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Assembling Regional Expertise: Co-creation Workshops in EU-funded Research on the German Coal Phase-out

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Abstract

Regional expertise is a crucial aspect of effective and legitimate policy formulation within the multilevel governance system of the European Union (EU). We argue that EU-funded research contributes to the multilevel network governance in the EU. However, until now, this aspect of expertise formation has undergone little analysis. Drawing on materials from an EU-funded research project on energy transition processes as well as our participation in this project as contracted researchers, we investigate how regional expertise is assembled in co-creation workshops of scientists and regional stakeholders. We first reconstruct the implicit programme theory of transformative research which emphasises the value of practical knowledge of (regional) stakeholders in complementing scientific knowledge for governance purposes. Using our analysis of the interactions between workshop participants, we point out the benefits and challenges of assembling regional expertise from heterogeneous actors. Finally, we compare this hybrid mode of knowledge co-creation with (hypothetical) more segregated forms of expertise.

Keywords

INTRODUCTION

Some decades ago, scientists were divided in their assessment of whether society was able to adapt to the environmental risks that emerged as externalities of human activity on earth (Beck 1992; Luhmann 1989). The different logics of the functional subsystems of society, such as science and politics, were regarded as being major obstacles (Luhmann 1989). It is the task of expertise to bridge these logics by assembling reliable knowledge for collective decision-making. While politics has relied on academic expertise for many years, this relationship has recently become closer, but also more contentious, transforming both the production of knowledge as well as the governance

structures. For several decades, policy advice and expertise have been provided by think tanks operating at the interface between science and policy (Gellner 1995; Weaver 1989). The European Union (EU) has become especially known for relying on expertise when formulating its policies (Radaelli 1999). Yet, this proliferation of expertise seems to have also contributed to the current crisis in which policy knowledge is needed but is also mistrusted (Bechmann 2003; Eyal and Medvetz 2023). In the EU, this paradox has been addressed by structural changes to knowledge production as well as new forms of multilevel governance in networks (Börzel and Heard-Lauréote 2009). However, within these networks, regions have had extremely diverse and often (only) informal influence (Bauer and Börzel 2010). This paper focuses on the hybridisation of knowledge production for governance purposes in an EU research project, which contributes, at the same time, to the creation of policy networks among regional stakeholders.

One structural change in scientific knowledge production results from the framing of funding programmes by formulating so-called "grand challenges" (Isakova et al., 2024; Kaldewey 2018), such as climate change, and the uncertainties these represent for policymaking (Ruser 2018). The aim is to align research questions with the knowledge demands of policy formulation from the outset. The EU's Horizon 2020 funding programme, for example, encourages grant proposals oriented toward policy goals (Gengnagel et al., 2022; Kim and Yoo 2019), such as climate mitigation research (Boezeman and Coninck 2018).

Furthermore, in response to the perceived gap between science and policy, the production of knowledge has also been transformed from within science. The concept of a Mode 2 society, for example, assumes that the production of scientific knowledge becomes more integrated with society to produce "socially robust knowledge" (Nowotny 2003; Nowotny et al., 2001), i.e., knowledge that is scientifically reliable as well as socially accepted by potential users. Helga Nowotny (2003) suggested three possible strategies for creating such knowledge: widening the circle of those who are considered legitimate contributors to knowledge production; experimenting with methods that account for the uncertainties implied in knowledge production; and repeatedly testing and modifying knowledge. Yet, "socially robust knowledge" has been criticised as being a term that is more programmatic than analytical (Weingart 2008). This paper, in contrast, turns to the empirical example of a research project which aimed to produce such knowledge, and explores some benefits and difficulties that arise in pursuing this objective. We analyse a project from the EU Horizon 2020 programme in which, following a transformative science approach, co-creation workshops made up of scientists and regional stakeholders were designed to produce "socially robust" policy recommendations based on the scientific and practical knowledge of the region.

The co-creation workshops from the ENTRANCES (ENergy TRANsitions from Coal and carbon: Effects on Societies) project are exemplary in highlighting the hybridisation of knowledge production at the interface between science and policy because they embody both a theoretical and methodological approach to research. Some of the recently defined transdisciplinary scientific approaches are regarded as playing a particular role in contributing to the responses to societal challenges (Renn 2021) and hence aim to restore academic as well as political agency. Among those, transformative research (Schneidewind et al., 2016; Strohschneider 2014; Trevors et al., 2012) is an approach which strives to create "socially robust" knowledge that can be translated into policy formulation, implementation and, consequently, social change. This catalytic understanding of research deviates from the assumption that objectified scientific knowledge is necessarily superior to less universal forms of knowledge. Regarding regions as places with unique properties, for instance formal academic knowledge, is incomplete because it lacks the practical knowledge base of

regional actors (Groves 2017). Accordingly, deliberative methods of knowledge co-creation that integrate researchers and issue stakeholders are valuable due to their potential to create transformative knowledge based on principles of reciprocal interaction (Renn 2021). However, the rather messy empirical reality of the interaction between such heterogeneous actors has rarely been examined (e.g., Fritz et al., 2019).

We build our theoretical perspective on concepts of knowledge and expertise (Collins and Evans 2002; Epstein 2023; Scott 1998). Using these concepts heuristically, we analyse programmatic literature on transformative research in order to reconstruct the "programme theory" (Bickman 1987) of the scientific approach. Programme theory describes the assumptions that are explicitly or implicitly made in any line of organised action. The aspiration of transformative research to produce knowledge for catalysing social change neatly fits the notion of expertise, which emphasises the assemblage of knowledge for governance purposes. While some theoretical approaches would lead us to assume that certified experts and scientific knowledge are likely to dominate a setting in which researchers and practitioners interact in a co-creative task (Collins and Evans 2002; Scott 1998: 311), this would contradict the declared objective of transformative research. Others argue for a more nuanced view. The notion of lay expertise, for instance, stresses the hybrid nature of expertise marshalled by groups with members who are not formally considered experts. Lay expertise assembles heterogeneous knowledge bases, including formal and experiential knowledge, to make expertise effective in informing collective action (Epstein 2023). We conceptualise regional expertise as a specific form of lay expertise that includes formal and practical knowledge about a region, including singular regional features and particular people and networks.

EU-funded research projects offer good opportunities to study how researchers and practitioners interact to produce policy expertise. The ENTRANCES project was one of the Research and Innovation Actions (RIA) funded under the Horizon 2020 call "Building a low-carbon, climate resilient future: secure, clean and efficient energy". RIAs are intended to establish new knowledge and explore "a new or improved technology, product, process, service, or solution" (REA n.d.). The ENTRANCES project combined several theoretical frameworks but had a strong focus on transformative research. The project applied a mixed-methods case-study approach to compare thirteen European coal mining and/or carbon intensive industrial regions. The methods applied in ENTRANCES ranged from the secondary analysis of administrative data, to content analysis of media, standardised surveys, semi-structured regional stakeholder interviews, focus groups and co-creation workshops made up of regional stakeholders whose objective was to formulate policy recommendations. This paper focuses particularly on the co-creation workshops with regional stakeholders, whose lay expertise was considered crucial for formulating and implementing policy in the regional transition process following the phase-out of mining activities. The co-creation workshops embody most clearly the transformative aspiration of the project because they explicitly aimed to formulate policy recommendations. Focussing on these workshops, *we investigate the ways in which academics and regional stakeholders interact in co-creation workshops when they are expected to formulate policy recommendations for German lignite mining regions. How can the knowledge of regional stakeholders be utilised in policy formulation?* Our objective is to establish an empirical base for reflecting upon the potential benefits and problems of co-creation workshops as a research format that aims to create "socially robust knowledge" for policy recommendations.

Our empirical analysis is based on the mixed-methods case studies of the lignite mining regions Central Germany (*Mitteldeutschland*), Lusatia (*Lausitz*) and Rhineland (*Rheinland*) which were

developed within the framework of the ENTRANCES project. We participated in this project as contracted researchers and were involved in coordinating regional surveys, conducting semi-structured stakeholder interviews, and moderating focus groups and co-creation workshops. We also participated (virtually) in the project's final hybrid conference, where results were presented and discussed with representatives of the European Commission in Brussels. We performed a secondary analysis of the project materials and reflect on our participation as researchers in the project, especially our moderation of the co-creation workshops.

We begin by describing the institutional background of the research project, then outline the paper's theoretical context and methodological approach. The section headed 'The co-creation of research expertise' presents the results of our empirical analysis, and these are discussed in the subsequent section.

THE MULTILEVEL GOVERNANCE OF REGIONAL DECARBONISATION

Political and institutional work has been performed at various social levels to reduce global CO_2-emissions, as well as to mitigate negative economic and societal effects of clean energy transitions. Political aims of climate change mitigation have been formally defined at the international level, most importantly with the 2° C and 1.5° C thresholds agreed on in the Paris Agreement of 2015 (Folkers 2022:94). The document was ratified by both the EU and Germany. One important element of climate change mitigation policies is the phase-out of coal and lignite mining (David and Gross 2019).

