Environmental Communication

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/renc20

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To cite this article: Artem Antonyuk, Vera N. Minina, Alexander Pivovarov, Kseniia Puzyreva & Nikita Basov (26 Nov 2024): The Space of Coordination: Accounting for Multiple Expert Knowledges in Environmental Communication, Environmental Communication, DOI: 10.1080/17524032.2024.2429729

To link to this article: https://doi.org/10.1080/17524032.2024.2429729

ENVIRONMENTAL COMMUNICATION
https://doi.org/10.1080/17524032.2024.2429729

Routledge
Taylor & Francis Group

RESEARCH ARTICLE

The Space of Coordination: Accounting for Multiple Expert Knowledges in Environmental Communication

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ABSTRACT

Activists, private companies, and nonprofits increasingly address environmental issues along with scientific and governmental bodies, each bringing valuable experience and original perspectives. However, the growing diversity of expert knowledges in environmental communication may complicate policy development and implementation. To help address this issue, we propose an account of environmental communication as a dynamic space involving multiple expert knowledges. To enable this account, we offer a computer-assisted mapping technique relating these knowledges to each other at various time points. We illustrate the proposed approach with a case study on flood risk management in the UK, where diverse expert groups have been engaged in a shared communication space which enabled coordination of their knowledges over time. Researchers can use the proposed technique to trace knowledge dynamics in environmental communication. Communication practitioners can use it to map thematic areas that experts specialize in, identify knowledge gaps, find relevant documents, and facilitate expert communication.

ARTICLE HISTORY
Received 1 March 2023
Accepted 9 November 2024

KEYWORDS
Communication space; expert knowledge; flood risk management; topic modelling

Environmental problems are complex natural, social, and technical phenomena involving multiple levels and sectors of society (Hedlund et al., 2021). The participatory approach to environmental policymaking increasingly stresses the importance of engaging knowledgeable practitioners (Nowotny, 2003), whose expertise extends beyond that of policy-makers (Hardoš, 2018). They can contribute valuable insights and additional perspectives on planning, coordination, financing, education, and citizen participation (Sprain & Reinig, 2018). Accordingly grows the recognition of the relevance of "knowledges" (Holmes & McEwen, 2020) of experts, such as non-governmental organizations, consultancies, businesses, and local activists, which address environmental challenges in practice (Sprain & Reinig, 2018).

At the same time, communication barriers are inevitable between diverse experts, which often result in misunderstandings (Brulle, 2010) and delayed action. These challenges are further complicated by the questioning of the authority of government agencies (Pearce et al., 2017), disagreement among experts (Boholm, 2009; Hardoš, 2018), uncertainty about policy measures and their

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The Centre for German and European Studies was operational until 30 June 2024.
Supplemental data for this article can be accessed online at https://doi.org/10.1080/17524032.2024.2429729.

predicted outcomes (Boholm, 2009; Daviter, 2019), and increasing specialization (Hardoš, 2018). Ultimately, this results in a lack of coordination between expert knowledges (Martin, 2007) and may lead to inefficient and fragmented policies (Daviter, 2019; Zarb & Taylor, 2023).

To gain insight into the barriers to and means for communication about environmental problems and policies, environmental communication scholars study frames, discourses, and narratives employed by experts (Baake & Kaempf, 2011; Leipold et al., 2019). Simultaneously, studies usually assume communication to be linear, unidirectional (e.g. from policymakers to others), and dyadic (e.g. between public and private sectors, or between science and policy), overlooking the diversity of experts and their multiple knowledges reported by others (Boholm, 2009; Martin, 2007). In communication campaigns, the failure to account for how multiple expert knowledges coexist and co-evolve can lead to unintended consequences, such as the questioning of scientific evidence (Boholm, 2009), misinterpretation of policies or their irrelevance to the local context, confused action, or inaction.

Recent analytical solutions dealing with multiple perspectives, such as discourse network analysis (Fisher & Leifeld, 2019) or the discursive agency approach (Leipold & Winkel, 2017), usually start deductively with a manual coding of statements about environmental beliefs in policy discourse. These methods are insightful when the following conditions are met: the problem area is well-established, its knowledge base is agreed upon by participants and researchers, the area of expertise is rather narrow, and the time span of the study is short. However, studies of emerging, declining, or otherwise highly dynamic problem areas of transforming/contested practice-driven knowledge involving diverse expertise, especially over long time spans, require inductive methods that rely on computational mapping of texts prior to researchers' interpretations (see Basov et al., 2021). In this context, researchers of environmental policies call upon open-ended methods that incorporate loosely structured perspectives, are sensitive to agency and practice, and can assist human interpretation by mapping patterns in large bodies of text data (Leipold et al., 2019).

To bridge this gap, we relied on the sociological field theory to propose an account of environmental communication as a shared dynamic space involving multiple experts with their multiple knowledges. The communicative dynamics of environmental knowledge in this space is complex, as expert knowledges simultaneously diverge (Boholm, 2009; Hardoš, 2018) and get integrated (Sprain & Reinig, 2018).

To enable capturing of these complex dynamics and answering the question of *how multiple expert knowledges relate to each other over time in a dynamic shared communication space*, we propose a computer-assisted technique for inductively mapping and visualizing mutual positions of expert knowledges based on textual documents produced by experts.

We illustrate our proposal by analysing the space of environmental communication on flood risk management (FRM). Successful implementation of FRM relies on participatory communication of multiple knowledges on environmental, socio-economic, technical, and regulatory aspects of flooding. This is particularly important to improve resilience, especially for residents who may not be aware of their vulnerability to flooding or have insufficient understanding of policies and protection measures (Holmes & McEwen, 2020). Furthermore, FRM demonstrates communication about environmental risks that goes beyond the one-way and dyadic models (Boholm, 2009).

Our study focuses on the case of FRM in Shropshire County, UK. Over the last decades, the UK has suffered several serious flood events that have significantly damaged the livelihood of thousands of people, as well as businesses and infrastructure. To address the problem of flooding, the government cooperated with research institutions, private companies, non-governmental organizations, and local activists. The analysis reveals how the UK government encouraged and facilitated their engagement in communication on FRM, enabling the coordination of diverse expert knowledges to develop a joint societal response to the complex environmental challenge. This process has taken a long time, encountered many obstacles, and is not yet over. Its analysis using our approach

yields insights on how diverse interests and perspectives on environmental problems can be accommodated to stimulate knowledge coordination in a shared communication space.

The paper is organized as follows. The next section lays out the foundations of our idea of a space of communicative coordination between growingly diverse expert knowledges. This is followed by a presentation of our case where FRM experts in the UK, we argue, managed to create such a space of coordination. After that, we describe the dataset and the proposed knowledge mapping technique capturing the mutual dynamics of multiple expert knowledges. We then present the results of applying this technique to our data and of our subsequent analysis of expert knowledges' coordination over time, enabled by the mapping. Finally, we present the key takeaways of our analysis for environmental communication research and practice, and outline the ways our approach can be used by researchers and practitioners in the field.

The diversity of expert knowledges and the space of communicative coordination

Expert knowledge is a generalized description of a practical area that aims at informing solutions to practical problems (Sovacool, 2008). Since environmental problems are embedded in natural, technical, and social contexts, experts need to take into account local communities' understanding of the environmental situation, technical systems' conditions, and social capacities to suggest locality-relevant courses of action (Sprain & Reinig, 2018). At the same time, expert knowledge is "focused on universalizing prescriptions" to address different audiences, in contrast to lay knowledge, which is "embedded in the world, shared and developed informally within social groups and communities" (Sprain & Reinig, 2018, p. 359). When the optimal balance between relevance to practical problem-solving and applicability across local settings is achieved, expert knowledge gains the authority to guide actions in addressing problems.

