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Imagining climate resilient futures: A layered Delphi panel approach

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ABSTRACT

This paper in using a novel application of the Delphi panel method, explores and consolidates the future visions of a low carbon and climate resilient future in Ireland through community-based visioning processes that emerged through co-created, deliberative approaches at local level. It embraces a visioning process that applies a transdisciplinary approach, which aims to match different visions and stakeholder needs, combining bottom-up and top-down perspectives. Community visions were articulated by means of a series of deliberative futures workshops facilitated by the transdisciplinary project research team. Through iterations of the Delphi feedback loop, the notion of deep and shallow agreement is explored to examine the spectrum of consensus to dissent around the co-developed future visions and pathways of climate action, articulated by the Irish community case study. This approach enables a critical exploration of the conventional science-policy-practice nexus through the use of innovative creative communication and engagement methods. Findings suggest that more deliberative forums which bring together a diverse range of stakeholders are needed to develop a shared vision for the future; the importance of language use and the creation of a shared vocabulary of climate action; and the power of civic imaginaries in helping to create useful future narratives.

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1. Introduction

Public participation is increasingly acknowledged as a key requirement for the effective implementation of climate action, yet there remains unresolved ‘tensions’ in how such processes relate to science and governance (Felt & Fochler, 2011; Pallett, Chilvers, & Hargreaves, 2019). Notably, public participation tends to be compartmentalized, to either a particular stage of innovation or policy making, for instance facilitating upstream or downstream engagement processes (but seldom both), or limiting participation to a specific part of a given system, for example, limiting deliberative processes to sites of institutional decision-making (Chilvers & Longhurst, 2016). These tensions have been the source of contention and conflict, and consistently undermine confidence, salience and efficacy in adopting participatory approaches (Barnett, Burningham, Walker, & Cass, 2012). Thus, there is a need to reconceive public participation as an emergent and continuous process (Byrne, 2022a; Chilvers & Longhurst, 2016; Mullally et al., 2022; Flood, Jerez Columbié, Le Tissier, & O’Dwyer, 2022). Transdisciplinary research and co-creation practices attempt to provide greater flexibility within research processes to re-define roles and expectations around system change (Bracken, Bulkeley, & Whitman, 2015). Trans-disciplinarity has been defined as a reflexive approach that contains both interdisciplinary collaboration among experts and scholars as well as collaboration between academics and non-academics, individuals and stakeholders dealing with real-world problems through mutual learning, knowledge integration, emergence and experimentation (McGookin, Ó Gallachóir, & Byrne, 2021a; de Freitas & Weaver, 2019; Jahn, Bergmann, & Keil, 2012; McGookin, Ó Gallachóir, & Byrne, 2021b; Miller et al., 2014; Polk, 2014, 2015; Schmidt, Falk, Siegmund-Schultze, & Spangenberg, 2020; Wiek, Farioli, Fukushi, & Yarime, 2012; Revez, Cortes-Vazquez, & Flood, 2017). Such approaches seek to reposition researchers and policymakers into more co-creative spaces, drawing from enhanced deliberation with other societal actors (OECD, 2020). Here synergies and points of connection with the concept of the ‘hybrid imagination’ are explored (Jamison, Christenses, & Botin, 2011). They suggest that this hybridity for scientists responds to ‘the need to transgress disciplinary boundaries and combine non-technical skills with their scientific and technical competence in order to produce knowledge in what Haarstad and his co-authors have termed “contexts of application” (p.3) or to create actionable knowledge’ (Haarstad et al., 2018).

The ‘public’ (Barnett et al., 2012) is heterogeneous, ambiguous and fluid but nevertheless is also socially and politically meaningful. ‘Publics’ are intangible in their essence, serving as imaginaries that need to be operationalised to serve administrative or other practical purposes (Pesch, 2019). The imagined publics literature argues that experts who design technological systems necessarily do so with an idealized imagined public in mind (Eaton, Burnham, Hinrichs, & Selfa, 2017). They distinguish between obligatory publics that must be engaged directly and other passive or quiescent publics that must be persuaded. Experts expect publics to act in certain ways, and these expectations are “anticipated and internalized into organizational practices and working practices” (Eaton et al., 2017, p.66). As Walker, Cass, Burningham, and Barnett (2010) suggest, the ways in which the subjectivity and agency of publics is imagined are internalised into organisational strategies and working practices may have more significance than the ‘real’ publics encountered. The dominant assumption of ‘the public’ is encoded as ‘a body of people in need of enlightenment and persuasion by the experts’ (Nerlich, Koteyko, & Brown, 2010, p. 104). There is an emerging body of research that imagines specific publics negatively e.g., uninvited or unruly publics, but at the same time recognises that imaginaries ‘capture local, cultural and temporal aspects’ within heterogeneous groups (Froese & Mevissen, 2020, p.4). Several studies of environmental controversies in Ireland have highlighted the gap between expert and lay knowledge and the fact that different groups operate with very different interpretations of what is at stake (Fox & Rau, 2016, 2017; Garavan, 2007; Lennon & Scott, 2015; Moran & Rau, 2016; Mullally & Sage, 2017; Revez, Cortes-Vazquez, & Flood, 2017).

An important consideration for public participation and policy development is an understanding of top-down versus bottom-up governance and decision-making approaches. Top-down strengths (awareness of longer-term drivers) and weaknesses (cannot easily incorporate community values), and bottom-up strengths (empowering) and weaknesses (may not adequately leverage insights or resources from higher scales) need to be carefully considered and appreciated. Consequently bottom-up strategies and visions are influenced by community members’ experience of local drivers and their immediate needs and are constrained by their limited power (Butler et al., 2014; Conway & Mustelin, 2014). Complementarities between the strengths of these approaches, which if explored could result in increased capacity for climate action than either may achieve in isolation (Sweeney, 2020).

Current models of public engagement and participation often adopt and replicate the aforementioned compartmentalised approaches. However, alternative and experimental approaches to counter these limitations are gaining momentum among researchers and practitioners, and there is a notable need to provide new methods and an associated knowledge base to inform actionable pathways to climate mitigation and adaptation (Beier, Hansen, Helbrecht, & Behar, 2016; Byrne, 2022a; DeCrappeo, Bisbal, & Meadow, 2018; Mullally et al., 2022; Sobel, 2021; Flood, Jerez Columbié, Le Tissier, & O’Dwyer, 2022). It is often the case that one specific methodology or approach is unlikely to meet the needs and expectations of all stakeholders involved in transdisciplinary processes, so this paper engages with a layered hybrid research approach (Landeta, Barrutia, & Lertxundi, 2011).

We explore the use of a hybrid of top-down and bottom-up approaches to policy/future vision articulation by employing quantitative and qualitative analysis techniques in the creation of more salient and connected research. In doing so, this study critically compares and analyses the different characteristics and converging points in the use of these different techniques. A key novelty emerging from this process is to look at convergence and divergence around local pathways and visions of change. In addition, the potential power and complexity of unlocking and exploring narrative framing and visioning approaches is discussed. This paper thus aims to facilitate bridge building between different knowledge actors.

