Do you grow vegetable or fruits by yourself? Food 4

Personal Preference
- How do you treat your home waste? Such as general waste; food waste; paper waste. Waste 1
- Do you bring your own bag when shopping? Waste 2
- Plastic bags are charged by supermarkets, do you support this? Waste 3
- What else do you think should be done to reduce waste? What can you contribute? Waste 4

Consumption habits
- How many pieces of clothing do you have in your wardrobe? Clothes 1
- How many new clothes have you bought in the last 12 months? Clothes 2
- If there are some rips in your clothes, do you have a habit of repairing them? Clothes 3

Personal Preference
- What is your preferred means of transportation? Travel 1
- If you could use public transport to reach your destination, would you choose to drive? Why? Travel 2
- Do you choose walking/cycling instead of public transport in your daily life? Travel 3
- Do you travel by flight? How often? Travel 4

Experiences
- Did you fly back to your home country before COVID? Do you have any plans to fly back to your home country in the future Travel 5
- Did you have any long-distance travel in the last 12 months? How did you travel? How did you make your decisions? Travel 6

Perspectives

Experiences — Please give us good examples of what you have done to reduce carbon emissions. Perspectives 1

Plan — Could you please tell me what you would like to do to help achieve net zero emissions in the future? Perspectives 5

Experiences — Please pick the cards that you think can describe your life. Perspectives 6

Codebook of Study A

Nodes

Name	Description	Files	References
3-11		2	1148
C06 Migrant reasons		1	36
Better living conditions		1	1
Education		1	10
Job opportunities		1	16
High education		1	8
Low education		1	8
Political and religious		1	1
Reunion with family		1	13
International families		1	8
Travelling		1	1
C11 Culture differences		1	36
Cultural differences		1	31
Chinese concept		1	8
Eating habits		1	3
English language		1	5
Higher quality education		1	7
Open-mindedness		1	4
The lack of British background		1	3
Economic factors		1	6
Political background		1	7
Social environment		1	22
Cultural Inclusion		1	9

Name	Description	Files	References
Education difference		1	3
Lack of protection		1	2
Work life balance		1	8
C13 Training		1	36
Company training		1	4
Confidence & Mindset		1	1
English Training - Home Country		1	7
Free Courses - Community & Church		1	6
Learn from the locals		1	6
No training&unaware		1	12
Self-study		1	6
C14 Culture shock&Coping strategies		1	36
Coping strategies		1	20
Apply for government benefits		1	2
Learn English		1	6
BBC radio		1	2
Good newspaper		1	1
Translators & Dictionaries		1	2
TV		1	1
Online search		1	1
Participate in social activities		1	1
Self-learning & not giving up		1	10

Name	Description	Files	References
Culture shock		1	43
Accommodation		0	0
Different education systems		0	0
Discrimination		1	8
Food differences		1	11
language		1	12
Physical illnesses		1	8
Weather		1	4
C15 Social support		1	37
Community		1	7
Education		1	1
Family		1	3
Friends		1	11
Government		1	14
LIbrary		1	1
Media		1	3
No need		1	5
Unware&lack info		1	4
C16 Chinese thoughtshabits		1	36
Changed		1	11
Multiculturalism		1	3
Next Generation Change		1	4
Pace of life		1	2
No change		1	27
For children		1	10

Name	Description	Files	References
Hardworking		1	3
Thrifty and diligent		1	6
Similar cultures		1	3
Take the best and discard the worst		1	3
C22 Net-zero knowledge		1	36
2030 2050 targets		1	1
Climate change		1	13
Education & Concepts		1	2
Environmental protection		1	10
Cigarette		1	1
New Energy		1	1
Vehicle Exhaust		1	2
Food waste		1	4
Increasing Energy bills		1	16
Recycling		1	6
Resources		1	2
Rising temperatures		1	5
C25 Warm strategies		1	36
Change temperature		1	5
Exercise - Calories		1	1
Fire-Warming		1	2
Heating units - Electric		1	6
Thermal insulation		1	3
Timer - On & Off Heating		1	13
Wear more clothes		1	10

Name	Description	Files	References
C26 Energy prices		1	41
Price increases		1	14
Receive benefits - enough		1	5
Received benefits - not enough		1	4
Save		1	7
C27 Diet changes		1	36
Cook at home-chinese food		1	20
Cheap&fresh vegetables		1	4
Diet change		1	26
Desserts		1	2
Diversified meals		1	14
Increased meat consumption		1	2
Less choice		1	8
C28 Meat and dairy		1	36
Meat increase		1	3
Meat is cheap		1	4
Milk - Reduce		1	2
Milk cannot drink		1	7
Milk everyday		1	10
Milk just for drinks		1	5
C29 Eat Vegetable		1	37
Eat lots of vegetables		1	26
Reduced vegetables		1	2

Name	Description	Files	References
C30 Grow vegetable		1	36
Not planted		1	12
No places		1	3
No time		1	4
Planted		1	19
For fun		1	3
Government leases		1	2
C31 Source of food		2	38
Buy special food		1	7
Expensive		2	9
Finding alternatives		1	2
Local supermarkets are sufficient		1	8
Not fresh enough		2	6
C32 Treat waste		1	36
Classified		1	33
2 categories		1	13
3 categories		1	3
4 categories		1	7
Be educated		1	1
Lack of introduction		1	1
Not classified		1	2
C33 Bring own bag		1	36
Bring own		1	26
Fabric bag		1	6
No bring - bring		1	1
Shopping Cart		1	1

Name	Description	Files	References
Sometimes buy		1	4
C34 Charge Plastic		1	36
No support		1	4
Costs are not transparent		1	1
Too expensive		1	2
Support		1	26
Stop Plastic		1	2
C35 Reduce waste		1	45
Clothes		1	8
Food		1	6
Furniture		1	2
Last generation lifestyle		1	7
Planting		1	6
Recycle package paper		1	12
Save energy		1	5
C36 Clothes number		1	36
100+		1	16
Before-like to buy		1	3
Cheap		1	3
Nice-looking		1	5
21-50		1	9
51-100		1	7
C37 Bought-12		1	36
1-9 pieces		1	11
10-20 pieces		1	5
30-50 pieces		1	2

Name	Description	Files	References
Not bought		1	7
C38 Repair rips		1	38
Not repaired		1	17
Donate		1	3
Hard-wearing material		1	4
Repaired rips		1	17
Particularly favourable		1	5
Tailors		1	8
C39 Means of transportation		1	36
Cars		1	35
Convenient		1	8
London transport issues		1	3
Save time		1	3
Public Transport		1	46
Free Ticket - Older People		1	8
Motorbike-China		1	3
No driving licence		1	3
Walking & Cycling		1	24
C40 Public transport		1	36
C41 Walkingcycling		1	36
C42 Travel by flight		1	36
Many times		1	6
No air travel		1	7

Name	Description	Files	References
Once every few years		1	4
Prefer by car&train		1	7
Several times a year		1	9
C43 COVID Impactplans		1	39
Affects travel		1	34
Bi-annual & Annual		1	12
No plans to return		1	10
Twice yearly		1	6
C44 Long-distance travel-12		1	36
Inbound travel		1	3
No travel		1	9
Outbound travel		1	11
Cruise ships		1	1
Flights		1	10
C45 Get information		1	36
Communities		1	1
Family & Friends		1	6
Newspapers		1	5
Procession		1	1
Radio		1	6
Search the Internet		1	2
Social Media		1	12
Facebook		1	1
Tiktok		1	1
Twitter		0	0
Wechat		1	3

Name	Description	Files	References
TV		1	4
C46 Channels of obtain info		1	36
Communities		1	8
Friends & Family		1	3
Google		1	1
Newspapers		1	1
Public Service Announcements		1	2
Radio		1	2
Social Media		1	13
TV		1	4
C47 Barriers of get info		1	44
Busy with work		1	2
Different perspectives		1	1
Don't believe this polucy		1	2
Eye problems		1	1
Ignoring useful information (boring)		1	2
Lack of interest and communication opportunities		1	10
Language barriers		1	16
Specialist vocabulary too difficult		1	3
The Chinese concept		1	8
C48 Reduce carbon emissions		1	37

Name	Description	Files	References
Avoiding food waste		1	7
Food labelling - note expiry date		1	1
By public transport		1	9
Electricity saving		1	5
Use of energy saving equipment		1	1
Grow your own food		1	1
Installing solar panels		1	1
New Energy Vehicles		1	4
Promote knowledge-Net zero		1	7
Reduce heating temperature		1	3
Reduce purchases		1	3
Reduce the frequency of MTR - Energy		1	1
Save fuel in cars		1	1
Waste utilization		1	5

Appendix Study B

Sample questions for the interview

Understanding low carbon decision making and the awareness of net-zero policies of older Chinese migrants in London

The interviews are semi-structured. Depending on the background and situation of the interviewees, they will be asked questions on different aspects.
Questions will be asked over 60-120 minutes, and the interview can be extended as appropriate.

Part 1

- **Different generations have different low-carbon behaviours**

Generation difference		
1)	What do you think is a good way of life?	☐
2)	What do you think we should learn from previous generations?	☐
3)	Do you have advice for the next generation?	☐

Part 2

- **Older Chinese migrants who still maintain low-carbon behaviour**

Low-carbon experience & Future plan		
1)	What makes you stick to low-carbon behaviour? Can you give more examples?	☐
2)	Do your family members support you in this practice? ☑Yes ☐No	☐
3)	Do you have any experience and advice to share with others?	☐
4)	Can you order the following according to your frugality, from the most to the least? A. food B. transportation C. clothes D. entertainment etc.	☐
5)	What do you think are the differences between the UK and China regarding low-carbon living, and what aspects can they learn from each other?	☐
6)	Do you face different challenges and difficulties in low-carbon living than the locals? If so, what are the reasons?	☐

7)	What measures should the government and society take to encourage people to live a low-carbon lifestyle, and what are the differences between the UK and China in this regard?	☐
8)	What are your dreams or plans for low-carbon living, and how do you plan to continue promoting these plans in the future?	☐

Part 3

- **Older Chinese migrants who received social welfare**

Low-carbon behaviour affected		
1)	What aspects of your life have you changed due to the government grant?	☐
2)	Why did you spend extra money on clothes, beauty, or heating? How did you make these decisions?	☐
3)	Would you still be frugal if you didn't have to save for your children or worry about retirement?	☐

Part 4

- **International family integration habits**

International Families		
1)	What have you changed since you started your international family in terms of home, transport, consumption, why?	☐
2)	How has low-carbon living affected your daily life, and what measures have you taken to reduce your carbon emissions? Have you influenced your close family members?	☐

Part 5

- **External factors influence low carbon behaviour**

Energy crisis		
1)	Has your energy-saving strategy been in place since this year? How did you do it before the energy crisis?	☐
2)	How did you acquire your energy-saving strategy? Did you gain it from your previous experiences? Did your family members give you advice? Did you look up the information?	☐

Part 6

- **Internal factors influence low-carbon behaviour**

Culture Shock		
1)	How do you source your ingredients, and do you try to buy locally or sustainably produced items in order to reduce your carbon footprint?	☐

2)	As a family, have you discussed or taken any measures to reduce food waste in your household?	☐
3)	Have you considered incorporating more plant-based meals into your family's diet in order to reduce your carbon footprint, and if so, how have you gone about doing that?	☐

Part 7

- **Approaches and perspectives on waste reduction**

Reduce waste		
1)	Is reducing waste something you have always done? Can you share more of your experience?	☐
2)	How did you get these experiences and skills? Did your parents teach you, for example? Or did you learn them from friends?	☐
3)	Is there a relationship between reducing waste and the economic situation?	☐
4)	What have you thought about in the process of reducing waste? Have you learned about the relationship between waste reduction and net zero?	☐

Part 8

- **Different modes of transport contribute to different carbon emissions**

Transportation		
1)	Has the free senior transport card changed your life? For example, where you used to drive, you now choose public transport. You used to walk, but now you choose to take the bus.	☐
2)	Are you aware that different modes of transport have different carbon emissions? What would you change?	☐

Part 9

- **Different attitudes to the net zero policy**

Do not believe in net zero policies		
1)	Where did you get your information about the net zero policy?	☐
2)	How much do you know about Net-zero?	☐
3)	Do you feel the policy is credible? why?	☐
4)	Do you support protecting the environment at a personal/individual level?	☐
5)	What do you think governments, policymakers, and communities should do to make residents aware of environmental and climate issues?	☐
6)	Would you change your mind if you knew more about net-zero policies?	☐

Believe in net-zero policies		
1)	Where did you get your information about the net zero policy?	☐
2)	How much do you know about Net-zero?	☐
3)	Why did you decide to implement and promote a net-zero policy?	☐
4)	What do you think governments, policy makers and communities should do to make people be aware of environmental and climate issues?	☐
5)	What do you think are the barriers to achieving net zero?	☐
6)	If you were an ambassador for this policy, what would you do to influence people around you?	☐

PARTICIPANT INFORMATION SHEET

Understanding low carbon decision making and the awareness of net-zero policies of older Chinese migrants in London

You are invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with your family and friends if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the purpose of the study?

This research (May 2023-May 2024) will target mainly older Chinese migrants in London. The aim is to understand the purpose of low-carbon behaviour among older Chinese migrants and their motivations for making these decisions; Understand their perceptions of the net zero policy and the reasons for these perceptions. The aim is to help older Chinese migrants understand low-carbon policies and the 2050 net-zero goal; understand their perspectives on the personal and social aspects of achieving net-zero goals and understand their current practices.

Why have I been invited to participate?

You are invited because you contributed valuable ideas in the previous interview-"Understanding the perceptions of net zero among older Chinese migrants". We think you may be able to offer more insights into this PhD research topic from the Chinese older migrant perspectives. We aim to include 12+ healthy Chinese older people (aged between 50-85), based on a voluntary basis.

Do I have to take part?

As participation is entirely voluntary, it is up to you to decide whether or not to take part. If you do decide to take part, you will be given in this information sheet to keep and you may be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time up until 25th May 2024 and without having to give a reason.

What will happen to me if I take part?

The research will be conducted through walking interviews, in person(if in person, a location will be chosen to ensure safety and convenience for you and the PhD researcher, with appropriate risk assessment in advance. The PhD researcher will ensure social distancing and wear a mask when necessary. The PhD researcher will bring a video camera and tape recorder. You can choose to be filmed or recorded during the interview; you can also apply to the PhD researcher to control the camera yourself to capture the environment and things you would like to share for the purpose of explaining the interview questions (from a first-person perspective). Each interview session will be between 60-120 minutes. To obtain appropriate data, this interview is open enough to choose the place and route you think is appropriate, as well as the length of the extended walking interview. The PhD researcher will introduce you to the background of her research, after which you will be asked questions and given sufficient time to answer and/or discuss these questions and make suggestions/comments.

Are there any lifestyle restrictions?

There are not any lifestyle restrictions.

What are the possible disadvantages and risks of taking part?

Please be aware that while every effort is made to ensure your safety, vaccination is proven to decrease the risk of transmission of Covid-19 and to reduce the likelihood of severe illness. Face coverings should be worn wherever possible for in-person interviews. You should wash or sanitise your hands regularly.

What are the possible benefits of taking part?

You will receive a small 'thank you' gift of appreciation(Eco bags for shopping**,** Plastic mug, Notebook); you will receive a copy of the video we have made for you.

What if something goes wrong?

If something goes wrong and you wish to complain about the experience, you can contact the Chair of the Research Ethics Committee of College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Will my taking part in this study be kept confidential?

All information that is collected about you during the course of the research will be kept strictly confidential (for three years, between May 2023-May 2026). Any information about

you which leaves the University will have all your identifying information removed. With your permission, anonymized data will be stored (On Brunel Onedrive only accessible to the research team) and may be used in future research – you can indicate whether or not you give permission for this by the Consent Form.

Will I be recorded, and how will the recording be used?

We intend to audio or video record the interviews as we plan to transcribe the data. The research team will use a Brunel-own laptop (password protected) or an audio/video recorder to do the recording. Your permission will be sought in advance, and the research team will clearly indicate it before the recording starts. The recording data will be transferred to a GDPR-compliant platform (e.g., a Brunel-owned computer) within three days of the data collection, and cleared from the recording device so no other people will accidentally access it. The data will be destroyed once the transcription is completed, before the 25th of May 2024.

What will happen to the results of the research study?

The results will be written up as part of a research dissertation and associated publications. The participants will not be identified in any report or publication unless you specifically request it. With the permission of the participants, video interviews with participants may be shared at academic conferences.

Who is organising and funding the research?

The research team (Miss Qing Ni, Prof Hua Dong, Dr. Antonios Kaniadakis) are organizing the research.