Traditional expertise in environmental problems has been associated with publicly funded science identifying basic problems and informing engineering-based solutions. However, this view has been challenged (Leipold et al., 2019) by the growing realization that technical measures alone are insufficient for tackling flooding (Koks et al., 2015). Owing to the increasing complexity of environmental problems, a rising number of participants, such as private companies, non-governmental organizations, consultants, and activists, become involved in expert knowledge creation by providing valuable alternative solutions and approaches (Pearce et al., 2017; Sigalla et al., 2021). The value of their knowledges is conditioned by their closeness to local practice, deliberations with established experts, consultations with local communities, training, and hands-on experience with environmental issues. These knowledgeable practitioners are increasingly recognized as legitimate experts (Fischer, 2000) whose knowledge competes with that of governmental agencies. Ultimately, this constitutes a diversity of specialized and, in some cases, integrated expert "knowledges" (Holmes & McEwen, 2020) on environmental problems. Specialized knowledges are based on closely related ideas from a specific domain (such as engineering), while integrated knowledges combine heterogeneous ideas from different domains (such as engineering and hydrology or public administration and finance) (Carnabuci & Bruggeman, 2009).

Simultaneously, epistemological systems and roles in environmental knowledge creation become increasingly blurred, and disagreements often arise among experts (Boholm, 2009). This poses the challenges of identifying knowledge gaps, building common ground, and developing the interfaces of mutual understanding, which makes the successful management of environmental problems dependent on the arrangement of communication between experts (Fabricius et al., 2006).

An analysis of communication between diverse knowledges can be inspired by a spatial perspective, such as the one offered by the sociological field theory. This theory emphasizes coordination between competing participants occupying different positions in a professional area. In line with this theory, norms and rules shared by experts enable communication between them despite differences in their knowledge (Fligstein, 2001; Fligstein & McAdam, 2012) and access to power and

resources. For instance, common platforms for discussions are established, where different experts can express their different understandings of environmental problems and associated risks, even if they challenge the knowledge of more powerful experts. The latter, then, often take the role of facilitators of communication rather than producers of the only "true knowledge". They help field participants to express their understandings of the environmental situations based on common interest in solving an issue, despite the differences in knowledge bases (Zietsma et al., 2017).

Based on this view, we propose to consider environmental knowledge communication as a heterogeneous and multicentred space, where – guided by shared norms and rules of communication – expert knowledges are publicly expressed in the form of documents that reflect experts' contributions to the understanding of environmental issues, related risks, and activities. Such expressions are then broadly discussed and negotiated in multi-expert meetings, to inform follow-up documents. We posit that such communicative coordination of expert knowledges leads to their integration and/or interrelated specialization over time (Oberg et al., 2017).

Empirical illustration: communication of expert knowledges on FRM in Shropshire, UK

Research setting

For a long time, the English government addressed FRM issues in a top-down manner. However, since the influential Pitt Review recommended to involve affected communities in policy development, local residents and other experts have become increasingly active in knowledge production and communication. As a result, the government's role has shifted from solely providing information to facilitating communication between expert groups.

The Flood and Water Management Act of 2010 (FWMA) formalized the new approach (see a detailed description of the roles of experts in the UK and Shropshire and patterns of communication between them in Appendix A of the supplementary material). This Act presupposes that various risk management authorities (RMAs) implement a range of FRM policies and activities in England. The RMAs are the Environment Agency (EA), Lead Local Flood Authorities (LLFAs) (unitary authorities or county councils), National Highways, water companies, internal drainage boards, and district and borough councils. Besides, local community groups engage in FRM.

To fulfil their obligations for managing flood risks, the national and local authorities produce flood risk maps, assessments, and investigations, neighborhood plans, and instructions for local communities – often in collaboration with private consultancies. Active nonprofits such as the National Flood Forum (NFF) reach out to local communities across the UK and provide information on how to set up local activist groups and increase flood awareness. Local community activist groups, in turn, develop working plans, survey flood-prone areas, gather information from local residents and help them orient before, during, and after a flood event (Puzyreva et al., 2022).

In accordance with the inclusive and decentralized model of communication set out in the Flood and Water Management Act 2010, the experts cooperate with each other and share information, while allowing flexibility in the type of partnerships they establish. When coordination is necessary, experts communicate through various means, such as face-to-face multi-agency meetings, public consultations with residents, workshops, and training sessions. In order to facilitate long-term collaborations, experts establish partnerships and engage in ongoing communication through meetings, emails, and the collaborative development of reports.

Shropshire, as a historically flood-prone area, represents an exemplary setting for studying the interplay between knowledges of multiple experts from different societal sectors. It experienced serious floods in the recent decades, leading to increased activity of authorities and other experts. We expect that the documents produced by the experts will demonstrate how expert knowledges are coordinated over time in the multicentred FRM communication space.

Data

To study the coordination of expert knowledges over time, we rely on expert documents relevant to FRM in Shropshire. We obtained the documents through an exhaustive search of websites of relevant FRM experts in the UK and Shropshire. The search encompassed general and case-specific official FRM documents, including laws, strategies, plans, reports, leaflets, and other expert texts. The general documents are authored by EU bodies that establish overarching rules, as well as by one or more core official UK agencies (e.g. the EA) responsible for translating the EU regulations to address FRM issues on a large geographical scale – in the country, region, or river basin. The case-specific documents are authored by (1) an official local flood management authority (e.g. county council), and/or (2) a local branch/office/representative of a country-level agency, and/or (3) organization(s) actively involved in FRM in the region of study (e.g. NGOs, universities and/or other scientific institutions, water companies, and flood risk assessment contractors). These documents address issues in relation to the area under study at different levels, including land, county, town, and village. To focus on the most authoritative, potentially widely shared, and influential documents on the general questions of interaction of FRM participants, we excluded those aimed at specialists, such as technical appendices to reports.

The corpus comprises 83 documents published between 2000 and 2020 and created by 32 experts relevant to FRM in Shropshire. To facilitate analysis, we grouped the experts according to the societal sector to which they belong. The sectors include local, national and EU government, private companies, nonprofit, academia, and local communities (see a list of experts by group in Table B1 in Appendix B of the supplementary material). The study period starts in 2000, the year of adoption of the groundbreaking EU Water Framework Directive, which has informed much of the subsequent FRM efforts in England. The upper boundary is the year of data collection. The document sizes range from approximately 100 to about 215,000 words, totalling over 900,000 words.

The documents cover various aspects of expert knowledges on FRM. This includes the main notions associated with floods and related environmental, technical, and social phenomena, descriptions of key issues in FRM, guidelines for flood risk assessments, prescribed roles and activities of the involved experts, and practical advice on FRM activities – mostly at the national level and in Shropshire.

Overall, the corpus is suitable for studying expert knowledges on FRM as it is vast, represents relevant experts, and covers a significant time frame during which the FRM system in the UK developed, including the periods of transformation towards a more inclusive model of FRM communication. Here and on, we refer to this set of documents as the "whole corpus". To enable reproducibility of our analysis, Tables C1–C3 and Figure C1 in Appendix C of the supplementary material provide detailed information about the corpus. After compiling the whole corpus, to enable detailed analyses, we created three subcorpora based on one of the two criteria: collaboration between the expert groups and the period of document creation.

The "single-expert" subcorpus features 66 documents (around 627,000 words) created by each group of experts individually. It allows us to establish a baseline of knowledge produced by expert groups.

Two additional subcorpora were created for the analysis: "2000–2014" (16 documents, approximately 329,000 words) and "2015–2020" (67 documents, approximately 574,000 words). These subcorpora contain both single- and jointly-authored documents created during the specified time periods. Notably, the number of expert groups in the communication space substantially increased during the second period. Such a division allows distinguishing knowledge created during the period of intense communication that followed severe floods from knowledge created during calmer times.

