ClairCity: Citizen-led air pollution reduction in cities

D4.7 Role of Delphi in Air Quality and Carbon Management

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Description	This report evaluates the role of the Delphi methodology, as used in the public engagement activities of the ClairCity project (Work Package 4) ClairCity project, in air quality and carbon management research. Focusing on ClairCity this report asseses the use of the methodology in citizen-focused research (Citizen Delphi) and makes recommendations for future use of Delphi methodology in similar studies.

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Executive Summary

ClairCity sits within a context of complex air quality and carbon management challenges. Implementation of climate change strategies and reduction of local air pollutants, and their concomitant impacts on public health, have proven difficult to achieve. To reduce the harmful effects of air pollutants and carbon emissions, it is clear that more collaborative citizen involvement needs to be embedded within political decision making processes. It is with this aim that the ClairCity project utilised a Delphi method within its citizen enagement work package.

The Delphi Method is intended to draw together a range of opinions on an intransigent problem to try to elicit a solution. The Delphi Method has been used in air quality, carbon and wider environmental management research before, but is most frequently used to draw together the opinions of expert groups. Within ClairCity, however, it has been adapted to involve citizens as experts in their own lives. Their knowledge and experience of travelling in their areas, heating their homes and the opportunities and problems of their cities or regions were drawn together by successive rounds of data collection. By treating citizens as 'experts' in their own lives, Citizen Delphi used in ClairCity seeks to better inform policy making from the bottom up.

The methodological approach was essentially a modified 'Policy Delphi', comprising three rounds (two surveys and a workshop) as detailed in ClairCity Deliverable *D4.1 Delphi Guidelines and Pilot*. The ClairCity Delphi was conducted across the six cities/regions by the respective city/region partners and buddies, generating a total of 3,059 respondents for the Round 1 survey and 1,423 respondents for Round 2; Round 3 workshops comprised smaller groups (3 – 59 participants per city/region). Corresponding with the principles of Delphi, our sampling techniques did not aim to be fully representative, however efforts were made to ensure some of the barriers to participation were removed for as wide a selection of participants as possible.

The Citizen Delphi used in ClairCity has demonstrated that whilst primary public engagement can be a valuable tool in informing and shaping policy on air quality and carbon management, there are significant challenges to implementing this technique more widely. The report concludes with recommendations for replicating the approach drawing on lessons learnt through this project, which may be utlised by other researchers or policymakers in future. These recommendations include:

1. In undertaking a Citizen Delphi approach, it may be more practical to engage with representative bodies, e.g. citizen panels or community groups, rather than individuals directly, particularly if seeking insights from a broad spectrum of society.
2. A variety of engagement techniques can improve response rates and inclusivity.
3. A good understanding of the demographic make-up of the study area is required at the outset and purposive sampling of each demographic group is necessary.
4. Local context is important, therefore, you need to recognise that demographic groupings may not translate across different countries, or possibly even regions.
5. Feedback to participants is important to 'close the loop' and facilitate future engagement.

1 Introduction

1.1 Objective of this report

The purpose of this report is to evaluate the role of the Delphi methodology, as used in the ClairCity project (Work Package 4),, in air quality and carbon management research. The report discusses, with illustrative examples, the role of Delphi in other air quality and carbon management research. It then considers the need for community participation before assessing the use of Delphi in citizen-focused research (Citizen Delphi) within ClairCity. Finally, the report makes recommendations for future use of Delphi methodology in similar studies.

1.2 The positioning of Delphi in the ClairCity process

The ClairCity Project (www.claircity.eu) aims to substantially improve future air quality and carbon policies in European cities by initiating new modes of engaging citizens, stakeholders and policymakers. The latest social science thinking is applied to understand citizens' behaviour and source apportion air pollution emissions and concentrations, carbon emissions and health outcomes in order to attribute them not just by technology but by citizens' behaviour and daily activities. By putting people at the heart of both the problems and the solutions (primarily framed around transport and domestic energy use), ClairCity stimulates the public engagement necessary to tackle our challenging problems through the development of a range of citizen-led future scenario and policy packages. The four primary objectives of the ClairCity project are:

1. To put citizens' behaviour and activities at the heart of air quality and carbon management and policy making;
2. To develop a suite of innovative toolkits for enhanced quantification, engagement and impact evaluation;
3. To explore the integration of citizens' behaviour in relevant city policies and ensure that future city policies are reflective of citizens' visions for their future city; and
4. To raise awareness of environmental challenges and their solutions through proactive dissemination of the project outcomes.

The ClairCity process has three key process phases with a number of activities which work towards achieving the project aims and objectives. These three phases and related activities are briefly summarised here and illustrated in Figure 1 to help the reader understand the flow of evidence and the positioning of the Citizen Delphi within the wider ClairCity process. This process has been applied across all six ClairCity case study areas with some localisation and adaptation as required.

1.2.1 Phase 1: Establish the Baseline Evidence

The primary aim of Phase 1 is to understand and quantify the baseline status of air quality, carbon emissions and related public health in our cities. Phase 1 is achieved with the following main activities:

1. **Benchmarking behaviour**: Understanding the local demographic data and establishing the citizen practice-activity data to feed into the air quality models (WP3).
2. **Quantify the baseline**: Quantification of the baseline air quality emissions and concentrations, carbon emissions and public health impacts in our city (WP5).
3. **Assessment of Policy**: Collation and analysis of current policies (local, regional, national and EU) that influence the city (WP6).

1.2.2 Phase 2: Citizen and Stakeholder Engagement & Co-creation of Scenarios

Phase 2 has three key aims: (1) understand citizens' current behaviours, practices and activities, (2) enable citizens and stakeholder to co-create and visualise their low carbon, clean air, future city and (3) raise awareness of the environmental challenges and their solutions. Phase 2 utilised evidence from Phase 1 to help frame and inform the engagement activities. Phase 2 is achieved with the following main activities:

Citizen and stakeholder engagement & co-creation

1. The ClairCity Delphi method uses citizens as local experts to generate qualitative evidence of their entrenched behaviours and what enabling interventions would allow them to act and behave differently in future (WP4).
2. The Mutual Learning Workshop brings citizens and stakeholders together to debate the challenges facing the city and co-create policy interventions for cleaner, healthier futures (WP4).
3. The ClairCity Skylines Game 'crowd-sources' the public perceptions and public acceptability of different policy interventions (WP4)
4. Citizens and stakeholders come together in a Stakeholder Dialogue Workshop to review and debate the Delphi, Mutual Learning Workshop and ClairCity Skylines evidence and co-create scenarios for a low carbon, clean air, health futures (WP4 and WP7).
5. The scenarios generated in the Stakeholder Dialogue Workshop go through a rapid quantification step (WP5) and are then returned to the local citizens/stakeholders to discuss in a Policy Workshop (WP6) and agree a Unified Policy Scenario (WP7).

Public Engagement & Awareness: Additional awareness raising activities are also implemented across the project in each city (WP4). These include:

1. The GreenAnt App which allows citizens to becomes a citizen scientist and monitoring their transport activities, emission generation and exposure using mobile GPS data.
2. The School Competition: My City, My School, My Home engages young people in the air quality, carbon and public health debate utilising an online platform for the students to select the interventions that influence their housing, transport and use of resources in order to be able to design tools for change towards smart consumption, reduced emissions and healthy lifestyles.
3. Learning from the elderly filming activity engages the older, potentially vulnerable, community to talk about the changes in their city, their personal mobility and the steps they take to minimise their exposure.

4. The City Day: Discovering my City helps disseminate the final project results and provide healthy and smart tips to promote non-motorised mobility of citizens by highlighting availability and benefits of walking and cycling routes in the city.