What are the indemnity arrangements?

Brunel University London provides appropriate insurance cover for research that has received ethical approval.

Who has reviewed the study?

The Research Ethics Committee of the College of Engineering, Design and Physical Science Research Ethics Committee has reviewed the study.

Research Integrity

Brunel University London is committed to compliance with the Universities UK Research Integrity Concordat. You are entitled to expect the highest level of integrity from the researchers during the course of this research

Contact for further information and complaints

Researcher name and details: Qing Ni, Brunel Design School, 2105826@brunel.ac.uk

Supervisor name and details: Prof Hua Dong, Brunel Design School, hua.dong@brunel.ac.uk

For complaints, Chair of the Research Ethics Committee:

Chair of the Research Ethics Committee, College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Please note: Research ethics approval has been obtained for this study from the Research Ethics Committee of the College of Engineering, Design and Physical Sciences

CONSENT FORM

Understanding of low carbon decision making and the awareness of net-zero policies of older Chinese migrants in London

Principal Investigator: Qing Ni

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 25/05/2023 AND 25/05/2024

Please complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☐	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☐	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☐	☐
Who have you spoken to about the study?		
Do you understand that you will not be referred to by name in any report concerning this study?	☐	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☐	☐
• You don't have to give any reason for withdrawing	☐	☐
	☐	☐
• Choosing not to participate or withdrawing will not affect your rights?	☐	☐
• You can withdraw your data any time up to 25/05/2024		
I agree to my interview being audio and video recorded	☐	☐

I agree to the use of non-attributable quotes when the study is written up or published; anonymised photos might be used for academic publication purposes	☐	☐
The procedures regarding confidentiality have been explained to me	☐	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☐	☐
I agree to take part in this study.	☐	☐

Signature of research participant:	
Print name:	Date:
Witness Statement	
I am satisfied that the above-named has given informed consent.	
Witness signature:	
Print name:	Date:

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

23 May 2023

LETTER OF APPROVAL (Conditional)

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 25/05/2023 AND 25/05/2024

Applicant (s): Miss Qing Ni

Project Title: Understanding low carbon decision making and the awareness of net-zero policies of older Chinese migrants in London

Reference: 42739-LR-May/2023- 44906-1

Dear Miss Qing Ni

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- **Please ensure that you monitor and adhere to all up-to-date local and national Government health advice for the duration of your project.**
- **Please carefully consider locations for your walking and talking interview, please take into account any potential risks (slips, trips, falls, sun protection etc.) for both the research team and participants and prepare separate Risk Assessments for every location.**
- **Please remove the witness statement from your consent form, as this is only relevant to vulnerable participants**
- **We note that your proposed research end date is 25/05/2024. If you are intending to conduct this research over a prolonged period; please be mindful that when you get the Final Ethical Approval, you will need to ensure that you follow the agreed protocol to conduct this research. Any changes to the agreed protocol will require you to either submit an 'Amendment' or a new Ethics Application.**

Please note that:

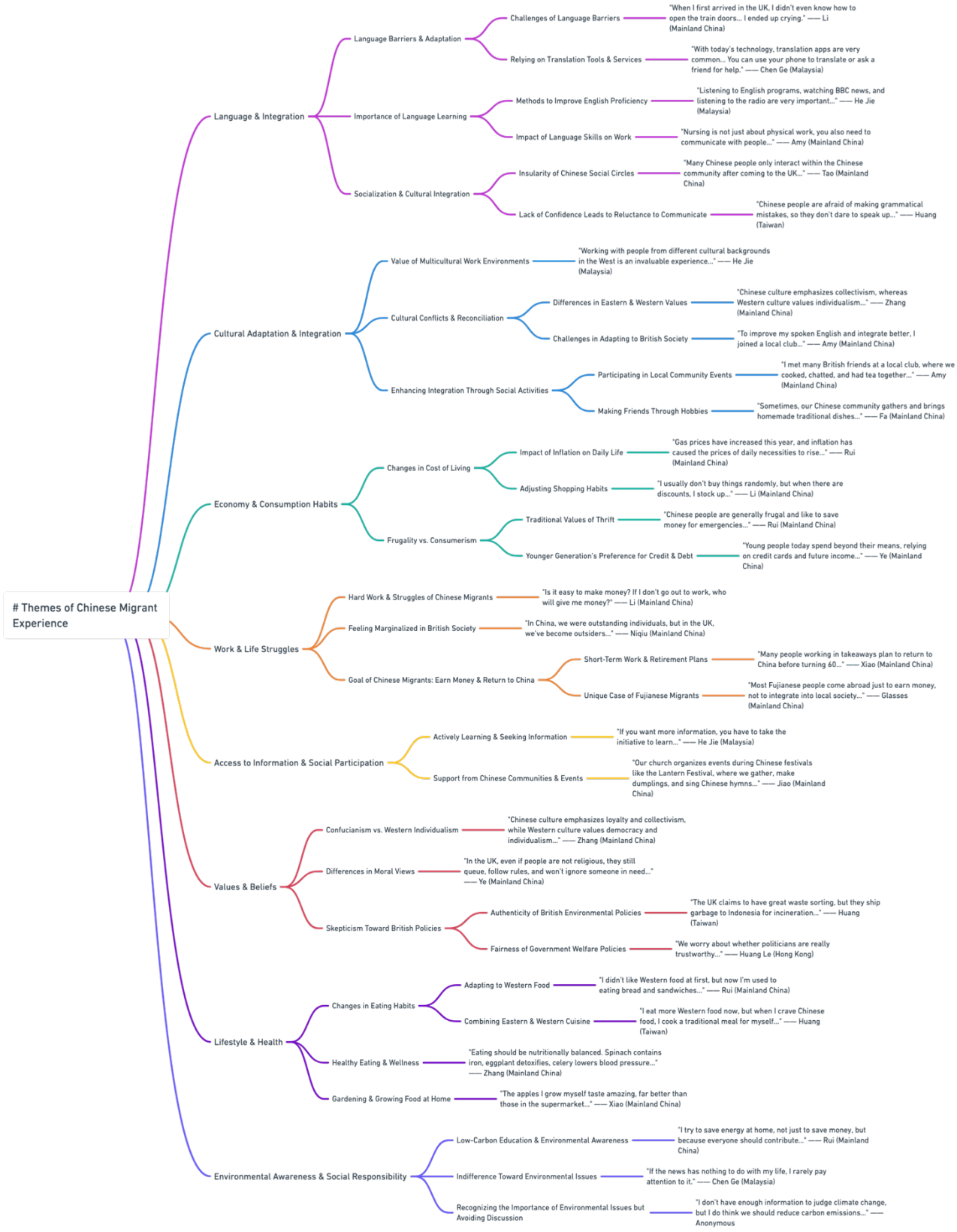
- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to any conditions that may appear above.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- If your project has been approved to run for a duration longer than 12 months, you will be required to submit an annual progress report to the Research Ethics Committee. You will be contacted about submission of this report before it becomes due.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.



Professor Simon Taylor

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Code Themes of Walking Interview



Appendix Study C

Sample questions for the interview

Low Carbon Co-Design Workshops Older Chinese Migrants in London

The interviews are semi-structured. Questions will be asked over 2-4 hours.

Workshop 1 (older Chinese immigrants)

- **User Journeys**

1)	What are your activities at different times of the day? Phases & Actions
2)	Which activities related to Net zero (A. Transport B.Housing C: Food)
3)	What was your motivation for doing these actions at the time?
4)	What activities would you like to share? What difficulties have you encountered?

- **Information access and sharing**

1)	Pick two information channels to simulate posting a low-carbon practice. (Design assistants help) • Category: What categories of low-carbon practices would you like to share? • Image/Video/Text: What will be included in the content? • Audience: Who will read the information? • Reason: Why did you decide to post this information?

- **Self-worth and role**

1)	What are your values? Provide 4 scenarios.
2)	What is your community?

- **Your Contributions**

1)	Will you make your values work in the climate change/net zero area? Extended from four scenarios.
2)	Who / where will benefit from it? Please select sites and relevant stakeholder cards.

- **Information perference**

1)	Pick one information channel (chose one from them)
2)	What does it look like?

- **Future system planning**

1)	Use cards and hand drawings to describe future scenarios.

PARTICIPANT INFORMATION SHEET

Low Carbon Design Workshops for Designers and Older Chinese Migrants in London

Invitation Paragraph

You are invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the purpose of the study?

This research (Dec 2023 - Dec 2024) will focus on older Chinese migrants and designers in London. Through co-design workshops between the two groups, the aim is to understand the low carbon practices that older Chinese migrants are willing to share and their wish lists for achieving net-zero targets; and to gain designers' perspectives on net-zero informative design as well as to identify design opportunity points.

Why have I been invited to participate?

You are invited because we think you may be able to offer insights into this PhD research topic from the Chinese older migrant perspectives and the perspective of designers. We aim to include 6-12 healthy Chinese older people (aged between 50-85) and 6-12 designers voluntarily.

Do I have to take part?

As participation is entirely voluntary, it is up to you to decide whether or not to take part. If you do decide to take part, you will be given in this information sheet to keep, and you may be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time up until 31th Dec 2024 and without having to give a reason.

What will happen to me if I take part?

The research will be conducted through workshops, in person(if in person, a location will be chosen to ensure safety and convenience for you and the PhD researcher, with appropriate risk assessment in advance. The PhD researcher will wear a mask throughout to ensure social distancing and all COVID-19 safety measures are followed). Workshops will range between 2-4 hours, with breaks every 60 minutes. You will be asked questions and given sufficient time to answer and/or discuss these questions and make suggestions/comments.

Are there any lifestyle restrictions?

There are not any lifestyle restrictions.

What are the possible disadvantages and risks of taking part?

Please be aware that while every effort is made to ensure your safety, vaccination is proven to decrease the risk of transmission of Covid-19 and to reduce the likelihood of severe illness. The risk of getting infected by COVID-19 may increase for in-person sessions. Face coverings will be worn by the researchers and participants wherever possible and appropriate for in-person sessions with social distancing less than one meter. Researchers and participants should wash or sanitise their hands regularly.

What are the possible benefits of taking part?

You will receive a small 'thank you' gift of appreciation (Eco bags for shopping or daily necessities).

What if something goes wrong?

If something goes wrong and you wish to complain about the experience, you can contact the Chair of the Research Ethics Committee of College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Will my taking part in this study be kept confidential?

All information that is collected about you during the course of the research will be kept strictly confidential (for three years, between Dec 2023-Dec 2026). Any information about you which leaves the University will have all your identifying information removed. With your permission, anonymized data will be stored (On Brunel Onedrive only accessible to the research team) and may be used in future research – you can indicate whether or not you give permission for this by the Consent Form.

Will I be recorded, and how will the recording be used?

We intend to audio or video record the interviews as we plan to transcribe the data. The research team will use a Brunel-own laptop (password protected) or an audio/video recorder to do the recording. Your permission will be sought in advance, and the research team will clearly indicate it before the recording starts. The recording data will be transferred to a GDPR-compliant platform (e.g., a Brunel-owned computer) within three days of the data collection, and cleared from the recording device so no other people will accidentally access it. The data will be destroyed once the transcription is completed, before the 31st of December 2024.

What will happen to the results of the research study?

The results will be written up as part of a research dissertation and associated publications. The participants will not be identified in any report or publication unless you specifically request it.

Who is organising and funding the research?

The research team (Miss Qing Ni, Prof Hua Dong, Dr. Antonios Kaniadakis) are organizing the research.

What are the indemnity arrangements?

Brunel University London provides appropriate insurance cover for research that has received ethical approval.

Who has reviewed the study?

The Research Ethics Committee of the College of Engineering, Design and Physical Science Research Ethics Committee has reviewed the study.

Research Integrity

Brunel University London is committed to compliance with the Universities UK Research Integrity Concordat. You are entitled to expect the highest level of integrity from the researchers during the course of this research

Contact for further information and complaints

Researcher name and details: Qing Ni, Brunel Design School, 2105826@brunel.ac.uk

Supervisor name and details: Prof Hua Dong, Brunel Design School, hua.dong@brunel.ac.uk

For complaints, Chair of the Research Ethics Committee:

Chair of the Research Ethics Committee, College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Please note: Research ethics approval has been obtained for this study from the Research Ethics Committee of the College of Engineering, Design and Physical Sciences

CONSENT FORM

Low Carbon Design Workshops for Designers and Older Chinese Migrants in London

Principal Investigator: Qing Ni

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 31/12/2023 AND 31/12/2024

Please complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☐	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☐	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☐	☐
Who have you spoken to about the study?		
Do you understand that you will not be referred to by name in any report concerning this study?	☐	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☐	☐
• You don't have to give any reason for withdrawing	☐	☐
• Choosing not to participate or withdrawing will not affect your rights?	☐	☐
• You can withdraw your data any time up to 31/12/2024	☐	☐
I agree to my interview being audio and video recorded	☐	☐
I agree to the use of non-attributable quotes when the study is written up or published	☐	☐

The procedures regarding confidentiality have been explained to me.	☐	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☐	☐
I agree to take part in this study.	☐	☐

Signature of research participant:	
Print name:	Date:
Witness Statement	
I am satisfied that the above-named has given informed consent.	
Witness signature:	
Print name:	Date:

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

18 December 2023

LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 31/12/2023 AND 31/10/2024

Applicant (s): Miss Qing Ni

Project Title: Low Carbon Design Workshops for Designers and Older Chinese Migrants in London

Reference: 46666-LR-Dec/2023- 48594-1

Dear Miss Qing Ni

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- **Please ensure that you monitor and adhere to all up-to-date local and national Government health advice for the duration of your project.**
- **Please remove the witness statement from your Consent Form as it is only relevant to vulnerable participants**

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to any conditions that may appear above.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- If your project has been approved to run for a duration longer than 12 months, you will be required to submit an annual progress report to the Research Ethics Committee. You will be contacted about submission of this report before it becomes due.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.



Professor Simon Taylor

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London

Character image stickers





User Journey data

Table 1: User journey

Weekdays					
Participant code	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**
Location	Home	Home	Home	Home	Home
MEC01	**Breakfast** **Read news**	**Work from home** **Check information**	**Lunch and washing up**	**Take care of the garden**	**Exercise and Dinner**
Location	Home	Park	Home	On transport	Home
MEC02	**Coffee time** **Watch News or TV**	**Exercise**	**Rest**	**Pick up my granddaughter from school**	**Exercise** **Tutoring children's homework**
Location	Home	Home	Home	Home	Home
MEC03	**Breakfast**	**Work at home**	**Lunch**	**Work at home** **Meditation**	**Yuga** **Reading**
Location	Home	Park & Home	Pub & Restaurant	Chinese community	Home
MEC04	**Do housework**	**Do exercise** **Do Yuga**	**Meet friends**	**Dance** **Sing**	**Watch film at home**
Location	Home	Shopping mall	Chinese community	Chinese community	Home
MEC05	**I should do housework**	**I'm a female so I like shopping time**	**I teach dance for Chinese in London**	**Dance is also a social activity**	**Sharing time with my family**
Location	Park	Home	Shopping mall	School	Home
MEC06	**Do exercise for health**	**Do housework** **Read news**	**Meet friends** **Watch film**	**Teach student Chinese language**	**Read book**
Location	Home	Home	Workplace	On transport	Home

MEC07	**Dance and watch TV**	**Do housework**	**Work**	**Go to supermarket or off work**	**Stay with family**
Location	Home	Home	Home	Home	Home
NLC01	**Drinking Coffee**	Reading emails & news on computer	**Have a nap**	**Work from home** **Drink tea**	**Dinner time** **Watch TV**
Location	Home	Home	Home	Park	Home
NLC02	**Take care of grandchild**	**listen to Peking Opera** **Practice Peking Opera** **Practising Erhu**	**Practice singing with mobile app**	**Take a walk in the park after a nap**	**clean up the house**
Location	Home	Workplace	Shopping mall	Gym	Home
NLC03	**Wake up and have a coffee, Go to work**	**Meet with clients, go to office after construction site**	**Bank, and call my wife to buy stuff for house**	**Spend 2-3 hours, go to saunas**	**Take a shower,** **Have dinner, watch news**
Location	Home	Park & Supermarket	Café & Home	Home	Home
NLC04	**Exercise-Aerobic** **Clean the house** **Health is important for older people**	**Prepare lunch** **Shop groceries** **Shop vegetables from farmers** **Walk** **I need fresh vege and keep diet**	**Coffee with friends** **Cooking** **Fresh vegetables to support farmers and locals**	**Rest** **Check social media** **Documentaries**	**Teatime at home** **Watch news** **TV series (Chinese)**
Location	Home	Office	Office	Office	Home
NLC05	**Prepare to work** **Money & self actualisation**	**Working** **Managing & Control**	**Lunch** **No time go home**	**Working**	**Helping housework** **For happy family**
Location	Home	Home	Home	Home	Home