Research on past coal mine closures identified several socio-economic and societal challenges, such as rising unemployment, the establishment of new regional identity narratives, and the creation of a sense of justice (Diluiso et al., 2021; Measham et al., 2024; Strambo et al., 2019).[1] To compensate for possible negative effects of climate change mitigation policies, the EU put in place the Just Transition Mechanism, which will run from 2021 to 2027 and is expected to mobilise 55 billion euros for the regions most affected by the transition to a climate-neutral economy (European Commission n.d.). In Germany, the Commission on Growth, Structural Change and Employment ('Coal Commission') was created in June 2018 and presented its policy recommendations in January 2019. The political process in the run-up to the formation of the Coal Commission was embedded in increasingly heated public debates. These were most contentious around the time that the commission was formed and peaked in 2019 after the commission had presented its results (Bartl et al., 2022b: 106; Markard et al., 2022: 130). The energy transition narrative became deradicalised and hegemonial in national public discourse (Buschmann and Oels 2019). However, comparative studies suggest that regional discussions in mining regions have remained more contentious than the national public debate (MDR 2022; Radtke and David 2024).

In August 2020, the German Bundestag passed three acts as part of a legislative package, which we will refer to as the Coal Phase-out Act (*Kohleausstiegsgesetz*).[2] The act aims to phase-out lignite coal production in Germany by 2038, compensate power plant companies and affected workers (over the age of 58), and initiate significant investments in mining regions (Brachert et al., 2023: 17). In this context, several scenarios were published for an earlier phase-out of lignite, some of which were

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1 The following three paragraphs build on a section in Baron and Bartl (2024).

2 The legislative package consisted of the Act to Reduce and End Coal-Fired Power Generation (Gesetz zur Reduzierung und zur Beendigung der Kohleverstromung), the Coal Region Investment Act (Investitionsgesetz Kohleregionen) and the Structural Reinforcement Act for Mining Regions (Strukturstärkungsgesetz Kohleregionen).

commissioned by Germany's federal government (e.g., Luderer et al., 2021). In 2022, the state government of North Rhine-Westphalia, where the Rhineland mining area is located, and the federal government, agreed to accelerate the regional coal phase-out and complete it by as early as 2030. In contrast, the state governments of Brandenburg, Saxony and Saxony-Anhalt, responsible for the mining areas of Central Germany and Lusatia, rejected bringing forward the phase-out date to 2030, which corresponds to the opinion of the regional majority (MDR 2022, 2023).

As part of the legislative package, the Structural Reinforcement Act for Mining Regions (*Strukturstärkungsgesetz Kohleregionen*) allocated up to 14 billion euros to the lignite mining regions until 2038 for investments aimed at facilitating structural change. Furthermore, the federal government has also agreed to support the coal mining regions by providing another 26 billion euros until 2038 through its own measures (Bartl et al., 2022b: 50).

The legislative procedure was accompanied by structural development programmes created by the affected federal states themselves. These were preceded by bottom-up strategic visions (*Leitbilder*) for transforming the lignite mining regions (Heer et al., 2021) affected by the Coal Phase-Out Act (BGBl 2020: 1803–1808). Lignite mining regions, which historically have no formal boundaries, were created as spaces for policy intervention and were demarcated along county lines through the Coal Phase-Out Act (Ribbeck-Lampel et al., 2023: 35). The lignite mining regions of Central Germany and Lusatia straddle more than one federal state; therefore, new governance structures had to be set up to manage project approvals, the allocation of federal subsidies, and implementation (Heer et al., 2024: 7.). These governance structures differ considerably between regions (Barrett 2022: 46–49; Bartl et al., 2022a: 52–55; Bartl et al., 2022b: 49–52). Even though public participation in the regional governance of structural transformation processes is highly important for its acceptance (Heer 2020), opportunities have been rather limited (cf. Herberg et al., 2020; Radtke and David 2024).

Decarbonisation policies have been accompanied by research programmes at the national and EU level that strive to create expertise for policy purposes. Oriented toward climate change mitigation policy, the EU's Horizon 2020 programme has funded research that strives to generate and improve knowledge production at the science-policy interface through, e.g., "collaboration, stakeholder participation and iterative communication" (Boezeman and Coninck 2018: 1). The ENTRANCES project is an example of the coordination between policy and research at the EU level. The German phase-out policy is evaluated separately at the national level (Brachert et al., 2023).

FORMS OF EXPERTISE IN CO-CREATIVE RESEARCH

Transformative research was an important theoretical approach that informed the ENTRANCES project. While expertise is not a central concept in transformative research, we use the notion of expertise to reconstruct the co-creative methodological "programme theory" (Bickman 1987) of this approach and to analyse actual practices in co-creation workshops. The notion of expertise is especially useful for highlighting how co-creation workshops instrumentally create spaces of interaction for researchers and stakeholders, and for analysing how participants in these settings interact. In the ENTRANCES project, they were designed to form regional expertise from heterogeneous actors.

The hybridisation of expertise

Expertise is a form of assembling knowledge at the interface between science and policy. Paradoxically, governing public issues increasingly depends on expert knowledge; however, this knowledge is called into question more frequently and publicly (Büttner and Laux 2021; Eyal and Medvetz 2023). Two debates have emerged in response to this paradox: the question of participation in the formulation of expertise, and the relationship between certified academic knowledge and various forms of "alternative" knowledge (Epstein 2023). Public issues that require specialised knowledge might come under the scrutiny of societal actors who question the legitimacy of the expertise contributing to policy recommendations. One response to this critique has been to widen the circle of expertise taken into consideration when developing policy recommendations. Widening participation acknowledges that expertise is never purely technical but also normative because it (implicitly) has political consequences. A second line of critique towards formal academic knowledge questioned its technical effectivity. Several case studies showed that scientific expertise was often not enough to effectively respond to the problems at hand because it lacked a good deal of experiential knowledge about the subject (e.g., Wynne 1989: 37). Similar arguments have been put forward about the specific properties of places that are relevant for place-based policies (Groves 2017).

Both debates prompted attempts to delineate expertise on the basis of its epistemological foundation. Collins and Evans (2002), for example, distinguish between no expertise, interactional expertise and contributory expertise. At the same time, they acknowledge that relevant expertise is not necessarily grounded in formal academic knowledge but might be based on non-certified forms, variously referred to as experience, implicit knowledge and local knowledge. Concerning spatial planning, they clearly see a role for local expertise, but stress that it might nevertheless be partially or politically biased toward the location (Collins and Evans 2002: 267). Their understanding of local knowledge corresponds to the notion of place as a space with a unique identity that cannot be fully captured by formal measures (Knoblauch and Löw 2020: 274). Practical local knowledge encompasses singular features of a place including credible networks of issue stakeholders (cf. Levelt and Metze 2013). To rebalance this potential bias of local knowledge, Collins and Evans recommend combining local expertise with the knowledge of professional experts. Hence, in their view, local expertise is complementary to but also subordinate to academic knowledge, a view that is widely shared (cf. Epstein 2023: 82). James Scott, for instance, when distinguishing between academic and practical knowledge, is sceptical about combining them on equal terms: "The relation between scientific knowledge and practical knowledge is, as we shall see, part of a political struggle for institutional hegemony by experts and their institutions" (Scott 1998: 311).

Epstein's concept of lay expertise speaks to the same debate as the ideal types developed by Collins and Evans. Unlike their ideal types, lay expertise, an ostensible oxymoron, emphasises the hybrid character of knowledge situated between 'pure' experts and 'pure' lay people. Furthermore, in response to criticism that the epistemological foundation of such expertise had remained unclear, Epstein (2023: 84) adopts a definition of expertise that shifts the focus from knowing to doing: "Experts mediate between the production of knowledge and its application; they define and interpret situations; and they set priorities for action" (Grundmann 2017: 27). Furthermore, following Eyal (2013), he characterises expertise as a collective phenomenon that draws on diverse elements (Epstein 2023: 85). This emergent combination of heterogeneous elements becomes evident, for example, in stakeholder groups that lack formal credentials but draw on their subjective experiences as well as on scientific evidence to press for policy change (Rabeharisoa et al., 2014). But this combination also seems to be at play when lay expertise becomes a strategic complement to scientific knowledge as well as a legitimacy booster in transformative research.

Transformative research and the co-creation of catalytic knowledge

Transformative research aims to produce knowledge that is politically useful for changing social and economic conditions in the direction of sustainable futures, becoming itself a driver of change (Meisch 2020; WBGU 2011: 22). This requires knowledge of leverage points (Abson et al. 2017), transformative capacities (Wolfram 2016) as well as transformative interaction modes among the relevant stakeholders. Within this line of research, it is clear that neither a strong goal orientation nor well-thought-out transformation paths nor well-developed normative justifications necessarily lead to the desired outcome of sustainability transitions, as these processes are emergent and offer no guarantee of positive results (Geels and Schot 2007).

A methodological consequence of this contingency is that the recourse to formalised methods of knowledge production alone is considered insufficient (Fazey et al., 2020; Hölscher et al., 2021). Overly abstract disciplinary perspectives are often problematic in that the derived policy recommendations can be politically difficult to implement, for example, when strictly disciplinary solutions lack a regionally adapted embeddedness or when they have failed to generate the necessary local acceptance of a political action. Therefore, transformative research strives to gain insights into how societies can translate knowledge into action (Keeler et al., 2017).

Methodologically, transformative research seeks to integrate formal, academic expertise with the expertise of practitioners in co-creative research settings in order to produce knowledge that is likely to catalyse change (Pärli et al., 2022; Renn 2021; Schuck-Zöller et al., 2017). The creation of solution-oriented transformative knowledge that translates into implementable policies is assumed to be facilitated by minimising possible hierarchies between academic knowledge and the expertise of regional stakeholders. Such transdisciplinary research settings have rarely been analysed empirically (Fritz et al., 2019). Therefore, it is useful to investigate the extent to which such a level playing field can be achieved.