1.2.3 Phase 3: Quantified Policy Package & Knowledge Exchange

The primary aim of the final Phase 3 is to collate the evidence and lessons learned from Phase 1 and Phase 2 to generate a quantified, bespoke, citizen-led and citizen-inclusive policy package for each city. Phase 3 is achieved with the following main activities:

1. **Knowledge Exchange**: Collation of transferrable lessons and steps for better practice based on the experiences of the ClairCity project to inform other environmental and public health practitioners (WP3, WP4, WP5, WP7).
2. **Impact Assessment**: Rapid quantification of the scenarios generated in the Stakeholder Dialogue Workshop (WP4) and detailed impact assessment of the final Unified Policy Scenario generated in the Policy Workshop (WP6). This quantification includes an assessment of the source apportionment by behaviour or purpose; air quality emissions and concentrations, carbon emissions, air pollution related health impact and interventions cost analysis (WP5).
3. **Policy Package**: Development of a bespoke Policy Package for each city drawing together the findings from across the whole project (WP7).

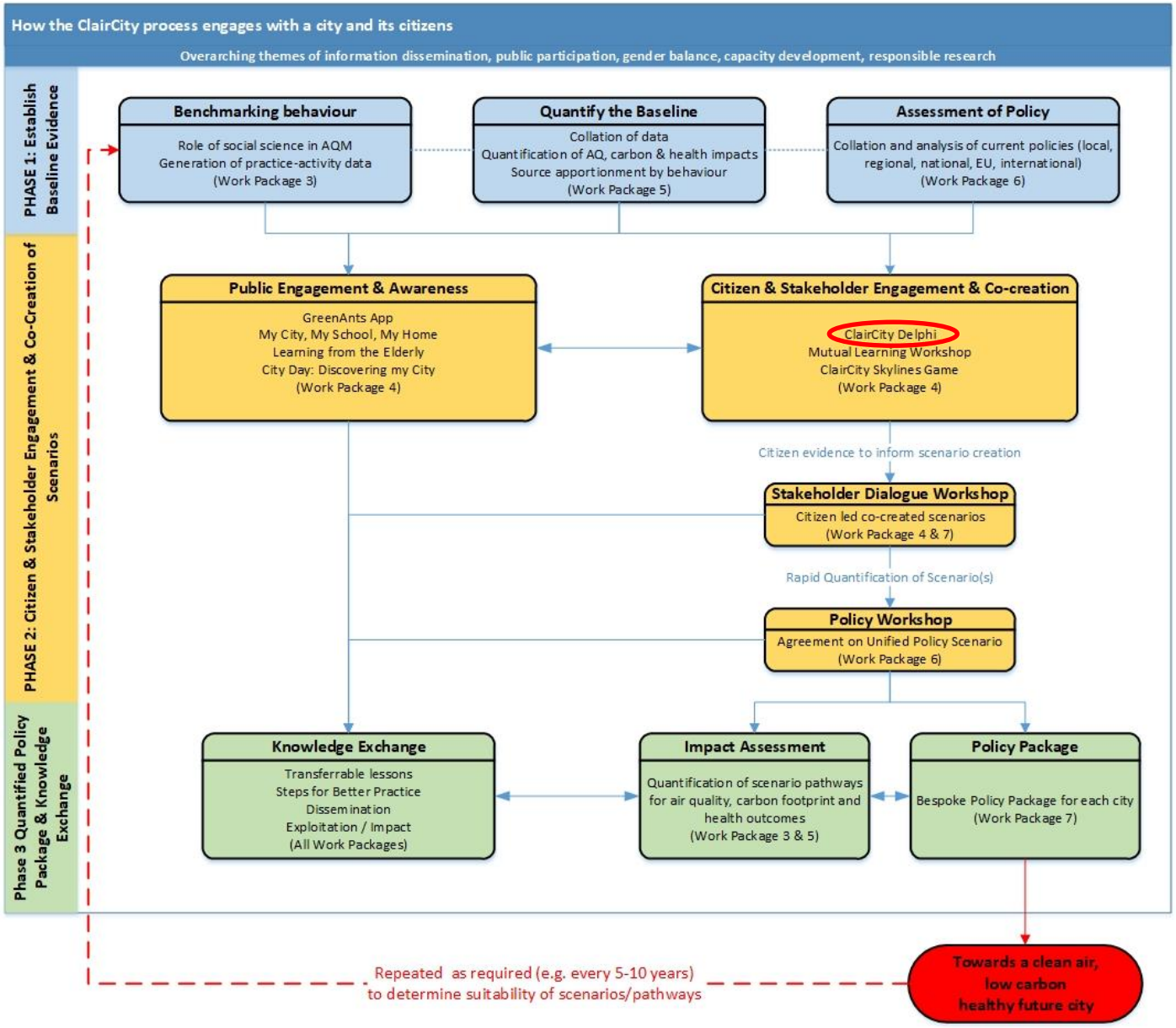

Figure 1: ClairCity process including key phases and activities

2 Introduction to Delphi

2.1 Delphi definitions

> *"Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem". (Linstone and Turoff, 2002)*

It is helpful to start with a brief look at the various definitions of Delphi. The originators define it as 'a method used to obtain the most reliable consensus of opinion from a group of experts by a series of intensive questionnaires interspersed with controlled feedback' (Dalkey and Helmer, 1963), and Lynn et al (1998) described it as an interative process designed to combine expert opinion into group consensus. On the other hand, Linstone and Turroff (2011) clarify in their 1975 book (reprinted 2002), 'The Delphi Method Techniques and Applications', that 'Delphi is"*a method for structuring a group communication process*", not a method aimed to produce consensus', quoting Coates (1975): "*the value of the Delphi is not in reporting high reliability consensus data, but rather in alerting the participants to the complexity of issues, by forcing, cajoling, urging, luring them to think, by having them challenge their assumptions*". The Delphi method is an ever-evolving technique, and hence definitions slightly differ depending on the application. Essentially, however, the Delphi process is intended to draw together a range of opinions on an intransigent problem to try to elicit a solution.

2.2 Delphi origins

In terms of its origins, the Delphi method was originally developed to forecast the impact of technology on warfare at the beginning of the cold war in 1944 (Custer *et al*., 1999) and then further refined through a series of studies undertaken at the RAND Corporation in the 1950s (Dalkey and Helmer, 1963). These latter studies aimed to develop a technique to obtain the most reliable consensus of a group of experts.

The term 'Delphi' may be linked with one of the most important oracles in the classical Greek world: the Oracle of Delphi. According to Keeney, Hasson and McKenna (2011) the term has "become synonymous with receiving good judgment on an issue". The term is regarded as being somewhat unfortunate and perhaps misleading however; Dalkey (1969) states that the Delphi method is perhaps the opposite as it is "primarily concerned with making the best you can of a less than perfect fund of information".

2.3 Delphi technique

Delphi is a widely used and accepted technique capable of setting priorities, gaining consensus and generating ranges of opinions (and predicting future events) to inform decision-making and policy development (Okoli and Pawlowski, 2004). It is appropriate for use in situations when judgements need exploring, when informed opinions need to be generated or correlated, and/or when diverse views need to be exposed. It is particularly effective in circumstances where research and societal problems cannot be precisely analysed but benefit from subjective opinion, where the study population is geographically

and professionally diverse and where it may not be feasible to hold frequent meetings (as a result of time and costs constraints).

The Delphi method is a multi-stage research approach that facilitates structured group communication to achieve convergence of opinion (concerning real-world knowledge) solicited from experts in certain subject areas. It is 'multi-stage' insofar as each stage of the Delphi process builds on the results of the previous one. Over iterative survey rounds (usually three) interspersed with feedback, the process works through phases of 'brainstorming', 'narrowing down' and 'ranking', to reach 'consensus' amongst participants on an important and complex problem or subject where none existed previously. The Delphi process is predicated on the rationale that "two heads are better than one, or ... *n* heads are better than one" (Dalkey, 1972). However, it has certain unique attributes which serve to increase its relative reliability and generalisability (Rowe and Wright, 1999). These are:

i. anonymity amongst panellists. This helps avoid group dominance problems commonly-experienced in focus groups and group interviews where strong-minded or more persuasive people may intimidate others and dictate the direction of discussion;

ii. iteration i.e. the feedback process that allows participants to change their minds as the process evolves. In each [survey] round, participants reassess their previously-made judgements in light of reported emerging group opinion. So, in a Delphi study, results of previous iterations regarding specific statements or opinions can be changed (or not) in subsequent rounds based on information generated about the collective thinking of the group.

iii. controlled feedback. This concept reduces the effect of noise and shows group-response distribution. Noise is that communication such as group or individual interest which can distort important problem-solving data. Multiple iterations reduce noise by encouraging participants to become more problem-solving oriented and to offer more insightful opinions (Hsu and Sandford, 2007).

iv. statistical group response. This expression of judgement using summary statistics reduces the potential of group pressure for conformity (Dalkey, 1972). Statistical analysis ensures that the opinions of each Delphi participant are well represented in the final iteration and allows for an objective and impartial assessment and summation of the collected data (Hsu and Sandford, 2007).