NLC06	Sending emails Administration	Help students solve problems	Teaching Research	Teaching Research	Do own research
Weekends					
Participant code	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**
Location	Home	Countryside	Countryside	Countryside	Home
MEC01	**Breakfast and read news**	**Hiking in countryside**	**Hiking in countryside**	**Hiking in countryside**	**Dinner** **Clean the house**
Location	On transport	Flea market	Home	Home	Home
MEC02	**Sending my granddaughter to tutorial classes**	**Look around**	**Rest**	**Cook for my granddaughter**	**Do the housework**
Location	Home	Church or community	Home	Town centre	Home
MEC03	**Communication with family in China**	**Volunteer at a church** **Learning to play a musical instrument in the community**	**Have rest and eat lunch**	**Shopping for next week**	**Yuga and relaxing**
Location	Home	Park &Home	Outside London	Outside London	Home
MEC04	**Do housework** **Cook**	**Do exercise** **Yuga**	**Day trips with friends around London, e.g. Oxford, Cambridge**	**Day trips with friends around London, e.g. Oxford, Cambridge**	**Preparing things to work on next week**
Location	Home	Church	Chinese community	Chinese community	Home
MEC05	**Make breakfast for my child and grandchild**	**Pray and meet friends**	**I have many students on weekends**	**All afternoon stay in Chinese community**	**I felt tired after teaching dance, so have a rest at home**

Location	Park	School	Museum	School	Home
MEC06	**Do exercise for health**	**Teach student Chinese language**	**Going with the family**	**Teach student Chinese language**	**Watch TV** **Cook**
Location	Church	Park	Supermarket	Chinese community	Home
MEC07	**Prepare breakfast for my child and go to church**	**I always meet friends after going to church**	**On weekends I have more time one shopping**	**I learn dance in Chinese community**	**Cook dinner and eat with family**
Location	Home	Home	Shopping mall	Chinese Community	Home
NLC01	**Work from home**	**Eat breakfast**	**Be with wife**	**Wife dance there**	**Be with family**
Location	Home	Park	Go bowling	Supermarket	Home
NLC02	**Breakfast**	**Although I don't speak English.** **I've been to a lot of parks.**	**Be with family**	**Grocery shopping**	**Cook for all family members**
Location	Home	Home	Shopping mall	Home	Home
NLC03	**Wake up, do housework**	**Make coffee and watch TV**	**Grocery shopping, be with wife**	**Eat with family and talk with family members**	**Have some tea and watch TV**
Location	Home	Park & café	Home	Daughter’s home	Park & Home
NLC04	**Breakfast and day planning** **Healthy diet and time keeping**	**Walk in the park** **Coffee with friends or family** **Socializing**	**Lunch time**	**Family time** **Spend time with grandchildren** **Building family bonds**	**If the weather is good-outside walk** **Otherwise stay at home and check social media**
Location	Home	Home	Home	Outside	Home
NLC05	**Relax**	**Relax**	**Be with wife**	**Shopping**	**Daughter come back**

Location	Home	Home	Home	Chinese Community	Home
NLC06	**Stay with family**	**Do research**	**Do research**	**Be with my wife**	**Stay with family**

Value Scenario data

Table 2: Value scenario Stage of the co-design workshop

Participant code	**Scenarios 1**	**Scenarios 2**	**Scenarios 3**
MEC01	Husband	Father	Cloud IT architect
Strengths	**DiY housing renovation, maintenance** **House cleaning** **Gardening**	**Role model for keeping fit for sons**	**Solution architecture** **Rigour** **Attention to detail**
MEC02	Grandfather	Father	Pensionist
Strengths	**Picking up my granddaughter from school** **Cook for her**	**Doing housework; providing a good environment for children**	**Hobby sports** **in good health**
MEC03	Mother	Wife	Scientist
Strengths	**Consulting**	**Understanding husband**	**Attention to details**
MEC04	Mother	Nurse	Partner
Strengths	**Caring for children** **Educate children**	**Helping the Older People** **Managing the team** **Caring for others**	**Communicative** **Maintain good relations**
MEC05	Wife	Mother	Teacher
Strengths	**Do housework, take care of the family**	**Cooking, educate my child**	**My students are all older women. I am happy that I can help them.**
MEC06	Mother	Teacher	Student

Strengths	**Taking care of children**	**Teaching Chinese to help ethnic Chinese in London**	**I'm still learning new things too.** **I'm very patient and attentive**
MEC07	Wife	Mother	Employee
Strengths	**I'm good at making good food for my family**	**I pick up my daughter from work. I also used to be responsible for my daughter's education.**	**I am responsible, I am always an excellent employee, and I take my job seriously every day.**
NLC01	Teacher	Husband	Father
Strengths	**Help students with studies**	**Cleaning the room**	**Accompanying & Support**
NLC02	Grandmother	Mother	Specialist in Early Childhood Education
Strengths	**Taking care of grandchildren**	**Honesty, good moral character** **Educated my daughter well, she is a post-doctoral Fellow**	**Educated** **Expertise in early childhood education** **Serious about work** **Provide help to children**
NLC03	Boss	Father	Friend & Husband
Strengths	**Good communication skills, very practical, good in math and architecture**	**Open minded, accepts when my children are wrong, playful, understanding**	**Good secret keeper, solve other people's problems, always be there when they need me**
NLC04	Pensionist	Mother	Grandmother
Strengths	**Organising the schedule according to your needs without depending on work**	**Good moral education, Love, respect for everyone and encouraging children to achieve their wishes and goals**	**Love, life experience, guidance, morals**
NLC05	Leader	Explorer	Father
Strengths	**Earn commitment & Giving the direction**	**Working in uncertainty**	**Work for family, for the future**
NLC06	Professor educator	Father	Husband
Strengths	**Best for every aspect** **Patience with students**	**Good example** **Teaching by actions**	**Taking care of my wife**

	Like teaching **Help students achieve their life**		**Spend time with my wife every weekend**

Information Dissemination data

Table 3: Information dissemination

Participant code	Low carbon themes	Audience	Reason
MEC01	Housing	Peers (similar age group) Younger generation	"I think my generation is more responsible and cares more about nature. Of course, these life experiences are also what I have gained from my life."
MEC02	Nature Transport	Next generation	"Good weather for human health."
MEC03	Transport	Colleagues	"I've started using an electric car and I'd like to persuade my colleagues to do the same. If everyone does a little, we can save our planet."
MEC04	Nature; health; Clothes; Transport	Myself; Next generation; Family	"If I have a good experience, I would like to share it with more people so that more people will be aware of this information, which will benefit the next generation."
MEC05	Next generation; Responsibility	Young people	"I am very concerned about the next generation, and I think modern young people lack responsibility."
MEC06	Health; Transport	Next generation; Friends; Family	"I have a sense of responsibility. So I want to use my ability to help more people."
MEC07	Responsibility	Friends & who are interested in	"I care about the next generation. Also, I am an optimistic and positive woman. I love sunshine and nature. I think young people don't pay attention to food waste. I hope I can change this."

NLC01	Nature; Transport; Housing	Friends & Public	“1. I am concerned about nature. I hope that nature will always remain very good. 2. I am also experienced in home renovations.3. I have some energy saving strategies and I am concerned about energy bills. I saw some pain points in my life, and I can share my experience.”
NLC02	Nature; Health; Next generation	Avoid sharing information	“I hardly share any information to the media. I would probably only use voice chat or talk to my family in person.”
NLC03	Economy; Housing; Food	Work: Policymakers Non-work: Friends & family	“Because I care about future generation and environment”
NLC04	Economy; Responsibility; Food; Housing; Transport	Friends; Relatives; Young generation	“I want to share my knowledge and good practices with others. I want to save water, save electricity and not over shopping. I am also concerned about waste separation, and green transport.”
NLC05	Nature; Next generation	Work: all relevant people Non-work: Friends &family	“1. I've worked in the UK for many years and I have a lot to say about it. 2. And, I have a lot of life experience without working.”
NLC06	Economy; Next generation; Housing; Politics	Students group Ex students	“I think my most important task is to teach my students, and I love that very much. I often have meetings with students or share research papers with them. If it's useful information for their lives, I want to share it with them first.”

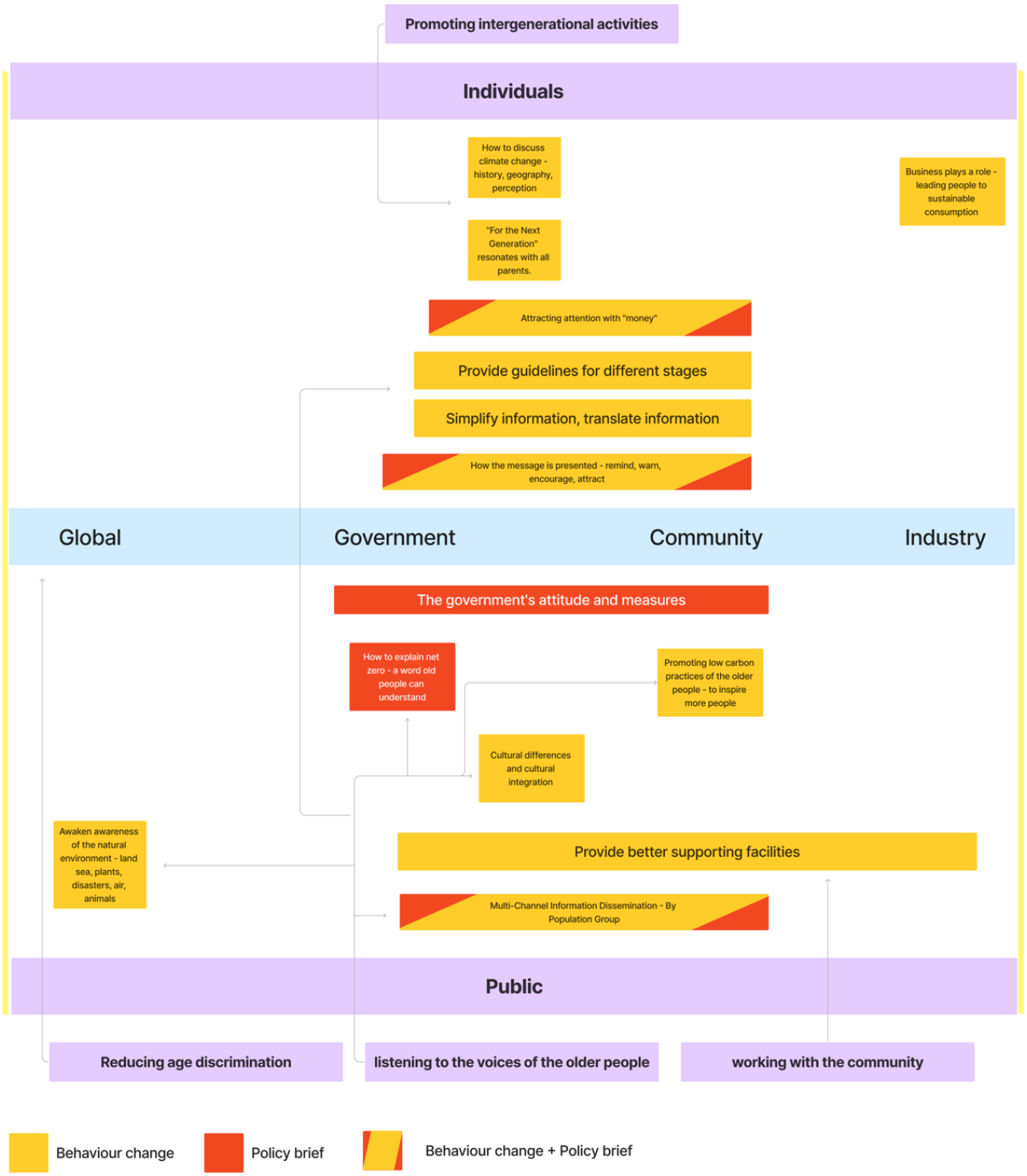
The Content of the Low-fidelity Information data

Table 4: The content of the information from Older Chinese migrants

Participant code	Descriptions
MEC01	“I'm experienced with composting as I tend a garden and I grow a lot of vegetables. I recently switched to a new energy car as my old one was charged a lot of money at the airport. I read the news every day and sometimes I share it on WeChat. If you ask me to share more, I think I'll share my experience of composting and saving energy. Some pictures, comments, data, and official words would be best.”
MEC02	“I think some pictures of nature would be best. Sky blue, pretty flowers, clear water.”
MEC03	“Stop use fuel energy; stop air pollution; use green energy. It’s what I can do. I prefer to share these concepts and ideas with my friends and colleagues. Maybe posters or leaflets that some advice from experts. Or from WhatsApp, because we talk other stuff on WhatsApp as well”
MEC04	“I think the information is diverse. For example, I get information from a variety of sources. My Chinese friends all use WeChat and I will share information with them. My British mate listens to the radio and watches the BBC, so some information is for this group. Normally I also use Facebook and check my emails. So if I could, I would probably share all sorts of information from many sources.”
MEC05	“I usually use WeChat and Facebook more. I usually share videos and photos of my dancing to WeChat, so if I can share some low carbon experiences, I'd like to do that.”
MEC06	“Maybe use social media. Like videos on YouTube, or using WeChat and WhatsApp to share something.”
MEC07	“I use social media more. I also use red, like a young person. I think some of the pictures and comments on social media are very engaging. You get to see different points of view.”

NLC01	“I want to share pictures about nature. Like snowy mountains and some sports activities in nature. I think a set of contrasting videos or pictures can attract people's attention. For example before penguins or polar bears were playing freely in the snow and now they have nowhere to go. Because nature has been destroyed. I would also like to have photos and videos of sports competitions like ice skating, skiing, water sports. While watching the competitions, you can also enjoy the nature.”
NLC02	“I want to educate my children, especially my son-in-law and grandchildren. But it wasn't very successful, so I gave up. I'm only in the UK for six months a year, and I have a different outlook from the young people. I insist on hard work and saving food and energy. My son-in-law doesn't agree with me, he says we should enjoy life.”
NLC03	“Video is preferred because it contains text and more images, I would share with people I know. I also like images; I would like to take a picture using my phone and share it”
NLC04	“I think information can include a lot of things. For example, videos on YouTube can contain great tips for life. TV news can contain policy briefs. I'm also an older person who likes to use social media and I check what's going on in the world every day. I would share videos to my daughter-in-law using Instagram and Facebook. Sometimes my son also asked me for recipes, and I would share them as well. We can teach the next generation a lot if they are willing to communicate.”
NLC05	“It depends on who the audience is, and it also depends on how literate the audience is. If the education level is low, I would use videos and pictures. For highly educated people, I think they can understand the text.”
NLC06	“Because I'm a scholar. I think if it's related to academics, maybe I think it's better to use text, where all the information comes from publication and research. The videos are not very academic, but I watch them as well. Videos can also share some policy information.”

Suggestions from Co-design Workshop



Appendix Study D

Sample questions for the interview

Understanding local seniors' practice and suggestions of net-zero in London

The interviews are semi-structured.

Questions will be asked over 30-60 minutes, and the interview can be extended as appropriate.

Climate change awareness	
1)	Have you heard about net-zero?
2)	What does climate change/net-zero/low carbon change mean to you? Do you talk about it with other people?
3)	What words do you use to talk about this issue? Do you use net zero or other words? Why?
4)	What kind of house do you live in? Detached House/Semi-detached House/ Bungalows/Terrace House/Flat & Apartment
5）	What changes may you consider for this winter?
6）	Can you share what you eat for three meals a day?
7）	Have you considered eating more vegetable? Do you grow vegetable？
8）	What is your preferred means of transportation? Public/car/ walk? Do you travel by flight?
Low carbon practice	
1)	What encourages you to care about climate change/net-zero/low carbon? When?
2)	What do you contribute to climate change/net-zero? Like home waste/ bring your own bag/reduce buy sth
3)	What would motivate you more about it?
Net-zero knowledge & information	
1)	How do you feel your contribution to climate change/net-zero/low carbon?
2)	Can you share information channels you think are reliable? Can you tell me other information channels that interest you?

	A: TV B: Newspaper and magazine C: Social media D: Website E: Community F: Friends and family G: Report H:others
3)	Which kinds of information can give advice to older people?
4)	Which aspects of climate change/net-zero/low carbon are you more concerned about? (Using selection cards) Why did you choose these aspects?
Net-zero knowledge sharing	
1)	How can we help ethnic minority groups and other older people understand climate change/net zero?
2)	If you need to share climate change/net-zero knowledge with older Chinese friends, how would you do about it?
3)	What challenges do you anticipate in doing so?