The iterative nature of the Delphi process sets it apart from traditional survey methods, as it allows participants to re-consider their original responses in light of the expressed knowledge and opinions of the other Delphi panel participants. Through this innovative method it can act as a means of generating social learning (Flood, Cradock-Henry, Blackett, & Edwards, 2018; Mathur, Price, & Austin, 2008; Revez et al., 2020; Harris & Hughes, 2020), where social learning is understood as a combination of cognitive (knowledge and

thinking), normative (norms and approaches) and relational (how people connect and network building) learning (Baird, Plummer, Haug, & Huitema, 2014; Baird, Plummer, Moore, & Brandes, 2016). One of the most powerful drivers of social learning is intense social interaction (Flood, Cradock-Henry, Blackett, & Edwards, 2018). Social learning is less likely to occur in a one-off engagement, so it is essential that community workshops build momentum and achieve continuity by generating mechanisms and processes that become part of an ongoing programme of stakeholder interactions. Deliberative workshops that generate high levels of social learning empower participants to take their new knowledge (cognitive learning), updated mental models (normative learning), and newly formed or enhanced networks (relational learning) and to apply these learnings in the real world (Flood, Cradock-Henry, Blackett, & Edwards, 2018).

In recent years the Delphi technique has evolved substantially, fulfilling the need for researchers to develop structured methodologies for assessing and integrating societal insights with expert inputs (Rowe & Wright, 2011). There has been an increased interest in incorporating qualitative insights into the Delphi process and combining approaches within a hybrid layered approach (Masse, Marchand, & Bernier-Cardou, 2014; Rowe & Wright, 2011; Tapio, Paloniemi, Varho, & Vinnari, 2011). Moreover, since its origins the Delphi method has been used as a collaborative tool, and it's not surprising that its role in transdisciplinary research is gaining further traction (Linstone & Turoff, 2011).

The paper is structured as follows. Section 2 provides an overview of the layered hybrid approach and modified Delphi panel process. The results of the Delphi panel are outlined in Section 3, with focus on the share of agreement/disagreement across both rounds, as well as convergence/divergence among the two expert groups. Section 4 offers reflections on the Delphi panel, draws out key findings from the results, and closes with some considerations for future research.

2. Methods

2.1. Delphi method

The Delphi method is a widely utilised technique for foresight and forecasting activities and is seen to be particularly useful in complex and multifaceted contexts (Masse et al., 2014; Ribeiro & Quintanilla, 2015). It is typically used to collect the opinion and insights of experts on a given issue, and it helps bring together a collective perspective on evolving and future-oriented concepts or

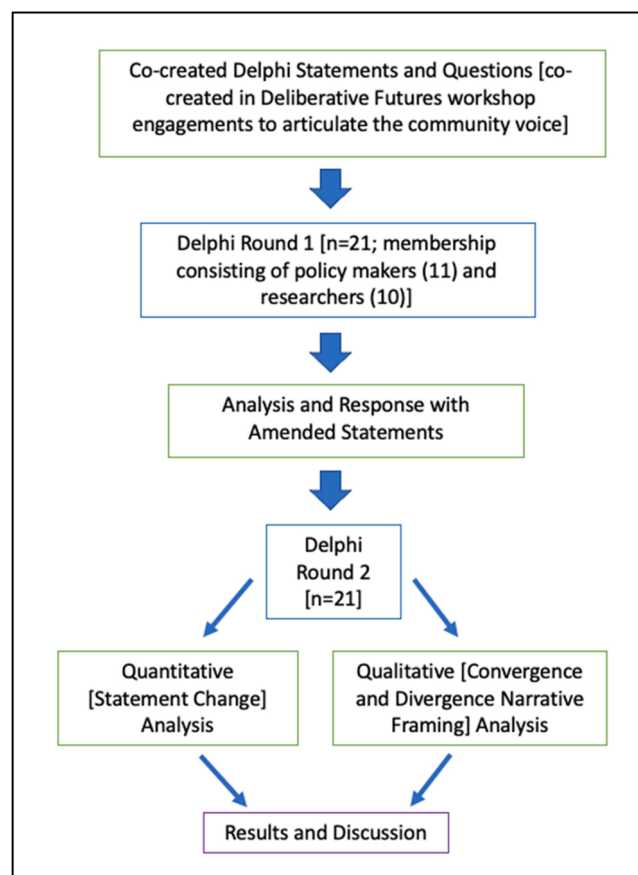


Fig. 1. Study design and methods overview.

problems (Kuusi, 1999; Tapio et al., 2011). The methodology is based on a ‘structured conversation’ using two or more rounds of surveys with a panel of experts (Makkonen, Hujala, & Uusivuori, 2016; Rowe & Wright, 2001). The staged and structured process of feedback and dialogue, enabled through these rounds, encourages respondents to reflect on their initial perspectives, learn from others, and reconsider their own stance (Hsu & Sandford, 2007). Therefore, insights gained in the first round are used as a source of information to shape subsequent rounds.

Rowe and Wright (1999) advance four key characteristics which are necessary for defining a Delphi procedure. These are anonymity, iteration, controlled feedback and statistical aggregation of results. The analytical and structure-based communication is pursued to obtain reliable consensus or indeed to identify dissent or non-convergence on a given issue (Devaney & Henchion, 2018; Hsu & Sandford, 2007; Hussler, Muller, & Rondé, 2011; Linstone & Turoff, 2011; Rowe & Wright, 1999). The way in which Delphi studies have been applied is evolving as different types of methods and techniques are engaged with (Linstone & Turoff, 2011; Melander, 2018). Rowe and Wright (2011) argue that Delphi methods have evolved towards mixed-method (or hybrid) orientations in order to fill a need to seek out more holistic approaches that address complex, “real world problems” (p. 1488). Indeed, it has been argued that the potential of the Delphi panel as a communication technique should be acknowledged and demonstrated more widely in light of the need to allow for a more iterative and transformative dialogue to emerge (Linstone & Turoff, 2011).

The first round of the Delphi panel is considered as largely unstructured and allowing for elaboration on expansion of issues considered relevant (Rowe & Wright, 1999). The subsequent rounds feature an added analysis on the role of feedback, aspect of the task, the measure used, and how the panellists interact. This is important in helping to assess how Delphi groups are transformed from one round to the next. This study engages with the Delphi approach within a broader research design process (Fig. 1).

As illustrated in Fig. 1, the Delphi method employed through this work comprised a co-creation process, and two Delphi rounds, followed by qualitative (convergence and divergence narrative framing) and quantitative (statement change) analysis. This is followed by results and a discussion.

2.2. Co-creation process

For this work, the Delphi statements were initially generated as an outcome of Deliberative Futures Workshops, which combined deliberative, participatory and anticipatory democracy methodologies (McGookin, Ó Gallachóir, & Byrne, 2021a; McGookin, Ó Gallachóir, & Byrne, 2021b).

The Delphi panel approach was used to test the feasibility and applicability of twelve statements and questions co-created through a series of Deliberative Futures workshops in two Irish towns, Athlone (n20) and Ballincollig (n22) (Fig. 2). Over two weekends in each location, several creative exercises were used to capture participants priorities and concerns with regards climate change, climate action and their visions for the future. The Deliberative Futures Workshops used research facilitators and moderators to guide the daily activities of the engagement and to organise, three ‘expert’-led presentations, which helped inform subsequent debates. These presentations offered information on climate mitigation, climate adaptation and the UN Sustainable Development Goals in an Irish context. The first weekend focused on a visioning phase, looking to explore and brainstorm converging and diverging conceptions of climate change and sustainability, while the second weekend focused on revisiting key ideas, identifying points of convergence and divergence to-develop pathways and scenarios for change. Expert presentations are a key part of the deliberative process, we followed a process of 20 % information giving and 80 % facilitated deliberation both with experts and with the other participants in order to develop what Offe and Preuß (1991) have defined as “fact, future and other regarding” recommendations.

Deliberative processes emphasise the value of informed, respectful and reason-based dialogue (Elstub, 2014). Participatory process on the other hand prioritise the benefits of wide participation, through inclusion, critical direct engagement and empowerment (Beier et al., 2016; DeCrappeo et al., 2018; Elstub, 2014; Escobar, 2017). Anticipatory democracy complements these approaches and it involves enhanced participation in terms of shaping the future towards more equitable and sustainable futures (Bezold, 2019). It is essentially an approach which seeks to counter short-cycle politics by ‘futurizing’ democratic processes (Bezold, 2019).

The approach adopted recognises the systemic turn in deliberative democratic theory and embeds a range of visioning and scenario co-creation tools within a wider deliberative action research approach (Mansbridge, 1999). In doing so we have attempted to draw in multiple experiences, voices and perspectives with a view to increasing and enhancing the number of ‘deliberative’ moments within the process.

The materials gathered in these workshops were wide-ranging and included community mapping, storyboarding, and audience polls. The end stage of the deliberative futures workshop was a ballot process, where communities decided on final recommendations. The use of the ballot permitted an equal voice for all at the final recommendation stage, removed any pressure for consensus and emulated the processes used by the Irish Convention on the Constitution (2012–2014) and the Irish Citizens’ Assembly (2016–2018). Although considering two separate and distinct communities, a number of common themes emerged. The analysis process of the recommendations from the deliberative futures workshops, involved thematic analysis and included a gradual identification and aggregation of recurring patterns of meaning within this rich qualitative data set (Braun & Clarke, 2006; Nowell, Norris, White, & Moules, 2017). The thematic analysis process led to the identification of four common themes (climate change policy in general, a strong local economy, social vibrancy, and a healthy environment) under the three pillars of economy, society and environment.

The original twelve statements generated from the community engagement in Athlone and Ballincollig, are presented in Appendix A.

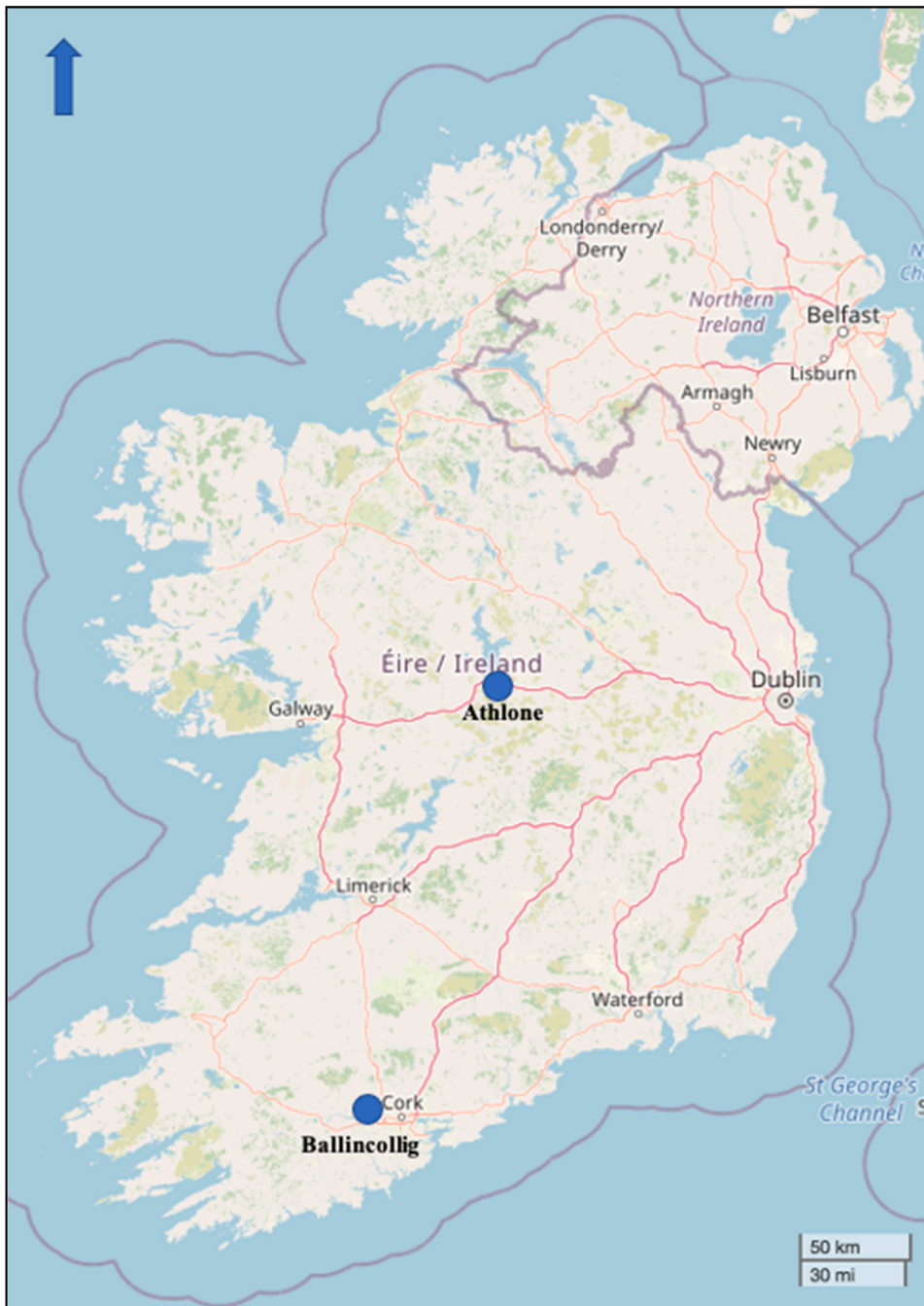


Fig. 2. Map of Ireland, marking engaged communities in Athlone and Ballincollig. ©OpenStreetMap (and) contributors CC-BY-SA.

2.3. Delphi panel selection and recruitment

Twenty policy makers and twenty researchers were contacted to participate in the Delphi process over two rounds between November and December 2020. The backgrounds of the participants was quite varied but in general, the policy makers came from Government departments and key public bodies, while researchers were found to cover the various elements of climate mitigation and adaptation science. In each round of the Delphi process, 21 responses were recorded, with responses from 11 policy makers and 10 researchers.

The policy maker respondents included regional and national mitigation and adaptation representatives with expertise in spatial planning, transportation, agriculture, engineering and flood management, the bioeconomy, and climate change governance. The

researcher responsees had climate mitigation and adaptation expertise in governance, hydrology, coastal management, community engagement, energy, environmental psychology, economics, biodiversity, sustainability, and media and communication.

The initial round established the context, provided basic information, and invited experts to provide their perspectives on the findings from the community engagements. Respondents were requested to indicate if they agreed or disagreed with each statement or question and then provide a brief commentary on each specific choice. Additionally, respondents had the option to reframe the statement or question. The second round was informed by an analysis of the responses to the initial round of the scientific and policy experts from across the field of climate action.

2.4. Analysis and response with amended Statements after Delphi round one

Through a reflective and collaborative process the research team consolidated the feedback from round one and recast the statements to reflect the rich aggregated Delphi panel feedback (Appendix B, Table 1). Written feedback was analysed to identify both common and unique themes and concerns. Statements were recast by the research team based on written feedback from Delphi respondents, share of agreement or disagreement indicated by respondents, and these were critically discussed and refined by the research team.

2.5. Delphi round two analysis

Round two of the Delphi analysis allowed the panel respondents to reflect on the revised statements, establish the share of agreement with each in turn, and provide detailed written feedback. This feedback was then incorporated into the subsequent qualitative and quantitative analysis by the research team. The research team used five questions and one specific inquiry to capture and synthesise the wide range of issues discussed by the Delphi panel respondents over the two rounds (Table 2). This initial analysis by the research team helped to shape a more granular second pass of quantitative and qualitative analysis.

To understand the extent to which statements were changed between the two rounds of the Delphi panel, a simple scoring metric was developed to carry out a quantitative analysis. Using a method based on, it assigned a representative weighting to the different types of restructuring or editing undertaken to give an indicative gauge of the statements that underwent the most significant changes.

Table 1
Revised Delphi statements.

Number	Revised Statements
1	In the context of a move to a sustainable and resilient society, there is a need to prioritise specific areas amenable to rapid short-term climate mitigation (e.g., public transport, freight, private cars, retrofitting buildings) and plan for systemic far-reaching long-term change (e.g., settlement patterns, reduced consumption, behaviour change, non-growth based economic activity).
2	Adequate funding for climate adaptation will need to go beyond the polluter pays principle due to a separation that sometime occurs between the polluter (e.g., private cars, freight, companies, households) and the site of climate change risk (e.g., sea-level rise, in-land flooding).
3	Sustainable transport and personal mobility will require people to have a choice of modes (including not travelling) that is (1) context sensitive, e.g. EVs for rural or remote areas and public transport and active modes (walking & cycling) for urban and suburban areas; and (2) sufficiently supported with funding and investment, e.g. adequate broadband, safe active modes infrastructure, etc; and (3) supported by societal values, e.g. flexible working arrangements.
4	One of the mechanisms for securing public support is the development of multi-actor ownership models that provide for community responsibility and gain.
5	Strict carbon tax ring-fencing should be introduced to fund climate action measures on a national basis and ensure transparency and fairness in allocation of funds to ensure nobody gets left behind.
6	Responding to climate change presents opportunities for economic diversification, e.g. the development of the circular bio-economy which values nature, and community development based on social enterprise and co-operation.
7	A key element of climate action will be strengthening community wellbeing and resilience.
8	When communicating with the public, it is important to highlight how local actions may contribute to national targets (e.g. in 2030 or 2050) that are part of our global obligations in addressing climate change.
9	Integrated spatial planning to ensure sustainable housing patterns and transport infrastructure is a critical area of climate action which will improve energy efficiencies, problematic commuter patterns and tackle urban sprawl.
10	Increases in the frequency of flooding, storm events, drought and decreasing levels of air quality form the key climate impacts facing local communities.
11	Communities acknowledged that a range of climate actions are needed. However, a preference was stated for micro-generation prioritisation over large scale renewable generation and, where appropriate, nature-based solutions prioritisation over hard infrastructure approaches to climate action.
12	Maintaining a healthy local environment (water, air and land, biodiversity) should be a priority.

Table 2
Framing analysis.

1	Indicate the level of agreement, and causes of disagreement?
2	Were there issues with language? What needed clarification?
3	Is there a type of action favoured? Small v big, technical v nature-based, etc.
4	Who is seen as being responsible for taking action? Government, community, industry, etc.
5	Elaborate on any mitigation and adaptation co-benefits addressed or potentially addressed by this question/statement and/or in the Delphi survey participant responses.
6	Any other emerging themes or questions?

The scoring system was devised as follows:

- Clarity on language (1 / 2) – depending on if it was just one word that caused confusion or multiple words that were changed in the revision;
- Adding more context (1) – minor addition to frame the statement and provide more context;
- Change in sentence structure (1 / 2) - depending on if it was just a minor rearranging or complete rearticulation of the statement;
- Complete change in statement (5) – entirely new statement created.

This quantitative analysis was complemented with a qualitative analysis to further explore these quantitative findings and understand the basis of agreement and disagreement, and provide additional insights into the nuances of consensus and dissent. In doing so, the qualitative analysis unearths narratives and framings from this situational study with wider universal policy and future visioning applications.

3. Results

Fig. 3 shows the share of agreement between rounds according to the two groups (policy experts, and researchers) over the two rounds for statements 3–12, with Tables 3 and 4 indicating the share of disagreement and agreement. The research team split the two groupings in the analysis to test for differences between the two cohorts (i.e. policy versus research). There is a clear increase in agreement from round one to two in Fig. 3. It also highlights differences between the two cohorts. The policy experts share of agreement differs from those of the researchers on specific questions, with disagreement noticeably higher in round one when compared with the research cohort. Note that questions 1 and 2 don't have first round results as the first round comprised of selecting multiple choice responses from a list generated from the community engagements. This meant that only statements 3–12 could be included in the t-test conducted.

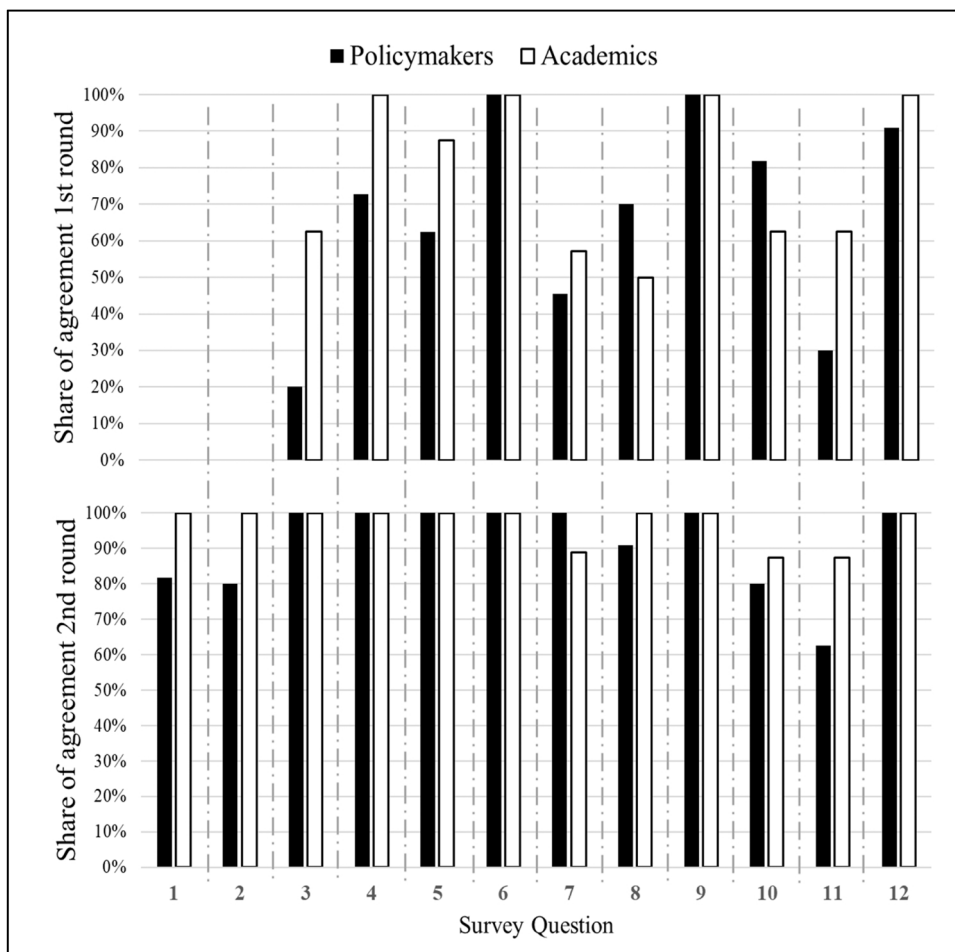


Fig. 3. Share of agreement of two Delphi rounds.

Table 3

Mean levels of agreement or disagreement with statements and significance of increase in agreement based on t-test.

Policymakers				Researchers				Total			
Agree		Disagree		Agree		Disagree		Agree		Disagree	
Mean values											
R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
67 %	93 %	33 %	7 %	78 %	96 %	22 %	4 %	73 %	95 %	27 %	5 %
p-value (significance of variation in agreement)											
95 % confidence		99 % confidence		95 % confidence		99 % confidence		95 % confidence		99 % confidence	
0.0078		0.0078		0.0084		0.0084		0.0043		0.0043	

Table 4

Analysis of variance on levels of agreement based on ANOVA (2-factor).

ANOVA (level of agreement) (p-value, 95 % confidence)		
Policymakers vs Researchers	Round 1 vs Round 2	Interaction
0.999999	0.000001	0.669995

Looking at the mean values shown in the top-half of [Table 3](#), we can see that the share of agreement from both cohorts increased from a mean of 73–95 % over the two rounds, with disagreement dropping from a mean of 27–5 %. This would seem to indicate that the revised statements in the second round had captured the majority of concerns raised during the first round. The statistical significance of the variation in agreement was confirmed using a t-test, with a p-value lower than 0.05 in all cases at both a 95 % and 99 % confidence interval (bottom-half of [Table 3](#)).

1. Policymakers had higher levels of agreement with the statements in the 2nd round ($M = 0.93$, $SD = 0.02$) compared to the 1st round ($M = 0.67$, $SD = 0.08$), $t(9) = -2.7$, $p = 0.0078$
2. Researchers had higher levels of agreement with the statements in the 2nd round ($M = 0.96$, $SD = 0.003$) compared to the 1st round ($M = 0.78$, $SD = 0.04$), $t(9) = -2.6$, $p = 0.0084$
3. The combined response had higher levels of agreement with the statements in the 2nd round ($M = 0.95$, $SD = 0.008$) compared to the 1st round ($M = 0.71$, $SD = 0.06$), $t(9) = -3$, $p = 0.0043$

To compare average levels of agreement between groups and between rounds, a 2-factor ANOVA was also performed. As shown in [Table 4](#), this ANOVA indicated that variation between groups was not significant (p-value = 0.99), that variation between rounds was significant (p-value < 0.05), and that there was no interaction effect between groups and rounds (p-value = 0.67). Due to different levels of response between policy-makers ($n = 10$) and researchers ($n = 6$) for levels of disagreement, it was not possible to perform an ANOVA analysis on this parameter.

Looking at the individual groups, during the first round, policymakers mean agreement was 67 % compared to 78 % for researchers. However, in the second round the mean share of agreement is quite similar at 93 % (policy) and 96 % (research). As displayed in [Fig. 3](#), in the second round, bar the exception of statement 7, the researchers had an equal or greater share of agreement than the policy-makers. It is striking that there was 100 % agreement with 9 out of 12 of the revised statements, whereas this was achieved with policymakers in only 6 out of 12 of the revised statements.

This initial quantitative analysis is complemented with thematically focused qualitative findings, under the four aforementioned themes, to provide a high level summary of results ([Fig. 4](#)).

The four headline findings are: climate impacts are leading to increased pressure on a healthy environment; a holistic approach beyond localised action and visions of change will catalyse social vibrancy; climate change policy needs to focus on integrated planning with harmonised and systemic strategies for the short and long term; a strong local economy will result when economic gains flow to communities carrying out climate mitigation and adaptation actions.

Next we focus on some of the key insights of the analysis through a quantitative approach. We aim to provide a synthesis of the range of feedback provided on the twelve statements and questions. The full list of responses is available in [Appendix B](#) for reference.

3.1. Quantitative statement change analysis

The results of assessing the change in statements can be seen in [Table 5](#), along with the combined acceptance of both groups. As statements 1 and 2 involved multiple choice questions these do not have acceptance rates in the first round. It should be noted that statement twelve in the second round was the only time all respondents choose an answer, in all other cases at least one or two respondents choose neither agree or disagree. The share of acceptance shown here represents total 'agrees' as a share of the number of participants not responses. Those that choose 'no answer' were removed from the total.

The analysis confirms that the most significant changes were made to the statements with lowest acceptance rates, as would be expected. Taking a closer look at some of the individual statements and the acceptance rates in [Table 5](#) a number of interesting findings



Fig. 4. Four key dimensions for a low carbon and climate resilient future at local level drawn from analysis of Delphi panel responses over two rounds of feedback.

arose. Firstly, minor changes were made to statement 4 to address issues with language raised by some of the policymakers, which significantly increased the acceptance but has resulted in a statement that is more convoluted and comprising of technical terminology and terms that need careful definition (Table 6).

It highlights a trend that was observed in a number of the policymaker responses, which sought further clarity and context for what might be seen as quite ambiguous statements coming from the community such as ‘getting the basics right’. Statement 11 was one of two that were completely rewritten, which doubled its approval among policymakers (Table 7).

However, it still received relatively low approval from researchers and thus had the lowest acceptance rate in round two. The primary issue raised by researchers was questioning the ability of small-scale solutions favoured by the community to meet energy needs. This again highlights what was a common trend in response, with concerns that focusing on community issues would be insufficient in the face of a global, interconnected crisis like climate change. In contrast the complete rewriting of statement 3 resulted in it moving from the lowest acceptance rate in round one to complete agreement (Table 8). However, the detailed restructuring of that statement to align with the variety of responses received demonstrates the complexity of energy issues like transport.

Building on this valuable quantitative picture, a qualitative analysis outlined below provides additional insights to further detail

Table 5
Quantitative analysis of statement amendments and agreement over two rounds.

	Clarity of Language		Add Context	Change in Sentence Structure		Complete Change in Statement	Score	Combined Agreement RND 1	Combined Agreement RND 2
	1 or 2 Words	Multiple Words		Minor	Major				
	1	2	1	1	2	5			
Statement	1					5	5	NA	90 %
	2					5	5	NA	89 %
	3					5	5	39 %	100 %
	4		1	1			2	85 %	100 %
	5	2	1				3	75 %	100 %
	6	1	1				2	100 %	100 %
	7	2			2		4	50 %	95 %
	8	2	1				3	61 %	95 %
	9	1		1			2	100 %	100 %
	10	1					1	74 %	83 %
	11					5	5	44 %	75 %
	12	1					1	95 %	100 %

Table 6
Statement 4 original and revised.

Original	“The key to securing public support is the development and use of community ownership models.”
Revised	“One of the mechanisms to securing public support is the development of multi-actor ownership models that provide for community responsibility and gain.”

Table 7
Statement 11 original and revised.

Original	“Micro-generation and nature-based solutions should be prioritised over large-scale and hard infrastructure approaches to climate action.”
Revised	“Communities acknowledged that a range of climate actions are needed. However, a preference was stated for micro-generation prioritisation over large scale renewable generation and, where appropriate, nature-based solutions prioritisation over hard infrastructure approaches to climate action.”

Table 8
Statement 3 original and revised.

Original	“Policies targeting personal mobility should prioritise electric vehicles as a low carbon solution.”
Revised	“Sustainable transport and personal mobility will require people to have a choice of modes (including not travelling) that is (1) context sensitive, e.g. EVs for rural or remote areas and public transport and active modes (walking & cycling) for urban and suburban areas; and (2) sufficiently supported with funding and investment, e.g. adequate broadband, safe active modes infrastructure, etc; and (3) supported by societal values, e.g. flexible working arrangements.”

the narrative framings and imaginaries engaged with by our panel and communities.

3.2. Qualitative analysis of share of convergence and divergence

In theory, a high rate of stated agreement about climate action (as reflected in our results over the two round of the Delphi panel process) would imply a higher consensus and fewer barriers to implementation. However, as has been stated in the context of an Irish parliamentary committee report on climate action (Little, 2020; O’Gorman, 2020), statements of cross-party consensus on climate action can mask dissent as expressed through voting preferences; in other words, declarations of (shallow) agreement can obscure preferences of (deep) disagreement. To explore this distinction, we conducted additional qualitative analysis on the narratives and framings as found in a selection of the responses to our Delphi survey.

A number of Delphi statements for each round, together with the comments and reframing suggestions from both sets of responders, were analysed to discern the underlying narratives and framings as employed by the responders. The individual narratives and framings were then compared to determine the share of convergence or divergence amongst the responders. Whereas the quantitative analysis investigated the responders’ share of agreement or disagreement *with the Delphi statements*, this qualitative analysis explored the share of convergence or divergence *between the Delphi responders*.

Comparing the first and second round, the analysis of narratives and framings showed little change in the share of convergence and divergence, i.e. despite the changes in the Delphi statements (and corresponding changes in rates of stated agreement/disagreement), most responders deployed the same narratives and framings in the first round as they did in the second round. For example, the narrative “*It is important to integrate diverse issues (e.g. land-use, urban design, transport modal shift, climate mitigation adaptation) into a holistic long-term plan.*” was exhibited by many responders in both rounds, suggesting convergence on this issue. Another issue which

Table 9

Convergent views on “most important aspects of mobility are travel needs and settlement context rather than car technology type”.

Framing	Quote
Technology switching a red herring for mobility issues	“massive push to get people from their petrol and diesel cars and into EVs. this does nothing for congestions, road safety, sedentary community (health issues)”
Context of settlement patterns crucial to sustainability of mobility system	“Ireland is very unique in that such a large amount of the population lives in rural settings. This will require a lot of flexibility in how we approach personal mobility. EVs (or other zero-emissions technology) will likely be the most viable solution in rural settings. In smaller towns, the use of shared EVs could be a possibility. In urban areas we will need a different approach”
Non-private car solutions are important	“Others measures like travel demand management and integrating cycling with public transport are suggested [...] as bringing considerable emissions savings, at low cost and towards 2030.”

was framed in a similar way in both rounds (again, suggesting convergence) was that *the most important aspects of mobility are travel needs and settlement context rather than car technology type* – see details in [Table 9](#) below.

This qualitative analysis also revealed a diversity of framings on topics that had a high share of stated agreement with the revised statements. For example, despite a high share of agreement (90 %) with Question 3 in Round 2 (“Sustainable transport and personal mobility will require people to have a choice of modes (including not travelling).”), divergent views on exactly what long-term sustainable settlement patterns means emerged from analysis of the supporting comments. This deep disagreement centred on conflicting narratives of “*We need to plan for sustainability from the starting point of working with the settlement patterns we have*” versus “*We need to change our settlement patterns to achieve sustainability*”.

Other framings and narratives (from other questions from both rounds) that revealed divergent views included *a focus on which actions versus what system; framings of agency and responsibility; an emphasis on societal-scale change versus individual scale change; and the compatibility of economic growth and climate action*. Some quotes associated with these divergent framings are shown in the [Tables 10–13](#) below.

Table 10

Divergent views on which actions versus what system.

Framing	Quote
Question about which action to prioritise and according to what criteria	“[...] all the above issues are important to address. However, if the question is which three issues should we prioritise, I am also unsure whether this means the fastest way to reduce emissions, or tackling the most damaging industries both of which requires specialist knowledge”
Assertion that individual actions are less important than system change	“I’m also unsure what use such questions [about which areas to prioritise] are when what is required is system change”

Table 11

Divergent views on different framings of agency and responsibility.

Framing	Quote
Society must fundamentally change	“None of the above options will change fundamentally unless the economic structure of society & the linked issues of people’s jobs are addressed internationally. [...] Problem is: “society” is not really attempting yet to tackle this core problem! Without fundamental change in economy, growth continues & even with an effective switch to non-renewables in energy, the perception of an infinite resource base persists. So, continued human unsustainable pressures on the planet”
Population is too high	“Globally, population is a major contributor to [climate change]”
A hitherto neglected sector must shoulder fair responsibility	“A large focus has been put on private cars in the past, but the freight industry continues to outpace its growth, and is poses a significant challenge in decarbonisation” “Agriculture is another significant emitter which is frequently left off the hook.”

Table 12

Divergent views on societal-scale change vs individual scale change.

Framing	Quote
Societal scale	“I view land use development, settlement patterns, urban form etc to be critical in the promotion of sustainable and climate resilient societies. In this era of significant population growth, urban sprawl is no longer an option. We need to promote compact settlement with integrated transportation and land use to change movement patterns and car dependency”
Individual scale	“[What about] behavioural change?”

Table 13

Divergent views on compatibility of economic growth and climate action.

Framing	Quote
Non-growth economic activity is an unhelpfully vague concept	“remove non growth based economic activity as it is unclear what this means”
Without low/non-growth economic activity, effective climate action is impossible	“fundamental economic system reform, to embrace “low/ non growth goals (& yet still address poverty)” is critical to the effective roll out of [all listed climate action measures]”

Although qualitative and not comprehensive, the analysis of different framings and narratives suggests less consensus among the Delphi panel responders than the quantitative analysis which pointed to a high share of agreement with the Delphi statements. It thus begins to gain an understanding into the nuances behind binary agreement or disagreement that provides important insights into critical leverage points when it comes to reaching deeper consensus and agreement on complex issues of climate policy.

3.3. Imaginaries

The analysis of narratives and framings involved 'delving deeper' into precisely what and how the Delphi panel responded to the statements. A 'deeper' exploration could probe the imaginaries that different participants employed, though such an analysis could only be suggestive and would cut across individual responders.

Many of the responses emphasised the need and/or importance of particular technologies, policy instruments and/or combinations of both – these responses could be said to exemplify a socio-technical imaginary "collectively held and performed visions of desirable futures animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff & Kim, 2015).

In other responses, a civic imaginary, "the capacity to imagine alternative realities in ways which acknowledge the role of civic agents in processes of change and bring new dimensions to real world spaces and places" was present in varying degrees. Many responses posited a somewhat top-down approach to change that involved civic agents whereas other emphasised the importance of bottom-up community involvement.

4. Discussion

4.1. Reflections on the Delphi panel process

This work demonstrates that the Delphi panel approach, driven by community co-designed statements and questions, provided an invaluable exercise in shaping rich transdisciplinary engagement and co-creation practices. The process has endeavoured to provide greater flexibility within research processes to re-define roles and expectations around system change, in an exploratory upending of the traditional public consultation approach whereby decision-makers share their visions with general public for input. The work embraced a visioning process that applies a transdisciplinary approach that aims to match different visions and stakeholder needs, combining bottom-up and top-down perspectives. Moreover, this approach enabled a critical exploration of the conventional science-policy-practice nexus through the use of innovative creative communication and engagement methods.

The work unearthed a number of overarching insights and findings. The importance of clear use of language came up consistently in the initial analysis and subsequent quantitative and qualitative analysis. Many Delphi respondents suggested the intricacies of the often highly technical statements would be challenging to understand. This was clearly articulated in the quantitative analysis where clarity of language, and requests to amend or edit the terms used demonstrated the importance of a shared vocabulary of climate action. A trend that was seen in a number of the policymaker responses, which sought further clarity and context for what might be seen as quite ambiguous statements coming from the community such as 'getting the basics right'. The primary issue raised by researchers was questioning the ability of small-scale solutions favoured by the community to meet energy needs. This again highlights what was a common trend in response, with concerns that focusing on community issues would be insufficient in the face of a global, interconnected crisis like climate change. This work also highlights some of the processes that might help develop a shared vocabulary of climate action. As climate change has moved from its scientific origins into the domain of governance (i.e. policymakers) and further again into impacted communities, its language and vocabulary has changed, or at least it ought to. One example of this new vocabulary is "climate action" which has risen in parallel with the mainstreaming of climate change policy. The Deliberative Futures Workshops and Delphi panels described here show this grappling with the meanings of words. For a shared vocabulary to emerge, there is a need to move beyond territorial disputes about definitions to a transdisciplinary deliberation on collectively agreed meanings.

Finally, an overarching concern was around the idea of integration versus a more siloed or topic specific approach. Communities organically view issues such as climate in an integrated and holistic manner, in the context of perceived increased community wellbeing. In contrast policy makers can be more siloed/domain focused in their thinking due to the nature of their mandates and programmes of work. Policy makers are most often connected to specific government departments that apportion tasks in line with output orientated work programmes. This could explain why researchers were happier with the statements overall. Researchers are more comfortable with intractable complexity by nature than more practicable decision-focused policy makers. In this sense the visions and imaginaries of researchers arguably align more closely with the voice of communities. However, such a statement should be carefully qualified to avoid generalisations, as responses from both cohorts (policy makers and researchers) discussed the need for integration, albeit the research cohort raised the issue in greater frequency than the policy makers.

We found that a deeper investigation of the narratives and framing of Delphi panel respondents provided valuable insights into the nuances, and indeed messy nature, of consensus and dissent. Among the Delphi panels, there were few references to conflict or contestation as a part of climate action policy. But the presence of divergent framings and narratives suggests that despite a high share of stated agreement with many of the statements, there continues to exist deep disagreement about *what* is the best way forward and *how* to resolve these divergent perspectives; as previously cited, shallow agreement masks deep disagreement. Despite a long track record of conflict and contestation in climate action policy to-date, there appears to be low levels of awareness of contestation as an issue for future climate action policy. It is possible that this reflects a tendency among experts (i.e. policy makers and researchers) to "think top-down" rather than "bottom-up" as has been observed elsewhere (Nader, 1981; Pielke, 2007; Sweeney, 2020). This points to

the value of deliberative forums that emphasise bottom-up approaches and bottom-up thinking. Moreover, it raises a question as to what extent progress depends on unanimity of purpose and intent (Peng et al., 2021; Sobel, 2021). Deliberation, in terms of informed, other regarding, inclusive and respectful argument also highlights the need to recognise and work towards consistency around points of convergence and divergence and the establishment of preferences in a manner that accurately considers all relevant perspectives (Niemeyer & Dryzek, 2007).

Another recurring issue was in relation to the ideas of power and the potential power and complexity of unlocking and exploring narrative framing and visioning, as well as the limitations of public as imaginaries. A good example can be found in the idea of settlement patterns. We need to ask ourselves to what extent are settlement patterns “locked in” and something we must work with vs something we must address, and indeed transform, to ensure sustainability? These differing worldviews or framings were evident in responses such as: “*We need to plan for sustainability from the starting point of working with the settlement patterns we have*” versus “*We need to change our settlement patterns to achieve sustainability.*” The project unearthed the significant potential in harnessing the power of the civic imaginary, as a domain of possibility often larger than the aspirations and visions of policy makers and researchers.

4.2. Emergent themes

Situating our findings within the existing literature we find a number of key themes that present in our paper.

(Flood, Cradock-Henry, Blackett, & Edwards, 2018) discuss the importance of developing a common language to enable discussions between scientists from different disciplines and allow misconceptions, in this case in relation to climate change game design, to be resolved. A common language—as well as clear communication in terms of science input—as jargon free as possible is a critical component of effective relational learning that essential to prioritise in game design (Eisenack, 2012; Parker et al., 2016).

Within the sphere of social and political theory the work of Haugaard, examining the relationship between power, knowledge and structure, and interrogating the role of the individual within society resonated with the ideas presented in the paper (Haugaard, 1997). Moreover, Habermas’ Theory of Communicative action, as discussed by Ryan, teases out the interplay between three types of rationality: the cognitive/instrumental (traditionally associated with science); the moral or practical (connected with law); and the aesthetic or practical (most closely aligned with art) (Ryan, 2008). We can see how these framings or types are relevant when attempting to gain insight into the positioning of publics, the policy community and the research community. In our case the cognitive/instruments is most closely aligned with the research cohort, policy makers are mostly aligned with the aesthetics or practical. Communities or publics are arguably aligned with all three types of rationality.

We argue that more engaged research is needed as the current model of science informing and shaping policy is not working. Roger Pielke (2007) work, sets out the four idealised roles of science in policy and politics: Pure Scientist; Issue Advocate; Science Arbiter, Honest Broker of Policy Alternatives (Pielke, 2007). Pielke’s influential writing set the stage for extended discussion and debate, over the last 15 years or so, on how best for science to inform policy. Creating better science driven policy decisions, that include meaningful engagement with a range of ‘publics’ or ‘communities’ is a perennial question that scholars are still asking. Sobel (2021) thesis that “useable climate science is adaptation science” speaks to the frustration than many physical climate scientists (IPCC WG1 authors). Sobel suggests that mounting scientific evidence is not resulting in policy decisions reflecting the urgency of climate mitigation action needed (Sobel, 2021). Sweeney echoes this frustration, he believes that the social consensus which has characterised climate change responses in Ireland has shifted and that ‘the issues have now moved beyond science and economics to a higher plane’ (Sweeney, 2020, p32). We can then ask if a societal mandate for transformative action will lead to the requisite political will to realise the actions needed?

Related to this question of action is a literature examining how we may navigate the path from being overwhelmed by the scale and scope and wicked nature of the climate problem to positive and realisable action (Herbert, 2021; Kalmbach, Marklund, & Åberg, 2020). Herbert’s socio-ecological imagination speaks to the idea that society needs to: “... carve out more regular spaces for activists, scholars, and citizens to come together to collectively envision desired socio-ecological futures” (Herbert, 2021, p379). Kalmbach develops the idea of crisis imaginaries and the dichotomy between the so-called crisis imaginary and a hopeful, in this case technological, futures (Kalmbach et al., 2020). Negotiating this crisis space through engaging with a historical understanding of imaginaries offers a potential approach to move from a state of crisis to action. Our paper calls for more deliberative spaces, in line with Herbert’s reasoning and aims to move past the crisis thinking to empowerment though catalysing social learning with an engaged community that can articulate their voice in the corridors of power, via engaged science and policy.

4.3. Considerations for future research

We also have to be cognisant of the limitation of any study. Qualifications and caveats apply to this research study, inter alia: panel size and composition; capturing the voice of the community; subjectivity in the interpretation of the exercise; and time availability to complete. The Delphi panel (consisted of engaged researchers and policy makers) with a limited sample size of 21. The community voice was captured and articulated in statements. The project set out to reach and engage with ‘ordinary’ members of the public rather than special interest groups or political representatives to get the perspectives of the community members ‘on the ground’. However, including political representatives, NGOs, civic society in the community would have increased the diversity of sample. A limited number of the Delphi panel respondents didn’t fully understand the exercise in the first round, as they appeared not to have fully read and digested the instructions. This could be improved in future through more careful wording, and/or examples to help illustrate the instructions. The potential for researcher bias must also be acknowledged in the framing of analysis and when recasting statements. The Delphi process involves a reasonable time commitment from the panel members of approximately 3–6 h over the two rounds. The

details of comments varied across responses, as it was clear some panellists were time poor, or else felt they had provided enough detail with a limited comment. However, the full complement of panellists returned both rounds. This shows strong engagement and interest in the exercise. An added limitation to the approach taken in this research is due to the fact the iterative process did not fully convey the feedback from the Delphi panel back to the participants in local communities. This was more a logistical and resource shortcoming, linked to COVID restrictions than an actual oversight on the part of the project's program of engagement.

Digging deeper we can ask some interesting questions:

1. What would a shared vocabulary of climate action look like?
2. From what sources should it be developed?
3. How would it be developed?
4. Would deliberative forums help?
5. How can we better harness and cultivate, and give voice to the civic imaginary?
6. What is the potential, and limitations, of imaginaries to create futures?
7. How can we increase the agency and empowerment of communities while making policy decisions that need to be optimal, often over a range of scales?
8. As documented in the literature there is a perceived weakening of agency reported when discussing big picture systemic issues (Herbert, 2021; Kalmbach, Marklund, & Åberg, 2020; Mullally & Sage, 2017; Revez, Cortes-Vazquez, & Flood, 2017). How can we better articulate and realise the interplay between the so-called top-down and bottom-up nature of engagement, decision making and governance, and avoid the, often *status quo* approach of compartmentalised public participation?
9. Can concepts such as the hybrid imagination offer solutions and enrich the decision-making space to create more deliberative moments (Jamison et al., 2011)?
10. If we educate our scientists and practitioners to appreciate humanist and sociological perspectives, including the cultural and social contexts of science and technology, can we create more balanced values driven decision making?

5. Conclusion

This paper presented a novel application of the Delphi panel method using a layered research approach combining qualitative and quantitative methods. A key innovation of the approach was the generation of community statements to be subject to reflection by a (Delphi) panel of experts.

This study makes several original contributions to the literature. First and foremost, it demonstrated an exploratory upending of the traditional public consultation approach whereby decision-makers share their visions with general public for input. We also embrace a transdisciplinary approach, aiming to match different visions and stakeholder needs, and combining bottom-up and top-down perspectives. Co-creation and deliberative approaches were applied in order to explore and consolidate future visions of, and pathways to, a low carbon and climate resilient future in Ireland.

This approach enables a critical exploration of the conventional science-policy-practice nexus through the use of innovative creative communication and engagement methods. Through iterations of the Delphi feedback loop, the notion of deep and shallow agreement was explored to examine the spectrum of consensus to dissent around the co-developed future visions and pathways of climate action articulated by Irish communities.

This paper has unearthed a rich array of future directions for research and recommendations. It articulates a wider narrative in the literature on how we can 'bring people' to the climate science (Peng et al., 2021). With the publication of IPCC Working Group II, Sixth Assessment report (IPCC (Intergovernmental Panel on Climate Change), 2022) it will be interesting to see the increasing importance and evolving shape of the social sciences in the IPCC process, and climate change research and practice more generally. We know that the current model is not working and we need more engaged research (Pielke, 2007; Sobel, 2021; Sweeney, 2020). The approach adopted in this paper offers a way to bridge this gap. The interdisciplinary research team brought fresh perspectives to bear and realised the hybrid imagination.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.futures.2023.103100](https://doi.org/10.1016/j.futures.2023.103100).

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