Transformative research as a form of valorising lay expertise

We draw these two perspectives together by using the notion of lay expertise as a sensitising concept for the declarative and procedural knowledge of practitioners. We consider expertise to be a form of knowledge that is distinct in its aim to inform collective decision-making and implementation (Epstein 2023; Grundmann 2017). Transformative research is a paradigmatic case for this notion of expertise because it aims to achieve the co-creation of knowledge that catalyses social change by methodologically integrating certified academic knowledge with the knowledge of practitioners. In the governance of mining activities, local knowledge of the place is crucial because of the unique identity of places. Furthermore, for policy purposes, networks among regional stakeholders can be considered pivotal. We assessed how researchers and practitioners, confronted with the task of providing recommendations for regional policy, interact in an actual workshop setting.

ASSEMBLING REGIONAL EXPERTISE: THE ENTRANCES PROJECT

Our empirical findings are based on our participation as contracted researchers in the ENTRANCES project and in particular on the comparative analysis of three co-creation workshops, each one organised with stakeholders from the still active German lignite mining regions (Central Germany, Lusatia, Rhineland). The project employed a complex mixed-methods approach including secondary analysis of administrative data, content analysis of media publications, standardised regional surveys, semi-structured stakeholder interviews, focus groups, and co-creation workshops. The basic

objective of the co-creation workshops was to develop policy recommendations for an effective regional sustainability transition. Below, we present the workshop design, the characteristics of the participants, and the analytical approach we used in this paper. Our analysis is based on a secondary reading of the workshop transcripts and an ethnographic reflection of the interactive performance of expertise between researchers and other actors involved.

Workshop design

Since the project consortium consisted of twelve research institutions, considerable effort was made to standardise methods across case studies. At the same time, interdisciplinary differences, professional judgement and regional specificities limited the effects of standardisation. Nevertheless, project meetings often provided a general direction of how to conduct the research. For instance, a phrase that was used by anglophone colleagues for characterising the ethical orientation of our case studies was that we should conduct "non-extractive research", i.e., research that benefits the researched as much as the researchers. While such an orientation could have been supported by explicit references to academic literature (e.g., Gaudry 2011), coordination was based to a large extent on an implicit understanding of oral communication. Such an implicit understanding was possible because the concepts of transformative research and co-creation overlap rather significantly with concepts that have been around for decades:

> A co-creation approach, when used for example in research, has similarities with co-production, transdisciplinary research, transdisciplinary knowledge co-production, action research, participatory research, and stakeholder engagement. Beyond research, it has commonalities with social innovation and collaborative governance (Prager and Nicholas 2024: 51).

Hence, the design of the co-creation workshops was guided by a mixture of explicit criteria and implicit professional judgement. Two criteria shaped the workshop design: the use of scenario techniques by researchers and the involvement of regional stakeholders from different categories.

Table 1: Workshop structure by region

Region	Duration (h:mm)	Moderators	Differences in content
Central Germany	2:41	3	Presentation of survey results and discussion Three quantified scenarios
Lusatia	3:42	1	Two qualitative scenarios
Rhineland	3:43	3	Presentation of survey results and discussion Three quantified scenarios

The workshops included the initial description of alternative scenarios for the future of the region. Scenarios do not claim to be correct or comprehensive and are best understood as approximations of a possible corridor of development, within the limits of which an actual development might be assumed (Kosow and Gaßner 2008). However, future scenarios are more than mere speculation. The scenarios we used were grounded in earlier empirical analyses of the ENTRANCES project. They took the challenges and coping strategies of the mining regions identified in the project and extrapolated these approaches into the future. Scenarios provide added value for finding and designing viable future development paths by questioning conventional assumptions and considering options that may be 'unthinkable' today. Thus, future scenarios ideally enable regional actors to gain a better understanding of the dynamics and interactions shaping socio-ecological and technical systems. By using this modelling, they are able to foster strategic decision-making impulses

for stakeholders within and beyond the region (Wilkinson et al., 2013). The categories used to invite regional stakeholders (politics, economy, civil society, environmental NGOs) were roughly in line with the Quintuple Helix innovation model (Carayannis and Campbell 2010).

Scenarios in two of the three workshops were based on socio-economic projections of statistical data (Table 1). While these formal projections were visualised in the workshops for Central Germany and Rhineland, in the Lusatian co-creation workshop, the quantitative socio-economic simulations were qualitatively reworked into narrative stories to make the scenarios easier for the participants to discuss. Furthermore, one of the authors of this paper interpreted the request for non-extractive research as an invitation to use the co-creation workshops to inform regional stakeholders about the initial results of the project and to give them the chance to comment on them. Therefore, in the workshops for Central Germany and Rhineland, results from a survey analysis comparing economic concerns in the mining regions were presented. Such first-hand results were thought to be of interest to regional stakeholders and an immediate benefit for investing their time. Due to these differences in design, the workshops varied in duration between under three hours to nearly four hours.

The workshops in Central Germany and Rhineland were moderated by a three-person team consisting of two economists and one sociologist, all members of regional research institutions. The workshop in Lusatia was moderated by a political scientist affiliated with a regional research institution. In each case, involving regionally embedded researchers was meant to establish trust among regional stakeholders and to portray the ENTRANCES project as being motivated by a genuine interest in regional development and not merely an extractive research exercise.

Participants, data collection and analysis

Participants in the co-creation workshops came from a pool of 50 to 60 stakeholders per region that were divided into three categories (politics and public administration, the economy, civil society and environmental NGOs) through desktop research at the beginning of the ENTRANCES project. During the project, these stakeholders were sequentially contacted for individual interviews, focus groups and the co-creation workshops. In Central Germany and Rhineland, the entire pool of stakeholders was invited by personalised emails to participate in the co-creation workshops. The pattern of participation was the result of self-selection, with little overlap to former participation in interviews and focus groups. In Lusatia, regional stakeholders that were interviewed or took part in focus groups earlier in the project were individually invited to participate in the co-creation workshop. To achieve a broad representation of the three stakeholder categories, members of missing categories were specifically contacted. In Lusatia, there was a greater overlap in stakeholders who had participated in previous project activities.

Table 2: Participants by region and stakeholder category

	Politics and public administration	Economy	Civil society and environmental NGOs	Total
Central Germany	1	4	2	7
Lusatia	3	2	1	6
Rhineland	1	2	6	9
Total	5	8	9	22

The workshops took place online between 24 April and 31 May 2023. In the end, a total of 22 regional stakeholders participated, seven in Central Germany, six in Lusatia and nine in Rhineland (Table 2). Five participants were involved in politics and public administration, eight were economic stakeholders, and nine came from civil organisations and environmental NGOs.

Most of the participants from Central Germany were economic stakeholders, three representing a large labour union and one representing the regional chamber of crafts. One civil society representative identified themselves as a researcher in regenerative energy supplies and an activist for environmental issues through "community organising" (Meier et al., 2022). The second civil society representative was a professional historian, knowledgeable about the economic and cultural heritage of the region. The political stakeholder was an active member of a local city council from a centre-left party.

The participants in the Lusatia workshop were representatives from state politics and public administration across various levels of government. The civil society representative had once been a long-term mayor of a village now known for its vibrant local community. Economic actors represented the regional chamber of industry and commerce and the regional branch of a large energy supplier.

Most participants in the Rhineland workshop were active in civil society, four were actively involved in environmental issues at different levels of government, one worked in a regional education network, and one represented a regional women's council. The economic stakeholders represented the regional business association of the chemical industry and the agricultural business chamber.

With prior consent of the participants, the workshops were recorded via a web-based meeting platform and transcribed afterwards.

Secondary qualitative content analysis and ethnographic reflection

Our aim in this paper is to reconstruct the interactive performance of expertise between researchers and regional stakeholders. While secondary analyses of qualitative data have yet to reveal their full potential (Heaton 2008), we did a secondary content analysis of the workshop transcripts (Kuckartz 2014). First, we analysed the transcripts sequentially, focusing later on communicative cues of declarative and procedural knowledge about the region. Since we were moderators of the workshops and participated in other parts of the ENTRANCES project, we also reflect upon our observations and experiences as participants in the field. During our participation in the project, we had no intention of being participant-observers (cf. Gold 1958), which helped us to perform our roles. Only afterwards did we reflect upon our observations and experiences and work on objectifying them through theoretical reflection (Scheffer 2002).

THE CO-CREATION OF REGIONAL EXPERTISE

In this section, we begin by presenting the range of role expectations that participants had in the workshop. Then we discuss the typical interaction patterns of the scientists and regional stakeholders that formed the hybrid character of the regional expertise. While scientists were expected to meet the regional stakeholders on an equal footing, the latter were expected to provide formal and practical knowledge about the region that was relevant for policy formulation at various levels of government. Finally, we discuss two issues surrounding selectivity that might undermine the formation of regional expertise.

Role orientations of individual participants

If we understand expertise to mean the marshalling of knowledge for action, it is important to note that the stakeholders in the workshops not only had professionally different knowledge bases but also differential access to policy formulation. The latter is especially evident in the expectations of actors regarding their role in the workshop.

The researchers participating in the workshop (including the authors of this paper) introduced themselves as representatives of the ENTRANCES project and hence advocates of the general objective to produce policy recommendations. In their roles as moderators, presenters of scenarios, and technical assistants, they were expected to put their views largely to one side and elicit the relevant knowledge from stakeholders.