PARTICIPANT INFORMATION SHEET

Understanding local seniors' practice of climate change/net-zero in London

You are invited to take part in a research study. Before you make your decision on participating in the research, it is important to understand why the research is being conducted and what it involves. Please consider taking some minutes to read the following information carefully and discuss it with your family and friends if you would like to. If there are any questions or worries, please feel free to ask. Thank you for reading this.

What is the purpose of the study?

This research (Aug 2023-Aug 2024) will target older people living in London. Moreover, it will find out the views of local older people on climate change/Net Zero and the practices they carry out. The study will pay attention to their practice and motivations for learning about climate change/Net Zero. The aim is to capture the learning experiences of local older people about net zero policies and their advice on achieving climate change/Net Zero.

Why have I been invited to participate?

You are invited because we believe you can provide valuable input into the learning and practice of climate change/net-zero. We aim to include 12+ healthy older people (aged between 50-85) in London, based on a voluntary basis.

Do I have to take part?

As participation is entirely voluntary, it is up to you to decide whether to take part. If you do decide to take part, you will be given this information sheet to hold, and you may be asked to sign a consent form. If you change your mind, you can withdraw at any time up to 25th Aug 2024 without providing an explanation.

What will happen to me if I take part?

The research will be conducted through focus groups /interviews in person (a well-ventilated room will be used ensuring social distancing and all COVID-19 safety measures are followed). The focus group /interview will range between 30-60 minutes. You will be asked questions and given sufficient time to answer and/or discuss these questions and make suggestions/comments. Your answers will be recorded by a recording device upon your agreement.

Are there any lifestyle restrictions?

There are not any lifestyle restrictions.

What are the possible disadvantages and risks of taking part?

Please be aware that while every effort is made to ensure your safety, vaccination is proven to decrease the risk of transmission of Covid-19 and to reduce the likelihood of severe illness. Face coverings should be worn wherever possible for in-person interviews. You should wash or sanitise your hands regularly.

What are the possible benefits of taking part?

You will receive a small 'thank you' gift of appreciation (Daily necessities); However, you may appreciate that your input will inform the promotion and improvement of the Net Zero policy/practice.

What if something goes wrong?

If something goes wrong and you wish to complain about the experience, you can contact the Chair of the Research Ethics Committee of College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Will my taking part in this study be kept confidential?

All information that is collected about you during the research will be kept strictly confidential (for three years, between Aug 2023-Aug 2026). Any information about you which leaves the University will have all your identifying information removed. With your permission, anonymized data will be stored (e.g. on the Brunel project laptop which is password protected or Brunel OneDrive only accessible to the research team) and may be used in future research – you can indicate whether you give permission for this by the Consent Form.

Will I be recorded, and how will the recording be used?

We intend to audio or video record the focus groups/interview as we plan to transcribe the data. The research team will use a Brunel-own laptop (password protected) or an audio/video recorder to do the recording. Your permission will be sought in advance, and the research team will clearly indicate it before the recording starts. The recording data will be transferred to a GDPR-compliant platform (e.g., a Brunel-owned computer) within three

days of the data collection and cleared from the recording device so no other people will accidentally access it.

What will happen to the results of the research study?

The results will be written up as part of a research dissertation, associated publications and will be shared through conference or journal publications. The participants will not be identified in any report or publication unless you specifically request it.

Who is organising and funding the research?

The PhD researcher Miss Qing Ni (with supervisors Prof Hua Dong, Dr. Antonios Kaniadakis) is organizing the research.

What are the indemnity arrangements?

Brunel University London provides appropriate insurance cover for research that has received ethical approval.

Who has reviewed the study?

The Research Ethics Committee of the College of Engineering, Design and Physical Science Research Ethics Committee has reviewed this study.

Research Integrity

Brunel University London is committed to compliance with the Universities UK Research Integrity Concordat. You are entitled to expect the highest level of integrity from the researchers during this research

Contact for further information and complaints

Researcher name and details: Qing Ni, Brunel Design School, 2105826@brunel.ac.uk

Supervisor name and details: Prof Hua Dong, Brunel Design School, hua.dong@brunel.ac.uk

For complaints, Chair of the Research Ethics Committee:

Chair of the Research Ethics Committee, College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Please note: Research ethics approval has been obtained for this study from the Research Ethics Committee of the College of Engineering, Design and Physical Sciences, Brunel University London.

CONSENT FORM

Understanding local seniors' practice of net-zero in London

Principal Investigator: Qing Ni

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 25/08/2023 AND 25/08/2024

Please complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☐	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☐	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☐	☐
Who have you spoken to about the study?		
Do you understand that you will not be referred to by name in any report concerning this study?	☐	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☐	☐
• You don't have to give any reason for withdrawing	☐	☐
• Choosing not to participate or withdrawing will not affect your rights?	☐	☐
• You can withdraw your data any time up to 15/08/2024	☐	☐
I agree to my interview being audio and video recorded	☐	☐

I agree to the use of non-attributable quotes when the study is written up or published	☐	☐
The procedures regarding confidentiality have been explained to me	☐	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☐	☐
I agree to take part in this study.	☐	☐

Signature of research participant:	
Print name:	Date:
Witness Statement	
I am satisfied that the above-named has given informed consent.	
Witness signature:	
Print name:	Date:

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

21 August 2023

LETTER OF APPROVAL (Conditional)

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 25/08/2023 AND 25/08/2024

Applicant (s): Miss Qing Ni

Project Title: Understanding local seniors' practice of net-zero in London

Reference: 44594-LR-Aug/2023- 46917-2

Dear Miss Qing Ni

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- **Please ensure that you monitor and adhere to all up-to-date local and national Government health advice for the duration of your project.**
- **We note that your proposed research end date is 25/08/2024. If you are intending to conduct this research over a prolonged period; please be mindful that when you get the Final Ethical Approval, you will need to ensure that you follow the agreed protocol to conduct this research. Any changes to the agreed protocol will require you to either submit an 'Amendment' or a new Ethics Application.**
- **Please remove the witness statement from your consent form, as this is only relevant to vulnerable participants**

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to any conditions that may appear above.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- If your project has been approved to run for a duration longer than 12 months, you will be required to submit an annual progress report to the Research Ethics Committee. You will be contacted about submission of this report before it becomes due.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.



Professor Simon Taylor

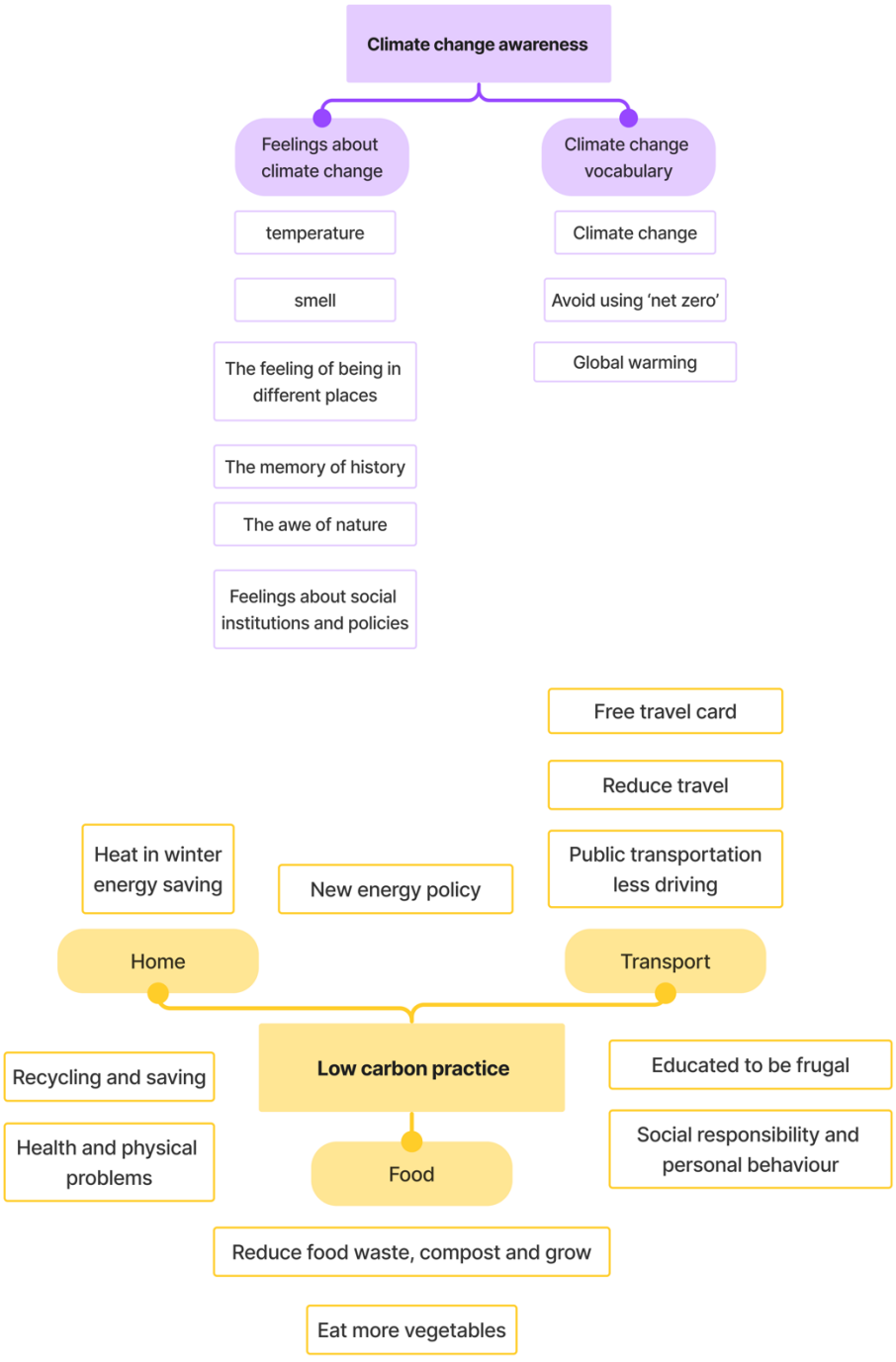
Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

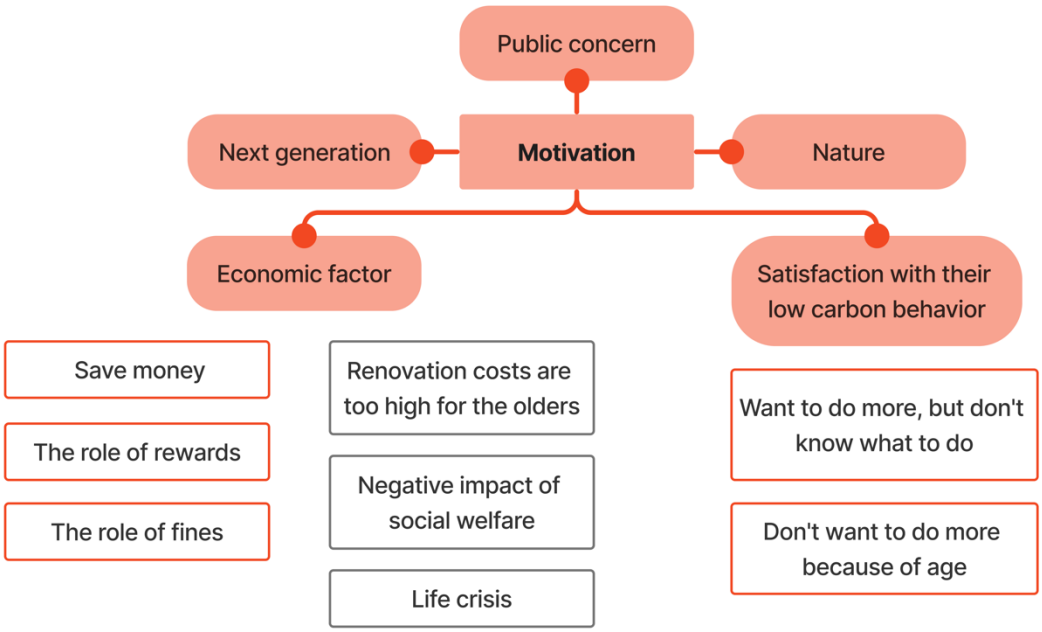
Brunel University London

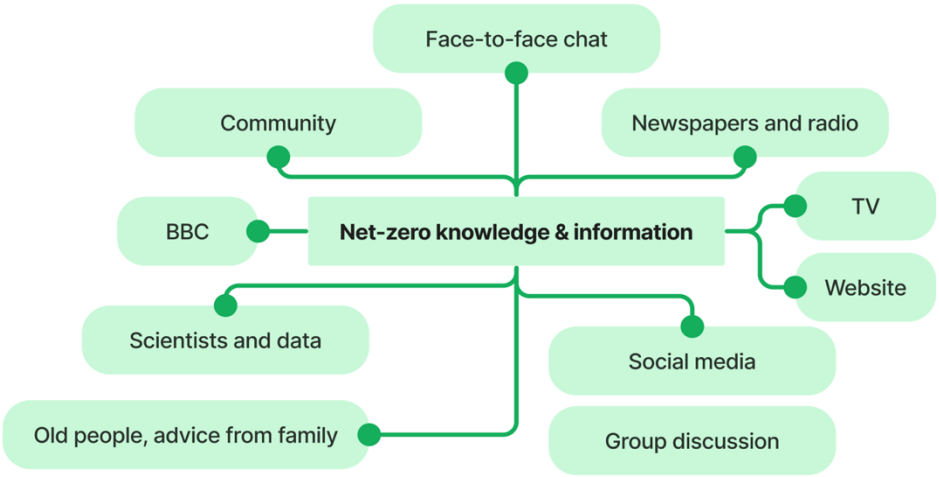
One Focus group in August 2023 for Study D

