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Productive science–policy interactions for sustainable coastal management: Conclusions from the Wadden Sea area

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ABSTRACT

In this paper we synthesise the findings from the papers in this special issue on Organising productive science-policy interactions for sustainable coastal management. Lessons from the Wadden Sea. We first briefly discuss some relevant theoretical debates, and then present our main insights and lessons from the empirical evidence reported in the papers. We conclude the paper with suggestions for further research.

1. Introduction

In this concluding paper, we take stock of the main lessons from this special issue. The aim of this special issue is to "(...) provide more insight into the dynamics of (joint) knowledge production and how, and under which conditions, specific arrangements for organising science–policy interactions contribute to scientifically and societally robust – i.e. credible, salient, and legitimate – knowledge" (Van Tatenhove et al., 2016). All contributions to this special issue focus on how science–policy interactions and arrangements affect decision-making and its outcomes. Most of the papers share an empirical focus on the Dutch Wadden Sea; an interesting coastal area to analyse science–policy interactions because of intense use, conflicting interests, the intensity in research, the number of governance structures and processes and the attention which is already paid to the improvement of science–policy interactions. These interactions are often seen as fruitful but also frequently as problematic. One paper of this special issue focuses on the German part of the Wadden Sea (Döring and Ratter, 2016) and one on both the Wadden Sea and the North Sea, with an emphasis on the latter sea (De Jong, 2016); coastal areas which have strong ecological – and socio-economic – interactions with the Dutch Wadden Sea, and facing similar challenges regarding science and policy.

In this concluding paper, we present some general observations from the different contributions in this special issue about science–policy interactions for coastal management. For this purpose, we will first briefly discuss some relevant theoretical debates, in particular concerning coastal management. Subsequently, we distill some main insights and draw some lessons from the empirical evidence reported in the papers. Eventually we formulate some final thoughts on research and applications.

2. Reflections on science–policy interactions

In coastal management literature and literature focusing on science–policy interactions (e.g., science and technology studies (STS), socio-ecological systems literature, environmental science, applied ecology, policy science, political philosophy), scholars have elaborated on a wide range of questions and approaches related to science–policy interactions. These vary from theoretical studies how to distinguish science from policy (e.g., Gieryn, 1983), to empirical studies about science–policy interactions (e.g., Bremer and Glavovic, 2013), and normative contributions on specific roles of scientists and non-scientists in policy (e.g., Pielke, 2010).

To understand and improve science–policy interactions, the focus is often on the role and nature of science. Ecologists and environmental NGO's complain about the misuse und underestimation of science by policy makers, while social scientists and philosophers stress the need for a more socially robust science, or as they call it, post-normal or Mode 2 science, in contrast to normal or Mode 1 science (Funtowicz and Ravetz, 1993; Jasanoff, 1987; Nowotny et al., 2001). This influential discourse about the role of

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science in modern society defines socially robust science as widely accepted by politicians, stakeholders and citizens as appropriate for the framing and/or solution of a certain societal problem. During the development and implementation or application of socially robust science, relevant actors are experts and scientists from different disciplines, governmental institutions, users of the knowledge and affected people. In addition, knowledge production requires the ability and willingness of all parties, scientific and non-scientific alike, to respect and cope with the knowledge and demands of other parties, looking for common grounds (see also Lentsch and Weingart, 2011). This implies interactive, integrative and reflexive knowledge production, in which basic science is not just applied to a new context, but where the context itself is part of the scientific process. Social robustness does not mean that more traditional scientific standards do not make sense anymore, but it emphasizes the tensions between social and scientific robustness, and between unambiguity versus a certain vagueness to bind together knowledge, values and actors (Van der Windt and Swart, 2007).

A related discourse is expressed by Cash et al. (2003). Their line of thinking is that science (and technology) have a major role to play in sustainable development. Science is "effectively linked to action" if it has an impact on how problems are defined and framed and on the set of alternative options that are considered. This 'idealised' role of science in the governance of sustainable development is echoed by other authors such as Van den Hove (2007) and (McNie, 2007).

Cash et al. (2003), in their search for a science for sustainable development, regard credibility, salience, and legitimacy,[1] as key terms which in turn enhances the chance of being used to inform decision-making. A key question however is *who* should promote the production of science that is salient, credible, and legitimate, and *how*? Cash et al. (2003) suggest that institutional mechanisms are needed that fulfil three core functions: communication, translation and "mediation across boundaries" (Cash et al., 2003, p. 8086). These functions can be fulfilled by various organisational arrangements and procedures or by specific boundary organisations. Important conditions for the effective fulfilment of the three functions are that boundary management is taken seriously; that there is dual accountability;[2] and the use of so-called boundary objects that facilitate the coproduction of knowledge (e.g., models, scenarios, assessment reports; collaborative efforts/outputs). Yet, Cash et al. conclude "How such knowledge systems for sustainability can best be structured remains a question for scholarly research, practical experimentation, and comparative learning" (Cash et al., 2003, p. 8090). This special issue aims to contribute to the need for more empirical research in this area.

Over the last 10–15 years many publications have identified, developed, and assessed a range of 'knowledge systems', governance approaches and science–policy interfaces that aim to enhance science–policy interactions. There is a growing body of empirical literature that addresses specific elements of how to enhance science–policy interactions. A variety of arrangements that aim to bring together science and policy has been described, including among other things scientific advisory bodies such as ICES, boundary organisations that have been established with the main task of forming an interface between science and policy, knowledge brokerage, knowledge co-production or other participatory methods, or principles or requirements for governing the science–policy interactions (e.g., Bremer and Glavovic, 2013; Hegger et al., 2012; Huitema and Turnhout, 2009; Lidskog, 2014; Linke et al., 2014; McNie, 2007; Partidario and Sheate, 2013; Van den Hove, 2007). Evidence of the *performance* of science–policy arrangements is mixed (see e.g., Koetz et al., 2012; Hegger and Dieperink, 2014). Some cases are considered successful in terms of contributing to the production and use of credible, salient, and legitimate knowledge, whereas others are not or to a lesser extent. Hegger and Dieperink (2014) explain the performance of joint knowledge production arrangements in terms of success conditions regarding the design of such arrangements, derived from the literature (e.g., include a broad range of stakeholders). The literature remains relatively silent about what science–policy interaction arrangements seem to suit what particular situations or problems best (e.g., McNie, 2007). Although contextual factors that render science–policy interaction arrangements successful or not have been addressed in some studies (Runhaar and Driessen, 2007; Hegger and Dieperink, 2014; Van Kerkhoff and Lebel, 2015), a systematic and thorough understanding of the importance of 'context' in the feasibility and functioning of science–policy interaction arrangements is still scarce). Several studies focus on two relevant developments within the (European) governance context that affect science–policy interactions. Firstly, politicians, policy makers and civil society actors are ambivalent about the role of science in policy-making. Policy makers are both willing to look for better policy–science interactions and to improve the absorptive capacity of policy institutions for scientific information and advices, and ignore parts of scientific information, link these to certain specific political aims or consider these as just viewpoints (EC, 2009). Secondly, responsibilities changed as a result of the double shift: from national policy to international policy and from national policy to regional authorities, stakeholders and citizens (Keulartz and Leistra, 2007). Consequently, there might be more space for new arrangements for scientific-governance at regional levels, but international legislation might proclaim restrictive legislative frameworks.

3. Insights from the papers of this special issue

The papers in this special issue provide rich empirical evidence by identifying, comparing and designing specific science–policy arrangements. We evaluated their performance in terms of contributing to the salience, credibility and legitimacy of knowledge and in terms of impact on decision-making, and the identification of contextual factors that influence the way in which these arrangements work as well as their outcomes.

3.1. Science and types of arrangements for science–policy interactions

Although the science–policy interaction arrangements and the way science is used and developed differ in a number of ways, the papers and the case studies show the following similarities:

- *The actors and their interactions.* In all cases, scientists and policymakers were involved. In the Delfzijl coastal zone case (Seijger et al., 2016) and the recreation case (Van der Molen et al., 2016), the direct involvement of other parties in knowledge development contributed to a common accepted outcome. In the cases of

[1] Credibility is defined as the scientific adequacy of information, salience as the relevance to the policy debate, and legitimacy to the perceived degree to which the production of knowledge has been respectful to the values and interests at stake. Of course there may be different interpretations of what salience, legitimacy and credibility mean (Kunseler et al., 2015) and Cash et al. (2003) indicate trade-offs may have to be made between the three criteria.

[2] This implies that science and policy remain separate to be two worlds. McNie for instance emphasises the careful management of the boundary between science and policy in order to "mitigate[s] the chances that the science becomes politicized or the decision making becoming 'scientized'" (2007: 32). Other authors however advocate a blurring of boundaries and a hybridisation of the worlds of science and policy, e.g., under the umbrella term of transdisciplinary science (see also Turnhout et al., 2013). In this paper we take an empirical approach and observe that in the Wadden Sea, at least in the cases reported in this special issue, science and policy are predominantly separate worlds.