Participants who introduced themselves at the beginning of the workshop as being able to contribute expertise in policy formulation were stakeholders from the political and economic sectors. Political actors in Lusatia, for example, expected the workshop to provide them with "food for thought" and "suggestions to concretise visions". Since policy formulation is part of the professional remit of politicians and administrators, the co-creation workshop offered them the opportunity to explore unconventional solutions and budget restrictions. The city council member in Central Germany regarded the workshop as a learning opportunity, especially about how a city could contribute to making the clean energy transition more equitable. The representative of the energy supplier in Lusatia had been well-established in the region for 25 years and also participated at the national level in the so-called Coal Commission. He was hoping to find ways to accelerate the process of the clean energy transition. Similarly, the representative of the business association in Lusatia hoped to "improve" the structural change process or "correct" maldevelopments that occurred in the course of this process.

A second functional understanding of expertise expressed by the participants was knowledge brokering through networking. Representatives of the labour union in Central Germany considered that their role in policy formulation was to ensure that workers participated in the change process by networking within and across the lignite mining regions. Similar networking approaches were used by the member of the chamber of crafts in Central Germany, the educational agency manager in Rhineland, and the members of the two environmental NGOs in Rhineland. For these stakeholders, participating in the co-creation workshop was a crucial element of their networking activities.

A third approach to expertise relates to the articulation of criticism. The representative of a county-level business development agency in Lusatia took a slightly critical view: While self-identifying as a political decision maker, he recognised the need to take "citizens more on board". Similarly, a former Lusatian mayor expressed the need for more attention to be paid to peripheral areas and for small-scale developmental projects to be considered in structural change funding schemes. The representative of a citizens' group from a village close to an open pit mine in Rhineland took an even more critical view towards the governance of the transformation process because he believed stakeholders from civil society were at a severe disadvantage in terms of political participation; the same views were held by the representative of a civil organisation in Central Germany.

The director of a historical collection in Central Germany was an interesting case. Although he did not feel he was "worthy" of participating in the workshop, he had nevertheless accepted the invitation because of his academic profession. While he explicitly denied having technical knowledge about

structural change, throughout the workshop, he contributed significant knowledge about the economic history of lignite mining. Due to his reflective professional role, he was able to introduce more visionary suggestions than other participants. A similarly visionary approach was taken by civil society stakeholders in Rhineland, who called for discursive spaces for debating values and developing utopias.

Even though participants were invited particularly because of their assumed practical expertise as members of stakeholder organisations, some doubted that they had any expertise at all about structural change. These stakeholders had been encouraged by others to participate, e.g., colleagues, their superiors, or the research team. The spokesperson of a women's association in Rhineland, for example, questioned her own expertise on the topic. Although she had been surprised to receive an invitation from the research team, she decided to participate because women were also part of the population affected by the lignite phase-out and she wanted to disseminate the knowledge she acquired in the workshop afterwards. A public administration officer at the district level in Rhineland belittled her own potential expertise by saying that her work was concerned with the "details of open pit mines rather than the broader picture". Later, she provided clear information on the recultivation options for open pit mines – but only after being directly addressed by a moderator who deliberately asked very basic questions that occurred to him as a lay person on that specific topic, e.g., What would happen if we did not do anything with the open pit mines? Would the mines not be automatically reclaimed by nature? She ruled this out as a viable option for legal and for safety reasons. The representative of the agricultural business chamber in Rhineland said she was new to the job and therefore had almost no expertise on the issue. These participants' low self-assessment meant that they only made marginal contributions to the discussion and some dropped out early.

The hybrid knowledge base of regional expertise

To investigate the assembly of regional expertise that was sought after in the ENTRANCES project, we compare the interaction of scientists and regional stakeholders in several instances where disputes over knowledge emerged or could be expected to emerge. Previous studies argued that experiential knowledge was often dominated by abstract forms of academic knowledge (Groves 2017). For this step of the analysis, we assumed that both academic and experiential knowledge could be relevant for assembling regional expertise, however, we wanted to examine how their relationship is situated by looking at how different forms were used by participants. Theoretically, experiential and formal knowledge could complement one another, but they could also conflict with one another as well.

Scientific knowledge challenged by regional stakeholders

We begin by describing how regional stakeholders interacted with scientific knowledge that was obtained through a standardised survey in an early attempt to evaluate policy. In the workshops for Central Germany and Rhineland, the moderator presented survey results relating to the development of personal economic concerns in lignite mining regions in Germany (2016-2021). These results were still under review by an academic journal and were based on the German Socio-Economic Panel Study which defined mining regions according to the statistical construct of labour market areas. Findings showed that there were no statistically significant differences between lignite mining regions and the rest of Germany. There was basically a downward trend in the likelihood of there being strong economic concerns. To a certain extent, this can be interpreted as a positive evaluation of the regional structural policy that accompanied the coal phase-out. Stakeholders actively engaged with the results, utilising their experience in interpreting numbers and their

knowledge about the regions. In Central Germany, for instance, they mentioned contradictory evidence from other surveys, especially for Central Germany and Lusatia (MDR 2022). Above all, they questioned the operationalisation of mining regions on the basis of economic arguments about labour market areas being too broad for the purpose of policy evaluation. Instead, they insisted that the legally codified definition of mining regions at the county level ought to be used. Regional stakeholders argued that applying the legal definition would assure comparability with other studies. As a consequence, the project team changed their operationalisation of mining regions to facilitate the commensurability of results. While the adjustment in the operationalisation of mining regions did not significantly change the results, it should be noted that the potential use of the results for policy formation was decisive for this workshop controversy and not theoretical arguments about territorially interlocking labour markets.

This part of our analysis demonstrates that it is possible for co-creation workshops to temporarily establish a level playing field among heterogeneous participants that allows for reciprocal exchange. This does not mean, however, that institutionalised hierarchies between academic and non-academic forms of knowledge no longer persist — as will be shown below.

Singular and commensurable regional knowledge

Since the ENTRANCES project aimed to generate policy-relevant knowledge about specific features of regions, we would like to describe how regional characteristics were marked communicatively during the workshops. Using an ideal typical distinction: were regions described as singular places or as commensurable territories?

When participants referred to the regions by name, but also by using indexical expressions, such as "here", "in our region" etc., both forms of reference demarcate regions as places with a unique identity and singular features. However, in order for subjective knowledge about a region to become policy-relevant, it needs to be connected to more general forms of knowledge, otherwise, it will be difficult to justify claims in public debates. The workshops provided several examples of how stakeholders translated specific collective experiences of regions into more commensurable terms that have already been established as scientific facts. For example, stakeholders in Central Germany and Lusatia discussed demographic decline and skilled labour shortages to a much larger extent than in Rhineland. This coincides with current scientific knowledge on the regional pattern of demographic change but also with the negative experiences of the people in the region, especially in Eastern Germany. Since public money is largely allocated to municipalities based on population figures, demographic decline means fewer monetary resources which is often accompanied by a decline in infrastructure. The effects of demographic decline have been felt most strongly in Lusatia because of the overall sparser population density there. Infrastructure is a spatially unique feature; hence, when projects are discontinued or never implemented, this is often perceived as a collective devaluation or an existential threat to the place itself. Stakeholders in Lusatia, for example, expressed their disappointment that railway projects they had hoped for have not been realised because "they [the federal government] think that there is not enough of us". Administrative regulations use viability thresholds, translating continuous variables (population numbers) into allocations in-kind (infrastructure categories for particular places). These criteria play out negatively for Lusatia because of demographic decline but also because the region borders the Czech Republic, which makes it a peripheral territory in a national sense despite being quite centrally located in Europe.

Hence, this brief example shows how the specific collective experience of a region can be translated into more commensurable terms, especially when academic knowledge backs it. However, academic

knowledge can also be used to challenge experiential knowledge. In another instance, the representative of the chamber of crafts in Central Germany argued that the value of water turbines in small streams to make energy production more efficient was being underestimated. While he had first-hand knowledge from practical cases on how to implement such turbines, his efficiency claim was challenged by a female environmental activist citing established expert knowledge which states that the potential for water-turbine-based energy production is basically exhausted in Germany. Her reference to this quietly ended this debate.

Conceptual debates initiated by regional stakeholders

Often, academic discourse that focusses on a critique of terms used in public or academic debate is considered too detached from practical relevance (Abend 2023). The debates of lay experts in these workshops question such a view by speaking to the performativity of academic debates in (mundane) politics.

The title of the ENTRANCES project includes the notion of "energy transition" as a way of defining its subject. There was, however, no strict language policy among project members during the actual project activities. Project members used terms such as "energy transition", "structural change", "sustainability transformation", "climate mitigation policy", etc., depending on their disciplinary or theoretical background and the situation at hand. The Coal Commission and the resulting federal legislation had a clear focus on economic terms, such as regional "investment" and "structural reinforcement" policies. The media, an important source of common knowledge, have not applied a consistent language policy when reporting on the coal phase-out. Hence, in the absence of clear terminological expectations, it is rather surprising that debates about the political implications of concepts emerged in two of the workshops. These debates were initiated by regional stakeholders, not researchers.