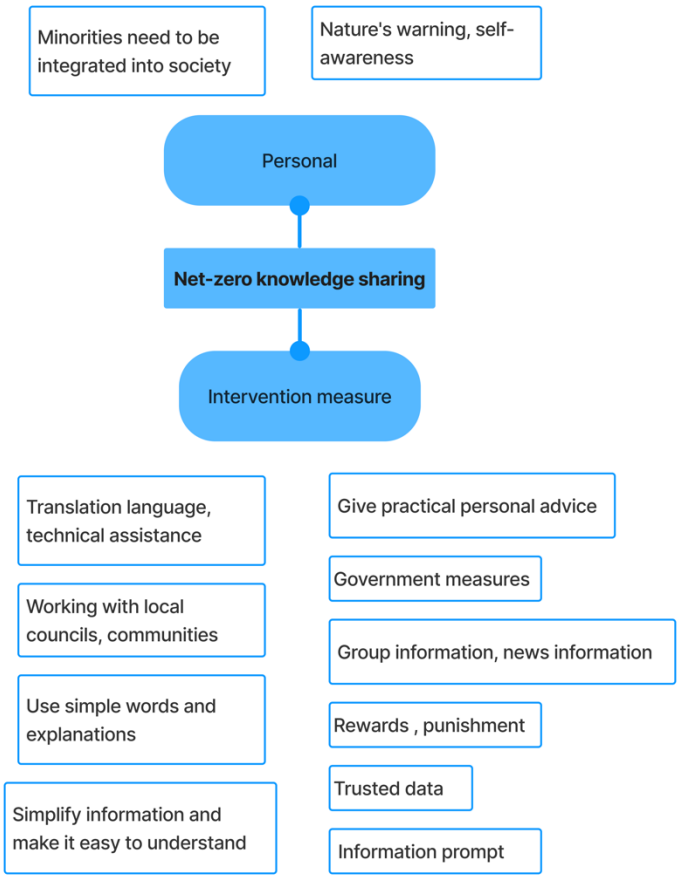


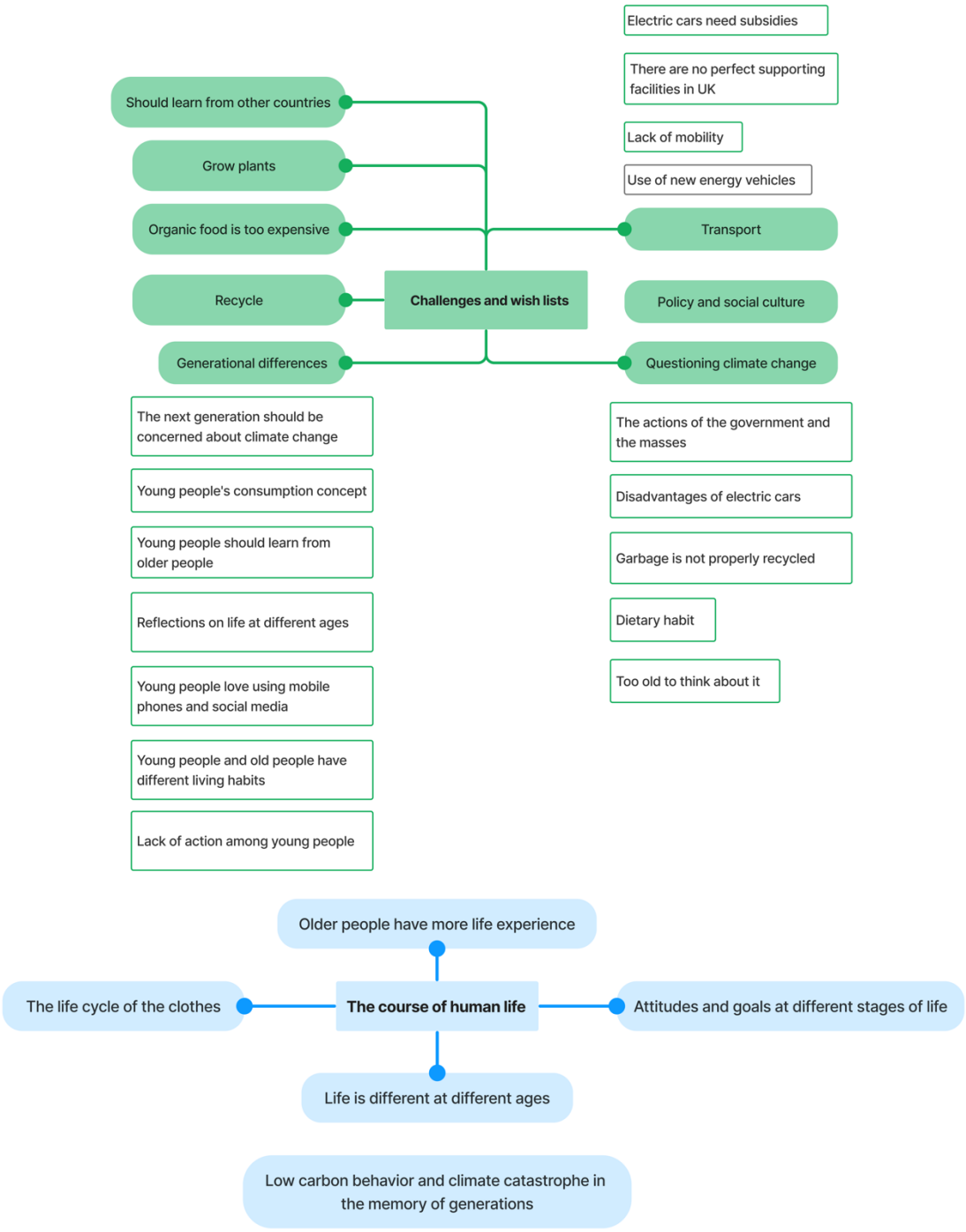
Thematic analysis frame for Study D

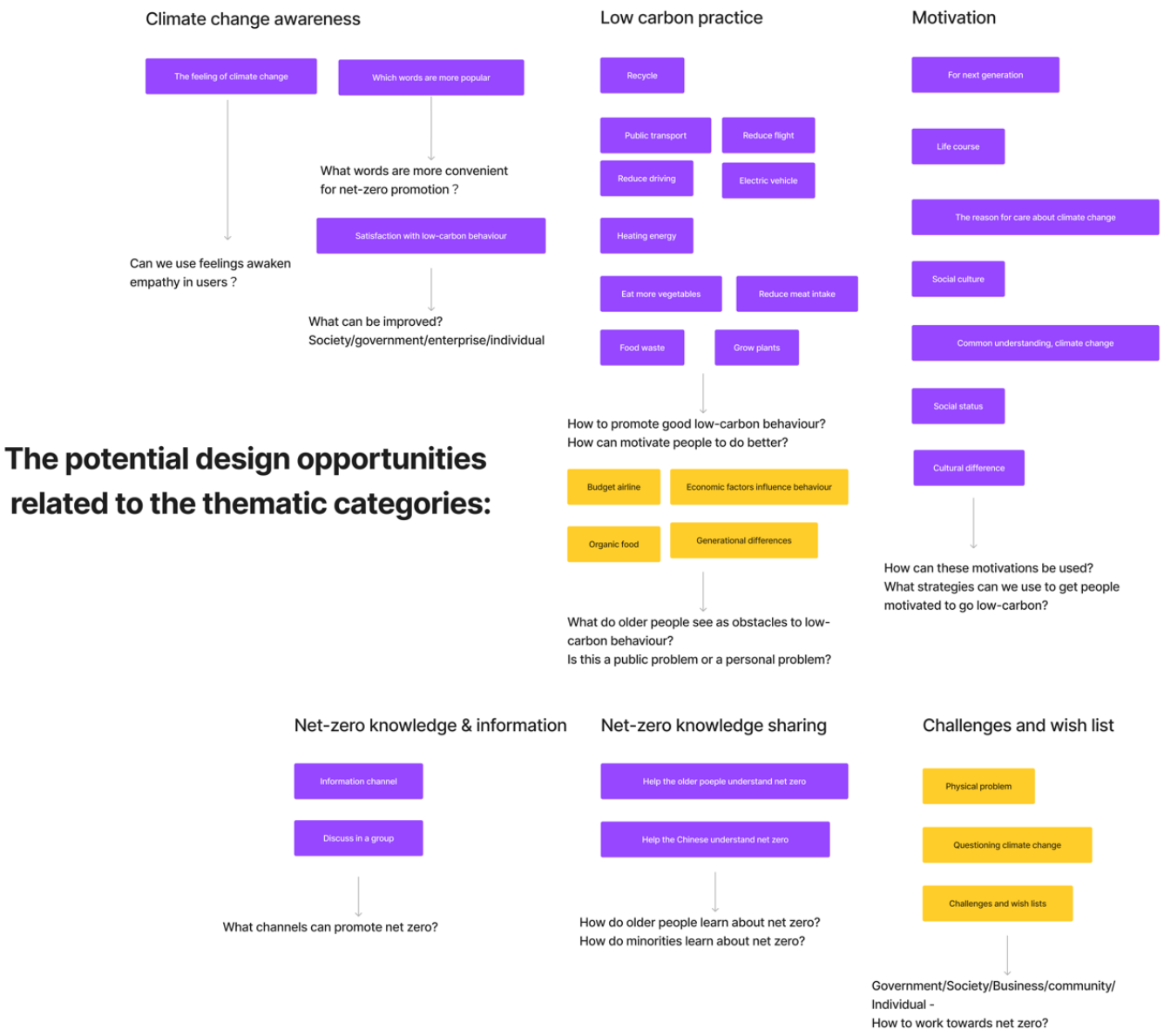


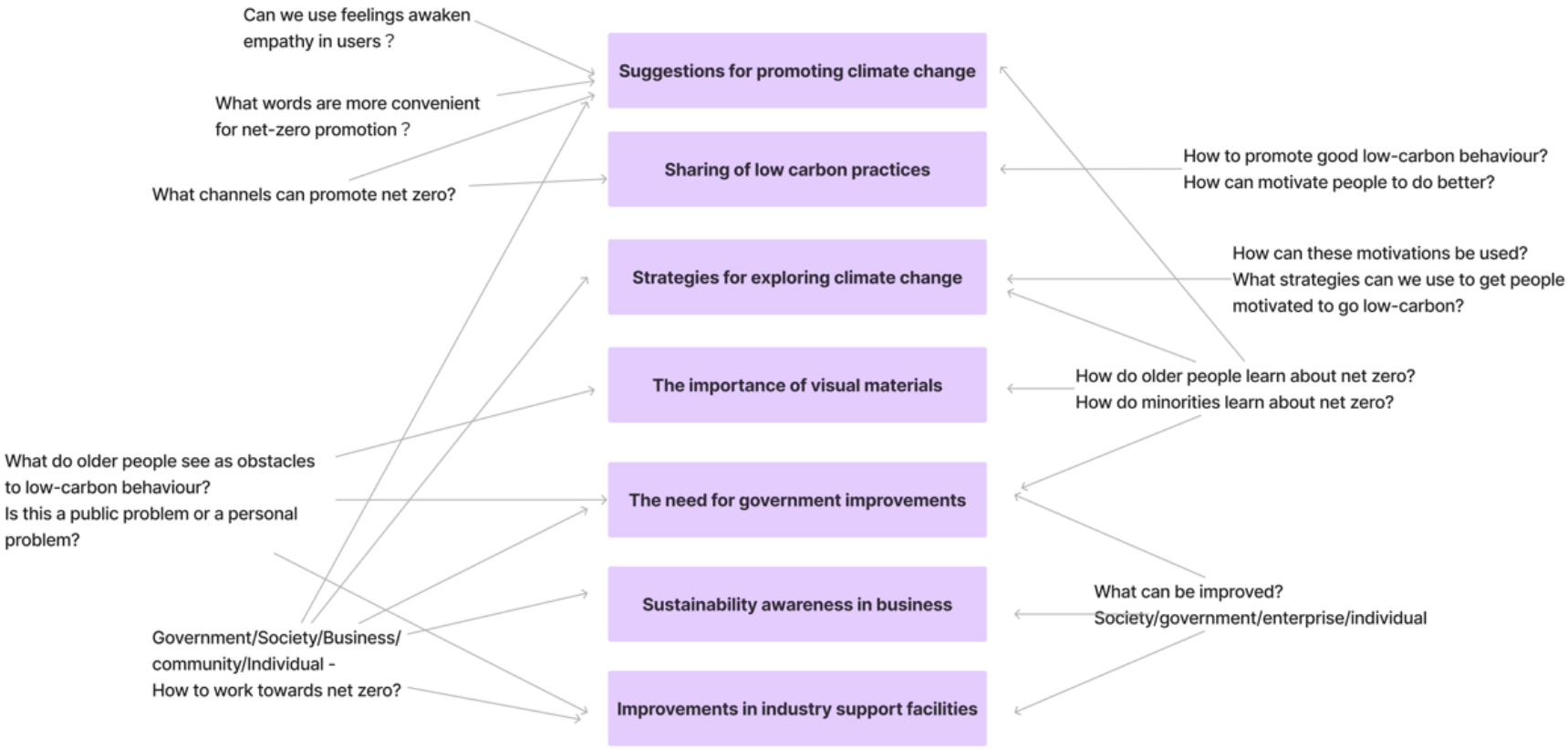

Public concern
Next generation
Motivation
Nature
Economic factor
Satisfaction with their low carbon behavior
Save money
The role of rewards
The role of fines
Renovation costs are too high for the olders
Negative impact of social welfare
Life crisis
Want to do more, but don't know what to do
Don't want to do more because of age


Face-to-face chat
Community
Newspapers and radio
BBC
Net-zero knowledge & information
TV
Website
Scientists and data
Social media
Old people, advice from family
Group discussion


Minorities need to be integrated into society
Nature's warning, self-awareness
Personal
Net-zero knowledge sharing
Intervention measure
Translation language, technical assistance
Working with local councils, communities
Use simple words and explanations
Simplify information and make it easy to understand
Give practical personal advice
Government measures
Group information, news information
Rewards , punishment
Trusted data
Information prompt


Challenges and wish lists
Should learn from other countries
Grow plants
Organic food is too expensive
Recycle
Generational differences
Transport
Policy and social culture
Questioning climate change
Electric cars need subsidies
There are no perfect supporting facilities in UK
Lack of mobility
Use of new energy vehicles
The next generation should be concerned about climate change
Young people's consumption concept
Young people should learn from older people
Reflections on life at different ages
Young people love using mobile phones and social media
Young people and old people have different living habits
Lack of action among young people
The actions of the government and the masses
Disadvantages of electric cars
Garbage is not properly recycled
Dietary habit
Too old to think about it
The course of human life
Older people have more life experience
The life cycle of the clothes
Attitudes and goals at different stages of life
Life is different at different ages
Low carbon behavior and climate catastrophe in the memory of generations


Climate change awareness
The feeling of climate change
Which words are more popular
What words are more convenient for net-zero promotion ?
Satisfaction with low-carbon behaviour
Can we use feelings awaken empathy in users ?
What can be improved? Society/government/enterprise/individual
Low carbon practice
Recycle
Public transport
Reduce flight
Reduce driving
Electric vehicle
Heating energy
Eat more vegetables
Reduce meat intake
Food waste
Grow plants
How to promote good low-carbon behaviour? How can motivate people to do better?
Budget airline
Economic factors influence behaviour
Organic food
Generational differences
What do older people see as obstacles to low-carbon behaviour? Is this a public problem or a personal problem?
Motivation
For next generation
Life course
The reason for care about climate change
Social culture
Common understanding, climate change
Social status
Cultural difference
How can these motivations be used? What strategies can we use to get people motivated to go low-carbon?
The potential design opportunities related to the thematic categories:
Net-zero knowledge & information
Information channel
Discuss in a group
What channels can promote net zero?
Net-zero knowledge sharing
Help the older poeple understand net zero
Help the Chinese understand net zero
How do older people learn about net zero? How do minorities learn about net zero?
Challenges and wish list
Physical problem
Questioning climate change
Challenges and wish lists
Government/Society/Business/community/ Individual - How to work towards net zero?


Can we use feelings awaken empathy in users ?
What words are more convenient for net-zero promotion ?
What channels can promote net zero?
What do older people see as obstacles to low-carbon behaviour?
Is this a public problem or a personal problem?
Government/Society/Business/ community/Individual - How to work towards net zero?
Suggestions for promoting climate change
Sharing of low carbon practices
Strategies for exploring climate change
The importance of visual materials
The need for government improvements
Sustainability awareness in business
Improvements in industry support facilities
How to promote good low-carbon behaviour?
How can motivate people to do better?
How can these motivations be used?
What strategies can we use to get people motivated to go low-carbon?
How do older people learn about net zero?
How do minorities learn about net zero?
What can be improved?
Society/government/enterprise/individual

Appendix Study E

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
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18 December 2023

LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 31/12/2023 AND 31/10/2024

Applicant (s): Miss Qing Ni

Project Title: Low Carbon Design Workshops for Designers and Older Chinese Migrants in London

Reference: 46666-LR-Dec/2023- 48594-1

Dear Miss Qing Ni

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- **Please ensure that you monitor and adhere to all up-to-date local and national Government health advice for the duration of your project.**
- **Please remove the witness statement from your Consent Form as it is only relevant to vulnerable participants**

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- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
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- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.



Professor Simon Taylor

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London

Opportunity points identified in Study D-large version



New

Key Points

1. Familiar Terms; Simplify and Relate Concepts;Prioritize Familiar Terms
2. Multicultural Environments as Learning Spaces; Low-Carbon Practices from Developing Countries; Cultural Inclusivity in Climate Communication; Enhancing Participation Through Integration
3. Traditional Media; Family and Intergenerational Dialogue; Digital Platforms; Community-Based Networks
4. Utilizing Translation Tools; Simplifying Information; Overcoming Language Barriers; Leveraging Social Media and Digital Platforms; Providing Practical and Relevant Information; Collaborating with Local Councils and Communities; Engaging Trusted Community Leaders

1. Food; Transportation; Recycling and Energy Use; Frugality; Social Responsibility

1. Memories of Specific Events; Personal Sensory Experiences; Localized Observations; Connection to Historical Contexts
2. Nature as Evidence; Role of Media; Emotional Depth
3. Concern for Future Generations
4. Financial Motivation for Low-Carbon Practices; Incentives and Penalties
5. Addressing Diverse Levels of Awareness; Fostering Agency and Collective Action
6. Reminder: Arouses awareness of the impact of the behaviour
   Warning: Send a more serious message
   Encouragement: Encouraging behaviour through positive reinforcement
   Attract: Generate interest through visual and creative design

1. Strengthen Recycling Systems; Align Policies with Climate Goals; Build Public Confidence; Clearer Messaging; Implement Rewards and Penalties; Engage Older Adults in Policy Development; Strengthen Community Involvement; Expand Renewable Energy Initiatives; Promote Business Accountability
2. Encouraging Sustainable Consumption; Leveraging Sustainable Business Models; Innovating Marketing Strategies; Supporting Circular Economy Practices; Collaborating with Consumers
3. Expanding Charging Networks; Simplifying Technology for Older Adults; Adapting Public Transport for Aging Populations; Promoting Elderly-Friendly Design in Infrastructure; Building Supportive Environments for Aging Populations

Suggestions from designers

Leadership by Institutions Cultural and Religious Activities Activities Tailored to Older Adults
Charity and Education Programmes Volunteers

Key Opinion Leaders (KOLs)

Multilingual Advocacy

Advertising and Memory Aids Revisiting Familiar Places
Documentaries and Videos Museum Exhibits and Immersive Experiences

AR/VR Technology Multi-Sensory Engagement AI Technology Data and Visual Communication

Intergenerational Story Sharing Family-Centric Activities Government Incentives and Public Rewards
Education and Behavioural Guidance Community Competitions and Reward Systems Support from Financial Institutions
Data-Driven Sharing and Virtual Rewards Corporate Rewards and Point Systems

Demographic-Specific Approaches

Establish a Supervision Department and Promote Transparency Transparency and Open Data Promote and Clarify Policies
Engage with Communities and Gather Feedback

Extending Product Life Cycles New Materials and Recycling
Transparency in Packaging Information
Improvement of Business Models Consumer Engagement and Experience

Community Shuttle Buses Elderly Assistance Services Optimising Bus Design Upgraded Stations
Walking Facility Enhancements Enhancing Support Facilities in Remote Areas Delivery and Shared Services

Appendix Study F

Full policy brief

Policy Brief: Empowering Older Adults for Climate Action

1. Policy Context

Older adults are often seen as vulnerable to climate change, yet they are a valuable and underutilised group for advancing sustainable practices at the community level. This brief outlines strategies to engage older adults—including immigrant seniors—in climate initiatives, paving the way for a more inclusive, sustainable approach to achieving net-zero targets.