Whilst there are several variants of Delphi (see Section 2.4), to maintain a high level of credibility, the classical approach entails (at least) two rounds of survey following an initial open-ended question to generate ideas and establish opinions. Feedback is initially subject to some form of thematic content analysis before being sent back to the panel of experts (comprised of specialist sub-groups) in the form of statements or questions. These are then ranked and rated over subsequent rounds until no new opinions emerge and a consensus is reached.

The Delphi method has been criticised for forcing consensus and not allowing participants to discuss and elaborate upon a particular issue (Walker and Selfe, 1996). Also, because it places significant emphasis on communication, some have perceived it as merely a data

collection method, but this is unjust since iterative feedback develops an insight which, in its totality, amounts to more than the sum of its parts (Turoff and Hiltz, 1996).

Despite the method being a multi-stage survey, unlike a traditional questionnaire that attempts to identify 'what is' from individual feedback, Delphi seeks to determine 'what could/should be' through a more-credible group consensus approach (Miller, 2006 as cited in Hsu and Sandford, 2007). Also, Delphi facilitates the exploration of complex problems; if a traditional survey were used to do this, it would not yield satisfactory results.

Compared with the more-traditional survey, it could be argued that the Delphi method is still in its developmental stage (Day and Bobeva, 2005). The method is recognised most amongst communities who have needed to investigate and deal with complex problems where often-superficial data generated from simple surveys simply will not do. In circumstances where difficult phenomena need to be addressed, the Delphi method may be the only remaining option since it is particularly suitable for situations where:

- In the absence of precise analytical techniques, subjective group judgements moderated through group consensus is the only option;
- Personal contact is not possible due to geographical, time and cost constraints, or is not desirable because of political concerns or interference (Linstone, as cited in Day and Bobeva, 2005).

2.4 Delphi type

Several different types of Delphi have evolved over time, including the 'Classic', 'Modified', 'Real-Time', 'Decision', 'e-Delphi', 'Argument' and 'Disaggregative' Delphi (Keeney, Hasson and McKenna, 2011). On the one hand, this is unhelpful; many adaptations exist because there is no one all-encompassing definition of the Delphi method (Linstone and Turoff, 2002; Mullen, 2003). On the other, however, it demonstrates that the technique (built around the core characteristics of anonymity, iteration, controlled feedback and group response) is extremely flexible and can be adapted to explore and address a broad range of complex problems in different situations.

The most commonly-used variants of Delphi are the 'Classical' and 'Modified'. In the latter, the Delphi technique takes the form of replacing the first opinion/idea-generation survey round with either face-to-face interviews or focus groups, or a survey based on pre-existing information (e.g. from an extensive review of the literature). This approach might speed up the process, but it does so at a cost i.e. biased responses or limit available options. Another popular choice is the 'Policy' Delphi which is similar to the 'Classical' form in that it uses the opinions of experts to come to consensus and agree policy development options for a given subject area.

2.5 Delphi application

This practical 'research with impact' approach of Delphi means that it is useful in many different research areas. The Delphi method has been applied in many different subject areas, including government, medical, health, environmental and social studies, and also business, information and industrial research (Linstone and Turoff, 2002). It has also been

used to fulfil various intentions, including needs assessment, resource utilisation, and programme and policy planning and development (Hsu and Sandford, 2007). Delbecq et al (1975, p.11) put forward that Delphi is an appropriate research method when attempting to:

- determine or develop a range of possible programme alternatives;
- explore or expose underlying assumptions or information leading to different judgements
- seek out information which may generate a consensus on the part of the respondent group;
- correlate informed judgements on a topic spanning a wide range of disciplines;
- educate the respondent group as to the diverse and interrelated aspects of the topic.

3 Delphi in Air Quality and Carbon Management

An in-depth literature review was undertaken across multiple search databases using relevant search terms. Relatively few studies to date that have applied Delphi methodologies in the context of air quality or carbon management were identified. The following sections illustrate with examples some of the approaches utlised.

3.1 Delphi in Air Quality

3.1.1 Local air quality management and public health in Wales, United Kingdom

Brunt et al. (2018) used a classic, or traditional, Delphi technique to elicit multiple viewpoints from a range of experts in Wales, United Kingdom. The object of the research was to form expert consensus to: clarify the role of public health bodies and specialists in local air quality management; describe opportunities for, and added value resulting from, improved integration and collaboration; and highlight linked barriers and solutions.

The study had three rounds, including a first idea-generation round due to the absence of existing evidence. To maximise credibility, a heterogeneous panel of experts was recruited, with three homogeneous sub-panels each having at least 10 experts. Given the relatively narrow field of research, it is likely that that participants may have known each other, however, rather than undermining the anonymity of the study, the feeling of exclusion may actually have motivated participation and hence improved response rates.

Thematic analysis was used to code open responses and consensus was based on a statistical analysis of central tendency as well as the stability of responses over the Delphi rounds. Interestingly, in this research, public health respondents demonstrated the least shift towards consensus when presented with the statistical feedback from the earlier rounds. This may have been due to the public health background of the researcher conducting the study, giving these respondents an unconscious sense the they were ‘on safe ground’, despite their relative lack of expertise in local air quality management.

Ultimately, consensus agreement was achieved on all suggested roles for public health in each sub-panel. The Delphi method proved successful in eliciting multiple viewpoints from a range of experts on this complex research problem, generating valuable evidence that can be used to inform future development of local air quality management to maximise public health integration, collaboration and impact.

3.1.2 Air quality policy in Belgium

Fallon et al. (n.d., in Torfs et al., 2011) set out to identify the institutional structures dealing with air pollution in Flanders and Wallonia, to determine the flows of information, and to reconstruct the decisional spaces in both regions. Using a web-based Delphi method, called ‘Mesydel’, they engaged experts from the policy domains of health, environment and transport in Belgium, including researchers from government institutions and universities, and public servants. Within the Delphi consultation exercise, the researchers investigated the possibilities to design a decision making process relying on the interaction between different disciplines and administrations mobilised by the target risk (interdisciplinarity) as well as on

the willingness of policy-makers (and eventually the public) to keep the issue of risk policy open to change.

One of the key obstacles to improving air quality identified by the participants was the lack of vision and political will on the part of the decision makers at the regional levels. Interestingly the research also highlighted that respondents did not see individual citizens as participants in air quality policy decision-making, but as instruments strategic to gaining policy support or as the target of communication, e.g. with regards to policies that may require behaviour change.

3.2 Delphi in Carbon Management

3.2.1 Low carbon future for Bristol, United Kingdom

Bailey et al. (2011; 2012) developed a modified Delphi approach to explore potential low carbon futures at a city scale in Bristol, United Kingdom, in order to help the city council achive it's (then) target of 80% reduction in carbon from 1990 levels by 2050. Rather than pursuing a single point of consensus, in order to 'future-proof' the research the methodology explicitly sought to generate several consensual scenarios, a feature of 'Policy Delphi' techniques (de Loe, 1995; Turoff, 2002). It also utilised a participatory backcasting workshop in the final stage of the Delphi, counter to the traditional approach, which does not generally include a discussion of the outcomes, and normally requires anonymity and a lack of face-to-face contact to limit the effect of dominant individuals on the outcome. The participants were experts in spatial planning, energy, transport and climate change from political, managerial/strategic, technical/operational and research/academic backgrounds.

Consistent with a typical Delphi methodology, the expert panel were asked broad open-ended questions in the first questionnaire, to explore the subject, alongside other 'closed' questions. The questionnaire responses were analysed using a Grounded Theory Methodology to ensure that the data generated were used for scenario construction, rather than the data being used as evidence of a pre-existing theoretical position. As well as identifying themes from the data, responses were also analysed by respondent type to identify any trends and commonalities.