Overall, regional stakeholders used "energy transition" and "structural change" roughly twice as much as "transformation". A civil society stakeholder in Central Germany explicitly asked which term to use in the workshop because of the normative and systemic implications of concepts. Civil society stakeholders in the Rhineland workshop discussed the conceptual implications of different terms more extensively and supported each other in criticising the narrow focus of North Rhine-Westphalia's regional policy on economic structural change when actually a much broader societal sustainability transformation was needed in their view. One civil society stakeholder used a local example to emphasise the practical implications of differentiating between concepts:

> And then you end up with what I call a technocratic understanding of how structural change can work. That's what I call the logic of economic development. You can see that here. That's how it works here. Occasionally, decisions are made. You find them a bit questionable. And then there are those who write letters to the editor. 'Why is the indoor riding arena at Soers Sports Park being subsidised?' And so on. What does that have to do with structural change? But the other thing would be to move away from or beyond this economic development logic to understand the whole thing as a transformation […] We are undergoing a major transformation, whether we like it or not. The transformation actually means, yes, doing business and living more sustainably. It also means taking biodiversity into account. That is also part of the process if we want to transform the mining area here in Rhineland (own transcript).

The historian in Central Germany argued for the strategic use of the term transformation because it allows a link to be made between the current aim of a sustainability transformation and the historical

experience in the region of the peaceful revolution in the former German Democratic Republic. He felt that it was crucial to create a connection between these two processes in order to reinforce the regional identity of the Central German region. In the Lusatian workshop, such conceptual issues were not discussed in depth. The most frequent term used in that workshop was structural change. Since the categorical composition of the regional stakeholders in the workshops differed significantly, it is difficult to ascertain whether this divergence is attributable to regional specificities or to the stakeholder categories.

Overall, the stances taken by regional stakeholders indicate a greater sensitivity for the implications that concepts can have on policy than that which was found among the participating researchers. The similarities between workshop and academic debates could be interpreted as a form of emergent scientisation of society (Beck and Bonß 1989; Weingart 1983).

Problems of selectivity

Scientific knowledge usually claims to be universal, a claim that is based on methodological standards on the one hand, as well as on the specification of a scope of validity. Two forms of selectivity turned out to be especially problematic in relation to the production of regional expertise for multilevel governance in the co-creation workshops that we analysed.

Selective participation

When interpreting the recommendations produced in regional co-creation workshops, it would be ideal to be able to control the categorical composition of the stakeholders. In the workshops we analysed, participation was highly selective. There are many reasons for this, including the fact that the workshops fostered existing regional policy networks. Another reason is that regional stakeholders face time restraints and some also lack self-confidence. Time restraints were mentioned, especially by civil society stakeholders, but probably apply to many other stakeholders that were invited but did not participate. A lack of self-confidence became indirectly clear in the reluctance of some participants to actively contribute to the workshop debates. Assuming an equal composition of stakeholders, specific workshop topics could arguably be interpreted as indications of regional specificities. In lieu of controlling stakeholder participation, information from workshops can be cross-checked with current academic knowledge of the region for external validation. Otherwise, it is difficult to draw conclusions about regional singularities.

The problem is exemplified by the topic of qualified workforce shortages. Such shortages were alluded to in all regions, with problems being portrayed as being most severe in Lusatia, followed by Central Germany and Rhineland. This rating corresponds to the scientific information available (Jansen and Schirner 2020). However, problems related to vocational education were only discussed in great detail in Central Germany. Economic stakeholders there consisted of three labour unionists and a delegate from the chamber of crafts. Their expertise was based on universal knowledge as well as copious experience of the competition between vocational and academic education programmes, on the one hand, and school dropouts on the other. Their normative and analytical emphasis of this problem is in contrast with stakeholders in Lusatia and Rhineland. Another example of the subject-related influence of stakeholder positions and thus evidence for the importance of workshop recruitment is the evaluation of participatory governance instruments in designing regional policies of structural change. Although participatory governance instruments were considered important in all regions, existing procedures were most vigorously criticised by civil society stakeholders in Rhineland. Since no systematic comparisons of participatory governance instruments across the

three lignite mining regions exist, it is difficult to assess where improvements would be needed the most. What can be seen, however, is the degree of elaboration on the arguments put forward. Stakeholders in Rhineland, for example, justified their criticism by providing more than just negative experiences. They also suggested that improvements could potentially be made through "citizen councils" (Dienel 2002; Lietzmann et al., 2021). The discussion of participatory governance was fundamentally different in Lusatia, where stakeholders criticised citizen participation as often being ineffective and inefficient. Instead of participatory governance, a broader distribution of the benefits of clean energy projects at the local level was considered a superior form of "economic participation".

Hence, if co-creation workshops are expected to gain information on regional specificities, it would be crucial to minimise selection bias in participation. While a random selection of participants seems to offer a possible solution to this problem, it does not rule out selectivity completely and might miss the point of recruiting regional stakeholders, who are relevant for policy formulation and implementation, instead of individual citizens.

Selective aggregation and communication

As in every research endeavour, contributions to co-creation workshops do not speak for themselves – they have to be interpreted, evaluated and aggregated to be able to inform policy. This argument assumes that policy recommendations are written up by researchers in a report or are orally presented to policymakers. Reports for comparing a relatively large number of regional case studies (in ENTRANCES there were 13) can be highly standardised and, as a consequence, much of the regionally specific knowledge is levelled out in the writing process. Alternatively, leaving more space for professional judgement runs the risk of producing regional reports that are difficult to compare and aggregate into meaningful messages. While policy recommendations from the co-creation workshops in ENTRANCES have been documented in public reports, we do not aim to systematically compare them here. Instead, we would like to describe how we experienced the oral presentation of policy recommendations to representatives of the European Commission in Brussels, which was another format of co-creation that we attended virtually.

At a certain stage of the workshop, a summary of the policy recommendations was presented. It was a rather long list of diverse issues with no explicit aggregation criteria and without a single "take-home message". These recommendations were later discussed in a round table attended by several principal investigators of the project. During this discussion, the conclusion of one economist stood out to us. He asserted that the conclusions to be drawn were obvious: As a society, we have to restrict our energy consumption. The best way to achieve this was to raise energy prices, mainly through carbon emission trading. This would mean less growth in the future compared to what could be expected were there no restrictions on energy consumption. But the latter would mean not achieving the internationally agreed on global warming targets, which he did not consider to be an option.

Hence, there it was, a clear message for policymaking, ready to be translated into governance structures. It was difficult to see how these comparatively clear-cut conclusions could have been drawn from the diverse list of policy recommendations presented earlier. Instead, they corresponded mainly to economic theorising about climate mitigation policy (MacKenzie 2009). These policy recommendations could have been generated (and indeed have been implemented to a certain extent) without the co-creation workshops in different European regions. Were these workshops then in vain?

We (the authors of this paper) discussed this question and came up with the following answer: Today, policy – including the coal phase-out policy – is created by actors at different levels of governance. While the formally derived policy recommendation of economists could have been obtained without co-creation workshops, the policymakers relevant for such a policy operate at rather high levels of governance, such as the EU or the national level. At the same time, the design and implementation of structural change policies accompanying the coal phase-out are, to a large extent, decided at rather low levels of governance, such as the regional or local level. At these governance levels, the problem of aggregation is either absent or less severe. Furthermore, at the regional and local level, co-creation workshops not only contribute to policymaking through the development of declarative knowledge but also provide procedural knowledge by virtue of being carried out. Co-creation workshops constitute not only instances of co-operative debate but also potential networking among participants that could be activated at a later point.

DISCUSSION AND CONCLUSIONS

In this paper, we set out to analyse the objectives and practice of co-creating regional expertise. We applied the notion of expertise to the objective of transformative research to produce "socially robust" knowledge that is assumed to catalyse social change. In transformative research, co-creation of knowledge between researchers and practitioners is considered a way to produce such knowledge. In terms of concrete workshops that aim to generate policy recommendations, this places certain expectations on participants. We analysed three co-creation workshops in German lignite mining regions to assess how these expectations are met empirically. In this section, we summarise our results on the assembling of regional expertise in co-creation workshops and then reflect upon the role of such hybrid forms of knowledge production for science and politics.

We summarise our results by highlighting three points: *First*, the role orientations of regional stakeholders in co-creation workshops depend on their access to political power. They ranged from being open to new ideas among policymakers, to a rather fundamental critique of existing policies among civil society actors, to a rejection of the notion of being an expert at all. Ideally, such different viewpoints can stimulate each other to create an emergent form of collective regional expertise that is more than the sum of its parts. Indeed, interaction formats that enable trust-based relationships between scientists, decision makers and technical administrative staff are most likely to facilitate policy learning (Rittelmeyer et al., 2024). For facilitators of workshops with heterogenous target groups, it is crucial to be attentive to the self-marginalising voices among participants and to encourage them to make themselves heard. The participants who saw themselves as being rather ill-equipped to contribute to collective regional expertise were either a) working in a subordinate position, b) academics scholars from the humanities or c) female. *Second*, during the interaction in workshops, the participants did not establish a clear hierarchy between academic and experiential forms of knowledge so that the collective knowledge base was a rather hybrid one. This became evident in two ways: Facilitators explicitly encouraged participants to share their views, and regional stakeholders both challenged the academic knowledge presented to them and drew on objectified knowledge themselves in addition to their practical knowledge. *Third,* the regional specificity of expertise is most valuable at lower levels of governance. If experience-based knowledge is translated to higher levels of governance, this does not mean that it is actually devalued, but it almost necessarily changes its form (Demszky and Nassehi 2012, cf.). It is also at local and regional governance levels that the networking effect for participants of co-creation workshops is most relevant for further exchange in the future (cf. Levelt and Metze 2013). Such networking effects can be especially valuable for the practicability of policies, i.e., enhancing their efficiency. While the EU

uses network governance to increase the efficiency and legitimacy of its policies (Börzel and Heard-Lauréote 2009), we were able to show how EU research policy fosters this approach.

However, reflecting upon this workshop format, we also identified two main challenges: *First*, participation in co-creation workshops is highly selective. This selectivity in the composition of workshop participants is also reflected in how they contribute during the workshop. Because of this selectivity, the aim to widen the knowledge of expertise can therefore be questioned not only from a scientific but also from a democratic standpoint. Stakeholders involved in the co-creation of (regional) expertise are still self-interested actors (Seibicke 2024). Whose voices are likely to be assembled into regional expertise? One scientific response to the problem of selectivity is professional research ethics: Researchers conducting co-creation workshops bear the responsibility of ensuring a balanced interpretation of results. This responsibility can be pre-structured by developing professional guidelines for developing policy recommendations (Rudnicki and Wojnicka 2024). Furthermore, from a democratic perspective, it can be argued that policy recommendations resulting from co-creation workshops are typically fed into policymaking processes that usually enjoy democratic legitimacy and policymakers are free in their decision to use them or not. While co-creation workshops, such as the ones presented here, generate recommendations for policymakers, it is the task of politics to create political liability from them.

A *second* potential limitation that we identified was the aggregation of regional expertise to higher governance levels. While there is no obvious or unchallenged mechanism available in processes of knowledge co-creation to aggregate diverse forms of knowledge, democratic political institutions usually provide formal and informal rules on how to aggregate a diversity of viewpoints.

Against this backdrop, we point out three possible alternative approaches to complement or stand in place of co-creation workshops for the purpose of assembling regional expertise: Citizen councils with randomly selected participants (Lietzmann et al., 2021), surveys with regionally representative samples, and more socio-demographically representative political institutions. While the first two alternatives have variously been implemented, the problem of more socio-demographically representative political institutions has remained unresolved. Engagement in political parties and candidates running for parliamentary office have increasingly come from an academic and urban background (Bovens and Wille 2017; Elsässer et al., 2017; Haffert 2024), which means that practical knowledge of various fields in a functionally differentiated society is systematically crowded out of policymaking. Therefore, this seems to be the most relevant challenge for the future of democratic governance.

What do we learn from this form of network governance in EU-funded research for the relationship between science, politics and society? *First*, our research shows that EU-funded research is an important force in the hybridisation of science and politics as proposed, for instance, in the Mode 2 literature. This is even more so because third-party funding has become an indispensable way of financing research. Indeed, third-party funding increases the likelihood of knowledge exchange between science and policy (Thune et al., 2023). Even though it can be argued that EU funding criteria that favour hybrid formats of assembling policy expertise have contributed to methodological innovation, these formats and their implications will continue to require scholarly reflection (Barbosa Mendes et al., 2024). *Second*, while our analysis suggests that (regional) expertise from such hybrid production formats does not permeate higher levels of the EU governance system to the same degree as lower levels, this is not necessarily a downside because demand for expertise is likely to correspond to the responsibilities of the respective governance levels. Other research suggests that there are also national varieties of evidence use in (energy) policy (McDowall 2024). At the same

time, the likelihood of policymakers participating in knowledge exchange increases in proportion to their own experience in academia (Luhmann 1977; Thune et al., 2023). Hence, taking a further step back from the hybridisation of formats for producing expertise (e.g., through funding criteria), it is the secular academisation process that produces a hybridisation of expertise in society that is often overlooked (Stock et al., 2024).

REFERENCES

Abend, G. (2023). *Words and distinctions for the common good: Practical reason in the logic of social science.* Princeton University Press.

Abson, D. J., Fischer, J., Leventon, J., Newig, J., Schomerus, T., Vilsmaier, U., Wehrden, H. von, Abernethy, P., Ives, C. D., Jager, N. W., & Lang, D. J. (2017). Leverage points for sustainability transformation. *Ambio*, *46*(1), 30–39. https://doi.org/10.1007/s13280-016-0800-y

Barbosa Mendes, A., Bruns, C., Mahr, D., & Driessen, S. (2024). Understanding methodological innovation in participatory research: insights from participatory EU-funded projects. *Journal of Science Communication*, *23*(06), N03. https://doi.org/10.22323/2.23060803

Baron, D., & Bartl, W. (2024). The Coal Phase-Out in Germany and its Regional Impacts on Economic Worries. *Social Sciences*, *13*, 339. https://doi.org/10.3390/socsci13070339

Barrett, T. (2022). *Lusatia Case Study Report* (ENTRANCES D3.2). Leibniz Institute of Ecological Urban and Regional Development (IOER). https://entrancesproject.eu/wp-content/uploads/2022/12/D3.2-Lusatia-Case-Study-Report.pdf

Bartl, W., Heinisch, K., Holtemöller, O., Sackmann, R., & Schult, C. (2022). *Central Germany Case Study Report* (Energy Transitions from Coal and Carbon: Effects on Societies [ENTRANCES] D3.4). https://entrancesproject.eu/wp-content/uploads/2022/12/D3.4-CentralGermany-Case-Study-Report.pdf

Bartl, W., Heinisch, K., Holtemöller, O., & Schult, C. (2022). *Rhineland Case Study Report* (Energy Transitions from Coal and Carbon: Effects on Societies [ENTRANCES] D3.3). https://entrancesproject.eu/wp-content/uploads/2022/12/D3.3-Rhineland-Case-Study-Report.pdf

Bauer, M. W., & Börzel, T. A. (2010). Regions and the European Union. In H. Enderlein, S. Wälti, & M. Zürn (Eds.), *Handbook on multi-level governance* (pp. 253–263). Edward Elgar.

Bechmann, G. (2003). The Rise and Crisis of Scientific Expertise. In G. Bechmann & I. Hronszky (Eds.), *Expertise and its interfaces: the tense relationship of science and politics* (pp. 17–34). edition sigma.

Beck, U. (1992). From industrial society to the risk society: Questions of survival, social structure and ecological enlightenment. *Theory, Culture & Society*, *9*(1), 97–123. https://doi.org/10.1177/026327692009001006

Beck, U., & Bonß, W. (1989). Verwissenschaftlichung ohne Aufklärung? Zum Strukturwandel von Sozialwissenschaft und Praxis. In U. Beck & W. Bonß (Eds.), *Weder Sozialtechnologie noch Aufklärung? Analysen zur Verwendung sozialwissenschaftlichen Wissens* (pp. 7–45). Suhrkamp.

BGBl (2020). Strukturstärkungsgesetz Kohleregionen. Vom 8. August 2020. *Bundesgesetzblatt, Teil I*(37), 1795–1817.

Bickman, L. (1987). The functions of program theory. In L. Bickman (Ed.), *Using program theory in evaluation* (pp. 5–18). Jossey-Bass. https://doi.org/10.1002/ev.1443

Boezeman, D., & Coninck, H. de (2018). Improving collaborative knowledge production for climate change mitigation: lessons from EU Horizon 2020 experiences. *Sustainable Earth*, *1*(1), 6. https://doi.org/10.1186/s42055-018-0007-0

Börzel, T. A., & Heard-Lauréote, K. (2009). Networks in EU Multi-level Governance: Concepts and Contributions. *Journal of Public Policy*, *29*(2), 135–151. https://doi.org/10.1017/S0143814X09001044

Bovens, M., & Wille, A. (2017). *Diploma democracy: the rise of political meritocracy*. Oxford University Press.

Brachert, M., Heinisch, K., Holtemöller, O., Kirsch, F., Neumann, U., Rothgang, M., Schmidt, T., Schult, C., Solms, A., & Titze, M. (2023). *Begleitende Evaluierung des Investitionsgesetzes Kohleregionen (InvKG) und des STARK-Bundesprogramms. Zwischenbericht vom 30.06.2023: Gutachten im Auftrag des Bundesministeriums für Wirtschaft und Klimaschutz.* Leibniz-Institut für Wirtschaftsforschung Halle (IWH).

Buschmann, P., & Oels, A. (2019). The overlooked role of discourse in breaking carbon lock-in: The case of the German energy transition. *WIREs Climate Change*, *10*(3), e574. https://doi.org/10.1002/wcc.574

Büttner, S., & Laux, T. (Eds.). (2021). *Umstrittene Expertise: Zur Wissensproblematik der Politik*. Nomos.

Carayannis, E. G., & Campbell, D. F. J. (2010). Triple Helix, Quadruple Helix and Quintuple Helix and how do knowledge, innovation and the environment relate to each other? a proposed framework for a trans-disciplinary analysis of sustainable development and social ecology. *International Journal of Social Ecology and Sustainable Development*, *1*(1), 41–69.

Collins, H. M., & Evans, R. (2002). The Third Wave of Science Studies: Studies of Expertise and Experience. *Social Studies of Science*, *32*(2), 235–296. https://doi.org/10.1177/0306312702032002003

David, M., & Gross, M. (2019). Futurizing politics and the sustainability of real-world experiments: what role for innovation and exnovation in the German energy transition? *Sustainability Science*, *14*(4), 991–1000. https://doi.org/10.1007/s11625-019-00681-0

Demszky, A., & Nassehi, A. (2012). Perpetual loss and gain: Translation, estrangement and cyclical recurrence of experience based knowledges in public action. *Policy and Society*, *31*(2), 169–181. https://doi.org/10.1016/j.polsoc.2012.04.006

Dienel, P. C. (2002). *Die Planungszelle: Der Bürger als Chance* (5. Auflage, mit Statusreport 2002). Westdeutscher Verlag. https://doi.org/10.1007/978-3-322-80842-4 (Original work published 1978)

Diluiso, F., Walk, P., Manych, N., Cerutti, N., Chipiga, V., Workman, A., Ayas, C., Cui, R. Y., Cui, D., Song, K., Banisch, L. A., Moretti, N., Callaghan, M. W., Clarke, L., Creutzig, F., Hilaire, J., Jotzo, F., Kalkuhl, M., Lamb, W. F., . . . Minx, J. C. (2021). Coal transitions—part 1: a systematic map and review of case study learnings from regional, national, and local coal phase-out experiences. *Environmental Research Letters*, *16*(11), 113003. https://doi.org/10.1088/1748-9326/ac1b58

Elsässer, L., Hense, S., & Schäfer, A. (2017). „Dem Deutschen Volke"? Die ungleiche Responsivität des Bundestags. *Zeitschrift Für Politikwissenschaft*, *27*(2), 161–180. https://doi.org/10.1007/s41358-017-0097-9

Epstein, S. (2023). The Meaning and Significance of Lay Expertise. In G. Eyal & T. Medvetz (Eds.), *The Oxford Handbook of Expertise and Democratic Politics* (pp. 76–102). Oxford University Press.

European Commission. (n.d.). *The Just Transition Mechanism: making sure no one is left behind.*

Eyal, G. (2013). For a Sociology of Expertise: The Social Origins of the Autism Epidemic. *American Journal of Sociology*, *118*(4), 863–907. https://doi.org/10.1086/668448

Eyal, G., & Medvetz, T. (2023). Introduction. In G. Eyal & T. Medvetz (Eds.), *The Oxford Handbook of Expertise and Democratic Politics* (pp. 1–26). Oxford University Press.

Fazey, I., Schäpke, N., Caniglia, G., Hodgson, A., Kendrick, I., Lyon, C., Page, G., Patterson, J., Riedy, C., Strasser, T., Verveen, S., Adams, D., Goldstein, B., Klaes, M., Leicester, G., Linyard, A., McCurdy, A., Ryan, P., Sharpe, B., . . . Young, H. R. (2020). Transforming knowledge systems for life on Earth: Visions of future systems and how to get there. *Energy Research & Social Science*, *70*, 101724. https://doi.org/10.1016/j.erss.2020.101724

Folkers, A. (2022). Preventing the Unpreparable. Catastrophe Thresholds from Covid to Climate. *Sociologica*, *15*(3), 85–106. https://doi.org/10.6092/ISSN.1971-8853/13564

Fritz, L., Schilling, T., & Binder, C. R. (2019). Participation-effect pathways in transdisciplinary sustainability research: An empirical analysis of researchers' and practitioners' perceptions using a systems approach. *Environmental Science & Policy*, *102*, 65–77. https://doi.org/10.1016/j.envsci.2019.08.010

Gaudry, A. J. P. (2011). Insurgent Research. *Wicazo Sa Review*, *26*(1), 113–136. https://doi.org/10.5749/wicazosareview.26.1.0113

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, *36*(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003

Gellner, W. (1995). *Ideenagenturen für Politik und Öffentlichkeit*. VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-322-95636-1

Gengnagel, V., Zimmermann, K., & Büttner, S. M. (2022). 'Closer to the Market': EU Research Governance and Symbolic Power. *Journal of Common Market Studies*, *60*(6), 1573–1591. https://doi.org/10.1111/jcms.13326

Gold, R. L. (1958). Roles in Sociological Field Observations. *Social Forces*, *36*(3), 217–223. https://doi.org/10.2307/2573808

Groves, C. (2017). Emptying the future: On the environmental politics of anticipation. *Futures*, *92*, 29–38. https://doi.org/10.1016/j.futures.2016.06.003

Grundmann, R. (2017). The Problem of Expertise in Knowledge Societies. *Minerva*, *55*(1), 25–48. https://doi.org/10.1007/s11024-016-9308-7

Haffert, L. (2024). Unequal Geographic Representation in a Mixed-Member Electoral System: Evidence from the German Bundestag. *German Politics*, *33*(1), 86–109. https://doi.org/10.1080/09644008.2021.1982901

Heaton, J. (2008). Secondary analysis of qualitative data: An overview. *Historical Social Research*, *33*(3), 33–45.

Heer, S. (2020). *Bürgerbeteiligung im Lausitzer Strukturwandel. Ziele und Ausgestaltung bürgerschaftlicher Teilhabe im Zuge des Braunkohleausstiegs* (IZS Policy Briefs). Leibniz Institute of Ecological Urban and Regional Development (IOER). https://doi.org/10.26084/06hc-t057

Heer, S., Büssers, S., Krehl, A., & Knippschild, R. (2024). *Towards an integrative, interdisciplinary perspective on governing regional lignite phase-out in Germany,* (Discussion Paper 14/2024). Niederrhein Institute for Regional and Structural Research. https://www.hs-niederrhein.de/fileadmin/dateien/Institute_und_Kompetenzzentren/NIERS/Discussion_Paper_Nr.17_2024_MS_17_Heer_etal_Braunkohle_.pdf

Heer, S., Wirth, P., Knippschild, R., & Matern, A. (2021). Guiding principles in transformation processes of coal phase-out. The German case of Lusatia. *The Extractive Industries and Society*, *8*(1), 159–167. https://doi.org/10.1016/j.exis.2020.07.005

Herberg, J., Kamlage, J.-H., Gabler, J., Goerke, U., Gürtler, K., Haas, T., Löw Beer, D., Luh, V., Knobbe, S., Reinermann, J., Staemmler, J., & Venghaus, S. (2020). *Partizipative Governance und nachhaltiger Strukturwandel: Zwischenstand und Handlungsmöglichkeiten in der Lausitz und im Rheinischen Revier*. Institute for Advanced Sustainability Studies (IASS).

Hölscher, K., Wittmayer, J. M., Hirschnitz-Garbers, M., Olfert, A., Walther, J., Schiller, G., & Brunnow, B. (2021). Transforming science and society? Methodological lessons from and for transformation research. *Research Evaluation*, *30*(1), 73–89.

Isakova, A., Neuwinger, M., Schulze Waltrup, R., & Uraiqat, O. (2024). Global challenges in world politics and their modes of construction. In A. Isakova, M. Neuwinger, R. Schulze Waltrup, & O. Uraiqat (Eds.), *Constructing Global Challenges in World Politics* (pp. 3–20). Routledge.

Jansen, A., & Schirner, S. (2020). *Die Fachkräftesituation in Deutschlands Kohleregionen* (KOFA kompakt 10/2020). Kompetenzzentrum Fachkräftesicherung (KOFA). https://www.bildung-rheinisches-revier.de/fileadmin/user_upload/Dokumente/Kohleregionen.pdf

Kaldewey, D. (2018). The grand challenges discourse: Transforming identity work in science and science policy. *Minerva*, *56*(2), 161–182. https://doi.org/10.1007/s11024-017-9332-2

Keeler, B. L., Chaplin-Kramer, R., Guerry, A. D., Addison, P. F. E., Bettigole, C., Burke, I. C., Gentry, B., Chambliss, L., Young, C., Travis, A. J., Darimont, C. T., Gordon, D. R., Hellmann, J., Kareiva, P., Monfort, S., Olander, L., Profeta, T., Possingham, H. P., Slotterback, C., . . . Vira, B. (2017). Society Is Ready for a New Kind of Science-Is Academia? *Bioscience*, *67*(7), 591–592. https://doi.org/10.1093/biosci/bix051

Kim, J., & Yoo, J. (2019). Science and Technology Policy Research in the EU: From Framework Programme to HORIZON 2020. *Social Sciences*, *8*(5), 153. https://doi.org/10.3390/socsci8050153

Knoblauch, H., & Löw, M. (2020). The Re-Figuration of Spaces and Refigured Modernity – Concept and Diagnosis. *Historical Social Research*, *45*(2), 263–292. https://doi.org/10.12759/HSR.45.2020.2.263-292

Kosow, H., & Gaßner, R. (2022). *Methoden der Zukunfts- und Szenarioanalyse: Überblick, Bewertung und Auswahlkriterien* (Werkstattbericht No. 103). Institut für Zukunftsstudien und Technologiebewertung (IZT). https://www.izt.de/media/2022/10/IZT_WB103.pdf

Kuckartz, U. (2014). *Qualitative text analysis: A guide to methods, practice & using software*. Sage.

Levelt, M., & Metze, T. (2013). The legitimacy of regional governance networks: Gaining credibility in the shadow of hierarchy. *Urban Studies*, *51*(11), 2371–2386. https://doi.org/10.1177/0042098013513044

Lietzmann, H. J., Renn, O., Freier, N., Kirby, N., & Oppold, D. (2021). *Bürgerräte als eine zeitgemäße Ergänzung der repräsentativen Demokratie: Handreichung für eine Implementation deliberativer Bürgerräte*. Institut für Demokratie- & Partizipationsforschung (i:DPF). https://doi.org/10.25926/rj2t-2763

Luderer, G., Kost, C., & Sörgel, D. (Eds.). (2021). *Ariadne-Report: Deutschland auf dem Weg zur Klimaneutralität 2045. Szenarien und Pfade im Modellvergleich*. Kopernikus-Projekt Ariadne, Potsdam-Institut für Klimafolgenforschung (PIK). https://doi.org/10.48485/pik.2021.006

Luhmann, N. (1977). Theoretische und praktische Probleme der anwendungsorientierten Sozialwissenschaften. In N. Luhmann (Ed.), *Interaktion von Wissenschaft und Politik: Theoretische und praktische Probleme der anwendungsorientierten Sozialwissenschaften* (pp. 16–39). Campus.

Luhmann, N. (1989). *Ecological communication*. Translated and introduced by John Bednarz Jr [Ökologische Kommunikation]. Polity Press.

MacKenzie, D. (2009). Making things the same: Gases, emission rights and the politics of carbon markets. *Accounting, Organizations and Society*, *34*(3), 440–455. https://doi.org/10.1016/j.aos.2008.02.004

Markard, J., Isoaho, K., & Widdel, L. (2022). Discourses around decline: Comparing the debates on coal phase-out in the UK, Germany and Finland. In Z. Koretsky, P. Stegmaier, B. Turnheim, & H. van Lente (Eds.), *Technologies in Decline* (pp. 118–144). Routledge.

McDowall, W. (2024). Exploring cultures of evidence in energy policymaking in the UK, Germany, and the Netherlands. *Policy and Society*, *43*(4), 463–478. https://doi.org/10.1093/polsoc/puae035

MDR. (2022). *Kohleausstieg – festhalten oder verschieben?* Mitteldeutscher Rundfunk (MDR). MDR fragt. https://www.mdr.de/nachrichten/mitmachen/mdrfragt/mdrfragt-ergebnisse-kohle-100-downloadFile.pdf

MDR. (2023). *Habeck-Vorstoß: Kohle-Aus 2030 - nach NRW nun auch im Osten?* Mitteldeutscher Rundfunk (MDR). MDR fragt. https://www.mdr.de/nachrichten/mitmachen/mdrfragt/mdrfragt-ergebnisse-kohleausstieg-100-downloadFile.pdf

Measham, T., Walker, J., McKenzie, F., Kirby, J., Williams, C., D'Urso, J., Littleboy, A., Samper, A., Rey, R., Maybee, B., Brereton, D., & Boggs, G. (2024). Beyond closure: A literature review and research agenda for post-mining transitions. *Resources Policy*, *90*, 104859. https://doi.org/10.1016/j.resourpol.2024.104859

Meier, T., Penta, L., & Richter, A. (Eds.). (2022). *Community Organizing: eine Einführung*. Beltz Juventa.

Meisch, S. (2020). *Transformative Research: The IASS Approach* (IASS Discussion Paper). Institute for Advanced Sustainability Studies (IASS). https://doi.org/10.2312/iass.2020.021

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

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*. Polity Press.

Pärli, R., Fischer, M., Späth, L., & Lieberherr, E. (2022). Transdisciplinary research for sustainable development-doing research about research. *GAIA*, *31*(4), 238–242.

Prager, K., & Nicholas, G. (2024). Co-creation. In F. Darbellay (Ed.), *Elgar Encyclopedia of Interdisciplinarity and Transdisciplinarity* (pp. 50–53). Edward Elgar. https://doi.org/10.4337/9781035317967.ch12

Rabeharisoa, V., Moreira, T., & Akrich, M. (2014). Evidence-based activism: Patients', users' and activists' groups in knowledge society. *BioSocieties*, *9*(2), 111–128. https://doi.org/10.1057/biosoc.2014.2

Radaelli, C. M. (1999). The public policy of the European Union: whither politics of expertise? *Journal of European Public Policy*, *6*(5), 757–774. https://doi.org/10.1080/135017699343360

Radtke, J., & David, M. (2024). How Germany is phasing out lignite: insights from the Coal Commission and local communities. *Energy, Sustainability and Society*, *14*(1), 7. https://doi.org/10.1186/s13705-023-00434-z

REA. (n.d.). *Horizon Europe - How to apply*. https://rea.ec.europa.eu/horizon-europe-how-apply_en

Renn, O. (2021). Transdisciplinarity: Synthesis towards a modular approach. *Futures*, *130*, 102744. https://doi.org/10.1016/j.futures.2021.102744

Ribbeck-Lampel, J., Spohr, P., & Otto, A. (2023). *Revier ist nicht gleich Revier: Die Bedeutung von Raumstrukturen für die Transformation der Braunkohleregionen in Deutschland.* Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR). urn:nbn:de:101:1-2023062811070627379870

Rittelmeyer, P., Lubell, M., Hovis, M., Heikkila, T., Gerlak, A., & Pozzi, T. (2024). Knowledge is not power: Learning in polycentric governance systems. *Review of Policy Research*. Advance online publication. https://doi.org/10.1111/ropr.12606

Rudnicki, S., & Wojnicka, K. (2024). Leaping the Abyss: The Problematic Translation of Social Research Results into Policy Recommendations. *Sociological Research Online*, Article 13607804241228688. Advance online publication. https://doi.org/10.1177/13607804241228688

Ruser, A. (2018). *Climate Politics and the Impact of Think Tanks: Scientific Expertise in Germany and the US*. Palgrave Macmillan.

Scheffer, T. (2002). Das Beobachten als sozialwissenschaftliche Methode - Von den Grenzen der Beobachtbarkeit und ihrer methodischen Bearbeitung. In D. Schaeffer & G. Müller-Mundt (Eds.), *Qualitative Gesundheits- und Pflegeforschung* (pp. 351–374). Huber.

Schneidewind, U., Singer-Brodowski, M., & Augenstein, K. (2016). Transformative Science for Sustainability Transitions. In H. G. Brauch, Ú. Oswald Spring, J. Grin, & J. Scheffran (Eds.), *Handbook on Sustainability Transition and Sustainable Peace* (pp. 123–136). Springer. https://doi.org/10.1007/978-3-319-43884-9_5

Schuck-Zöller, S., Cortekar, J., & Jacob, D. (2017). Evaluating co-creation of knowledge: from quality criteria and indicators to methods. *Advances in Science & Research*, *14*, 305–312. https://doi.org/10.5194/asr-14-305-2017

Scott, J. C. (1998). *Seeing like a state: How certain schemes to improve the human condition have failed*. Yale University Press.

Seibicke, H. (2024). Investigating stakeholder rationales for participating in collaborative interactions at the policy–science nexus. *Policy and Politics*, *52*(3), 477–500. https://doi.org/10.1332/03055736Y2023D000000010

Stock, M., Mitterle, A., & Baker, D. P. (2024). Academization: A New Perspective on Occupations. In M. Stock, A. Mitterle, & D. P. Baker (Eds.), *How Universities Transform Occupations and Work in the 21st Century: The Academization of German and American Economies* (pp. 1–24). Emerald Publishing. https://doi.org/10.1108/S1479-367920230000047001

Strambo, C., Aung, M. T., & Atteridge, A. (2019). *Navigating coal mining closure and societal change: learning from past cases of mining decline*. Stockholm Environment Institute. https://www.sei.org/wp-content/uploads/2019/07/navigating-coal-mining-closure-and-societal-change.pdf

Strohschneider, P. (2014). Zur Politik der Transformativen Wissenschaft. In A. Brodocz, D. Herrmann, R. Schmidt, D. Schulz, & J. Schulze Wessel (Eds.), *Die Verfassung des Politischen* (pp. 175–192). Springer VS. https://doi.org/10.1007/978-3-658-04784-9_10

Thune, T., Reymert, I., Gulbrandsen, M., & Simensen, E. (2023). Populating the science-policy co-production space: academic and policymaker perspectives on knowledge exchange. *Studies in Higher Education*, *48*(5), 733–746. https://doi.org/10.1080/03075079.2023.2187772

Trevors, J. T., Pollack, G. H., Saier, M. H., & Masson, L. (2012). Transformative research: Definitions, approaches and consequences. *Theory in Biosciences*, *131*(2), 117–123. https://doi.org/10.1007/s12064-012-0154-3

WBGU. (2011). *World in Transition: A Social Contract for Sustainability* (Flagship Report). German Advisory Council on Global Change (WBGU). https://www.wbgu.de/fileadmin/user_upload/wbgu/publikationen/hauptgutachten/hg2011/pdf/wbgu_jg2011_en.pdf

Weaver, R. K. (1989). The changing world of think tanks. *Political Science & Politics*, *22*(3), 563–578.

Weingart, P. (1983). Verwissenschaftlichung der Gesellschaft - Politisierung der Wissenschaft. *Zeitschrift Für Soziologie*, *12*(3), 225–241. https://doi.org/10.1515/zfsoz-1983-0303

Weingart, P. (2008). How robust is "socially robust knowledge"? In M. Carrier, D. Howard, & J. A. Kourany (Eds.), *The challenge of the social and the pressure of practice: Science and values revisited* (pp. 131–145). University of Pittsburgh Press.

Wilkinson, A., Kupers, R., & Mangalagiu, D. (2013). How plausibility-based scenario practices are grappling with complexity to appreciate and address 21st century challenges. *Technological Forecasting and Social Change*, *80*(4), 699–710. https://doi.org/10.1016/j.techfore.2012.10.031

Wolfram, M. (2016). Conceptualizing urban transformative capacity: A framework for research and policy. *Cities*, *51*, 121–130.

Wynne, B. (1989). Sheepfarming after Chernobyl: A Case Study in Communicating Scientific Information. *Environment*, *31*(2), 10–39. https://doi.org/10.1080/00139157.1989.9928930

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