2. Key Insights

- **Terminology and Communication:**
  Older adults tend to understand familiar terms like "climate change" better than abstract concepts such as "net zero." Using simple, relatable explanations improves engagement.
  Example Quote:
  "I think whatever channel of information you want to get the message across, you need to make the message very easy to understand… That's one of the reasons I think climate change is better than net zero."
  (Female, 82)
- **Cultural Diversity and Integration:**
  Immigrant older adults often bring low-carbon practices from their cultures. However, language barriers and cultural isolation can limit their participation in local climate initiatives.
- **Communication Channels:**
  Trusted sources include traditional media (e.g., BBC, newspapers, TV) and personal networks, while digital platforms are underutilised due to accessibility and trust issues.
- **Motivations for Climate Action:**
  Key drivers include intergenerational concern (leaving a healthy planet for future generations), economic benefits from cost-saving measures, and a sense of social responsibility developed over time.
- **Barriers to Engagement:**
  High upfront costs of green technologies, health and mobility challenges, and

skepticism toward government and business-led initiatives hinder participation.

3. Policy Recommendations

1. **Simplify Climate Communication**
   - Use clear, relatable language and replace technical terms like "net zero" with practical explanations (e.g., balancing emissions through renewable energy).
   - Develop visually engaging materials (infographics, videos, podcasts) tailored to older adults.
2. **Strengthen Cultural and Community Integration**
   - Translate climate resources into multiple languages and collaborate with community leaders and ethnic organisations to build trust.
   - Encourage the sharing of low-carbon practices across different cultures.
3. **Foster Intergenerational Collaboration**
   - Create programmes that allow older adults to share their experiences while younger generations assist with adopting new technologies.
   - Encourage family-based dialogue to strengthen collective climate action.
4. **Invest in Infrastructure**
   - Expand accessible, age-friendly green infrastructure, such as improved public transport and electric vehicle charging stations, to address mobility challenges.
5. **Build Trust Through Transparent Policies**
   - Promote consistency in climate policies and include older adults in advisory panels and community consultations.
   - Encourage public–private partnerships that support sustainable business practices.

4. Call for Action

To fully harness the potential of older adults as climate advocates, policymakers, community organisations, and businesses should consider:

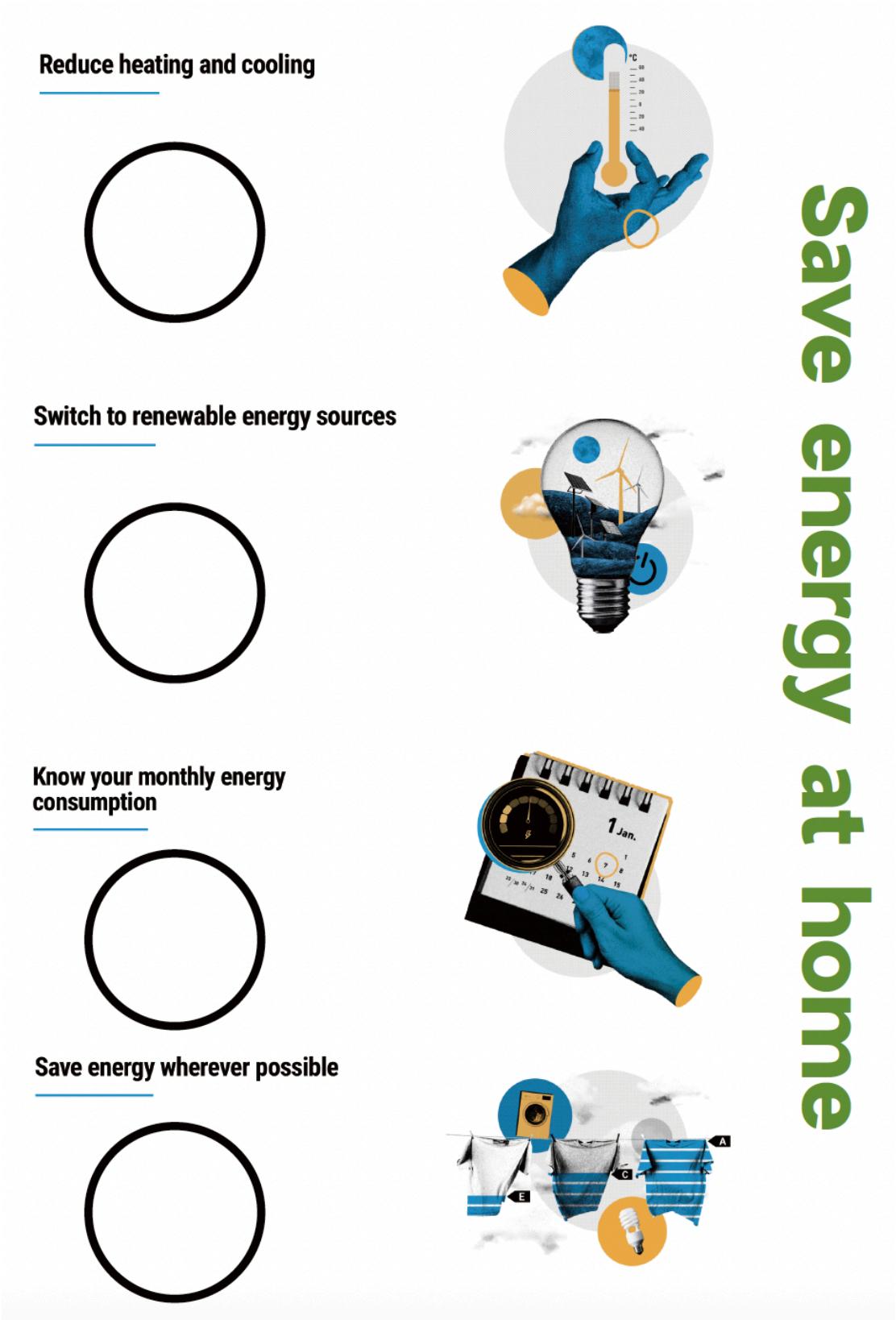
- Investing in inclusive, culturally tailored communication and offering economic incentives to lower participation barriers.
- Enhancing community collaborations and intergenerational knowledge-sharing.
- Supporting transparent, consistent policies that build trust and encourage sustainable practices.

Auxiliary Visual Materials

Ice-breaking card for climate knowledge



Ice-breaking self-questions for climate categories



Walk, bike or take public transport

Be mindful of flying



Walk, bike, take public transport, or carpool



Consider shared modes of transportation



Consider an electric vehicle



Reduce, reuse, repair and recycle



Clean up your environment



Make your money count

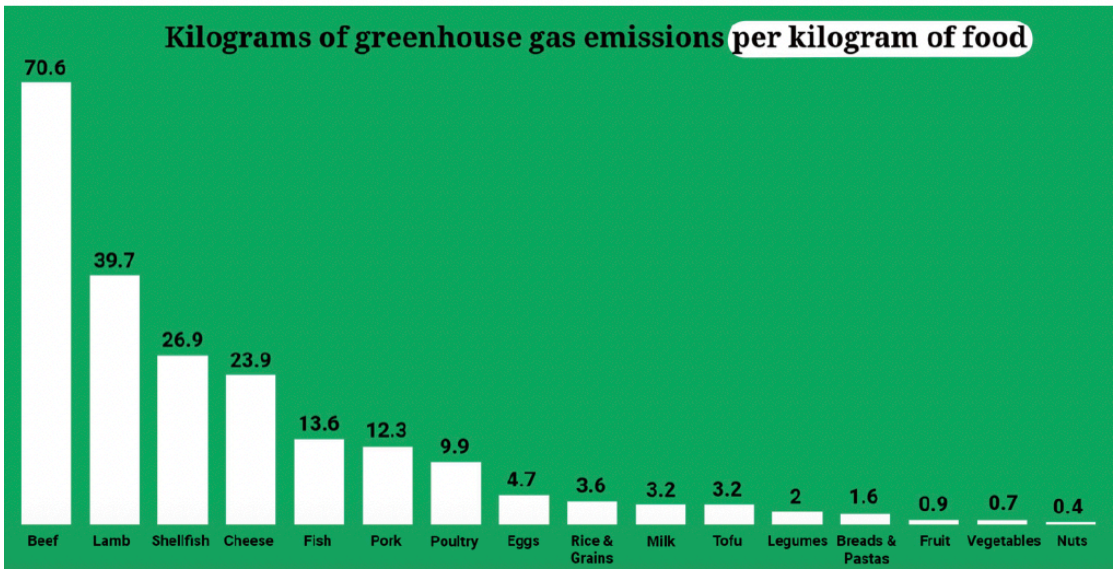


Throw away less food



Eat more vegetables





Shop local and organic



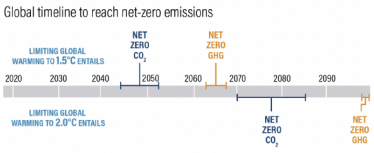
Start composting




20°
25
淨零科普手冊
Net-Zero Science Brochure
Source: Net Zero Public Dialogue - A Report by Newgate Research and Cambridge Zero

什麼是淨零？

「淨零」是減少溫室氣體排放和/或確保任何持續的排放與清除平衡。
淨零中的「淨」很重要，因為在所需的時間範圍內將所有排放量減少到零是非常困難的。除了深度和廣泛地減少排放外，我們可能還需要擴大清除量。為了使淨零有效，它必須是永久性的，也就是說，任何溫室氣體的清除不會隨著時間的推移而泄漏到大氣中，例如通過森林的破壞或清除的二氧化碳的不當儲存。
永久「淨零」是指所有溫室氣體源和源之間的平衡，在匹配的時間尺度上保持平衡。



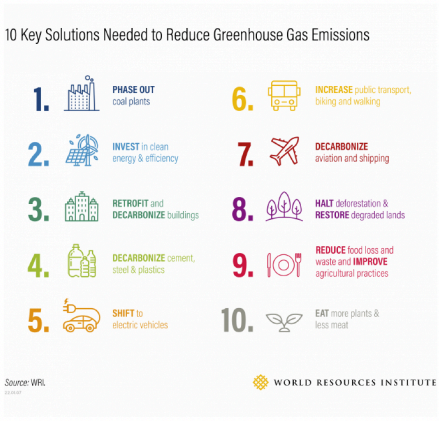
Source: WORLD RESOURCES INSTITUTE

達到淨零排放意味著什麼？

當人類活動釋放的所有溫室氣體排放都通過碳去除的過程中從大氣中去除溫室氣體來實現平衡時，將實現淨零排放。
首先，人為排放（例如化石燃料汽車和工廠的排放）應盡可能減少到接近於零的水平。然後，任何剩余的溫室氣體都應與等量的碳去除量相平衡，這可以通過恢復森林或使用直接空氣捕獲和儲存（DACS）技術等方式實現。



實現淨零排放需要做什麼？



Source: WORLD RESOURCES INSTITUTE



政策、技術和行為需要全面轉變。例如，在達到 1.5 攝氏度的路徑中，到 2050 年，可再生能源預計將提供 70-85% 的電力。能源效率和燃料轉換措施對於減少交通排放至關重要。提高糧食生產效率、改變飲食選擇、製止森林砍伐、恢復退化土地以及減少糧食損失和浪費也具有減少排放的巨大潛力。

促進行為改變，實現淨零排放

在激勵個人行為的改變以減少碳排放方面，存在著一些挑戰。人們對淨零排放或實現淨零排放所需的行為（包括技術采用和需求減少）的認識、知識或理解都很有限（準確）。氣候變化問題的規模和複雜性也意味著，在人們的註意力被各種其他當前問題所占據的環境中，它可能很難得到突破（在本研究中主要是COVID-19）。參與者認為具有直接財務影響（如更換鍋爐）或便利/舒適影響（如降低恒溫器的溫度）的行為，對人們來說相對容易立即排除。同時，應對氣候變化被認為是一個巨大的全球性問題；人們不懂對當前有偏見，而且他們還需要感覺到他們的行動是有意義的，並與其他人的行動相一致，包括工業和其他國家。在促進行為改變方面，重要的是把重點放在明確的、短期的、可管理的行動上，以及利用社會規範和獎勵的反饋機製上。



Source：Net Zero Public Dialogue - A Report by Newgate Research and Cambridge Zero



讓人們參與到實現淨零排放的旅程中

「人們對國家或更多地方的減少碳排放的政策/措施的認識非常有限，或對公眾參與氣候變化問題的機製的認識也非常有限（例如，英國氣候大會）。我們應該清楚地認識到讓公眾參與對話的價值，以了解和考慮他們的觀點，特別是對他們的生活方式有直接影響的政策。」

Source：Net Zero Public Dialogue - A Report by Newgate Research and Cambridge Zero

對達到淨零排放的期望

廢棄物



人們提高了他們的家庭回收水平，減少了相應的廢物產生量。這被認為是增加使用回收設施的結果，但也需要地方政府和商店的支持（提供回收設施），需要有成本效益的維修選擇，以及需要商店和製造商減少塑料包裝的使用。就對碳排放的預期影響而言，這通常被列為第一或第二優先行動。

Source：Net Zero Public Dialogue - A Report by Newgate Research and Cambridge Zero



旅行

減少使用私人汽油柴油車進行本地旅行和通勤，轉而使用公共交通和更積極的出行方式；在此，人們對汽車的依賴程度很高，許多家庭擁有多輛汽車（尤其是在城市之外）。改善公共交通的可及性和可靠性，並激勵其使用，被認為是有助於使人們遠離汽車的行動。減少航空旅行，防止公司推廣不可持續的行為，如通過大量的航班折扣。

住房

減少使用化石燃料發電，用可再生能源。消費者也可以選擇可再生能源的電價。

在住宅建築中安裝能源效率和可再生能源措施。





Source: Net Zero Public Dialogue - A Report by Newgate Research and Cambridge Zero

食品

少吃肉（尤其是紅肉）和乳製品；通常由素食者/素食者或實行替代飲食的人提出。

人們購買和消費更多本地生產的食品，並在購物時減少使用一次性塑料。



Source: Net Zero Public Dialogue - A Report by Newgate Research and Cambridge Zero