By using this modified Delphi methodology the research was able to overcome some of the limitations of conventional forecasting, particularly weaknesses in dealing with the long-term and its predictive rather than goal-oriented nature. However, it was recognised that visioning for the region over a 40-year period may result in a 'wish list' of low carbon solutions, and that anticipating changes over this timescale may challenge the imagination of some experts. Visualising the potential futures for the city region and working backwards to the present may, however, have broadened the scope of solutions being considered and given policymakers insight into whether current and near-future decision making was likely to achieve the necessary low carbon vision. In general, the modified Delphi methodology was seen to be an efficient, effective and inclusive way of exploring and creating broadly consensual scenarios for a future low carbon city.

3.2.2 CO_2 emissions from transport in Finland

The ILARI project (Tuominen et al., 2014; Järvi et al. 2015) set out a similar pluralistic backcasting method to Bailey et al. (2011, 2012). The aim was to structure multiple visions of future CO_2 emissions from transport in Finland up to 2050 for the use of the policy-makers in their decision-making process. A set of visions of the future were transformed to scenarios for different sectors of transport and then complemented with pathways from the present to the future. The visions of the future were formed using expert opinions about future development and trends obtained through a two-rounded Delphi study of around thirty experts complemented by an interview round in-between.

Participants were asked to give their opinion for two different futures, the future they considered most probable and the future they considered most desirable (and realistic) based on quantitative estimates of volumes of different transport modes in both passenger and freight sectors. CO_2 emissions were calculated based on these estimates and then partipants were interviewed about the qualitative arguments related to the quantitative estimates and about their broader views on the development of the transport sector and climate issues in Finland in 2020 and 2030. Both of the first two rounds fed into the third round questionnaire , which also looked at policies and drivers of development covering the years 2020, 2030 and 2050.

In the ILARI study the two visions selected for backcasting both turned out to require substantial investments that might be unrealistic. However only one of the two options was able to achieve the national target of an 80% reduction in CO_2 emissions, indicating that major shifts in the current transport system are required to substantially reduce levels of GHG emissions, which can only be realised by deep structural changes entailing co-evolution and multi-dimensional interactions between the various actors of the society: industry, technology, markets, policy, culture and civil society.

As illustrated in these examples, Delphi can be applied in multiple different approaches to air quality and carbon management from traditional, to policy and web-based. However, in all of these examples, a traditional approach has been applied in using experts as participants. In the following section the importance of citizens in the development of future air and carbon policies is discussed as an introduction to the critical appraisal of Citizen Delphi utilised in ClairCity.

4 Citizen Delphi in ClairCity

4.1 Community participation and engagement

ClairCity sits within a context of complex air quality and carbon management challenges. Implementation of climate change strategies and reduction of local air pollutants, and their concomitant impacts on public health, have proven difficult to achieve following traditionally hierachical policy methods (EEA, 2018; IPPC, 2018).

Many academics and practitioners have therefore argued that we need a new attitude to forming air quality and carbon policies, with citizen involvement heralded as a key approach. This third-order public engagement (i.e. multiply-framed, contextual, contended, as opposed to one-way, top-down 'first order' or two-way, bottom-up dialogic 'second-order') (Irwin, 2008; Grand et al., 2010) enables decisions to be made which reflect the lives of the citizens the policies will impact upon, and are more likely to garner support from communities as it enables co-creation with citizens and importantly may go on to achieve co-governance and greater accountability. This is the thinking behind climate protest groups such as Extinction Rebellion (in United Kingdom and Netherlands) who are calling for deliberative democracy processes such as Citizens' Assemblies to distribute power and decision-making to mitigate the impacts of climate change (BBC, 2019; United Kingdom Parliament, 2019).

Improved citizen engagement in democratic decision making is therefore important for many reasons, with Gradinger et al. (2013) identifying three main value systems:

- Fair conduct (process values): Partnership/equality in decision-making; respect/trust between citizens and policymakers/politicians; openness and honesty; independence; and clarity.
- Real-world policies (substantive values): Effectiveness of the policies; quality/relevance; validity/reliability; representativeness/objectivity/generalisability; and evidence-based.
- Equitable democracy (normative values): Empowerment of citizens; enabling change/action; improved political accountability/transparency; improved rights; and ethical governance.

These values should feed through all political decision-making, but in reality, many democratic decision making processes do not allow for these lofty goals. Much has been written about the problems inherent in citizen engagement, including: constructing representivity of citizens from a wide variety of demographics (Martin, 2008a); knowledge and cultural capital barriers for people from lower socio-economic backgrounds (Carpini, Cook and Jacobs, 2004); accessibility, communication and geographical barriers (Yang and Callahan, 2007); and power dynamics between people from different genders, ethnicities, and socio-economic status (Martin, 2008b).

It is therefore important to consider how we construct 'the public' when discussing citizen engagement. While it is generally agreed that there is no such thing as an all encompassing public (McCallie et al., 2009), policymakers often draw a line between those they consider to have expertise on a topic, and those they do not. Braun and Schultz (2010) suggest four models of publics which enable certain speaking positions while foreclosing others;

- the *general public* which represents a generic 'voice of the people' about what is deemed acceptable/normative in society;
- the *pure public* consisting of individual citizens who have little knowledge about the topic in question;
- the *affected public* who have lived experience of the topic;
- and the *partisan public* who come together in groups with a shared viewpoint on an issue.

In undertaking any public engagement, it becomes apparent that the selection of these citizens and their domain 'representativeness' is critical for legitimacy (Parkinson, 2003). Hainz, Bossert, & Strech (2016) discussed the methods of sampling we might use to achieve representation, including self-selection, elected/delegated, quantitative, discursive and qualitative engagement. It is therefore important to understand the dynamic interplay of individual and structural factors, valuing different forms of participation, and having participatory structures and processes embedded in organisational settings (Radermacher and Sonn, 2010).

Through attentive consideration of these issues, policymakers involved in air pollution and carbon emission reduction may aim to work towards enhancing environmental and scientific citizenship for members of the public. Involvement and participation in policymaking processes changes those involved; individual citizens who were selected for their lack of knowledge on the topic become informed and empowered, which in turn changes their legitimacy as non-partisan members of the public.

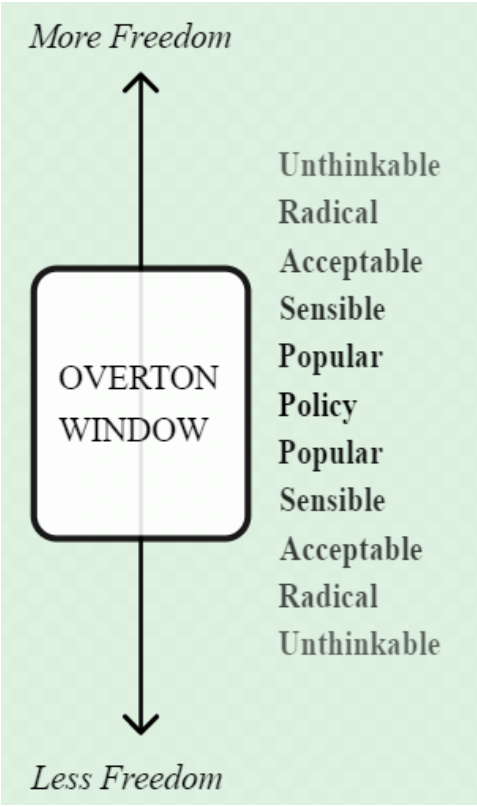

Figure 2: Overton Window (from Wikimedia Commons)

These individual and group dynamics play out in all deliberative discussions – we are heavily influenced by the social groups we identify with, and the normative social values of the time. Social identity theory indicates that these 'social badges' play out whether in front of others or by ourselves, with unconscious biases resulting against the non-dominant 'out group' in society (Tajfel and Turner, 1979). This means that we cannot presume that even individual non-partisan citizens will be completely honest or even consciously aware of their attitudes, values, and behaviours (Leiserowitz, 2006).

In politics, this has been described as the 'Overton Window of Political Possibility' (Figure 2) (Mackinac Center for Public Policy, 2019), whereby only certain political ideas and policies are acceptable at one point in time. However, the Overton Window can shift so that an idea moves from unthinkable, to radical, to acceptable, to sensible, to popular, and finally into policy. Politicians will generally only pursue policies that are widely accepted throughout society as legitimate policy options, or otherwise they may risk losing popular support and become unelectable.

This then raises the question of gatekeeping expertise and privileging socially constructed narratives of knowledge, in that policymakers and experts may keep out 'non-experts' who they view as threatening the dominant direction of travel (Petts, 2007). Both experts and inidvidual citizens will assess each other for intent of their message and trustworthiness, and the capability and competency to carry out their interaction (Fiske and Dupree, 2014). However, learning that transcends participation processes is critical if public engagement is to translate into a legacy of enhanced environmental citizenship (Bull, Petts, & Evans, 2008).

We can therefore see three models of environmental citizenship emerging (Elam & Bertilsson, 2003), that of *advanced consumers* ensuring the laws which are enacted suit those they wil affect; *radical/pluralist* democracy with many views coexisting together, and *deliberative democracy* where a consensus and direction of travel is agreed between citizens.

To reduce the harmful effects of air pollutants and carbon emissions on health, it is clear that more citizen involvement needs to be conducted within political decision making processes. It is with this aim that the ClairCity project utilised a Delphi method within its citizen enagement work package.

As discussed in Sections 2 and 3, Delphi is most frequently used to draw together the opinions of expert groups. However, within ClairCity it has been adapted to involve citizens as experts in their own lives (Bloor et al., 2015). Their knowledge and experience of travelling in their areas, heating their homes and the opportunities and problems of their cities or regions was drawn together by successive rounds of data collection. Effectively, Citizen Delphi treats citizens as the 'experts' in their own lives in order to better inform policy making from the bottom up.

The activities conducted under Citizen Delphi fit into wider research fields of travel choice surveying and social research on housing options. Surveys can identify latent demand or support the assessment of public acceptability for new schemes. Data collected from the public can identify issues across or between populations, offering stronger support for policy proposals than modelling or technical evidence alone may provide to policymakers or service providers.

In the multi-disciplinary fields of transport and domestic energy behaviours and choice, understanding and predicting citizen behaviour has been an ongoing topic of interest. The impact of spatial planning on behaviours (Schwanen and Mokhtarian, 2005), cultural norms and identity (Anable, 2005), or how material infrastructure interacts with behaviours have all been included in the field (Cass and Faulconbridge, 2016). Exploring not only the actions (self-reported or observed) of individuals is useful, but intervening directly to pose questions about the rationales behind a person's behaviour adds valuable data to the research, as "the same behaviour can take place for different reasons and that the same attitudes can lead to different behaviours" (Anable, 2005).

ClairCity looked to identify areas of consensus and dissensus primarily on transport and home heating policies. Our participants, while they may not have had specialist knowledge of air quality or carbon emissions modelling, could provide expertise and experience over a spectrum of personally relevant behaviours and practices and their rationales behind them (Devenish et al., 2012).

4.2 Citizen Delphi methodological approach

The methodological approach taken, essentially a modified 'Policy Delphi', is detailed in ClairCity Deliverable *D4.1 Delphi Guidelines and Pilot*. The data was collected via:

- Round 1 survey: a mix of open and closed questions presented online and face-to-face by interviewers and in self-complete forms
- Round 2 survey: a mix of open and closed questions presented online
- Round 3 workshop: a face-to-face event facilitated by city/region partners and buddies, with groups of between 3 and 59 citizens per city/region. (Reported in ClairCity Deliverables *D4.2* and *D4.3*.)

Corresponding with the principles of Delphi, our sampling techniques did not aim to be fully representative, however efforts were made to ensure some of the barriers to participation discussed earlier were removed for as wide a selection of participants as possible. The sampling methods included:

- Self-selection
    - Round 1 and 2 survey and Round 3 workshops were targeted at city-wide media and emailing lists.
    - We therefore would expect to recruit the affected and partisan publics who had an interest in the topic, as well as the general public who are interested in decision-making for the city/region.

- Delegated
    - Round 1 and 2 survey and Round 3 workshops were targeted at known emailing lists and community groups who had expressed an interest in air pollution and carbon emissions, or the city/region's future.
    - We therefore would again expect to recruit the affected and partisan publics.

- Qualitative engagament
    - To overcome some of the barriers around digital literacy, accessibility, and topic awareness, we converted the Round 1 survey into a face-to-face questionnaire. We then purposively sampled areas which were known to have reduced engagement in city/region decision making, with lower socio-economic status, and in some cases high ethnic diversity.
    - Similarly, some of the Round 3 workshops were conducted in areas with reduced engagement with city decision-making.
    - As well as affected and partisan publics, we therefore aimed to recruit individual citizens described as 'pure publics', i.e. citizens who have little knowledge about the topic in question.

The ClairCity Delphi was conducted across four cities and two regions by the respective city/region partners and buddies. A total of 3,059 respondents completed the Round 1 survey across all of the cities, with 1,423 responding in Round 2 and 149 attending the Round 3 workshops (Table 4-1). The Round 1 sample represents between 0.28% and 0.04% of the populations in each area, which although low in population terms actually represent a significant number of total respondents. We did not collect demographic data on respondents

who attended Round 3 workshops; as interactions were between groups, it was less feasible to track an individual's perspective in the final data set.

4.3 Participation rates

Response rates to the Round 1 and 2 surveys varied considerably across the cities/regions (Table 4-1). In part this of course reflects the differences in population sizes, however there are clearly other factors at play. For example, differences in the receptiveness and awareness of the general public in each city/region, and technical and seasonal difficulties in engaging with publics by city partners. Response rates fell between Round 1 and Round 2, which is common in Delphi studies, but in ClairCity also reflects the fact that this was predominantly an online-only survey and, although targetted at interested individuals as well as promoted widely via social and traditional media, was less actively promoted in face-to-face environments. Much lower numbers attended the Round 3 workshop, in part due to the necessities imposed by venue size, but also the difficulties in convening members of the public at a mutually-convenient time without incentive.

Table 4-1: Number of Round 1 and 2 respondents and populations for each city/region

City/region	Number of Round 1 respondents	Number of Round 2 respondents	Number of Round 3 participants	City/region population
Amsterdam	638	269	6	834,713 (City survey 2016)
Aveiro Region (CIRA)	794	280	33	370,394 (Census 2011)
Bristol	500	230	59	428,100 (Census 2011)
Liguria Region	646	456	19	1,570,694 (Census 2011)
Ljubljana	198	72	3	280,310 (City survey 2017)
Sosnowiec	283	116	29	204,013 (City survey 2017)
TOTAL	**3059**	**1423**	**149**	**3,688,224**

4.4 Demographic analysis

Full demographic analyses, with comparisons from local census data, for all cities/regions are presented in (Appendix 1 and 2). The demographic breakdown for Round 1 respondents across all cities/regions are summarised in Table 4-2. With the exception of Amsterdam, females were more highly represented in all cases and overall. However this represents a tendency for women to be more likely to be involved in the environmental movement than men and therefore more likely to engage (McCright and Xiao, 2014). The age profile of respondents varies across all cities, with a higher proportion of older participants in Amsterdam (69% over 50 years), and a relatively higher proportion of younger participants in Sosnowiec (46% under 37 years). Questions about ethnicity were not asked in every city/region due to acceptibility; in all other cases white/local respondents dominate (100% in Sosnowiec), with a slightly higher proportion of non-white/non-local respondents in Amsterdam and Bristol reflecting the relative ethinic diversity of these cities. Education classifications varied across the cities/regions refecting the different education systems in those countries. The classifications were therefore simplified to with/without a degree. In Amsterdam, Aveiro and Bristol, respondents were more highly educated, with the proportions reversed in Ljubljana. Education levels were slightly more balanced in Liguria and Sosnowiec. Whilst demographic groups may not be representative of the target populations, with the exception of non-white/non-local ethnicities in Sosnowiec, no demographic group was completely unrepresented.

Table 4-2: Demographic summary of entire Round 1 survey for each city/region

All %	City/ Region %	Ams %	Aveiro %	Bristol %	Liguria %	Ljb %	Sos %	Total %
Gender	Male	55	41	38	40	39	37	**43**
	Female	45	52	57	59	59	59	**54**
Age category	16-24 years	2	13	11	17	4	25	**12**
	25-36 years	8	21	26	17	35	21	**19**
	37-50 years	20	35	31	25	38	26	**29**
	51-65 years	43	21	18	29	17	16	**26**
	65+	26	4	11	11	5	10	**11**
Ethnicity	White/ local	83	N/A	82	94	N/A	100	**90**
	Non-white/ non-local	14	N/A	13	5	N/A	0	**8**
Education	High school	31	25	26	52	65	46	**41**
	Degree	66	68	69	46	31	53	**56**

* Missing percentages are accounted for by ‘prefer not to say’

5 Discussion/conclusions

As suggested by the respondent numbers and demographics, conducting the Citizen Delphi across the six cities/regions presented a mixed challenge, with engagement and responses dependent on the awareness of the local populations to the issues being discussed, the different engagement mechanisms that were available to the ClairCity staff and the expertise and effort employed in seeking broad engagement from the populace. In some cities/regions it was possible to make use of citizen panels, consultation groups of self-selecting citizens that are commonly used to help inform policy development. In others, an absence of such readily-available engagement tools meant the city/region partners and buddies needed to be resourceful and imaginative in exploring opportunities to reach as many members of the public as possible.

Engagement with the public in a Citizen Delphi requires substatially more preparation, effort and resource than engaging with expert groups. Typically participant numbers in Delphi studies involving experts tend to be much smaller, however in a Citizen Delphi that seeks to gain insights from a wide range of individuals, such as in ClairCity, it was necessary to target thousands in broad recruitment campaigns in order to obtain responses from a fraction of society (Coelho et al., 2018; Trozzi, Vaccaro and Trozzi, 2018). However, even that relatively small fraction equated to several hundred responses per survey, which then require substantial effort to translate, code and analyse in order to prepare the next round of the Delphi.

In a typical ‘expert’ Delphi, each round utilises the same respondents as the previous round so that individual participants can reflect on their previous responses in light of the results from all respondents and, if inclined, modify their position, thereby drawing towards a consensus (or, in some cases, multiple consensuses) for the group. In a Citizen Delphi, it is harder to maintain engagement across a spectrum of public participants over the course of the project. This was particularly the case in ClairCity, given the numbers involved drawn from across each of the cities/regions. In this aspect the Delphi approach employed in ClairCity departed significantly from the traditional Delphi. However, by treating the public as a whole with each individual an expert in their own lives, the need to maintain continuity of participants across the rounds was not deemed as important as if engaging with specific subject experts.

The issue of ‘representivity’ was raised on many occasions, both within the research team and with city partners. Unlike other survey techniques, in traditional Delphi (which itself receives misjudged criticism on this point due to it’s small number of expert participants), the intention is not to be able to generalise the findings, but rather to gain insight (Devenish et al., 2012; de Meyrick, 2003). In treating citizens as experts in their own lives, ClairCity sought to gain insight into their understanding, desires, behaviours and concerns collectively in order to be able to inform and shape policy. There were also concerns about representivity of participants with the tendency for those that are already aware/concerned about air pollution and climate change to want to be involved. In some cities/regions, engagement with the older population dominated, due to availability, interest and desire to faciltate change. In order to gain a broad understanding of the variability in citizens lives in each city/region, the research therefore needed to engae with a broad spectrum of society.

As discussed in Section 4.1, the purpose of engaging the public through the Citizen Delphi in ClairCity was to inform the policy discourse by evaluating measures through the prism of people's lived experiences. However, as illustrated by the Overton window it is not technically feasible to expect non experts to come up with non-normative ideas, and hence, citizen suggestions were, at least theoretically, unlikely to challenge currently proposed policy solutions. Furthermore, it might be expected that citizens' lack of expertise may also see any radical suggestions dismissed by policy makers. By looking for common themes in responses and generally seeking consensus through popularity of particular measures amongst the public, there is also a tendency towards the middle-ground and away from the extremes. This is important for agreeing with experts on a shared way forward, but means that radical ideas from citizens may not be valued.

It is these traditional power dynamics in political decision making, in which citizens with a lack of technical or political expertise can't control the conversation, that ClairCity, and in particular the Citizen Delphi, sought to design out (Hayes et al. 2018). By putting citizens at the heart of the debate and forcing stakeholders and policy makers to acknowledge their concerns and ideas, some cities/regions were challenged by the ambition of policies that citizen's were prepared to accept. There was widespread recognition that air quality and carbon management are significant issues of concern for public health and environmental reasons in their areas and more widely. There was also a strong desire to personally move towards more environmentally sustainable behaviours, which were currently stymied by both real and perceived difficulties (e.g. lack of adequate public transport, unsafe/non-existent cycle infrastructure) (Deliverable *D4.4,* Barnes et al., 2019; Boushel et al., 2018). The public's willingness to push politicians to be more ambitious in their timescales and uptake of measures to address these issues in order to enable and facilitate their desire for a city/region in which they could proactively contribute to a better and healthier environment for them and their families was therefore a key finding of the research.

Citizen Delphi has demonstrated that whilst primary public engagement can be a valuable tool in informing and shaping policy on air quality and carbon management, there are significant challenges to implementing this technique more widely. The following section makes recommendations for replicating the approach drawing on lessons learnt through this project, which may be utlised by other researchers or policymakers in future.

5.1 Recommendations

5.1.1 Engage citizen representatives

In undertaking a Citizen Delphi approach, it may be more practical to engage with representative bodies, e.g. citizen panels or community groups, rather than individuals directly, particularly if seeking insights from a broad spectrum of society. In this way it may be possible to ensure continuity of engagement across the Delphi rounds and therefore facilitate consensus-building. However, there may be trade-offs in gaining insight by proxy rather than from the citizens directly that would need to be managed, and there is a risk that marginalised groups would continue to be underrepresented.

5.1.2 Use a variety of engagement techniques

Use of web-based surveys can help to reach a high number of respondents with little effort, but there is the potential to miss potential respondents that do not have ease of internet access or are less comfortable with this medium. As this research has demonstrated, the greatest response rates are achieved when surveys are personally distributed, although this clearly leads to a trade-off in effort as mentioned above. Workshops will by their nature limit the number of respondents so should only be used to focus on specific areas of interest.

5.1.3 Try to ensure demographic representivity

Whilst Delphi does not seek to provide generalisable results, it is important to ensure no demographic group is deliberately excluded. To that end, a good understanding of the demographic make-up of the study area is required at the outset and purposive sampling of each demographic group, perhaps using community groups as suggested above, is necessary. Additional resource will need to be employed to target typically underrepresented groups.

5.1.4 Be aware of local contexts

It is also important to recognise that demographic groupings may not translate across different countries, or possibly even regions. Comparability of results on that basis should therefore be considered if this is an aim of the research.

If working with citizens across different languages it is also vitally important to ensure survey and workshop materials are provided in the local language. Accurate translation in preparation of the questions and analysis of the responses is vital to ensure validity of the data.

5.1.5 Feedback to participants

It is always good practice to ensure that research feeds back to participants to ‘close the loop’ and facilitate future engagement. Although this research didn’t necessarily retain the same participants across the Delphi rounds, feedback was ensured by the methodology’s cyclical nature and the opportunities given to participants to provide contact details to remain engaged in subsequent rounds. Comminques of the key findings are in preparation and the project has also taken available opportunities to present the results of the research in public fora, thereby allowing them to see the value of their engagement in shaping local policy.

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Appendix 1 - Delphi demographic summaries by city (summarised from Deliverable *D4.4*)

Amsterdam

In total, 638 people responded to our survey in Amsterdam, out of a city population of 834,713[1]. The Amsterdam respondents were 55% male, which is slightly higher than the city gender ratio. Our respondents were disproportionately older compared to the city population, with 89% of respondents aged 37 or older in our Round 1 sample, compared to only 52% of the city population. Our sample was more educated (i.e. had higher level of qualifications) than average, with limited representation of those who had a low level of education compared to the categories used to collect city-wide data. In our sample, 67% of the respondents had a "high" level of education with only 5% having "no/low" level of eduation, compared to the city population where 47% have a "high" level, and 22% have a low level of education. In The Netherlands, categories are more relevant regarding the national identity rather than ethnicity of respondents. The "non-Dutch" population of Amsterdam is around 14% according to city statistics. In Round 1, 13% of our sample were non-Dutch nationals with 5% of the total coming from Western countries (Europe, North America, Japan etc) and 8% coming from other non-Western countries.

In Round 2, we had a predominantly male sample in Amsterdam with 57% of respondents identifying as male. As with Round 1, the respondents were disproportionately older with 76% of them over the age of 54, compared to only 23% of the city in this category. 73% of respondents had a high level of education, compared with 47% of the city as a whole. 91% of the respondents were Dutch nationals, compared to 86% of the Amsterdam population.

Aveiro

Aveiro survey was completed by 1031 people out of a regional population of 370,394[2]. 52% of our respondents were female, but only 4% of our respondents were over 65 years, compared to a regional proportion of 18%. However, our Round 1 proportion of 16-24 year olds was relatively accurate with 13% of our sample, compared to 10% of the overall population. Our respondents are disproportionately educated, with 4% receiving a basic or no education, compared to 72% of the general population of the region. 68% of our sample have a more than a degree or professional education, compared to only 15% of the general population. We have not collected ethnicity or nationality data from our Portuguese sample, as this is not typically reported as a demographic cleavage for Portuguese studies. We had a higher rate of women answering our Round 2 survey, with 60% female respondents. The level of education was high compared to the region, with 77% of respondents holding the equivalent of a degree or higher compared to only 15% of the region. The dataset underrepresented older people, with only 3% over 65, compared to 18% of the city.

[1] UrbiStat. Municipality of Amsterdam Statistics 2016, Avalable from https://ugeo.urbistat.com/AdminStat/en/nl/demografia/eta/amsterdam/23055764/4 Accessed on 3 October 2018.
[2] Portugal Census 2011

Bristol

Our Bristol Round 1 survey received 500 respondents, out of a city population of 428,100.[3] The respondents were 57% female, and our representation of age for the adult population was roughly approximate, with 29% over the age of 51 compared to 28% of the city population, and 11% of our respondents aged 16-24 compared to 15% of the city. The average education level of our respondents was less representative; our sample is highly educated compared to the city average – 58% of our dataset have a degree or higher, compared to 32% of the general population. Only 1% of our respondents have no qualifications, compared to 20% of the city population. 15% of the city population are BME (Black and Minority Ethnic), and 13% of our respondents in Round 1 also identified themselves as BME. Within these categories, we had slightly fewer "Black or Black British" (3% compared to 6% of the city) but more "Mixed (White & Black Caribbean, White & Black African, White & Asian, Other mixed)" (4% compared to 3% of the city).

Bristol was reasonably balanced with 52% female respondents. Only 2% of our respondents were in the 16-24 age category, with over-representation of the 25-49 age group. Less than 0.5% of our respondents were registered as having "no qualifications" compared to 20% of the city. In Round 2, our ethnicity representation was poorer, with 93% of respondents identifying as "White (British, Irish, Any other white background)" compared to 85% of the city.

Liguria

We received 646 responses to our Round 1 survey in Liguria, out of a regional population of 1,570,694.[4] The majority of our respondents were female, with only 59% identifying as female. Over 65s are under-represented in our responses, with a disproportionate number of younger respondents in our data set. Only 11% of our respondents are over 65, compared to a regional proportion of 27%. Our respondents are disproportionately educated, with 28% holding a degree equivalent or higher, compared to the regional average of 11%. 56% of the region has received either no education or only up to primary school, compared to less than 1% of our respondents. We have not reported nationality data for Ligurian respondents, as age and education statistics were determined to be sufficient to understand the representivity of our sample.

More of our respondents were female, at 59% of the sample. 42% of our respondents were aged 35-49, compared to only 23% of the region. Older people were underrepresented at only 11% over 50, compared to 48% of the population as a whole. The respondents were also highly educated, with 59% holding a professional or degree equivalent title, compared to 38% of the city.

[3] Bristol Census 2011
[4] Italy Census 2011

Ljubljana

In Ljubljana, we received 199 responses out of a city population of 280,210[5]. 58% of our respondents were female. In Ljubljana, we have an under-representation of the oldest and youngest categories, with more than two thirds of respondents aged 25-50 compared to 38% in this category in the city as a whole. Our respondents are highly educated, with 65% holding a university education compared to only 24% of the city population. A third of Ljubljana residents have vocational education qualifications, but only 1% of our survey respondents have this. In Slovenia the national or cultural identities of citizens is a politically charged topic due to the histories of Former Yugoslavian populations. As a consequence for ethical reasons we have not used nationality or ethnicity as a demographic identifier for population sampling in Ljubljana.

The majority of respondents were female, making up 68% of the Round 2 respondents. The 37-50 age category were a disproportionate set in our data, at 51% compared to only 24% of the total population. This was at the cost of older people, with only 3% of our Round 2 sample over 65, compared to 15% of the city. The data also represents the highly educated more than the average citizens, with 85% holding some form of higher education certificate, compared to only 31% of the general population.

Sosnowiec

We had 283 responses to our Round 1 survey in Sosnowiec, out of a city population of 204,013.[6] 59% of our respondents in Round 1 were female. Sosnowiec respondents were disproportionately young, with a high response rate in the 16-24 year old category. Those over 65+ were underrepresented, with only 10% of responses from this category compared to 19% of the city. Our respondents were highly educated compared to the city average, with 53% holding a degree or equivalent, compared to 25% of the city overall. In this region of Poland, with an highly ethnically homogenous population, representation of ethnic minorities has not been a significant issue and therefore has not been relevant to record for our study. In Sosnowiec, 63% of our Round 2 respondents were women. Older people were underrepresented, with only 3% of the sample but 19% of the general population. Similarly, 82% of our sample had some form of degree or equivalent education, compared to only 25% of the Polish population as a whole.

In Sosnowiec, 63% of our Round 2 respondents were women. Older people were underrepresented, with only 3% of the sample but 19% of the general population. Similarly, 82% of our sample had some form of degree or equivalent education, compared to only 25% of the Polish population as a whole.

[5] City survey 2017, data shared by Ljubljana City Council with the project.
[6] UrbiStat Sosnowiec http://ugeo.urbistat.com/AdminStat/en/pl/demografia/eta/sosnowiec/2475/3

Appendix 2 - Full demographic data by city/region

Gender

Across our samples, there were some variations in the gender of respondents working from a baseline that our areas are approximately 50% male, 50% female. With the exception of Amsterdam, women were more represented than men across both rounds of the survey.

Table A2. 1: All areas gender data for Round 1 and Round 2

	Round 1			Round 2		
City/region	Male	Female	Other/prefer not to say	Male	Female	Other/prefer not to say
Amsterdam	55%	45%	0%	57%	43%	0%
Aveiro Region (CIRA)	41%	52%	7%	38%	60%	2%
Bristol	38%	57%	4%	46%	52%	2%
Liguria Region	40%	59%	1%	39%	59%	2%
Ljubljana	39%	58%	2%	29%	68%	3%
Sosnowiec	37%	59%	4%	37%	63%	0%

Age

We only asked respondents aged over 16 across all of our sample areas. In examining the age spread of our respondents, sometimes comparisons with the published city or region data are more complex as different categories have been used.

Amsterdam

The Amsterdam respondents were disproportionately older compared to the city population, with 89% of respondents aged 37 or older in our Round 1 sample, compared to only 52% of the city population.

Table A2. 2: Amsterdam age data

Amsterdam age categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Amsterdam city data categories	Percentage of city census respondents
			0-17	18%
16-24	2%	0%	18-24	10%
25-36	8%	6%	25-34	20%
37-50	20%	17%	35-54	29%
51-65	43%	45%	54-64	11%
65+	26%	31%	65+	12%
Prefer not to say	1%	1%		

Aveiro region

The data for the Aveiro region is harder to comparatively analyse as the census collected age category is broad. However, it is clear that in both our Round 1 and Round 2 data, we are underrepresenting over 65s in our data set.

Table A2. 3: Aveiro age data

Aveiro age categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Aveiro region categories	Percentage of region census respondents
			0-14	14%
16-24	13%	16%	15-24	10%
25-36	21%	30%	24-64	57%
37-50	35%	33%		
51-65	21%	16%		
65+	4%	3%	65+	18%
Prefer not to say	6%	2%		

Bristol

In the Bristol census data, the categories used were slightly different. There are more respondents in the middle age categories between 25 and 50. The proportion of respondents over 51 is approximately representative.

Table A2. 4: Bristol age data

Bristol age categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Bristol census data categories	Percentage of city census respondents
			0-16	18%
16-24	11%	2%	16-24	15%
25-36	26%	34%		
37-50	31%	37%	25-49	38%
51-65	18%	20%	50-64	15%
65+	11%	6%	65+	13%
Prefer not to say	3%	1%		

Liguria

The categories in Liguria are only slightly different to the city data. Over 65s are under-represented in our responses, with a disproportionate number of younger respondents in our data set.

Table A2. 5: Liguria age data

Liguria age categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Liguria categories	Percentage of city census respondents
		4%	0-15	12%
16-24	17%	13%	15-24	8%
25-36	17%	30%	25-34	9%
37-50	25%	42%	35-49	23%
51-65	29%	10%	50-64	21%
65+	11%	1%	65+	27%
Prefer not to say	1%	0%		

Ljubljana

In Ljubljana, we have an under-representation of the oldest and youngest categories, with more than two thirds of respondents aged 25-50.

Table A2. 6: Ljubljana age data

Ljubljana age categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Ljubljana city data
16-24	4%	5%	13%
25-36	35%	16%	14%
37-50	38%	51%	24%
51-65	17%	22%	20%
65+	5%	3%	15%
Prefer not to say	1%	3%	

Sosnowiec

Sosnowiec respondents were disproportionately young, with a high response rate in the 16-24 year old category. Those over 65+ were underrepresented.

Table A2. 7: Sosnowiec age data

Sosnowiec age categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Sosnowiec categories	Percentage of city census respondents
			0-17	14%
16-24	25%	5%	18-24	7%
25-36	21%	32%	25-34	15%
37-50	26%	39%	35-54	27%
51-65	16%	21%	55-64	18%
65+	10%	3%	65+	19%
Prefer not to say	2%	0%		

Education

Given the variety in education systems and qualifications, our data is complex to compare between cities in detail. Overall, our respondents tended to be better educated than the city average, with some cities significantly more educated than the profile of their area. This is a typical finding in survey research, as more educated people are more likely to be willing to fill in questionnaires or respond to interviewers.

Amsterdam

Our Amsterdam survey was conducted via a "Citizen Panel" that had existing educational categories included. We have summarised these categories to make them more comparable with our other areas, and compared the results to Amsterdam data which uses a three band system of categorising education levels. Our sample was more educated than average, with limited representation of those who had a low level of education.

Table A2. 8: Amsterdam education data

ClairCity categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Amsterdam city categories	Amsterdam city data
No qualifications or basic education	5%	2%	Low education level	22%
High school	26%	20%	Medium education level	29%
Degree or above, including professional qualifications	67%	73%	High education level	47%
Unknown/prefer not to say	2%	2%	Unknown	2%

Aveiro region

Our responses in the Aveiro region were significantly more educated than the general population.

Table A2. 9: Aveiro education data

Aveiro education categories	Percentage of Round 1 respondents	Percentage Round 2 respondents	Percentage of city census respondents
PhD	6%	8%	>0%
Master's degree	22%	28%	1%
Degree/Professional education	40%	41%	14%
High school	21%	20%	13%
Basic education	4%	0%	61%
No education	0%	0%	11%
Prefer not to say	7%	3%	

Bristol

In our data, respondents were more highly educated than the city average, with nearly double the proportion of people holding degrees or above.

Table A2. 10: Bristol education data

Bristol education categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Percentage of city census respondents
Higher education (PhD, Masters)	24%	32%	32%
Degree	34%	36%	
Professional education	11%	11%	48%
Secondary school	19%	12%	
Vocational education	6%	5%	
No qualifications	1%	0%	20%
Prefer not to say	5%	4%	

Liguria

Our respondents in Liguria are disproportionately highly educated, with all of them having a secondary school qualification or above.

Table A2. 11: Liguria education data

Liguria education categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Percentage of census respondents
No education	0%	0%	7%
Primary school	0%	0%	49%
Secondary school	52%	38%	6%
Professional/vocational	20%	34%	27%
Undergraduate degree (or equivalent)	9%	10%	2%
Postgraduate degree (Masters, PhD)	19%	15%	9%
Prefer not to say	0%	3%	

Ljubljana

The data available on education from Ljubljana is from 2002, so it is possible that education levels may have increased over this time. However, even with some increase our data set is disproportionately educated compared to the city profile.

Table A2. 12: Ljubljana education data

Ljubljana education categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Percentage of city census respondents
Postgraduate studies (Master's Degree, PhD)	19%	18%	3%
University education	46%	48%	21%
Higher education	18%	19%	7%
High school education	12%	14%	21%
Vocational education	1%	0%	33%
No education	0%	0%	0%
Prefer not to say	4%	1%	

Sosnowiec

We are comparing the Sosnowiec data with national Polish data, as this is more readily available. Our sample in both rounds is disproportionately highly educated.

Table A2. 13: Sosnowiec education data

Sosnowiec education categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	National Polish data
No education/primary education	4%	0	15%
Secondary education	30%	17%	60%
Professional education	3%	1%	NA
Tertiary (degree or equivalent) education	53%	82%	25%
Prefer not to say	9%	0%	

Ethnicity

The representation of ethnic and national diversity has different salience in our partner regions and cities. For example in a United Kingdom context where over 12% of the population identify as people of colour, it is an important feature for understanding the representativity of a population sample. In the Netherlands and Italy, nationality rather than

race or ethnicity is the feature most commonly monitored for sampling. We have not reported nationality data for Ligurian respondents, as age and education statistics were determined to be sufficient to understand the representivity of our sample. In Poland and Portugal, with an ethnically highly homogenous population, representation of ethnic minorities has not been a significant issue and therefore has not been relevant to record for our study. In contrast, in Slovenia the national or cultural identities of citizens is a politically charged topic due to the histories of Former Yugoslavian populations. As a consequence for ethical reasons we have not used nationality or ethnicity as a demographic identifier for population sampling in Ljubljana.

Amsterdam

In The Netherlands, categories are more relevant regarding the national identity rather than ethnicity of respondents. The “non-Dutch” population of Amsterdam is around 14% according to city statistics. In Round 1, 13% of our sample were non-Dutch nationals, and in Round 2 this reduced to 7%.

Table A2. 14: Amsterdam ethnicity data

Amsterdam Round 1 nationality categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Dutch national data
Dutch	83%	91%	86%
Suriname	3%	2%	14%
Europe	3%	1%	
Western (U.S., Australia, Canada, New Zealand, Japan, Indonesia)	2%	2%	
Other Asia, other Middle or South America, other Africa	5%	2%	
Not answered	4%	2%	

Bristol

Our Round 1 sample data in Bristol is approximate for the ethnic diversity of the city, but Round 2 is less accurate. Black or Black British are underrepresented in both rounds compared to the census statistics, but other ethnic minority groups are represented within the sample.

Table A2. 15: Bristol ethnicity data

Bristol Round 1 ethnicity categories	Percentage of Round 1 respondents	Percentage of Round 2 respondents	Percentage of city census respondents
Asian or Asian British (Indian, Pakistani, Bangladeshi, Other Asian background)	5%	0%	5%
Black or Black British (Caribbean, African, Other Black background)	3%	0%	6%
Mixed (White & Black Caribbean, White & Black African, White & Asian, Other mixed)	4%	2%	3%
Chinese	1%	0%	1%
White (British, Irish, Any other white background)	82%	93%	85%
Prefer not to say	5%	5%	