Method

To trace the process and the outcomes of communicative coordination of expert knowledges, we compare the documents produced by the experts, evaluate the extent of their coordination, identify

documents that reveal knowledge integration and specialization, and analyse the dynamics of these processes over time. In order to do this, we propose a mixed-method technique that focuses on producing and examining maps of expert knowledges. This technique combines natural language processing, statistical analysis, and visualization with manual interpretative analysis of visualizations and documents.

Our first task is to measure the distances between expert knowledges on FRM as the differences in topics covered in expert documents. To do this, we need to account for the diversity of perspectives expressed in the vast body of documents. As deductive approaches to text analysis involving manual coding and keyword counting (King et al., 2017) are resource-consuming and prone to biases (Lee & Martin, 2015), we opt for inductive computational text analysis. Simultaneously, given our interest in comparing the general content of documents rather than the nuances of meaning, we do not need to explicate the structure of knowledge, such as in network analyses of text (see the related discussion in Basov et al., 2021). Therefore, we use the computational topic modelling approach (Valdez et al., 2018), which identifies topics as groups of words that co-occur in documents and produces numerical representations of documents as distributions of topics. It inductively assesses the full content of documents to account for the context of word usage, and as such captures the perspectives expressed in documents and enables quantitative assessment of text similarity. The assessment can then be used for relative positioning of documents in a visualization space. This approach has been successfully used for studying perspectives in environmental communication (Treen et al., 2022) and other areas (Valdez et al., 2018). Among the available topic modelling algorithms, we selected Latent Semantic Analysis (LSA) as the fastest and most versatile (Valdez et al., 2018).

Before conducting the main procedures, we pre-processed all documents in the whole corpus, applying lemmatization, lowercasing, stop word removal, and other minor text cleaning steps (see additional information in Appendix C of the supplementary material).

Next, we constructed a document-term matrix representing which words ("terms") were used in which documents and how often, weighing the frequency of word usage values in the matrix with the Term Frequency/Inverse Document Frequency scheme to better account for the importance of infrequent words specific to the corpus and discount frequent commonly used words (such as "thing" or "say"). Then, the LSA algorithm was applied to represent each text as a distribution of topics, which appears as a string of numbers (a vector) in a multi-dimensional space.

To assess distances between the contents of documents, we calculated coefficients of cosine similarity between the LSA vectors. The results were then exported in the format of a square similarity matrix, where each document was represented by a row and a column, and each cell was a similarity coefficient for a pair of documents (with the diagonal being similarities of documents to themselves, i.e. 1s).

To validate the accuracy of similarity assessment with LSA for our corpus, after running the procedures described above, we picked several pairs of documents that exhibited very high and very low similarity, respectively. Then we cross-read them to assess their similarity manually. When we compared our assessment with the similarities produced by the algorithm, the latter closely reflected the results of our manual assessment, which indicated that LSA yields sensible outcomes on our data. We then ran the algorithm on the three subcorpora.

The similarity scores obtained on our whole corpus and the three subcorpora were then used to complete the second task: representing the mutual positioning of expert knowledges in a common space. We did it by generating four two-dimensional visualizations (or maps) using multi-dimensional scaling algorithm (Groenen & Borg, 2014). This algorithm constructs a geometric representation of the data in which dissimilarities are represented as distances. In the maps, documents are represented by circles, and similar documents are positioned closer to each other while less similar ones appear further apart. Additionally, we created a color scheme assigning unique colors to expert groups and their combinations and used it to color the circles in the maps. As a result, we obtained four maps of knowledge that the experts contributed to the common communication space of FRM in Shropshire.

As the third and the last task, we manually interpreted the four maps using the original documents in four steps: (1) Visual assessment of the overall distribution of the documents, where we identified distinct themes in knowledge by locating clusters of similar documents and examining the titles and content of a sample of documents from these clusters; (2) Identification of thematic foci of the expert groups based on the information about authors' affiliation to one or several expert groups; (3) Identification of documents that embody specialized or integrated knowledge, based on documents' location within or between large clusters identified in step (1); (4) Manual in-depth examination of the identified documents – to determine the subjects they cover and the extent to which they exhibit the integration or specialization of knowledges on a particular theme.

Results: coordination of knowledges in a common communication space

Single-expert knowledges

This subsection presents an overview of the diversity of knowledges that were contributed to the common communication space by each expert group[1] individually between 2000 and 2020, based on the map presented in Figure 1. The documents on the map form a triangle, with the most distinct documents located at its corners. The three clusters of these documents likely represent specialized knowledges on different topics. We identified the themes of these clusters as "Strategy and planning", "Practical and technical FRM aspects", and "Community engagement"

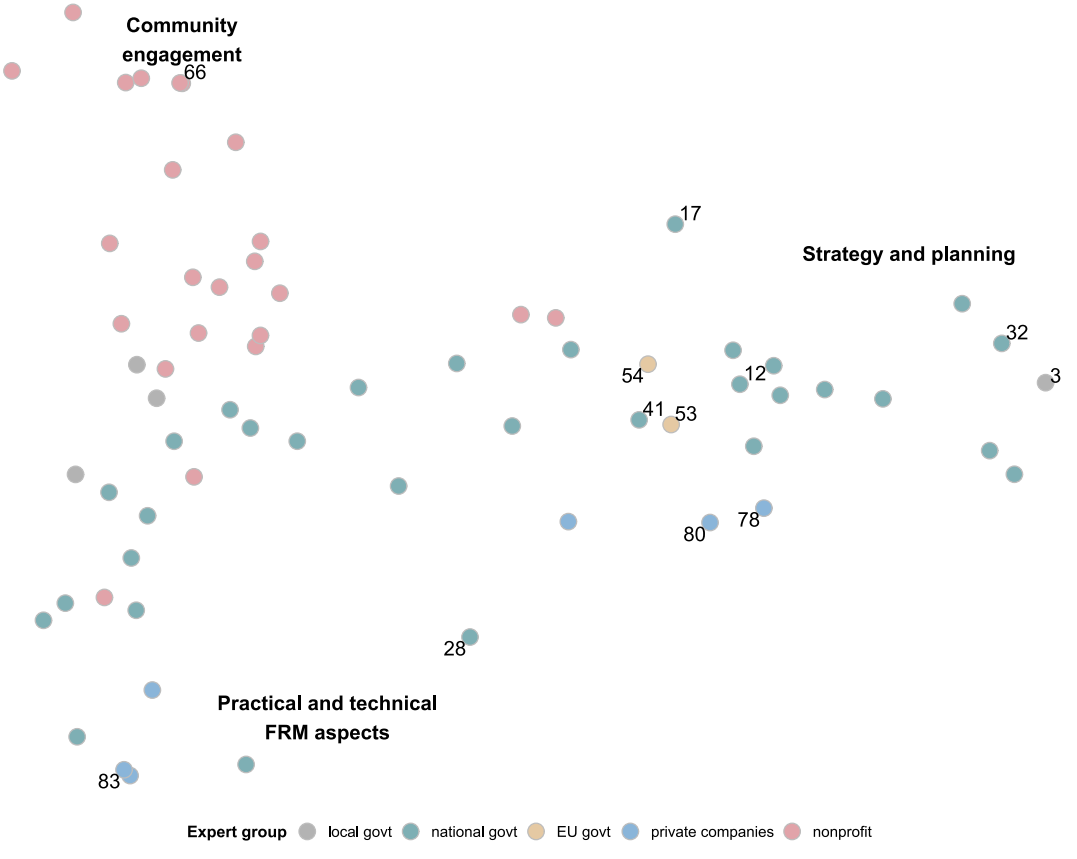

Figure 1. Single-expert FRM knowledges, 2000–2020. Note. Here and further: Circles = documents. Circle color = expert group of the main author(s) of a document. The labels of the documents mentioned in the text are displayed, referring to their corresponding numbers in Table C1 in Appendix C of the supplementary material.

(further referred to as "Strategy", "Practice", and "Community"). We begin by examining the documents produced by experts from different groups and assessing their contributions to these clusters.

Documents created by the government on its own at the local and national levels (4 documents totalling around 17,500 words and 23 documents totalling around 212,200 words, respectively) belong to "Strategy" and "Practice". These documents represent knowledges on strategic leadership in designing and implementing flood risk reduction measures, and on topics relevant to everyday practices of residents in flood-prone areas across the country, including flood risk factors, insurance, and health protection.

Government agencies and organizations contribute to this specialized knowledge in different ways. At the local level, Shropshire Council (SC) contributes most significantly to "Strategy" with its *Shropshire Local Flood Risk Management Strategy* (No. 3, here and further in Figure 1). For the Council, this document

> sets out roles and responsibilities for flood risk management, assesses the risk of flooding in the County, where funding can be found to manage flood risk, what [their] policies are as a Lead Local Flood Authority and what [their] objectives and actions are to manage flood risk. (Shropshire Local Flood Risk Management Strategy – Summary, p. 1)

The national government produces the vast majority of documents on "Strategy" and "Practice". For instance, the EA's *National Flood and Coastal Erosion Risk Management Strategy for England* (No. 32) is one of the most specific documents on "Strategy". It provides a common basis for activities of all RMAs dealing with floods and coastal erosion, supporting coordinated management of risks and consequences of flooding. It sets long-term goals and outlines short-term measures that account for the future increase in flood risk due to climate change. Its purpose is to strengthen resilience to flooding and coastal change, support sustainable investment in new buildings and infrastructure, educate the public about the risks, and equip them to respond to threats of flooding:

> We need to build a nation who understand their risk to flooding and coastal change, and know their responsibilities and how to take action. To do this, we need to educate and inspire people to take action before flooding or coastal change happens. … Risk management authorities, local responders and the insurance sector have a key role to play in helping people and businesses recover more quickly after flooding. (p. 93)

The private sector is represented by Severn Trent Water, which produces documents on its own. It contributes to the same thematic clusters as the government, although its contribution is less prominent (6 documents totalling about 62,000 words). Documents such as *Your Guide to Sewer Flooding* (No. 83) are among the most specific pieces of knowledge on "Practice". The Guide explains the causes of sewer flooding and the functioning of sewer infrastructure, which is the company's main area of expertise:

> Sewers are designed to take away sewage from your home for treatment and in some areas, rainfall from things like roofs. As the population grows, more of our green spaces are covered over. This means that we've lost some of the natural drainage we had before. (p. 4)

The company also provides action plans for residents that cover interaction with insurers, strategies to prevent sewer flooding, and mitigation.

A representative of the nonprofit sector, the NFF, produced 23 documents comprising approximately 16,000 words, which mostly belong to the "Community" cluster. Most of these documents are leaflets that provide guidance on how to engage communities in FRM. This includes setting up local flood action groups, collecting information on flood risks in the local area, collaborating with authorities and private companies, and preparing for floods. The NFF primarily adapts complex regulative, technical, and social ideas developed by other experts for local residents. For instance, the brochure *How to form a community flood action group within a diverse community – Slough pathfinder* (No. 66) is a concise guide for residents who wish to set up an activist FRM group. Such a group is expected to collaborate with the authorities by providing relevant information on the state of rivers and other watercourses in their area. It should also inform other local citizens

about flood risks, practical flood resilience measures, and the group's activities. The brochure presents information in an accessible and practical manner to support its quick uptake and implementation by the local community:

> Face to face communication on an individual basis to build relationships and to establish availability and resident concerns is the ideal initial first step. It is best to pre-arrange this face to face contact over the phone rather than utilising doorstep engagement, as this, especially unaccompanied by a familiar or trusted person, was often found to [e]licit a negative response.

This way, the target audience of activists grasps the concept of public participation developed in the national government's strategic documents, such as the *Pitt Review* (No. 12) and *Flood and Water Management Act* (No. 41).

Overall, the documents produced by each expert group individually indeed represent knowledge that corresponds to their specific interests, tasks, practices, and perspectives.

Simultaneously, most documents are located between the clusters rather than within them. This suggests that, in addition to specialized knowledges, there is a significant amount of integrated knowledge, supposedly resulting from communication between experts. To further explore this, we closely analyse the content of documents found between the thematic clusters.

The government here is again a major contributor. Two documents, the *Water Framework Directive* (No. 53) and the *Floods Directive* (No. 54), are the groundbreaking FRM regulations developed by the European Commission. They represent the earliest expert knowledge relevant to FRM in England within the study period. They set up a common regulatory framework, which constituted the basis for subsequent documents covering concrete aspects of FRM and providing additional detail. The Water Framework Directive proposes an integrated approach to emergency management and water management, calling for greater public participation in preparing and implementing water policies: "Member States shall encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the river basin management plans" (art. 14 para. 1). The Floods Directive sets requirements for the development of FRM plans:

> Flood risk management plans shall address all aspects of flood risk management focusing on prevention, protection, preparedness, including flood forecasts and early warning systems and taking into account the characteristics of the particular river basin or sub-basin. Flood risk management plans may also include the promotion of sustainable land use practices, improvement of water retention as well as the controlled flooding of certain areas in the case of a flood event. (art. 7 para. 3)

Remarkably, the ground-breaking role of these regulations is reflected by their central position on the map among the documents created during two decades of the evolution of FRM in the country.

A national government's document, the *Government response to the Multi-Agency Flood Plan Review* (No. 17) by the Department for Environment, Food, and Rural Affairs (DEFRA), is located between the "Community" and "Strategy" clusters. It provides the national government's comments on local planning related to flood risk. It describes the roles and responsibilities of organizations engaged in FRM at the local level, addresses the topic of funding, and outlines the role of communities and volunteers in increasing resilience to flood risks: "The government values and supports co-ordinated local response from communities and volunteers, and encourages local resilience forums to take an organisational, leadership role in such events" (p. 7).

The guide *Find out if you own a watercourse* (No. 28) is intended for residents who may be responsible for maintaining watercourses on their property. It is published by the EA on the UK government website and represents knowledges on "Strategy" and "Practice". It draws on the former and provides information on authorities that are responsible for managing watercourses. It also outlines the rights and responsibilities of owners as well as the rules for obtaining permissions for activities affecting a watercourse. The guide combines the knowledges to explain how owners can

fulfil their responsibilities for managing flood risk, e.g. by protecting existing flood defences and maintaining free water flow.

Severn Trent Water also contributes to integrating knowledge on "Strategy" and "Practice". Documents such as *Future Proofing – Severn Trent Water's Climate Change Adaptation Report* (No. 78) and *A9 Drainage and Wastewater Management Plan* (No. 80) integrate knowledge on flood risk assessments and plans for making the company's operations more sustainable with knowledge on specific actions the company will take to care for the water infrastructure. For instance, the Report sets several aims related to maintaining balance between water supply and demand:

> Our water resources management plan ensures we have enough water available over the next 25 years. …
>
> Our drought plan sets actions to provide a continuous water supply during a drought. (p. 38)

Overall, in the documents authored by single expert groups, we observe both specialization and integration of knowledges across the thematic clusters. On their own, expert groups can produce knowledge on specific topics and combine knowledges on different topics, in line with their focus of activity.

Collaborative expert knowledges

The creation of FRM knowledge often involves direct collaboration between experts. Figure 2 adds to the map the documents authored jointly by experts from different groups. Several new experts and expert groups that produce documents only in cooperation with others now appear on the map: local flood

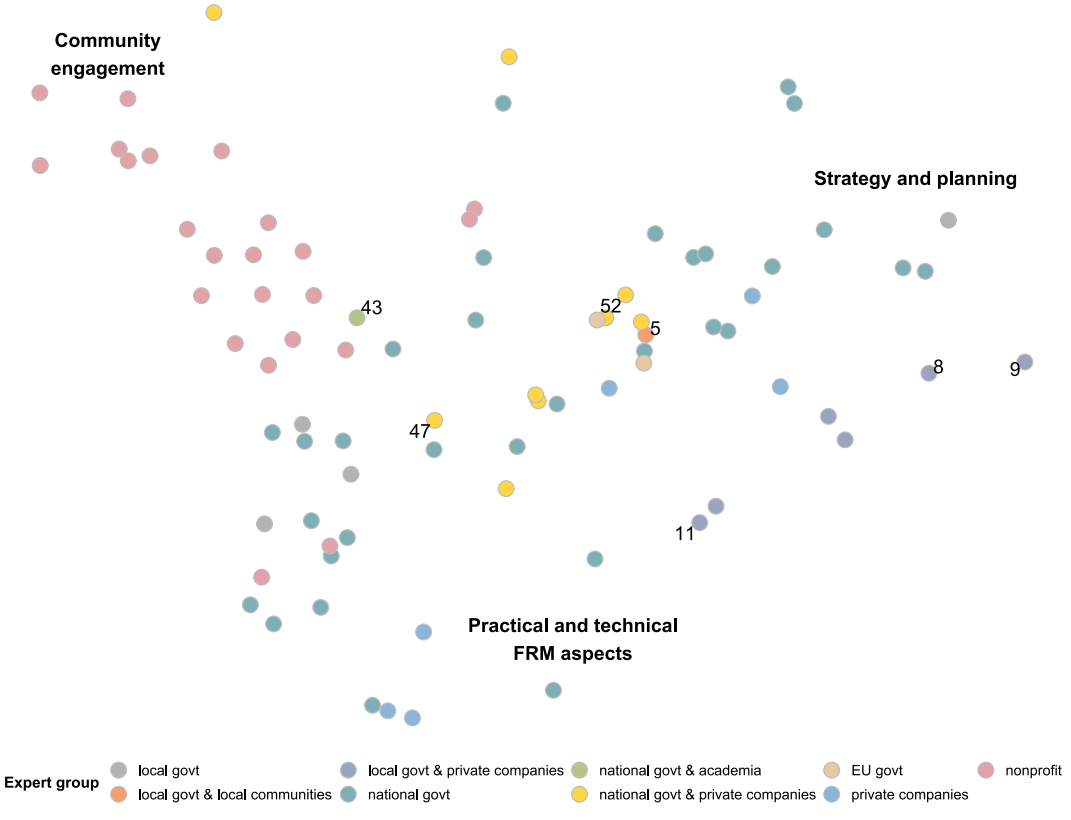

Figure 2. All expert knowledges on FRM, 2000–2020.

action groups, academia, and private consulting companies. The government co-authors all documents as it drives collaboration, while non-governmental experts do not collaborate independently.

The documents prepared jointly are distributed on the map in a similar manner to the one shown in Figure 1, with more documents located between the three thematic clusters. Most of these documents represent integrated knowledge.

The local flood action group, Shifnal Flood Partnership Group, in collaboration with the Shifnal Town Council, produced the *Shifnal Neighbourhood Plan* (No. 5, here and further in Figure 2) to reduce flood risk from new property development. The plan integrates the three thematic clusters by setting strategic objectives for new development in Shifnal (e.g. requiring adequate drainage), while addressing the needs of residents, businesses, and community groups, such as preserving the environment, improving transport routes, and protecting rural farming. The plan formalizes and recognizes the concerns of the local community:

> Through the engagement on the Neighbourhood Plan, the community has stressed the need for new housing development to be of a high quality that respects the character of the town and is in keeping with its immediate surroundings. The new development off Aston Street has been cited as a good example of new housing with a frontage of varied styles and elevation treatment. (p. 15)

The local government hired consultancies to conduct research and planning activities, resulting in documents on "Strategy". Two examples are the *Shifnal Surface Water Management Plan* (No. 8) and the *Shropshire Level 1 Strategic Flood Risk Assessment* (No. 9). The purpose of these documents is to provide a better understanding of flood risks and flooding mechanisms in the specified area and to delineate long-term risk reduction goals. For instance, the strategic flood risk assessment explains the importance of considering the features of local topography:

> The topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which a material allows water to percolate through it, the permeability, affects the extent of overland flow and therefore the amount of run-off reaching the watercourse. (p. 40)

Other documents integrate knowledges on "Strategy" and "Practice". *Flood Investigation Report* (No. 11) presents the findings of a scientific study on the consequences of an extreme flooding in Albrighton, providing technical details on flood protection infrastructure:

> During the flood event, a significant amount of flow was observed along Brooklands Road by the residents. This water was reported to pass through the properties at the end of the street before entering Windsor Road and continuing downhill. It is possible that the drainage on Brooklands Road was insufficient to cope with the flow towards this location due to the quantity and flow velocity caused by the storm intensity and the identified upstream catchment. (p. 21)

Collaboration between the national government, academia, and private companies contributed to knowledge integration. For example, the national government together with the University of the West of England produced the report *Supporting the Uptake of Resilient Repair in the Recovery Process* (No. 43), which combines knowledges on "Community" and "Practice". The report addresses resilient flood recovery, a critical issue for residents. It assesses the resilience of household and business properties repaired after flooding and argues for cooperation between experts:

> it is important that the coordination between the different professionals starts early, as recent developments in claims processes can now see reinstatement and drying companies being first on the scene. Lack of communication between companies, fragmentation within the supply chain, and between individuals in different operational divisions of a single company can also create difficulties. Given these facts, our conclusion is that clear contractual terms incentivizing resilience and good communications are essential. (p. 24)

Additionally, the report discusses relevant insurance schemes and promotes improved recovery materials, designs, and practices.

Collaboration between the national government, consultancies, and industry associations has also resulted in the creation of integrative documents. One such document is *A framework for the production of Drainage and Wastewater Management Plans* (No. 52), which integrates

knowledges on "Strategy" and "Community". The framework provides a unified approach for private water companies, such as Severn Trent Water, to develop long-term plans for managing drainage and wastewater infrastructure:

> A drainage and wastewater management plan (DWMP) will set out how water and wastewater companies intend to extend, improve and maintain a robust and resilient drainage and wastewater system. … The framework for DWMPs has been developed in response to the need to improve the approaches taken by the water sector to long-term drainage and wastewater planning with a view to providing greater transparency, robustness and line of sight to investment decisions that lead to cost to customers. (p. 6)

It also stresses the importance of involving customers and other interested parties in planning to learn about local risks and develop risk mitigation options.

Moreover, the national government has produced flood insurance framework agreements with representatives of insurance companies. For instance, the *Flood Re Proposal: Memorandum of Understanding* (No. 47) combines knowledges on "Strategy" and "Practice" to inform future insurance policy and outline responsibilities of experts regarding insurance payments and other related matters: "The industry will establish Flood Re as a not-for-profit entity, owned and managed by the industry itself, with the aim of providing affordable flood insurance to households at high flood risk" (p. 1), while the Government will

> introduce legislation in the Water Bill to ensure the industry levies … are paid by all participants in the home insurance market, and to compel any insurer offering home insurance to participate in Flood Re (thereby curing the "free-rider" problem). (p. 2)

Overall, we observe how multiple expert groups, including academia, local communities, and private companies – coordinated by the government – collaborate to produce a variety of documents that integrate knowledges on FRM along with the documents that are specific to the knowledge on "Strategy".

Expert knowledges over time

The results presented so far are based on the documents aggregated over 20 years. During this period, the communication space has evolved. Since 2014 there has been an increase, although uneven, in the number of relevant documents and expert groups involved in the production of FRM expertise (see the graph showing the number of documents per expert group by year in Figure C1 in Appendix C of the supplementary material). To understand how these changes in the communication space have affected the relationship between the expert knowledges, we examine the maps for the periods of 2000–2014 and 2015–2020.

Figure 3 shows the map for 2000–2014, where documents cover "Practice" and two themes that did not form specific clusters in the maps for the whole period: "European Union strategy" and "Insurance". Additionally, there is a cluster of documents (Nos. 8, 14, 18, 21), such as *Shifnal Surface Water Management Plan* (No. 8), that integrate knowledge on "European Union strategy" and "Practice". For instance, the Plan outlines the responsibilities of SC:

- to lead and co-ordinate the delivery of the relevant Pitt Review recommendations;
- to ensure a consistent approach in the management of current and future flood risk issues in the borough;
- to fulfil any new duties arising from the FWMA when enacted; and to coordinate the delivery of actions arising from the EU Floods Directive and FRR [Flood Risk Regulations].

> In conjunction with these, SC and the other partner organisations have further responsibilities to share relevant information and co-operate to facilitate the management of flood risk. (p. 18)

The documents were created mostly by the government on its own. During this early period of FRM development in the UK, the government dominated knowledge production, with little involvement from other expert groups in communication.

The map for the second period of 2015–2020 (see Figure 4) shows the emergence of two new specialized themes, namely "Community" and "Strategy". The government's contributions are

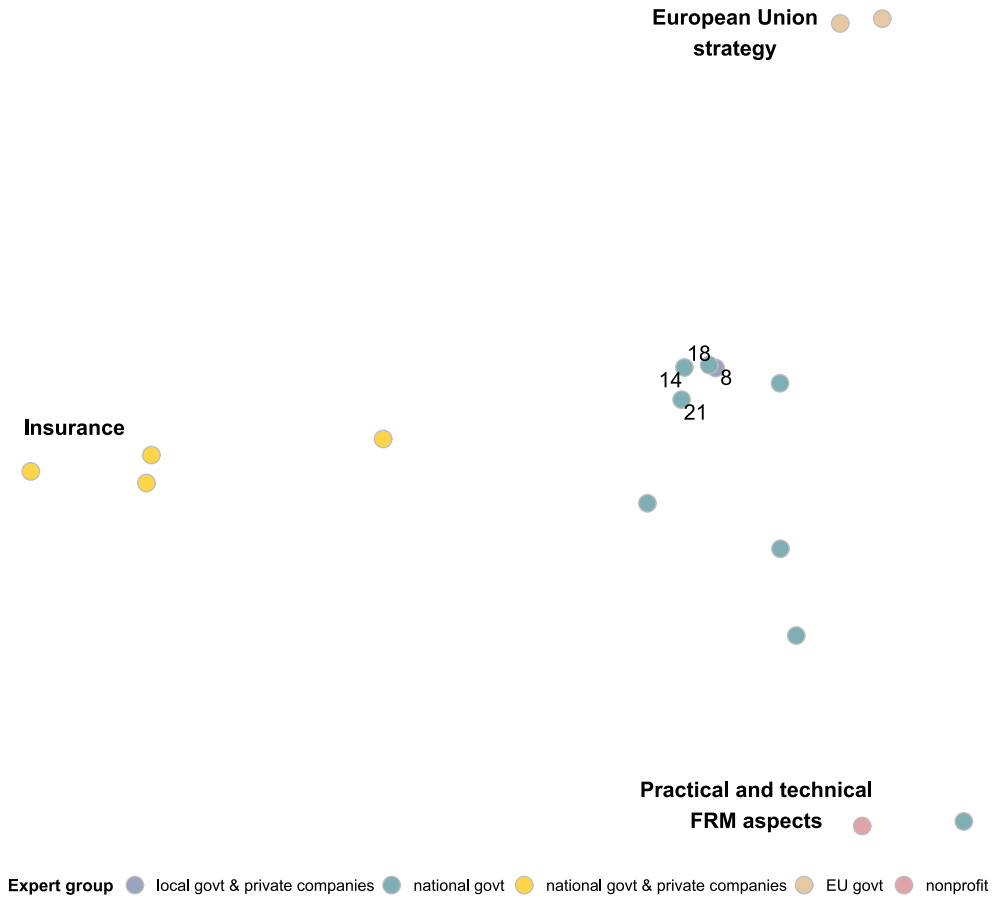

Figure 3. Expert knowledges on FRM, 2000–2014.

focused on "Strategy" and "Practice", indicating continuity with the earlier period. At the same time, the government has assumed a more collaborative role in the production of documents such as *A framework for the production of Drainage and Wastewater Management Plans* (No. 52), which combines knowledges on "Strategy" and "Practice", working in conjunction with other experts. Moreover, many documents, especially those related to "Community", such as the *Flood Risk Communities' Charter* (No. 76) that demands that "communities are at the heart of flood risk management", are now created by the NFF, a nonprofit, independently of the government. Thus, the authority of non-governmental expert knowledge has increased, while the government produces authoritative knowledge mainly in collaboration with non-governmental groups.

The advantage of multi-dimensional communication and decentralized, multi-expert creation of specialized knowledge coordinated in a common space is that non-governmental experts, especially local communities, now often address problems that the government may lack expertise in.

Furthermore, the integration of knowledge, especially in collaborative efforts, enabled the shift of focus from the traditional concept of "flood defence" to the more comprehensive ideas of "flood risk management" and "resilience", which emphasize a multifaceted approach to FRM, addressing social, economic, institutional, infrastructural, and community aspects of the problem. This approach gradually replaces the traditional one that narrowly focuses on technical flood protection measures.

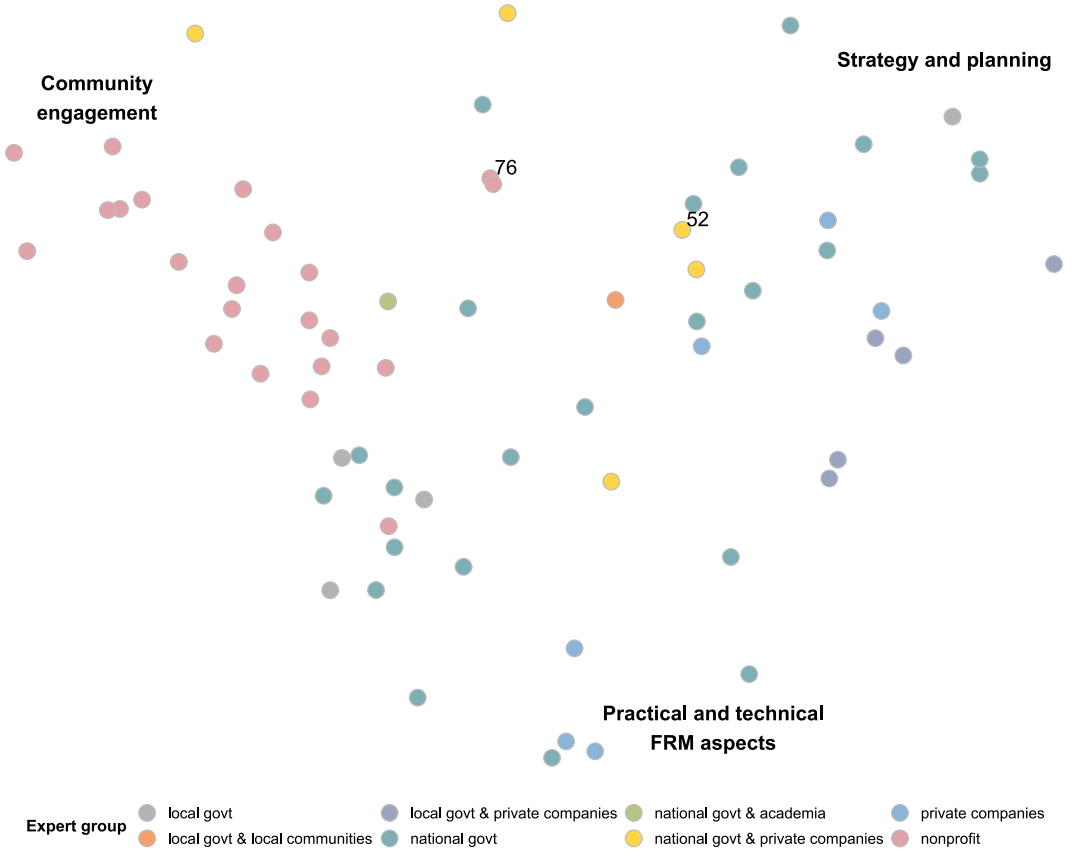

Figure 4. Expert knowledges on FRM, 2015–2020.

Conclusion

This paper proposed an account of environmental communication as a dynamic space involving multiple experts and knowledges. Based on this account, we offered a technique for visualizing mutual positions of expert knowledges and tracing their integration and specialization that reflect changes in approaches and practices of FRM over time. Our approach can be adopted by researchers as well as environmental communication practitioners.

Contributions to research

Our approach allows answering pertinent research questions such as: What are the themes that expert knowledges converge on and which themes remain in specialized domains? Which knowledges are integrated and which are not? How do expert knowledges vary over time and how do the changes correlate with policy shifts? In our illustrative study of FRM knowledge in the Shropshire County, UK, we gained insights into these questions. We observed the tendency towards knowledge integration through government initiatives and government-led collaborations with other expert groups, in line with the democratic ethos of FRM (Sigalla et al., 2021). We also registered the creation of specialized knowledges. Our analysis indicates that these processes are not contradictory, but complementary, being two ways of coordinated knowledge creation.

As our case study shows, communication in the common space enables public and private FRM experts to traverse traditional institutional boundaries and create knowledge together. However, the

involvement of new groups of experts in communication alters traditional expert roles of science and government. While knowledge on strategy and scientific knowledge are not necessarily dismissed, they have to be adjusted to knowledge of other experts. The government and science need to prove their authority in competition with other experts, and act as coordinators of the shared communication space. Our analysis shows how the government can lead these transformations rather than follow them by facilitating engagement of new experts in the shared communication space and offering a platform for interaction between them. Experts challenged by the diversification of expertise on environmental problems can model the Shropshire case to guide communication in similar settings. Note that further research is needed to assess to what extent the insights from this case can be applied to other counties in the UK and to other national contexts. Another avenue for further research is the exploration of communication strategies addressing challenges to expertise occurring in multicentred communication spaces.

Furthermore, we find that integration and specialization of knowledges are interrelated rather than contradictory processes, in line with previous research (Carnabuci & Bruggeman, 2009). Integrated knowledge is developed when experts achieve a common understanding of a problem or a solution. In our case the experts agreed that FRM should focus on building resilience to flood risks. This new understanding is reflected in documents such as the European Water Framework Directive and Floods Directive, which provide an overarching view of the problem. Once this understanding is achieved, expert groups interpret it according to their specialization.

Simultaneously, our results suggest reassessing what kind of knowledge integration is desirable and achievable. The goal of achieving knowledge uniformity among involved groups is not necessarily optimal for environmental communication (Pearce et al., 2017). Rather, the support should be directed at communicative coordination in a common space that creates an interface between multiple specialized expert knowledges, which can maintain their originality and contextual relevance, enhancing resilience and responsiveness to complex environmental challenges. Establishing a common communication space between experts, planners, and FRM activists, where differences in knowledge are accommodated, can help build productive partnerships and foster collaborative activities to improve resilience. Knowledge integration, in turn, may be instrumental in the interface areas, where common ground is needed to enable coordination between expert groups.

The proposed approach builds on the tradition of using spatial metaphors in environmental communication research. Concepts such as "boundary object" and similar have demonstrated the advantages of spatial perspectives on knowledge and communication, emphasizing potential for knowledge coordination. Our account rooted in field theory extends the spatial metaphor to make visible the invisible relationships of different knowledges when multiple communication participants are involved in a shared communication space. This makes the approach relevant for studies of policy fields, science-policy interactions, boundary organizations, and other similar phenomena.

Further research can address an important limitation of our study. To capture knowledge that may potentially influence all experts in the field, we have collected documents addressed to the general public, excluding technical and privately distributed documents. Other analyses can be nuanced by these additional data.

Contributions to practice

We see two possible contributions of the outlined approach to practice.

The approach can inform communication campaigns that address the fragmentation of environmental strategies. For instance, when strategies on civil contingencies and water management are not aligned (Gilissen et al., 2016; Hegger et al., 2016), prolonged and extensive communication involving the creation and sharing of knowledge is required to overcome fragmentation. To assist in this process, communication campaigns could benefit from maps that show existing knowledges on a problem, highlighting areas of integrated and specialized knowledges, and the thematic focus

of experts. Communication campaigns can draw on knowledge from different areas to find ideas, concepts, and even phrases that would resonate with intended audiences.

The approach can also help to identify bridging mechanisms (Hegger et al., 2016), which contribute to a coordinated knowledge base that combines specialized and integrated knowledges (Dieperink et al., 2018; Gilissen et al., 2016). These include organizations such as flood action groups, bridging concepts such as "resilience", policy instruments such as multi-agency meetings, specific documents such as the neighborhood plan, and financial instruments such as the "Flood Re" insurance scheme. Additionally, the maps can be used to find influential experts and identify potential knowledge coordination partners, such as a national government agency collaborating with a consultancy. The approach benefits greatly from ethnographic knowledge, which makes it attractive to practitioners who can use it to quickly produce actionable findings.

Note

1. The academia and the local communities produce documents only in collaboration with the government, but not on their own. We therefore cannot determine the thematic foci of these expert groups.

Acknowledgements

This work was supported by the Russian Science Foundation under Grant number 19-18-00394 "Creation of knowledge on ecological hazards in Russian and European local communities" (2019–2021). Positions of some of the authors are not necessarily aligned with that of the aforementioned institution. Authors would like to thank Darkhan Medeuov for discussing the methods used in this article. Nikita Basov thanks Lea Fünfschilling for comments and discussions.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by Russian Science Foundation [grant number 19-18-00394].

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References

Baake, K., & Kaempf, C. (2011). No longer "Bullying the Rhine:" Giving narrative a place in flood management. *Environmental Communication*, *5*(4), 428–446. https://doi.org/10.1080/17524032.2011.610807

Basov, N., De Nooy, W., & Nenko, A. (2021). Local meaning structures: Mixed-method sociosemantic network analysis. *American Journal of Cultural Sociology*, *9*(3), 376–417. https://doi.org/10.1057/s41290-019-00084-9

Boholm, Å. (2009). Speaking of risk: Matters of context. *Environmental Communication*, *3*(3), 335–354. https://doi.org/10.1080/17524030903230132

Brulle, R. J. (2010). From environmental campaigns to advancing the public dialog: Environmental communication for civic engagement. *Environmental Communication*, *4*(1), 82–98. https://doi.org/10.1080/17524030903522397

Carnabuci, G., & Bruggeman, J. (2009). Knowledge specialization, knowledge brokerage and the uneven growth of technology domains. *Social Forces*, *88*(2), 607–641. https://doi.org/10.1353/sof.0.0257

Daviter, F. (2019). Policy analysis in the face of complexity: What kind of knowledge to tackle wicked problems? *Public Policy and Administration*, *34*(1), 62–83. https://doi.org/10.1177/0952076717733325

Dieperink, C., Mees, H., Priest, S. J., Ek, K., Bruzzone, S., Larrue, C., & Matczak, P. (2018). Managing urban flood resilience as a multilevel governance challenge: An analysis of required multilevel coordination mechanisms. *Ecology and Society*, *23*(1), art31. https://doi.org/10.5751/ES-09962-230131

Fabricius, C., Scholes, R., & Cundill, G. (2006). Mobilizing knowledge for integrated ecosystem assessments. In W. V. Reid, F. Berkes, T. Wilbanks, & D. Capistrano (Eds.), *Bridging scales and knowledge systems: Concepts and applications in ecosystem assessment* (pp. 165–182). Island Press.

Fischer, F. (2000). *Citizens, experts, and the environment: The politics of local knowledge*. Duke University Press.

Fisher, D. R., & Leifeld, P. (2019). The polycentricity of climate policy blockage. *Climatic Change*, *155*(4), 469–487. https://doi.org/10.1007/s10584-019-02481-y

Fligstein, N. (2001). Social skill and the theory of fields. *Sociological Theory*, *19*(2), 105–125. https://doi.org/10.1111/0735-2751.00132

Fligstein, N., & McAdam, D. (2012). *A theory of fields*. Oxford University Press.

Gilissen, H. K., Alexander, M., Beyers, J.-C., Chmielewski, P., Matczak, P., Schellenberger, T., & Suykens, C. (2016). Bridges over troubled water – Towards an interdisciplinary framework for evaluating the interconnectedness within fragmented domestic flood risk management systems. *Journal of Water Law*, *25*(1), 12–26.

Groenen, P. J. F., & Borg, I. (2014). The past, present, and future of multidimensional scaling. In J. Blasius, & M. J. Greenacre (Eds.), *Visualization and verbalization of data* (pp. 95–116). CRC Press.

Hardoš, P. (2018). Who exactly is an expert? On the problem of defining and recognizing expertise. *Sociológia (Sociology)*, *50*(3), 268–288.

Hedlund, J., Bodin, Ö, & Nohrstedt, D. (2021). Assessing policy issue interdependencies in environmental governance. *International Journal of the Commons*, *15*(1), 82. https://doi.org/10.5334/ijc.1060

Hegger, D. L. T., Driessen, P. P. J., Wiering, M., van Rijswick, H. F. M. W., Kundzewicz, Z. W., Matczak, P., Crabbé, A., Raadgever, G. T., Bakker, M. H. N., Priest, S. J., Larrue, C., & Ek, K. (2016). Toward more flood resilience: Is a diversification of flood risk management strategies the way forward? *Ecology and Society*, *21*(4), art52. https://doi.org/10.5751/ES-08854-210452

Holmes, A., & McEwen, L. (2020). How to exchange stories of local flood resilience from flood rich areas to the flooded areas of the future. *Environmental Communication*, *14*(5), 597–613. https://doi.org/10.1080/17524032.2019.1697325

King, G., Lam, P., & Roberts, M. E. (2017). Computer-assisted keyword and document set discovery from unstructured text. *American Journal of Political Science*, *61*(4), 971–988. https://doi.org/10.1111/ajps.12291

Koks, E. E., Jongman, B., Husby, T. G., & Botzen, W. J. W. (2015). Combining hazard, exposure and social vulnerability to provide lessons for flood risk management. *Environmental Science & Policy*, *47*, 42–52. https://doi.org/10.1016/j.envsci.2014.10.013

Lee, M., & Martin, J. L. (2015). Coding, counting and cultural cartography. *American Journal of Cultural Sociology*, *3*(1), 1–33. https://doi.org/10.1057/ajcs.2014.13

Leipold, S., Feindt, P. H., Winkel, G., & Keller, R. (2019). Discourse analysis of environmental policy revisited: Traditions, trends, perspectives. *Journal of Environmental Policy & Planning*, *21*(5), 445–463. https://doi.org/10.1080/1523908X.2019.1660462

Leipold, S., & Winkel, G. (2017). Discursive agency: (Re-)Conceptualising actors and practices in the analysis of discursive policymaking. *Policy Studies Journal*, *45*(3), 510–534. https://doi.org/10.1111/psj.12172

Martin, T. (2007). Muting the voice of the local in the age of the global: How communication practices compromised public participation in India's Allain Dunhangan environmental impact assessment. *Environmental Communication*, *1*(2), 171–193. https://doi.org/10.1080/17524030701642595

Nowotny, H. (2003). Democratising expertise and socially robust knowledge. *Science and Public Policy*, *30*(3), 151–156.

Oberg, A., Korff, V. P., & Powell, W. W. (2017). Culture and connectivity intertwined: Visualizing organizational fields as relational structures and meaning systems. In P. Groenewegen, J. E. Ferguson, C. Moser, J. W. Mohr, & S. P. Borgatti (Eds.), *Structure, content and meaning of organizational networks: Extending network thinking* (pp. 17–47). Emerald Publishing. https://doi.org/10.1108/S0733-558X20170000053001

Pearce, W., Grundmann, R., Hulme, M., Raman, S., Hadley Kershaw, E., & Tsouvalis, J. (2017). Beyond counting climate consensus. *Environmental Communication*, *11*(6), 723–730. https://doi.org/10.1080/17524032.2017.1333965

Puzyreva, K., Henning, Z., Schelwald, R., Rassman, H., Borgnino, E., de Beus, P., Casartelli, S., & Leon, D. (2022). Professionalization of community engagement in flood risk management: Insights from four European countries. *International Journal of Disaster Risk Reduction*, *71*, 102811. https://doi.org/10.1016/j.ijdrr.2022.102811

Sigalla, O. Z., Tumbo, M., & Joseph, J. (2021). Multi-stakeholder platform in water resources management: A critical analysis of stakeholders' participation for sustainable water resources. *Sustainability*, *13*(16), 9260. https://doi.org/10.3390/su13169260

Sovacool, B. K. (2008). Spheres of argument concerning oil exploration in the Arctic national wildlife refuge: A crisis of environmental rhetoric? *Environmental Communication*, *2*(3), 340–361. https://doi.org/10.1080/17524030802396745

Sprain, L., & Reinig, L. (2018). Citizens speaking as experts: Expertise discourse in deliberative forums. *Environmental Communication*, *12*(3), 357–369. https://doi.org/10.1080/17524032.2017.1394894

Treen, K., Williams, H., O'Neill, S., & Coan, T. G. (2022). Discussion of climate change on Reddit: Polarized discourse or deliberative debate? *Environmental Communication*, 1–19. https://doi.org/10.1080/17524032.2022.2050776

Valdez, D., Pickett, A. C., & Goodson, P. (2018). Topic modeling: Latent semantic analysis for the social sciences. *Social Science Quarterly*, *99*(5), 1665–1679. https://doi.org/10.1111/ssqu.12528

Zarb, S., & Taylor, K. (2023). Uneven local implementation of federal policy after disaster: Policy conflict and goal ambiguity. *Review of Policy Research*, *40*(1), 63–87. https://doi.org/10.1111/ropr.12478

Zietsma, C., Groenewegen, P., Logue, D. M., & Hinings, C. R. (2017). Field or fields? Building the scaffolding for cumulation of research on institutional fields. *Academy of Management Annals*, *11*(1), 391–450. https://doi.org/10.5465/annals.2014.0052