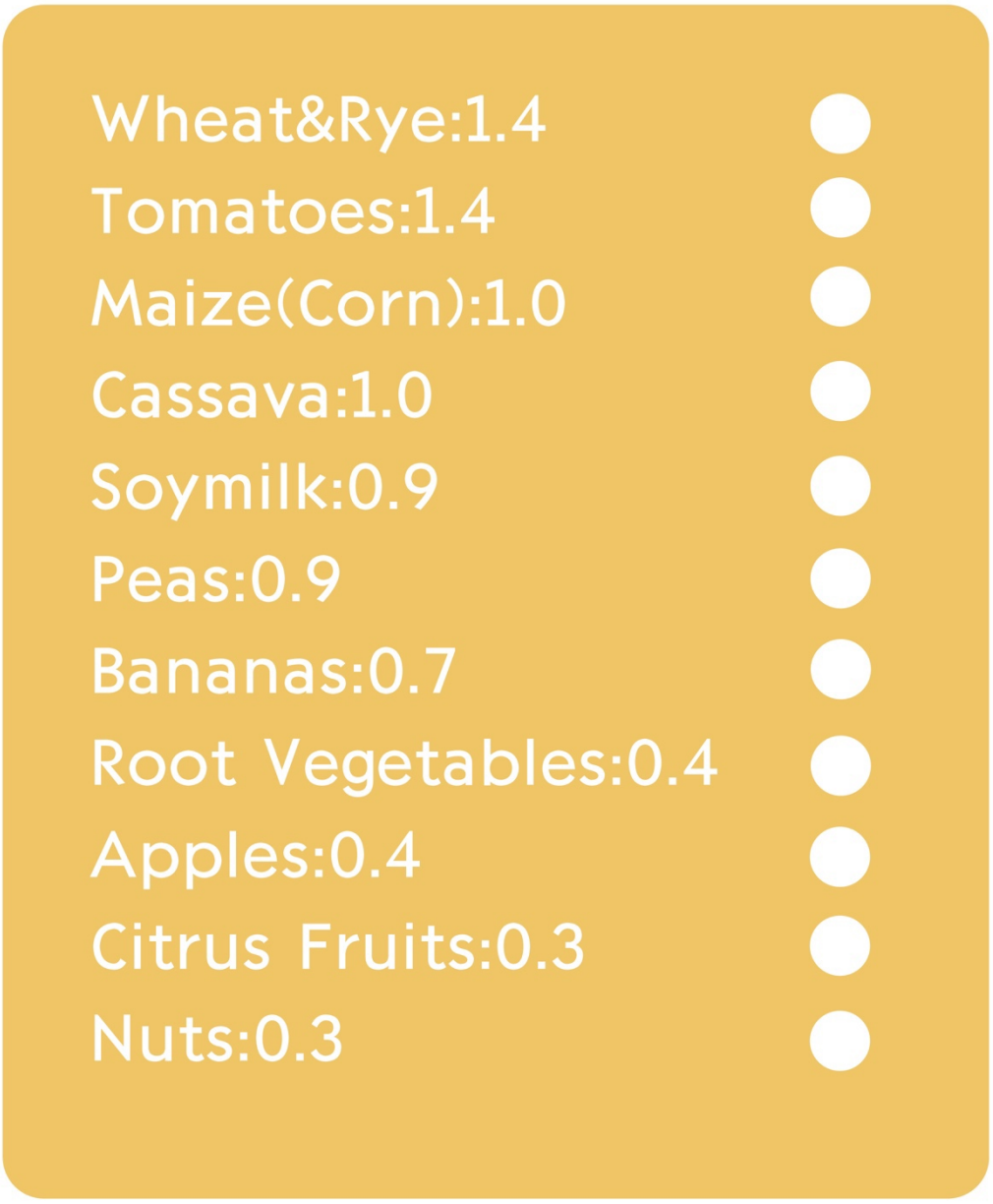
淨零科普手冊

NET-ZERO SCIENCE BROCHURE

Source: Net Zero Public Dialogue - A Report by Newgate Research and Cambridge Zero


Food:
greenhouse gas emissions
across the supply chain
Beef:60
Lam:24
Cheese:21
Chocolate:19
Cofee:17
Prawns:12
Pig meat:7
Fish:5
Eggs:4.5
Rice:4
Milk:3
Groundnuts:2.5
Greenhouse gas emissions per kilogram of food product

Food: greenhouse gas emissions across the supply chain



Greenhouse gas emissions per kilogram of food product

Transport:
The Carbon Cost of Transportation



Grams of carbon dioxide equivalents per passenger-kilometret

Living/Housing:

1 m^2 of heating =
47.65 kg of CO2 emissions

Carbon emissions

Electricity use: kWh 0.785 (kg)

Water use: tonnes 0.91 (kg)

Gas consumption: cubic metres 0.19 (kg)

Oil consumption: litres 2.7 (kg)

Climate Change Puzzle

Saw Puzzle 拼圖–Causes of Climate Change



Intervention function: Attract/Warn/Education

Energy is at the heart of the climate challenge – and key to the solution.

能源是氣候挑戰的核心，也是解決問題的關鍵。

Facts 事實:

Cities are major contributors to climate change. According to UN Habitat, cities consume 78 per cent of the world's energy and produce more than 60 per cent of green-house gas emissions. Yet, they account for less than 2 per cent of the Earth's surface.

城市是氣候變化的主要貢獻者。聯合國人居署(UN Habitat)的數據顯示，城市消耗了全球78%的能源，產生了全球60%以上的溫室氣體排放。然而，它們只佔地球表面的不到2%。

Saw Puzzle 拼圖–Causes of Climate Change



A Giant Beached Whale Illustrates the Plastic Pollution Problem
Photo by Vince Cinches

Intervention function: Attract/Warn/Education

The earth's resources are being depleted, but the population continues to grow.

地球上的資源正在不斷枯竭，但人口卻在持續增長。

Facts 事實:

If the global population reaches 9.8 billion by 2050, it will take nearly three Earths to provide the natural resources needed to sustain current lifestyles. The per capita material footprint of high-income countries is 10 times that of low-income countries.

如果到2050年全球人口達到98億，那麼將需要近三個地球來提供維持當前生活方式所需的自然資源。高收入國家的人均材料足跡是低收入國家水平的 10 倍。

Saw Puzzle 拼圖-Causes of Climate Change



Intervention function: Attract/Warn/Education

With 10 million hectares lost annually due to deforestation and approximately 70 million hectares affected by fires.

每年有1000萬公頃森林因砍伐而消失，約有7000萬公頃森林受火災影響。

Facts 事實:

Carbon emissions from manufacturing and industry come mainly from fossil fuels burned in the manufacture of cement, iron, steel, electronics, plastics, clothing and other goods. Mining and other industrial activities also release greenhouse gases.

製造業和工業的碳排放主要來自制造水泥、鐵、鋼、電子產品、塑料、服裝和其他商品時燃燒的化石燃料。採礦業和其他工業生產活動也會釋放溫室氣體。

Saw Puzzle 拼圖-Causes of Climate Change



Intervention function: Attract/Warn/Education

Most cars, trucks, ships and planes are powered by fossil fuels. This makes transport a major contributor to greenhouse gases, particularly carbon dioxide.

大多數汽車、卡車、輪船和飛機均通過化石燃料供能。這使得交通運輸成爲溫室氣體（特別是二氧化碳）的主要貢獻源。

Facts 事實:

The world's roadways are clogged with vehicles, most of them burning fossil fuels. Fossil fuels power the ships that carry trade and the airplanes that allow us to travel.
Greenhouse gas emissions from the transport sector have more than doubled since 1970, with around 80% of this increase coming from road vehicles.

自1970年以來，交通運輸部門的溫室氣體排放量增加了一倍多，其中約80%的增長來自公路車輛。
全球約10%的人口占總機動客運公里數的80%，而世界上大部分人口幾乎不旅行。

Saw Puzzle 拼圖-Causes of Climate Change



Consuming too much
過度消費

Imported clothing arriving at Canam's sorting facility in Kandla, India.Photo by Prashanth Vishwanathan/Bloomberg

Intervention function: Attract/Warn/Education

Your house, your electricity, your transportation, your food and your garbage all emit greenhouse gases. The consumption of goods such as clothing, electronics and plastics also emits greenhouse gases.

你的房子、用電、交通工具、食物和垃圾，都會排放溫室氣體。服裝、電子產品和塑料等商品的消費也會排放溫室氣體。

Facts 事實：

The richest bear the greatest responsibility: the richest 1% of the world's population emits more greenhouse gases than the poorest 50% of the world's population combined.

最富有的人承擔最大的責任：全球最富有的1%人口的溫室氣體排放量大於全球最貧窮的50%人口的總排放量。

Saw Puzzle 拼圖–Causes of Climate Change



Intervention function: Attract/Warn/Education

Electricity drives our lifestyles. Although some 750 million people in the world still lack access to electricity, for the rest, everything from a computer to a television to a refrigerator needs energy.

電力驅動着我們的生活方式。儘管世界上仍有7.5億人用不上電，但對其他人來說，從電腦到電視再到冰箱，所有東西都需要能源。

Facts 事實:

The energy supply sector (electricity, heat, and other energy) is the largest contributor to global greenhouse gas emissions, responsible for approx. 35% of total emissions. Globally, residential and commercial buildings, consume over half of all electricity.

能源供應部門(電力、熱能和其他能源)是全球溫室氣體排放的最大貢獻者，約佔全球溫室氣體排放總量的20%。佔總排放量的35%。

Saw Puzzle 拼圖-Effects of Climate Change



Intervention function: Attract/Warn/Education

As greenhouse gas concentrations rise, so does the global surface temperature. Nearly all land areas are seeing more hot days and heat waves.

隨着溫室氣體濃度的上升，全球表面溫度也在上升。幾乎所有的陸地地區都在經歷更多的炎熱天氣和熱浪。

Facts 事實：

The last decade, 2011-2020, is the warmest on record. Since the 1980s, each decade has been warmer than the previous one. Temperatures in the Arctic have warmed at least twice as fast as the global average.

2011-2020年是有記錄以來最熱的十年。自20世紀80年代以來，每一個十年都比前一個十年更暖。北極地區的氣溫上升速度至少是全球平均水平的兩倍。

Saw Puzzle 拼圖-Effects of Climate Change



BOSTON, MA / A person crosses the street during a 2022 blizzard in Boston. Much of the Northeast experienced harsh winter storms throughout January of this year. Photo by Scott Eisen/Getty Images

Intervention function: Attract/Warn/Education

As temperatures rise, more moisture evaporates, which exacerbates extreme rainfall and flooding, causing more destructive storms. The frequency and extent of tropical storms is also affected by the warming ocean.

隨着氣溫上升，更多的水分蒸發，加劇了極端降雨和洪水，導致更多破壞性風暴。熱帶風暴的頻率和範圍也受到海洋變暖的影響。

Facts 事實:

Destructive storms have become more intense and more frequent in many regions. Cyclones, hurricanes, and typhoons feed on warm waters at the ocean surface. Such storms often destroy homes and communities, causing deaths and huge economic losses.

在許多地區，破壞性風暴變得更加強烈和頻繁。旋風、颶風和颱風以海洋表面溫暖的海水爲食。這類風暴經常摧毀房屋和社區，造成死亡和巨大的經濟損失。

Saw Puzzle 拼圖-Effects of Climate Change



Tears of Drought / Satkhira, khulna, Bangladesh / Copyright Sujon Adhikary

Intervention function: Attract/Warn/Education

Climate change is changing water availability, making it scarcer in more regions.

氣候變化正在改變水資源的可用性，使更多地區的水資源更加稀缺。

Facts 事實:

Global warming exacerbates water shortages in already water-stressed regions and is leading to an increased risk of agricultural droughts affecting crops, and ecological droughts increasing the vulnerability of ecosystems.

全球變暖加劇了本已缺水地區的水資源短缺，並導致影響作物的農業乾旱風險增加，而生態乾旱則增加了生態系統的脆弱性。

Saw Puzzle 拼圖-Effects of Climate Change



Intervention function: Attract/Warn/Education

The ocean soaks up most of the heat from global warming. The rate at which the ocean is warming strongly increased over the past two decades, across all depths of the ocean.

海洋吸收了全球變暖帶來的大部分熱量。在過去的二十年裏，海洋變暖的速度在海洋的所有深處都有明顯的增加。

Facts 事實:

As the ocean warms, its volume increases since water expands as it gets warmer. Melting ice sheets also cause sea levels to rise, threatening coastal and island communities.

隨着海洋變暖，它的體積增加，因爲水隨着變暖而膨脹。冰蓋融化也導致海平面上升，威脅到沿海和島嶼社區。

Saw Puzzle 拼圖-Effects of Climate Change



Polluted skies in Beijing. A new study has found that air quality is particularly worrisome in regions such as southern Asia and eastern Asia. / BLOOMBERG

Intervention function: Attract/Warn/Education

Climate impacts are already harming health, through air pollution, disease, extreme weather events, forced displacement, pressures on mental health, and increased hunger and poor nutrition in places where people cannot grow or find sufficient food.

氣候影響已經通過空氣污染、疾病、極端天氣事件、被迫流離失所、精神健康壓力以及在人們無法種植或找到足夠食物的地方飢餓和營養不良加劇等方式損害健康。

Facts 事實:

Every year, environmental factors take the lives of around 13 million people. Changing weather patterns are expanding diseases, and extreme weather events increase deaths and make it difficult for health care systems to keep up.

每年，環境因素奪去了大約1300萬人的生命。不斷變化的天氣模式正在擴大疾病，極端天氣事件增加了死亡人數，使衛生保健系統難以跟上。

Saw Puzzle 拼圖-Effects of Climate Change



A woman of the Turkana tribe waits with plastic containers to get water from a well, amid the worst drought in East Africa's history, February 17, 2023. Photo by Simone Boccaccio / SOPA Images/Sipa USA

Intervention function: Attract/Warn/Education

Climate change increases the factors that put and keep people in poverty. Floods may sweep away urban slums, destroying homes and livelihoods. Heat can make it difficult to work in outdoor jobs. Water scarcity may affect crops.

氣候變化增加了使人們陷入貧困的因素。洪水可能席捲城市貧民窟，摧毀房屋和生計。高溫會使在戶外工作變得困難。缺水可能會影響農作物。

Facts 事實:

Over the past decade (2010 – 2019), weather-related events displaced an estimated 23.1 million people on average each year, leaving many more vulnerable to poverty. Most refugees come from countries that are most vulnerable and least ready to adapt to the impacts of climate change.

在過去十年(2010-2019年)中，與天氣有關的事件估計平均每年導致2310萬人流離失所，使許多人更容易陷入貧困。大多數難民來自最脆弱和最不準備適應氣候變化影響的國家。

Saw Puzzle 拼圖-Effects of Climate Change



Migrant labourers and their family members hold kitchen utensils as they protest against the government for the lack of food in a slum area CREDIT by NARINDER NANU / AFP

Intervention function: Attract/Warn/Education

Changes in the climate and increases in extreme weather events are among the reasons behind a global rise in hunger and poor nutrition. Fisheries, crops, and livestock may be destroyed or become less productive.

氣候變化和極端天氣事件的增加是全球飢餓和營養不良人數上升的原因之一。漁業、農作物和牲畜可能遭到破壞或產量下降。

Facts 事實:

With the ocean becoming more acidic, marine resources that feed billions of people are at risk. Changes in snow and ice cover in many Arctic regions have disrupted food supplies from herding, hunting, and fishing.

隨着海洋變得越來越酸，養活數十億人的海洋資源正處於危險之中。許多北極地區冰雪覆蓋的變化擾亂了放牧、狩獵和捕魚的食物供應。

Saw Puzzle 拼圖-Effects of Climate Change



Orangutans in Indonesia last year, when blazes from illegal land-clearing increased sharply.Credit. Photo by Ulet Ifansasti/Getty Images

Intervention function: Attract/Warn/Education

Climate change poses risks to the survival of species on land and in the ocean. These risks increase as temperatures climb.

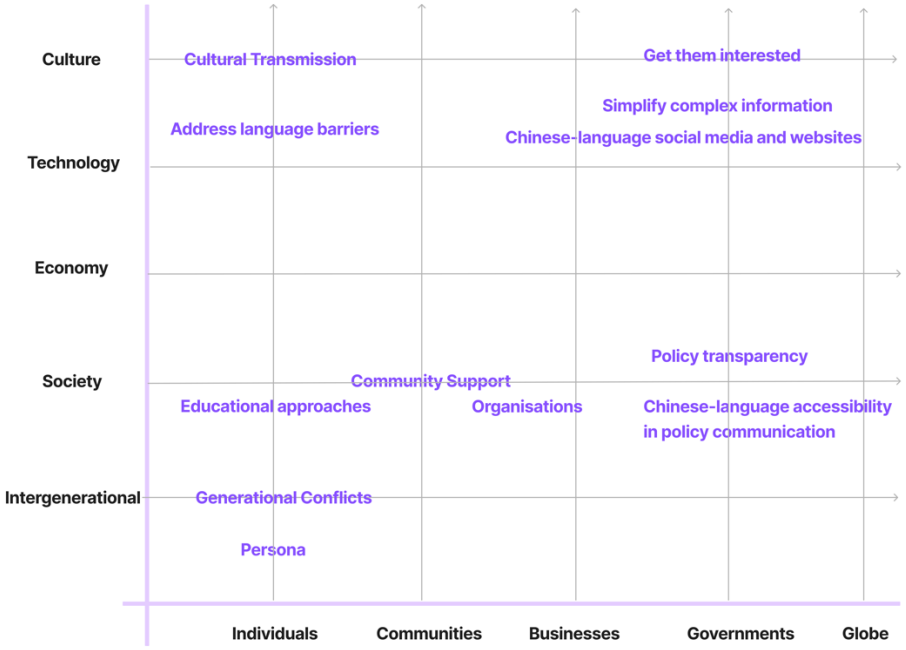
氣候變化對陸地和海洋物種的生存構成威脅。隨着氣溫的升高，這些風險也在增加。

Facts 事實:

These risks increase as temperatures climb. Exacerbated by climate change, the world is losing species at a rate 1,000 times greater than at any other time in recorded human history. One million species are at risk of becoming extinct within the next few decades.

