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Transforming knowledge for sustainability: Insights from an inclusive science-practice dialogue on low-carbon society in Germany

Anna Ernst*, Andrea Fischer-Hotzel, Diana Schumann

Institute of Energy and Climate Research – Systems Analysis and Technology Evaluation (IEK-STE), Forschungszentrum Jülich, 52425 Jülich, Germany

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ABSTRACT

In order to combat climate change and reduce carbon dioxide emissions as suggested by the Intergovernmental Panel on Climate Change (IPCC), the contemplation of different knowledge types is discussed as a leverage point for transforming towards sustainability. In order to analyse how a science-practice dialogue can improve the understanding of transformation processes towards low-carbon societies, we set up a dialogue process in North Rhine-Westphalia to envision a low-carbon future. We addressed the deficits of previous transdisciplinary projects and tested different dialogue formats. The approach applied put us scientists in the unusual position as facilitators of dialogue. This contained some challenges but also offered an in-depth understanding of the science-practice dialogue that would not been possible with traditional scientific methods. The participating stakeholder perceived bringing together different actors with complementary knowledge and experience and associated mutual learning as beneficial. However, the wish not only to gain knowledge but to influence decision making determines whether a dialogue process is perceived as effective. We found that envisioning processes are valuable to explore highly uncertain future processes. In addition, the envisioning workshop revealed the actual source of conflicts and thus, creates an effective dialogue by addressing the actual differences and not the symptoms.

1. Introduction: new modes of research enhance transformation towards a low-carbon society

In order to combat climate change and reduce carbon dioxide emissions as suggested by the Intergovernmental Panel on Climate Change (IPCC) [1], the contemplation of different knowledge types is discussed as a leverage point for successfully transforming towards sustainability [2]. The magnitude and interdependency of the environmental, social, and economic challenges of climate change mitigation have resulted in a discussion about appropriate tools to develop sustainable solutions [3]. It is frequently argued that dialogue between science and practice represent such a tool by which both scientific findings and political decision making can be enhanced through collaboratively produced knowledge (see, e.g., [4–6]). Currently new modes of knowledge production are applied and analysed in order to address wicked problems such as climate change [7]. However, the benefits and limitations of such processes are not yet fully understood. In this study we report on a dialogue project that explored how a science-practice dialogue can improve the understanding of transformation processes towards low-carbon societies.

The problem of combatting climate change is frequently considered a 'wicked problem' [8–11]. The term 'wicked problem', coined by Rittel and Webber [12], is applied when a problem is difficult to define, to delineate from other problems, and to solve permanently. They do not have right or wrong solutions but good or bad ones, and the respective assessment depends on the stakeholders involved [13]. Studies have shown that successful climate change mitigation depends on improved collaboration between science and society to develop robust and applicable knowledge to address wicked problems [14]. One-sided decisions that do not consider interdependencies and thus the plurality of impacts, it is argued, result in increasing anthropogenic damage to both natural and human systems [15].

Currently Germanys *Energiewende* is such a 'wicked' endeavour to combat climate change and transform the German energy system from a fossil fuel driven system towards renewable energy. The *Energiewende* has its roots in the early seventies [16] and the main lesson learned in the past decades is that not technical but social issues are directing the transformation. The transformation towards a low-carbon energy system 'encompasses profound changes to infrastructures, production processes, regulation systems and lifestyles, and extends to a new kind of interaction between politics, society, science, and the economy' [17]. This often results in conflicts between different parties. Furthermore,

* Corresponding author.
E-mail address: a.ernst@fz-juelich.de (A. Ernst).

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'society must learn to learn from the future' [18] in order to adapt decision making to the challenges posed by such a transformation. That is why investigating conflict constellations and possible future pathways by contemplating different knowledge types offers benefits for energy research and practice.

In order to tackle or 're-solve' (i.e., temporarily solve) [12] complex problems such as the transformation towards a low-carbon society, scientists have developed new modes of research beyond the traditional disciplinary academic mode. The basic assumption is that scientists should engage in social processes to enhance co-production of knowledge and ensure knowledge integration in the decision-making process [19,20] instead of merely analysing the process. Mode 2 research [21,22], e.g., explores ways of process or product innovation through interactions between research and industry while post-normal science [23] aims at supporting policy-making [24]. In European sustainability science transdisciplinary research (TDR) has become one of the major innovative research modes [14,19,25–28]. TDR denotes a process of knowledge co-production between an interdisciplinary research team and what TDR scholars call 'practitioners', i.e. stakeholders that are not scientists. It is closely related to participatory research as presented by Blackstock, Kelly and Horsey [29].

The common assumption of these new research modes is that there are different knowledge types such as intuitive, experiential or analytic, abstract knowledge, which are based on different cognitive processes [30]. TDR provides methodologies to integrate different types of knowledge, as well as values and norms of actors from science and practice [2,19,28]. Butler, Demski, Parkhill, Pidgeon and Spence [31] argue that improved understanding of (public) values can help assess uncertainties and thus areas of contestation and opportunity. Visions are normative images of a future in the sense that they are recognised as ideal and desirable by those engaged in the envisioning process [32,33]. Visions of possible futures resemble values and norms and as such are a tool to investigate current energy policy. TDR can be a valuable tool to generate visions of possible futures [34].

We initiated a science-practice dialogue based on van den Hove [35] concept of science-policy interfaces, i.e., a participatory social process to bring about communication between scientists and practitioners in order to exchange knowledge, values, and perspectives, producing collaboratively knowledge. Departing from the original TDR approach, science-practice dialogues do not aim at solving a specific social problem but at improving its understanding and exploration. That is why we understand 'co-production of knowledge' as bringing together different actors with complementary knowledge and experiences in order to produce knowledge improving the understanding of energy transformations.

Against this background, there are two primary aims of this study: 1. To apply and thus test (effective) participation in transdisciplinary research for low-carbon transformations 2. To investigate what are visions and open questions of actors from science and practice about a low–carbon society, and possible tools and measures to reach this normative goal. In the following section (Section 2), we discuss important characteristics of effective participation processes. Section 3 is concerned with the methodology used for this study and a description of the three process phases we applied. Section 4 discusses the results of our dialogue process. This paper ends with concluding remarks on the benefits and challenges of our approach.

2. Success criteria of dialogue in transdisciplinary and participation research

In order to structure and evaluate a dialogue process aiming at improving dialogue between science and practice and the understanding of the transformation towards a low-carbon society, we derived an approach from existing literature form TDR and participation research. Lang, Wiek, Bergmann, Stauffacher, Martens, Moll, Swilling and Thomas [19] defined three process phases of TDR: joint problem framing, the actual knowledge co-production by deliberating different knowledge types, norms and values, which are transferred to the third process phase of applying the knowledge both in societal and scientific practice (integration of knowledge). The first phase of TDR processes, joint problem framing, is considered essential [28,36]. Creating spaces for reflection and open exchange are considered as key elements of successful knowledge co-production. On a meta-level, such a learning environment is characterised by generating new perspectives for the actors involved that help them perceive their knowledge and demeanour from a distance [36]. This is seen as essential in order to identify and acknowledge both limitations and potentials of each knowledge-type and perspective [28]. However, confounded agendas, separate data philosophies, reluctance to face exposure, and co-existing values hamper this process and might make some knowledge-types or perspectives appear more relevant or legitimate than others. That is why appropriate facilitation is seen as essential to such a knowledge co-production process. Wiek [37] proposes an 'epistemediator' who mediates, structures discussion, and balances contributions in a way to 'cope with a great number of social aspects such as communication technology and virtuality, team size and structure (power, roles, possibility of participation), etc. that could greatly influence the knowledge-generation performance of the collaborating agents' [37].

Hisschemöller and Cuppen [38] argue that dialogue as the dominant mode of communication can help re-establish trust between different societal groups and reconfigure their relationships by improving the understanding of each other's way of thinking and acting. Following Escobar [39], dialogue is understood here as a way of interpersonal communication which constructs truth and knowledge [[40,41], see also [42]] as well as a way of considering the consequences of communication (i.e. how a particular exchange affects those involved and their interpersonal relationships) as well as its results (i.e. truth, knowledge) [43]. Dialogic communication follows the principles of collaboration as opposed to confrontation, curiosity and openness as opposed to certainty, multiple ways of knowledge as opposed to expertise as superior knowledge and process orientation as opposed to outcome orientation. In practice it entails the creation of safe communication spaces, inquiry and disclosure, the co-existence of different positions as well as a constant re-examination of all positions, active listening, and emergent and contingent speech contents [39,Table 2].

If knowledge co-production is to be successful, all the above mentioned features have to be taken into account. Therefore, in order to evaluate our own science-practice dialogue, we applied the evaluation concept for participation processes developed by Goldschmidt [44]. Goldschmidt's concept comprises six criteria: empowerment, fairness, legitimacy, transparency, efficiency, and effectiveness. The criteria 'empowerment' measures how well relevant knowledge and arguments were adequately and systematically integrated by the participants. 'Fairness' measures whether the justice expectations of the participants were met. 'Legitimacy' assesses how the participants perceived their own opportunities to influence the dialogue. 'Transparency' rates the clarity and traceability of the process. 'Efficiency' displays how the participants judge the value of the results in proportion to their own efforts. 'Effectiveness' displays how the participants rate the discussion and vision paper. In addition to these criteria, we also added the criterion of 'network-building' because becoming acquainted with each other and forming relationships are important features of a dialogue process. As facilitation is considered essential (see above this section), we added a respective criterion, which reflects on the competence and trustworthiness of the facilitator. These criteria constitute the fundament of our evaluation questionnaire, in which they are operationalized. (cf. Section 3.6).