

Title	Online stakeholder engagement to bridge the science-policy interface for marine pollution research: adaptation & evaluation of the focused conversation method and ORID framework
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Publication date	2025-06-23
Original Citation	Kopke, K, Agnew, S & Power, O P 2025, 'Online stakeholder engagement to bridge the science-policy interface for marine pollution research: adaptation & evaluation of the focused conversation method and ORID framework', Discover Oceans, vol. 2, no. 1, 23, pp. 1-16. https://doi.org/10.1007/s44289-025-00063-8
Type of publication	Article (peer-reviewed)
Link to publisher's version	https://www.scopus.com/pages/publications/105039496568 - 10.1007/s44289-025-00063-8
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Research

Online stakeholder engagement to bridge the science-policy interface for marine pollution research: adaptation & evaluation of the focused conversation method and ORID framework

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Received: 23 December 2024 / Accepted: 10 June 2025

Published online: 23 June 2025

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Abstract

This paper introduces an online adaptation of the Focused Conversation Method (FCM), demonstrating through three marine pollution projects how structured online stakeholder dialogues can inform research and support informed decision-making. The approach involved applying an ORID Framework (Objective, Reflective, Interpretive, and Decisional) implemented in six online workshops (2 per project) to engage scientists, policy experts, decision makers, research funding agencies and industry representation with focus on underwater noise (JONAS), microplastics analyses of seawater samples (ANDROMEDA), and evidenced based science communication on microplastic pollution (RESPONSE). Results demonstrated that the method could be successfully implemented to maintain high quality interactions in online environments, and facilitated structured, inclusive discussions that generated actionable recommendations tailored to each project's objectives. Participant feedback underscored the value of structured dialogue for enhancing collaboration and producing tangible outputs. The findings demonstrate the adaptability of the ORID framework and its effectiveness in online settings, offering a robust tool for stakeholder engagement. By fostering meaningful dialogue, balancing structure with flexibility, and integrating feedback for continuous improvement, the study demonstrates that online stakeholder engagement can greatly contribute to bridging the gap between marine research and relevant policy development in a meaningful way. The work underscores the importance of structured methods for advancing research relevance, influencing policy, and fostering collaboration across disciplines and sectors, with recommendations for future online stakeholder engagement strategies.

1 Introduction

This paper demonstrates the potential of structured online dialogues to integrate stakeholder perspectives into ongoing research to improve informed decision-making. The study aims to provide a practical and replicable method for online stakeholder engagement, which was implemented across three marine research projects. For the purpose of this paper, we adopt the Canfield et al. [1] definition of 'a stakeholder as any individual or entity that may have influence over, be impacted by, and/or have a vested interest in the project' and may involve governmental decision makers at different levels, industry representatives, and members of civil society [1, 2]. Kulala et al. [3] definition of stakeholder engagement has been applied to this study, whereby 'Stakeholder engagement refers to the aims, activities, and impacts of stakeholder relations in a moral, strategic, and/or pragmatic manner'.

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Stakeholder engagement to improve the marine science-policy interface and support informed decision making is widely recognised as an important aspect in diverse coastal and marine research areas such as marine spatial planning [2, 4], the development of coastal infrastructures [5, 6], or marine plastic pollution [7–10]. The International Council for the Exploration of the Sea (ICES), for example recognises stakeholder engagement as vital for improving the organisation's scientific decision-making and highlights the need for a cohesive stakeholder engagement strategy, informed by relevant data and an understanding of how stakeholder engagements occur [11]. Similarly, Black et al. [8] emphasise the important role that stakeholders have for the development of informed policy responses to address marine plastic pollution and advocate for the integration of diverse stakeholder perspectives and expertise to achieve this.

Successful stakeholder participation in European research requires incentives and capacity for stakeholders to engage with research to provide feedback, shape research agendas or actively participate in the research that is being conducted [6, 12–14]. Scientific information can inform appropriate responses to environmental issues when stakeholders perceive it as credible, relevant, and legitimate [6, 13]. Associated effective stakeholder engagement necessitates transparency, inclusivity, and expertise that supports successful communication and collaboration [1, 3, 6, 8, 9, 15–17]. To facilitate effective stakeholder engagement, it is necessary to identify both the stakeholders and a suitable participatory approach. There are many examples of participatory stakeholder approaches in marine research literature including focus groups [18, 19], workshops [20–22], the application of various dialogue techniques such as cross sectoral thematic workshops [23, 24], and policy labs [25].

In this context, the importance of including stakeholder perspectives in research that seeks to inform decision-making processes is highlighted through transdisciplinary research efforts but also challenges associated with inadequate communication and difficulties in generating evidence for policy development based on stakeholder input [1, 6, 9, 26, 27]. Furthermore, the nature and extent of stakeholder involvement can vary depending on the research area that is being addressed, the type of research organisations involved or research project, and is determined by timeframes, available resources and power dynamics [12, 28]. Here, stakeholder engagement analysis can not only help to better understand the social dimension of an environmental issue but guide more successful stakeholder interactions [6, 8, 17, 28].

Stakeholder engagement research places emphasis on informing interactions for a variety of reasons such as value creation, innovation development, advancing knowledge, informing environmental policy, or increasing social responsibility [3, 10, 29–31]. Environmental management and policy literature has added a practical dimension to stakeholder engagement research by integrating stakeholder theory and policy literature to better understand and implement stakeholder interactions [3, 32–34]. This pragmatic approach puts emphasis on the quality of interactions and the importance of dialogue and collaboration for mutual benefit [3, 32, 34].

The paper documents the adaptation of the Focused Conversation Method (FCM) for online interactions applying an Objective, Reflective, Interpretive, Decisional (ORID) framework of questioning with stakeholders in three marine research projects and reflects on the approach with a particular focus on the quality of stakeholder interaction. The FCM, developed by the Institute of International Cultural Affairs (ICA), is effective in guiding decision-making and establishing direction, especially with diverse participants [35, 36] in participatory events. The method was originally applied in the humanities however, it has been shown to be widely applicable for example in teaching and training environments [37], consumer research [36], game design [38], prioritising issues for smart farming [39] or creating co-management mechanisms for fisheries [40].

FCM is structured around the ORID framework which employs four stages of questioning: Objective (facts), Reflective (emotions), Interpretive (implications), and Decisional (actions) [36, 37, 40, 41], which helps participants to foster a deeper understanding of a topic and develop actionable outcomes as a result [37]. Within the ORID framework, the Objective questions ensure that all participants clearly understand what is being discussed, while the Reflective questions allow the participants to recognise any emotions associated with discussed content. The Interpretive questions that follow, allow participants to identify the implications of the discussed content [36, 41]. The final Decisional questions allow participants to come to informed conclusions about the discussed content, that can result in planned actions or recommendations [36, 41]. The approach allows the facilitator to guide participants to further explore a topic's significance by breaking down assumptions and allows for the transformation of assumptions by embracing multiple viewpoints to derive meaning and informed conclusions emerge from observation of various subjective opinions [37, 38].

Traditionally, participatory and stakeholder-based events, including FCM and ORID were structured and conducted as in person events [35–38]. However, the sudden outbreak of the COVID-19 pandemic in 2020 placed drastic and immediate limitations on how stakeholders could be engaged in academic research [42–44]. The restrictions on travel and implementation of social distancing, meant that in-person interaction was not possible, and researchers were required

to postpone, cancel or adapt originally planned in-person engagement activities such as focus groups [43, 45, 46] in creative and accessible ways.

The Science Communication, Stakeholder Engagement and Societal Impact (SCEI) research group at University College Cork, Ireland, led the science communication and stakeholder engagement efforts for the JONAS, ANDROMEDA and RESPONSE projects. JONAS (2019–2022), co-funded by the European Regional Development Fund (ERDF) through the INTERREG Atlantic Area Programme, focused on addressing underwater noise in the Northeast Atlantic. ANDROMEDA (2020–2023), funded by the Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans), addressed nano- and microplastic quantification and risk assessment for marine environments and RESPONSE (2020–2023), also funded by JPI Oceans, investigated micro- and nanoplastics in marine ecosystems with focus on species health, food webs, and plastic accumulation zones [9, 47–50]. Stakeholder interaction across the projects was specifically focused, but not exclusive to engaging policy and decision makers.

2 Documenting the adaptation of the focused conversation method

2.1 Online workshop context & overview

The first JONAS stakeholder workshop was originally planned for March 2020 as an in-person event to bring key stakeholders together with project partners to discuss underwater noise pollution. However, the rapid escalation of the COVID-19 pandemic necessitated a shift to an online format, requiring careful adaptation to maintain meaningful discussion and collaboration [47]. The SCEI group chose to adopt the FCM using the ORID framework for the first online workshop with the overall aim to facilitate a knowledge exchange between regulators, policymakers and underwater noise researchers to support further JONAS research activities [47]. A limited number of up to ten workshop participants were invited to ensure active contributions and balanced perspectives [47]. In April 2022, following the success of the first online workshop and positive participant feedback, the team was invited to host a second JONAS workshop [48]. This experience informed the approach for subsequent online workshops in ANDROMEDA [49, 50] and RESPONSE [9], which all took place in 2023.

All six stakeholder workshops across the three projects were held online and applied FCM with the ORID Framework to support structured dialogue and limited stakeholder participants to a maximum of ten per workshop. Table 1 highlights the thematic focus, participant types, aims, engagement purpose and methodology used within the workshops. In the JONAS project, two online workshops were organised primarily to present research findings, gather feedback, and build consensus on project research direction and outputs, while ANDROMEDA hosted two consecutive and iterative workshops in 2023, designed to assess cost-effective microplastic analysis methods and refine a predictive tool for selecting appropriate methodologies. The RESPONSE project also employed consecutive and iterative workshops but focused on improving evidence-based science communication on microplastic pollution. A key takeaway is that while each workshop was tailored to the specific thematic focus of the project—from underwater noise to microplastic pollution and science communication—all emphasised the importance of structured discussions, and actionable recommendations aiming to bridge scientific research and policy development.

2.2 Stakeholder identification & composition in workshops

The workshops identified and engaged stakeholder participants in alignment with the project workshop aims (see Table 1, Sect. 2.1). A limited number of up to 10 workshop participants were invited to each workshop to ensure active contributions and balanced perspectives [9, 47–50].

In JONAS, stakeholders were selected based on their relevance to marine policy, legal requirements, and expertise in underwater noise management. Workshop participants included governmental agencies, academic institutions, research organizations, and international bodies [47, 48]. Notable participants included government bodies such as Marine Scotland, MITECO (Ministry in Spain) and DGRM (Portuguese Government Department), alongside research organizations like IEO (Spanish Public Research Organisation), Laboratory of Mechanics and Acoustics (LMA Research Unit, France) and CNR-ISMAR (National Research Council, Italy). Stakeholder identification and selection ensured balanced representation from regulatory, academic, and research sectors to comprehensively address underwater noise challenges in both workshops, resulting in two sets of workshop recommendations documented in the JONAS workshop reports [47, 48].

Table 1 Workshops focus, participants, aims, engagement and method

Category	JONAS workshops	ANDROMEDA workshops	RESPONSE workshops
Thematic Focus	Monitoring and managing underwater noise in the northeast Atlantic	Cost Effectiveness of Microplastic analysis for sea-water samples	Science communication around marine microplastic pollution
Participants	Policy experts and Decision-makers, Regulators, Scientists and Researchers, NGOs	Workshop 1: Scientists and Researchers Workshop 2: Research funding agencies, Policy experts and Decision-makers	Workshop 1: Scientists and Researchers Workshop 2: Research funding agencies, Industry Representatives, Policy experts and Decision-makers
Primary Workshop Aim	1. Facilitate knowledge exchange between regulators, policymakers and scientists, with a focus on project outputs and results 2. Gather stakeholder input and feedback 3. Foster consensus on JONAS research and future direction of research	1. Facilitate knowledge exchange on cost-effective methods 2. Explore preliminary results with participants considering policy, legal, and regulatory needs 3. Work on recommendations relevant for scientists, policymakers, and decision-makers	1. Facilitate discussions on inaccuracies and challenges in media concerning microplastics 2. Identify barriers to effective science communication and propose recommendations 3. Encourage shared understanding and collaboration
Engagement	Engaged participants to refine research tools and outputs and inform future research	Integrated participants feedback into ongoing research and encourage collaboration between researchers and policymakers	Advanced discourse and understanding with participants on science communication for complex environmental issues
Methodology	Focused conversation and ORID used for structured feedback and consensus-building	Focused conversation and ORID used to facilitate discussions, feedback integration and to make recommendations	Focused conversation and ORID used to ascertain participants experiences, develop a common understanding and to make recommendations

ANDROMEDA engaged researchers and scientists specialising in microplastic analysis, alongside marine pollution policy experts and decision-makers, and research funding agencies that allocate funds to marine microplastic research to ensure the workshop topic is of relevance to participants and to include required expertise in the workshops. The first workshop gathered ten researchers from eight European countries to provide feedback on preliminary survey results and cost-effective analysis techniques while collaboratively developing recommendations [49]. The second workshop built on these discussions by incorporating additional presentations informed by Workshop 1 and involved policymakers and research funding agencies to explore how findings could shape policy development. Notable participants included representatives of OSPAR, JPI Oceans and the European Commission's Joint Research Centre (JRC) as well as national agencies from Belgium, Ireland and the UK [50]. The iterative engagement with workshop participants directly contributed to a scientific publication on the subject [10], with recommendations from each workshop documented in the dedicated ANDROMEDA workshop reports [49, 50].

Similarly, RESPONSE followed an iterative workshop structure that focused on improving evidence-based science communication on microplastic pollution in succession. The first workshop brought together eight European researchers that work in microplastics research, representing six research organizations, across five European countries to discuss their experienced challenges concerning science communication and elicit recommendations from a research perspective [9]. The second workshop expanded these discussions by incorporating perspectives from seven representatives of seven European organisations. Participants included policy experts, because miscommunication about microplastics has implications at policy level, funding agencies, because effective science communication needs to be resourced, and industry representatives, because providing clear, transparent, and reliable information from industry and scientific research around microplastics is essential for maintaining public trust. Notable participants included representatives from JPI Oceans, the European Environment Agency and Plastics Europe as well as national agencies from Ireland, Sweden and Spain [9]. Insights from the progressive refinement of recommendations contributed to a report on science communication, targeting audiences such as microplastic researchers and scientists, funding bodies supporting microplastic studies, policymakers and decision-makers, and professionals responsible for communicating complex environmental issues [9].

In summary, the JONAS workshops featured technical presentations that highlighted different aspects of JONAS underwater noise research and sought feedback and recommendations on various project results and outputs [47, 48]. These workshops benefited from a diverse group of participants in each workshop, to allow for a wider scope of expertise on underwater noise pollution in workshop discussions. ANDROMEDA prioritised scientific feedback and researchers' insight in the first workshop before presenting Workshop 1 findings [49] to policy and decision makers in Workshop 2 to assess cost-effectiveness from a policy and legal perspective [50]. This approach informed ongoing research and clarified distinctions between cost-effectiveness in research settings and policy and regulatory environments [10]. The RESPONSE workshops were structured to build upon each session, refining recommendations for evidence-based science communication on microplastics. Similar to ANDROMEDA, an in-depth discussion with researchers in Workshop 1 allowed their perspectives to be presented in Workshop 2, enabling further exploration and refinement of recommendations with policy and decision-makers, funders and Industry representatives [9].

2.3 Adaptation of FCM and ORID in the online workshops

All six online workshops shared a common structure. Each workshop was allocated approximately three hours, and the events were divided into two sessions with a short break in between. The first section in each workshop focused on a short introduction of the respective project (JONAS, ANDROMEDA and RESPONSE) to provide context, which was followed with in-depth presentations in relation to the thematic focus of each workshop (see Table 1, Sect. 2.1) and an open Q&A session to allow for clarification and understanding of presented information [9, 47–50]. The second section of the workshops included the facilitator led guided conversation (FCM with ORID) and took place after a short comfort break. One additional presentation was included in this section of the workshops in the 2nd ANDROMEDA and RESPONSE workshops prior to the guided conversation. Here a summary presentation of the first workshop in each project was provided to participants, as these workshops were implemented in an iterative and consecutive format (see Sect. 2.1) with the overall aim that guided conversation discussions can build upon Workshop 1 recommendations and explore these further.

The overall workshop structure and duration remained largely unchanged across all online events. However, the time allocated to the FCM and ORID sessions increased from 40 min in the JONAS workshops to 60 min in the ANDROMEDA and RESPONSE workshops. This adjustment was based on participant evaluations after the JONAS workshops (see Sect. 3). All workshops applied the FCM framework and followed the ORID question levels and while similar questions were used

in each session (see Table 2), they were adapted in each workshop to reflect the overall aim and focus. With additional time being allocated in the ANDROMEDA and RESPONSE workshops to guide participants through all ORID stages, time for individual presentations was reduced in order to maintain the maximum overall workshop duration, which was considered appropriate by workshop participants (see Sect. 3) [9, 47, 49, 50].

Table 2 outlines the steps taken within the guided conversation (FCM & ORID) in the online workshop. While the online format followed ORID levels of inquiry, some changes were necessary for practical reasons e.g. to stay within overall allocated workshop duration. In-person workshops typically include multiple Objective questions based on provided data and presented information. In the online workshops, the Objective step was condensed into a single icebreaker question, as the Q&A session that took place in the first part of the workshop provided clarification and facilitated discussions based on presented data and factual information. In the guided conversation (FCM with ORID) segment of the workshops, the objective question encouraged all invited participants to speak, fostering engagement and helping facilitators establish an inclusive tone, as objective questions are typically easy to answer [35].

In-person sessions may also have more Reflective questions than those applied in the six online workshops, where a limited number of questions was applied to maintain engagement within the allocated timeframe for the online event. Despite this reduction, the step proved to be crucial because it allowed participants to express their emotions and perspectives, fostering mutual understanding among participants in each workshop (Table 3). The Interpretive questions required more time, which is also evident in in-person settings, as responses involved deeper reflection and analysis. Allocating more time to these questions in the online setting was essential to allow participants make sense of earlier discussions and explore potential meanings (Table 3). The Decisional question stage, which is typically shorter than the Reflective and Interpretative stages (in both; in person and in online settings), is vital for generating actionable insights. The discussion in this Decisional stage allowed participants to apply their reflections and analyses, ensuring practical outcomes and a sense of closure (Table 3). Table 3 summarises JONAS, ANDROMEDA and RESPONSE workshop discussions and outcomes, which are detailed in the respective workshop reports [9, 47–50], in relation to the applied ORID level.

The ORID framework facilitated project specific discussions and recommendations. In JONAS, the workshops highlighted the urgent need for standardised underwater noise monitoring protocols and improved data-sharing mechanisms to support regulatory efforts. Participants emphasised the importance of predictive modelling and cross-sector collaboration to enhance noise pollution assessments and policy implementation. Discussions in ANDROMEDA workshops underscored the lack of harmonised microplastic sampling and analysis methods, which leads to inconsistencies in research and policy applications. The workshops concluded that cost-effective monitoring tools, increased funding for method validation, and inter-laboratory collaboration are essential for improving data reliability. The RESPONSE workshops identified gaps in public understanding and policy translation of microplastic research and emphasised the need for clearer communication strategies. Here participants recommended strengthening collaborations between scientists and policymakers, developing accessible educational materials, and implementing targeted outreach campaigns to support informed decision-making.

3 Workshop evaluation

All workshop participants were given the opportunity to provide feedback through post-workshop evaluation surveys that were prepared and distributed via Typeform. Each survey included three distinct feedback methods: a five-point Likert Scale with responses ranging from 1 to 5 (Where 1 means 'Strongly Disagree' and 5 means 'Strongly Agree') (Table 4), a multiple-choice question (Table 5), and open-ended questions and comment. These workshop evaluation surveys aimed to gauge the participants overall workshop experience and provide feedback in relation to the quality of the interactions (Tables 4, 5). Individual workshop evaluations are documented in the JONAS workshop reports [47, 48], the ANDROMEDA workshop reports [49, 50] and the RESPONSE Science Communication of Marine Plastic Pollution report [9]. Prior to disseminating these reports publicly, draft reports were shared with workshop participants to ensure individual workshop report content was agreed upon with all participants, which included participant input in relation to the workshop evaluation process.

The workshop evaluation process [9, 47–50] allowed the SCEI team to maintain quality of, or improve relevant aspects of in the subsequent workshops. For example, the post-evaluation surveys undertaken in JONAS informed and improved the design and implementation of the ANDROMEDA and RESPONSE workshops. Overall, the evaluations [9, 47–50] helped to identify areas that worked well i.e. overall event duration, organisation, presentations and workshop relevance

Table 2 ORID questioning framework and its application in online workshops

Step	Focus	Purpose	Online question
Objective	Data, facts, and external reality	Establish common ground and ensure coherence in later discussions	What is your name and affiliation/relationship with <i>the subject matter</i> (i.e. Underwater Noise Pollution or Micro-plastics)?
Reflective	Personal connection to the topic	Encourages participants to express emotions and associations with the topic	- Can you please state a positive aspect and a concern that you can share regarding today's presentation? - Do you feel confident or doubtful about the presented approach's ability to address <i>the subject matter</i>?
Interpretive	Meaning, significance, and implications of the topic	Helps participants analyse perspectives and explore strengths, weaknesses, and alternatives	- Where do you see potential strengths and weaknesses in the presented approach? - How could the identified weaknesses be addressed moving forward?
Decisional	Resolution, implications, and future actions	Facilitate consensus-building and decision-making based on discussions	- What data or information would support informed and effective decision-making in relation to <i>Subject Matter</i>? - What recommendations do you have for policymakers and decision-makers based on the discussion in this workshop?

Table 3 Summary of Workshop Discussion and Outcomes in relation to the ORID steps

Projects	JONAS	ANDROMEDA	RESPONSE
Steps			
Objective	Participants discussed challenges in monitoring, including data standardisation across regions	Participants discussed the limitations of current monitoring due to inconsistent sampling and analysis techniques, as well as the high costs of existing methods	Participants discussed the disconnect between scientific research and public understanding, alongside challenges in implementing evidence-based policies
Reflective	Participants expressed concerns over the growing effects of noise on marine life and the lack of regulatory frameworks	Participants highlighted the need for harmonised methodologies and cost-effective tools for large-scale implementation	Participants stressed the importance of evidence-based science communication to address misinformation and greenwashing
Interpretative	Discussions emphasised the importance of improved data-sharing platforms, predictive modelling, and cross-sector collaboration, as well as exploring alternative underwater noise monitoring approaches for large-scale implementation	Discussions underscored the need for harmonised, accessible and cost-effective monitoring tools for large-scale use, along with increased collaboration between laboratories	Discussions focused on the need for improved science communication strategies, targeted messaging, and stronger stakeholder engagement to bridge gaps between research and public understanding of micro-plastic pollution
Decisional	Recommendations included to develop standardised protocols, to increase funding for long-term studies, and to develop stronger partnerships for data-driven policy decisions, with a call for more international cooperation	Recommendations included to develop approaches that are widely accessible and feasible, to enhance inter-lab collaboration, and to allocate funding for method validation and broader application of the tool by incorporating more environmental factors	Recommendations included to create more accessible educational resources, to refine messaging to combat misinformation, to improve collaboration between scientists and policymakers, and to launch public outreach campaigns that drive informed decision-making

Table 4 Average score of workshop participants responses per project based on the five-point Likert Scale evaluation methos employed, with responses ranging from 1–5 (Where 1 means Strongly Disagree and 5 means Strongly Agree)

Statements	JONAS Avg. Score	ANDROMEDA Avg. Score	RESPONSE Avg. Score	Meaning
The duration of the online event was right	5	4.6	4.5	Respondents felt the duration was appropriate
The online event was well organised	5	4.7	4.9	Events were perceived as well-organised
The presenters communicated information clearly	4.8	4.9	4.7	High clarity of information presented
The presenters made the subject matter compelling	4.8	4.6	4.4	Engaging and compelling presentations
The online event was relevant to your work	4.6	4.6	4.3	Events were relevant to most participants' work
Your participation will influence your future work	3.6	3.7	3.9	Some respondents felt participation may influence future work
The workshop supports your engagement with people in the same field	4.2	4.1	3.8	Respondents agreed the workshops fostered peer engagement

Table 5 Workshop participant feedback from Multiple-Choice Question per project with choice of one category per participant to indicate which aspect of the workshop they found most useful for their purpose of attending

Category	Presentations	Q&A	FCM/ORID	All Aspect
JONAS	–	–	1	10
ANDROMEDA	6	1	2	7
RESPONSE	–	–	5	9

(Table 4), and areas that would benefit from improvement within and across the projects through Open-Ended feedback options.

A total of 41 respondents across JONAS (11 out of 19), ANDROMEDA (16 out of 18), and RESPONSE (14 out of 15) provided feedback. Across all projects, participants rated organisation, clarity of presentations, and relevance highly. Table 4 shows the consolidated feedback from Likert Scale assessments per project:

Survey participants were also asked, which aspect of the workshop they identified as most useful for their purpose of attending the workshop via a Multiple-Choice Question (Table 5). Participants were given the option of selecting one category only (Presentations, Q&A, Guided Conversation with FCM/ORID or All Aspects) to determine participants preferences.

Across all projects 26 out of 41 survey participants selected 'All Aspects' of the workshops as being most useful for their purpose of attending and eight specifically selected 'Guided Conversation with FCM/ORID', which indicates that using this approach within the workshop was recognised as positive and beneficial by survey participants. The most variation for this question was recorded in the ANDROMEDA workshops, where several participants selected 'Presentations', while nearly all JONAS workshop survey participants selected 'All Aspects'. Most of the RESPONSE workshop participants also selected 'All Aspects', however several survey participants selected the 'Guided Conversation with FCM/ORID' category only (Table 5).

In the Open-Ended feedback options of the evaluation, participants detailed their appreciation of the structured discussions and guided conversation (FCM with ORID) aspects of the workshops, the clarity of presentations, and engagement opportunities [9, 47–50], indicating that discussion, dialogue and collaboration were perceived as important and successful by survey participants. Suggestions for improvement included to extend discussion time and to incorporate additional topics [47, 48] or to consider using tools like Mentimeter and Slido [49] and to share material, questions or results in advance to deepen discussions [9, 49]. Further suggestions highlighted participants interest in attending future workshops before research commences to allow for policy and decision maker input from the start of a study [50] and to consider involving citizens in future workshops for broader perspectives on workshop subject matter [9].

The participant evaluation after every workshop highlighted areas that worked well, which were applied in subsequent workshops i.e. workshop duration, organisation and workshop structure [9, 47–50]. Furthermore, the evaluation also highlighted areas that could benefit from modification, specifically through the Open-Ended feedback options, which allowed the team to make incremental changes to improve participant's experience. These changes included adding more topics relevant to the subject matter, which was implemented in JONAS Workshop 2 [48] based on JONAS Workshop 1 evaluation [47] and reducing the length of presentations in the ANDROMEDA and RESPONSE workshops [9, 49, 50] to increase time for discussion in the FCM with ORID part of the workshops based on both JONAS Workshop evaluations [47, 48].

4 Discussion

4.1 The focused conversation approach and ORID framework in the online workshops

The online workshops represent a series of successful, iterative efforts that addressed critical marine environmental issues. The study shows that online workshops can be a valuable contribution to engage stakeholders in ongoing research processes, specifically if they are aimed at informing policy and decision-making and when participation in face-to-face events is constrained. Such constraints may include environmental considerations (i.e., increased efforts to reduce the carbon footprint associated with travel), logistical and temporal limitations, financial restrictions related to hosting in-person gatherings, or externally imposed travel restrictions. The here presented online

workshop format can mitigate such barriers and offers an alternative that still supports inclusive participation. Importantly, online workshops can increase the likelihood of engaging targeted stakeholders who might otherwise be excluded due to the aforementioned constraints, which was evident in the presented study, where the virtual format enabled participation across multiple organisations and countries, thereby enriching the diversity of perspectives within the workshops.

A key aspect of the workshops was the structured conversational method, specifically the ORID framework, which proved instrumental in facilitating collaborative discussion and consensus-building between the researchers in the projects and among stakeholders, including policy and decision makers in the online environment. FCM with ORID allowed participants to critically examine a topic with each other, which in turn allowed to deconstruct individual assumptions and to integrate diverse perspectives [37, 38] into workshop recommendations. The approach promotes participants collaboration, while many other online formats e.g. webinars, place participants into a predominantly observational role with limited opportunity to interact with each other i.e. via chat function.

A unique feature of the online workshops was the emphasis on full-group discussions with a smaller number of workshop participants (maximum of 10) rather than splitting larger groups of participants into several smaller breakout groups. This decision was deliberate, based on the understanding that small group conversations foster greater cohesion, allowing for consensus building with everyone in the workshop and a continuous exchange of ideas. By avoiding breakout groups, which invariable break momentum and don't offer full transparency to all participants regarding issues raised, the workshops were able to maintain a consistent flow of dialogue with everyone, allowing for greater inclusion of diverse perspectives. This focus on full-group discussions not only encouraged equal participation but also ensured that all voices were heard by everyone that participated, which is particularly important in multi-disciplinary and multi-sectoral settings.

The ORID framework was consistently applied across all six online workshops, providing a clear and structured process that also ensured all participants could engage with the content. The structure allowed for open dialogue and encouraging participants to share diverse perspectives while maintaining focus. The collective decision-making process fostered by the ORID method was particularly effective in reaching consensus on workshop recommendations, detailed in the workshop reports [9, 47–50] and summarised in Table 3. Furthermore, the interactive nature of the workshops ensured that the outcomes were grounded in the collective expertise and perspectives of all participants.

For instance, in the JONAS workshops, the ORID framework helped identify key issues such as data standardisation challenges and the growing impacts of underwater noise on marine life. As participants progressed through each ORID stage, they were able to reflect on these concerns, analyse implications, and develop actionable recommendations, such as the need for standardised monitoring protocols and enhanced international cooperation [47, 48]. Many challenges and recommendations are being addressed by research that commenced after JONAS concluded i.e. in the SATURN project, which has advanced standardised terminology, harmonised acoustic metrics and test signals, and developed guidelines for sound particle motion mapping [51]. The authors are not claiming a direct link from the JONAS workshop discussions to funding being allocated to subsequent research that aligns with JONAS workshop recommendations but would like to highlight that collaborative stakeholder engagement and the research in JONAS would have contributed to inform what research areas to prioritise.

In ANDROMEDA, the iterative use of ORID allowed participants to explore cost-effective microplastic analysis techniques, with discussions evolving across two workshops. The interpretive stage, where participants assessed the strengths and weaknesses of the proposed techniques to assess cost, was particularly fruitful, leading to recommendations that included development of accessible and feasible approaches, to enhance inter-lab collaboration, and allocate funding for method validation and broader application incorporating more environmental factors [49, 50]. In the RESPONSE workshops, ORID structured discussions identified public understanding and policy translation challenges, highlighted miscommunication concerns, emphasised targeted messaging and stakeholder collaboration and in the decisional stage led to recommendations that focused on developing educational resources, refined messaging, and outreach campaigns to support informed decision-making [9]. In all the workshops, ORID was not only a means of organising discussions but a tool for drawing out actionable insights. By moving from factual observations to emotional and interpretive reflections, and ultimately to decisions, the workshops achieved a better understanding that informed both ongoing research and policy recommendations. This structured approach also helped navigate the complexities of online engagement, ensuring that even in a virtual setting, the workshops remained productive and collaborative.

4.2 Workshop evaluation

The evaluation of the workshops provided insights into both strengths of the methods employed and areas that required improvement. Feedback gathered from participants consistently highlighted the perceived value of the focused conversations with ORID. Overall, evaluation results (Sect. 3) across all three projects pointed to high levels of satisfaction with workshop organisation, clarity of presentations, and the relevance of the content (Table 4). However, responses varied regarding the influence of the workshops on participants' future work, suggesting that while the workshops were perceived positive, understanding the workshops longer-term influence could be strengthened. Overall, the inclusion of the initial ice-breaker question may have mitigated for any initial discomfort of participants in engaging with the workshop topic through the FCM with ORID and together with the relatively small participant group size per workshop allowed for comfortable interactions amongst the participants. All stakeholders participated throughout all six workshops and engaged in the guided conversation discussions. This experience in all workshops in combination with positive post workshop evaluations were a strong indication to the team that all participants felt comfortable in the online workshops.

The evaluation of the workshops provided several insights. First, there is a clear need for balancing structured facilitation with flexibility to allow for organic dialogue between participants and to accommodate the unique dynamics of each group. While ORID provided a clear framework, it was important to allow for dialogue and reflection, which in its nature is more interactive than for example a webinar, a Q&A session or an online poll. This was particularly important in the interpretive stage, where participants analysed complex issues together. Second, the importance of ensuring sufficient time for reflection and discussion was highlighted across all three projects. Participants repeatedly emphasised the value of having adequate space to process information, share perspectives, and engage in meaningful dialogue. In JONAS, for instance, participants requested additional time for in-depth discussions, which was integrated into subsequent workshops in ANDROMEDA and RESPONSE.

Another important takeaway is the value of providing pre-workshop materials. Participants in workshops suggested that receiving materials such as background information or survey results in advance would enable more informed contributions and allow for deeper engagement during the sessions. This practice could be beneficial in future workshops, ensuring that participants come prepared and are able to contribute in a more meaningful way. The evaluations of the JONAS, ANDROMEDA, and RESPONSE workshops illustrate the importance of feedback to maintain and improve quality in the design and delivery of online workshops. Key lessons—such as the need for preparation, balanced time allocation, and inclusivity—offer insight for implementing future online engagement that is engaging, productive, and impactful.

4.3 Lessons learned & conclusions

The application of FCM with ORID in the six online workshops demonstrates the methods versatility in engaging diverse stakeholder groups across different subject areas, which has been documented for in person events in the literature [35–38]. In turn, the forced shift to online formats during the COVID-19 pandemic underscored the importance of adaptability in stakeholder engagement. The successful delivery of structured, meaningful discussions using the ORID framework demonstrated that virtual platforms can effectively facilitate dialogue, knowledge exchange, and collaboration in an accessible manner [9, 47–50]. The method provided a systematic framework; by moving from Objective to Decisional questions, participants were able to clearly understand the topic, were able to reflect on implications, and subsequently collaboratively develop recommendations. The approach mitigated communication barriers, ensuring that diverse perspectives were heard and integrated into the workshop reports and recommendations.

The identification and recruitment of relevant stakeholders was important to the online workshops, as participants were aligned to the specific goals of each project, thus the workshops ensured that discussions remained relevant and facilitated tangible contributions, while achieving targeted outcomes. Post-workshop evaluations played an important role in refining the workshop format, with participant feedback emphasising the importance of pacing, clarity in instructions, adequate discussion time, and the provision of pre-event materials to enhance stakeholder preparedness and engagement. The feedback collected through the Open-Ended feedback options allowed the team to implement incremental changes to the workshop structure to improve the quality of interactions in later workshops.

The successful adaptation of the FCM with ORID to online settings for marine pollution research projects, demonstrates its robustness as a tool for structured stakeholder engagement. Across JONAS, ANDROMEDA, and RESPONSE,

the online workshops achieved their goals of advancing knowledge exchange, gathering stakeholder input, and developing actionable recommendations [9, 10, 47–50]. The workshops produced workshop reports, that provided direction and feedback for the projects themselves, while updating and informing the wider stakeholders communities of the projects. The reports were made publicly available and summarise the workshop discussions, findings and include recommendations that can inform ongoing and future research on marine pollution topics. For instance, the ANDROMEDA workshops fed directly into a peer-reviewed publication [10] that detailed cost-effective microplastic analysis approach, providing a foundation for adapting these findings to other contexts. The here documented experiences for online workshops, can provide a roadmap for adapting stakeholder engagement methods to online settings with key conclusions as follows:

Online Platforms can be effective for stakeholder engagement but require strategic planning: The experience highlighted that meaningful engagement could occur in virtual settings, if workshops are well-structured, clearly communicated, and tailored to participants' needs. Applying ORID in an online setting, combined with careful facilitation, ensured productive discussions and collaborative outcomes.

Stakeholder engagement improves research and policy relevance: Involving stakeholders in research ensures that outputs are credible, relevant, and legitimate, as stakeholders provide real-world insights and feedback. The JONAS workshops, for instance, helped refine research outputs, in ANDROMEDA the workshops influenced and improved direction of ongoing research and the RESPONSE workshop discussions and recommendations provided a focal point for a tangible and accessible project report catering for science communicators, researchers, funding bodies and policy makers alike.

Structured dialogue ensures flow of communication: The ORID framework enabled participants to move from observation to action, fostering a shared understanding of complex marine issues. The systematic approach helped overcome common challenges in stakeholder engagement, such as power imbalances and communication barriers, by creating a space for open, inclusive dialogue.

Evaluation and iteration are critical for success: Continuous evaluation and incremental improvements based on participant feedback strengthened the effectiveness of the workshops over time. Clear instructions, sufficient time allocation, and pre-event materials were identified as key factors that can enhanced stakeholder engagement in online workshops.

Collaboration across disciplines and sectors is essential: The workshops underscored the value of collaboration between scientists, policy and decision makers, research funding organisations and industry representatives in addressing marine environmental challenges. Such cross-sectoral engagement can foster innovation, align research with policy needs, and support the development of practical solutions.

4.4 Future research opportunities & limitations of this study

This study is subject to certain limitations, notably the exclusion of an evaluation of policy impact and the implementation of its outputs, which were beyond its intended scope. Extended timelines characteristic of policy processes from the formulation of recommendations through consultation and review to eventual implementation make it difficult to assess the immediate impact of workshop outputs at the policy level. However, such challenges highlight a valuable direction for future research, particularly studies that trace the influence of such participatory processes on policy development over time. Furthermore, the workshops were designed to address the specific needs of the research projects, with stakeholder identification tailored to each session's objectives to ensure topical relevance. As a result, the approach was not tested with broader stakeholder groups, such as the general public, nor was it evaluated in comparison to other structured engagement methods. This presents an opportunity for future research to compare the online events using FCM with ORID with alternative approaches such as the Delphi technique, World Café, or Nominal Group Technique, across a range of settings, including both in-person and online formats. Future studies could also explore the applicability and limitations of ORID when engaging diverse stakeholder groups, including underrepresented economic sectors or the general public, and assess the relative effectiveness of these methods in fostering inclusive, participatory dialogue.

Author contributions Kathrin Kopke wrote the main manuscript and Sonya Agnew and Orla-Peach Power reviewed the manuscript. All authors were involved in the peer review process.

Funding The research was been funded during three research projects, in the JONAS project through the INTERREG Atlantic Area funding mechanism and in the ANDROMEDA and the RESPONSE projects through the Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans), and specifically the Marine Institute in Ireland.

Data availability The datasets analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate No ethical approval was required as relevant data and information such as the individual workshop content, structure and evaluation have been published in referenced workshop reports and were approved by workshop participants to share publicly. Informed consent was obtained from all individual participants of the workshops to include and analyse obtained information for the purpose of improving future workshops, to share relevant information in respective workshop reports and for peer review publication about the workshops.

Consent to publications Not applicable.

Competing interests The authors have no competing interests as defined by Discover, or other interests that might be perceived to influence the results and/or discussion reported in this paper.

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