在氣候變化的影響下，世界物種的流失速度比人類歷史上任何時候都要快1000倍。在未來幾十年內，有100萬種物種面臨滅絕的危險。

Building up the Intervention Strategy Study A-E



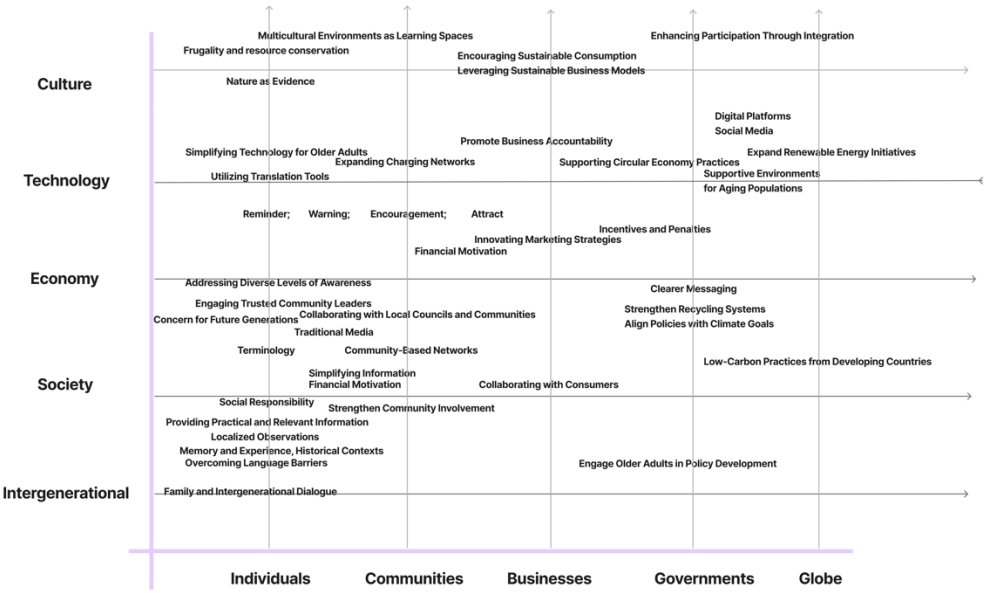
Study A



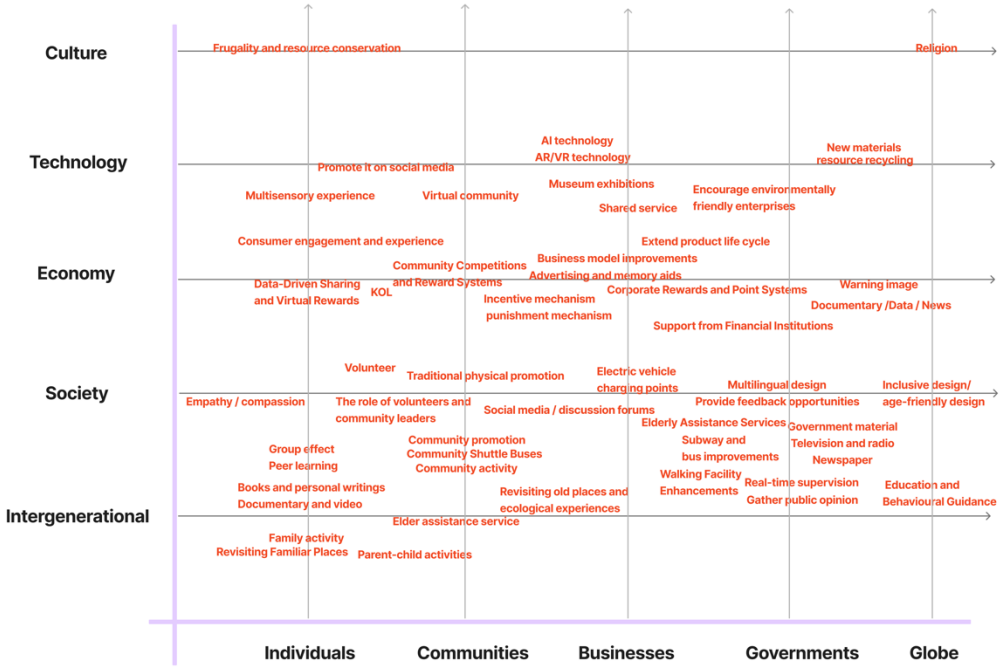
Study B



Study C



Study D


Culture
Technology
Economy
Society
Intergenerational
Frugality and resource conservation
Religion
AI technology
AR/VR technology
New materials
resource recycling
Promote it on social media
Museum exhibitions
Encourage environmentally
friendly enterprises
Multisensory experience
Virtual community
Shared service
Consumer engagement and experience
Extend product life cycle
Community Competitions
and Reward Systems
Business model improvements
Advertising and memory aids
Data-Driven Sharing
and Virtual Rewards
KOL
Incentive mechanism
punishment mechanism
Corporate Rewards and Point Systems
Warning image
Documentary /Data / News
Support from Financial Institutions
Volunteer
Traditional physical promotion
Electric vehicle
charging points
Multilingual design
Inclusive design/
age-friendly design
Empathy / compassion
The role of volunteers and
community leaders
Social media / discussion forums
Provide feedback opportunities
Elderly Assistance Services
Government material
Community promotion
Subway and
bus improvements
Television and radio
Group effect
Community Shuttle Buses
Peer learning
Community activity
Newspaper
Walking Facility
Enhancements
Real-time supervision
Gather public opinion
Education and
Behavioural Guidance
Books and personal writings
Documentary and video
Revisiting old places and
ecological experiences
Elder assistance service
Family activity
Revisiting Familiar Places
Parent-child activities
Individuals
Communities
Businesses
Governments
Globe

Study E

Appendix Study G

Sample questions for the interview

Evaluation of climate change design intervention toolkits

for older Chinese migrants and designers in London

The interviews are semi-structured. Questions will be asked over 1-1.5 hours.

Climate Change Chatterbox

1)	Do you drive?
2)	What are your saving strategies?
3)	Do you care about nature?
4)	How many bedrooms do you have?
5)	How do you keep healthy?
6)	How many clothes do you have?
7)	What do you usually have for lunch?
8)	What do you want to say to the next generation?

Climate Change Memory Turntable

1)	Tell me about the pictures/videos you saw.
2)	Let's talk about the weather in the past.
3)	Were winters cold in the past?
4)	Do you remember Mom's cooking?
5)	Did your friends talk about climate change?
6)	Does your child care about climate change?
7)	What climate change disasters do you remember?
8)	Where have you traveled? Do you think the world has changed much?
9)	How did you feel about climate change at the time?
10)	Can you describe your most memorable day?
11)	What was the climate like in your childhood?
12)	What did you do for climate change in the UK?
13)	What do you do in summer and winter?
14)	Is the food different from when you were young?

Climate Change Conversation card

1)	What did your mother cook when you were a child?
2)	Have you studied tailoring?
3)	What skills do you have to teach the next generation?
4)	Do you think nature is important for the next generation?
5)	Do you think the climate will get better and better in the future?
6)	What energy saving tips do you have in winter?

PARTICIPANT INFORMATION SHEET

Evaluation of climate change design intervention toolkits

For older Chinese migrants and designers in London

Invitation Paragraph

You are invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part. Thank you for reading this.

What is the purpose of the study?

This research (Sep 2024 - Sep 2025) will focus on older Chinese migrants and design researchers in London. By observing and recording the process of Older Chinese migrants using the design intervention toolkit, the aim is to obtain the feedback and suggestions of Older Chinese migrants on the design intervention toolkit. Design researchers will be invited to evaluate the entire toolkit; the aim is to get advice from their industry knowledge.

Why have I been invited to participate?

You are invited because we think you may be able to offer insights into this PhD research topic from the Chinese older migrant perspectives or design researcher perspectives. We aim to include 12-16 healthy Chinese older people (aged between 50-85) and 8-12 design researchers.

Do I have to take part?

As participation is entirely voluntary, it is up to you to decide whether or not to take part. If you do decide to take part, you will be given in this information sheet to keep, and you may be asked to sign a consent form. If you decide to take part, you are still free to withdraw at any time up until 31th Aug 2025 and without having to give a reason.

What will happen to me if I take part?

The research will be conducted through workshops or interviews, in person(if in person, a location will be chosen to ensure safety and convenience for you and the PhD researcher, with appropriate risk assessment in advance. The PhD researcher will wear a mask if preferred by the participants to ensure social distancing and all COVID-19 safety measures are followed). You can choose to participate in an interview or workshop, and the duration will be 1-1.5 hours. You will be invited to use the Design Intervention toolkit and will be asked questions; you have sufficient time to answer and/or discuss these questions and make suggestions/comments.

Are there any lifestyle restrictions?

There are not any lifestyle restrictions.

What are the possible disadvantages and risks of taking part?

Please be aware that while every effort is made to ensure your safety, vaccination is proven to decrease the risk of transmission of Covid-19 and to reduce the likelihood of severe illness. The risk of getting infected by COVID-19 may increase for in-person sessions. Face coverings will be worn by the researchers and participants wherever possible and appropriate for in-person sessions with social distancing less than one meter. Researchers and participants should wash or sanitise their hands regularly.

What are the possible benefits of taking part?

You will receive a small 'thank you' gift of appreciation (Eco bags for shopping or daily necessities).

What if something goes wrong?

If something goes wrong and you wish to complain about the experience, you can contact the Chair of the Research Ethics Committee of College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Will my taking part in this study be kept confidential?

All information that is collected about you while the research will be kept strictly confidential (for three years, between Sep 2024 and Sep 2027). Any information about you that leaves the University will have all your identifying information removed. With your permission, anonymized data will be stored (On Brunel Onedrive only accessible to the research team)

and may be used in future research – you can indicate whether or not you give permission for this by the Consent Form.

Will I be recorded, and how will the recording be used?

We intend to audio or video record the interviews; we also use cameras to take pictures. We plan to transcribe the data for analysis.

The research team will use a Brunel-own laptop (password protected) or an audio/video recorder to do the recording. Your permission will be sought in advance, and the research team will clearly indicate it before the recording starts. The recording data will be transferred to a GDPR-compliant platform (e.g., a Brunel-owned computer) within three days of the data collection and cleared from the recording device so no other people will accidentally access it. The data will be destroyed once the transcription is completed, before the 31st of September 2025.

What will happen to the results of the research study?

The results will be written up as part of a research dissertation and associated publications. The participants will not be identified in any report or publication unless you specifically request it.

Who is organising and funding the research?

The research team (Miss Qing Ni, Prof Hua Dong, Dr. Antonios Kaniadakis) are organizing the research.

What are the indemnity arrangements?

Brunel University London provides appropriate insurance cover for research that has received ethical approval.

Who has reviewed the study?

The Research Ethics Committee of the College of Engineering, Design and Physical Science Research Ethics Committee has reviewed the study.

Research Integrity

Brunel University London is committed to compliance with the Universities UK Research Integrity Concordat. You are entitled to expect the highest level of integrity from the researchers during the course of this research

Contact for further information and complaints

Researcher name and details: Qing Ni, Brunel Design School, 2105826@brunel.ac.uk

Supervisor name and details: Prof Hua Dong, Brunel Design School, hua.dong@brunel.ac.uk

For complaints, Chair of the Research Ethics Committee:

Chair of the Research Ethics Committee, College of Engineering, Design and Physical Science Research Ethics Committee, Professor Simon Taylor (simon.taylor@brunel.ac.uk)

Please note: Research ethics approval has been obtained for this study from the Research Ethics Committee of the College of Engineering, Design and Physical Sciences

CONSENT FORM

Evaluation of climate change design intervention toolkits for older Chinese migrants and designers in London

Principal Investigator: Qing Ni

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 15/09/2024 AND 15/09/2025

Please complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☐	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☐	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☐	☐
Who have you spoken to about the study?		
Do you understand that you will not be referred to by name in any report concerning this study?	☐	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☐	☐
• You don't have to give any reason for withdrawing	☐	☐
• Choosing not to participate or withdrawing will not affect your rights?	☐	☐
• You can withdraw your data any time up to 15/09/2025		
I agree to my interview being audio and video recorded	☐	☐

I agree to the use of non-attributable quotes when the study is written up or published	☐	☐
The procedures regarding confidentiality have been explained to me.	☐	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☐	☐
I agree to take part in this study.	☐	☐

Signature of research participant:	
Print name:	Date:
Witness Statement	
I am satisfied that the above-named has given informed consent.	
Witness signature:	
Print name:	Date:

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

30 August 2024

LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 15/09/2024 AND 15/09/2025

Applicant (s): Ms Qing Ni

Project Title: Observations on the use of climate change design intervention toolkits for older Chinese migrants and designers in London

Reference: 49684-LR-Aug/2024- 52754-1

Dear Ms Qing Ni

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- **Please remove the witness statement from the Consent Form as it is only relevant to vulnerable participants**

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to any conditions that may appear above.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- If your project has been approved to run for a duration longer than 12 months, you will be required to submit an annual progress report to the Research Ethics Committee. You will be contacted about submission of this report before it becomes due.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.



Professor Simon Taylor

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London

Feedback form

Design Intervention Toolkit – Feedback form
設計干預–反饋表

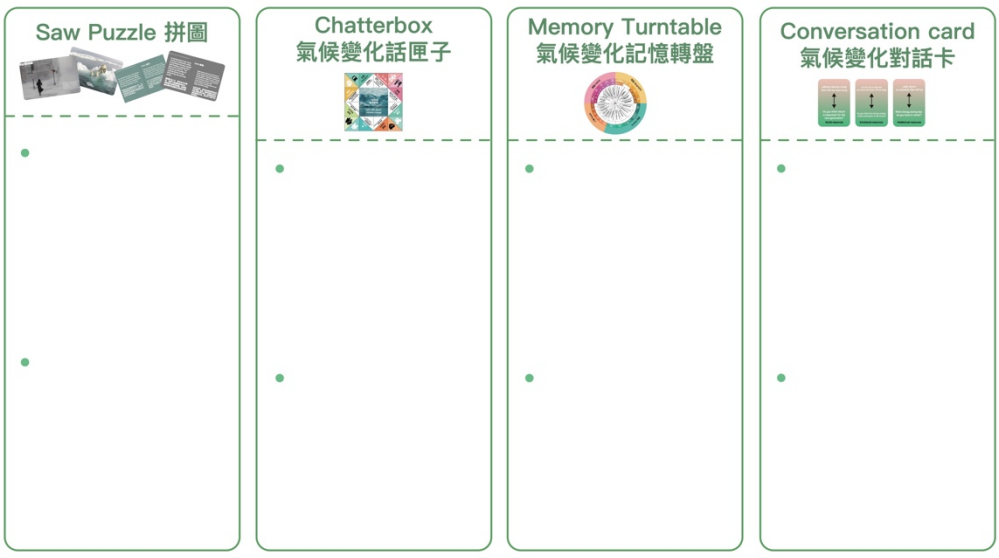
Reaction

1. How do you feel about these tools? 你覺得這些設計怎麼樣?



2. Which one do you like best and why? 你最喜歡哪一個，為什麼?

3. What can be improved? 有什麼需要改進的地方?



Learning

1. What skills do you learn from using these tools? 你從使用設計中學到了什麼技能?

- ◯ 對氣候變化的興趣 More awareness of Climate change
- ◯ 對氣候變化的興趣 An interest in climate change
- ◯ 無 No
- ◯ 對氣候變化的責任感 A sense of responsibility for climate change
- ◯ 其他 Other _____

Behaviour

1. Are you going to use these tools? 你會應用這些工具嗎?

- ◯ 會 Yes
- ◯ 不會 No

可以舉例你如何使用這些工具嗎?
Can you give an example of use?

Result

1. Who elso do you think would benefit from using these tools?
   你認爲它對其他人有用嗎?

○ 有
Yes

○ 沒有
No

您認為誰是受益者?
Who do you think will benefit from it?

- _____
- _____
- _____

2. Will you recommend to other people? 你會推薦它給其他人嗎?

○ 會
Yes

○ 不會
No

Thank you for your help!
謝謝您的幫助!

職業 Job:

移民時間 Duration of migration:

年齡區間 Age range: