

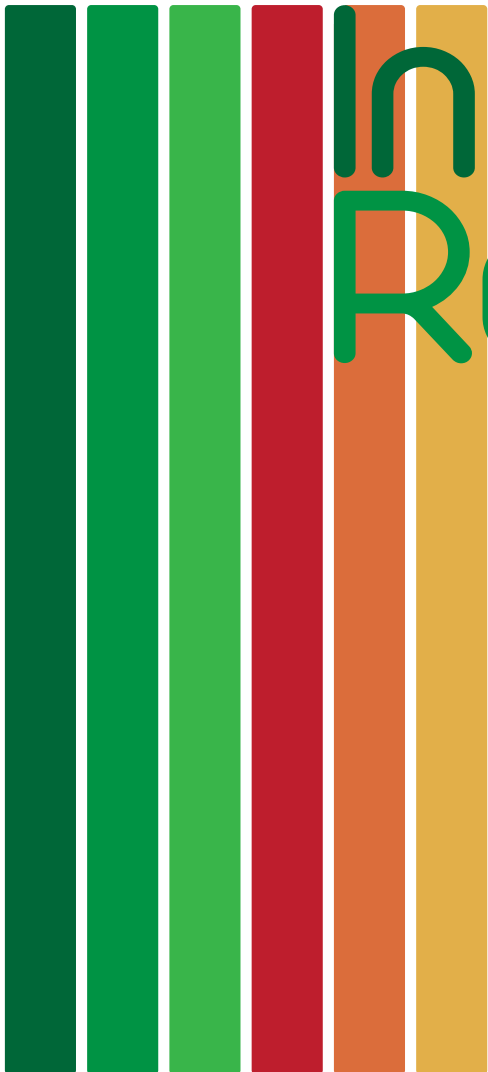


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Linking
Impact
Assessment
Instruments to
Sustainability
Expertise



Innovation Report

The
Science-policy
Interface



Project n. 243826



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by Sabine Weiland, FUB

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IN BRIEF

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Dear Reader,

The LIAISE ('Linking Impact Assessment Instruments and Sustainability Expertise') project aims to improve the quality and application of impact assessment tools and methods to support policy making. The idea is to increase the knowledge base of policy making, which is expected to result in better and more sustainable policies. Yet linking science and policy to meet sustainable development has proven to be a chronically difficult task. A direct impact of scientific knowledge on political decisions appears to occur only in a minority of cases, especially when the knowledge supports a course of action that was planned to be taken anyway. In many cases, research has a much more indirect and unintended impact on policy through conceptual use and ideas that enable policy makers to gradually revise their framings and definitions of the policy problem. In this context, the rise of policy impact assessment in many countries can be seen as an attempt to institutionalise the use of scientific knowledge in political decision making and, thereby, to develop more robust, adaptable and sustainable policies.

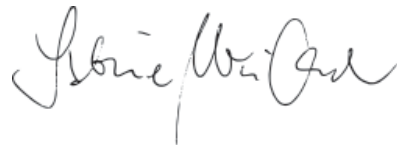
Much of the debate and practice of the science-policy interaction is however still informed by a one-directional transfer model – 'get the facts right, then act'. In fact, science's relationship with policy is much more complicated than this linear model suggests. Already the hypothesis of the two separate worlds of science and politics, of knowledge producers and knowledge users, may be misleading. Peter Weingart¹ claims that, on a macro level, the science-policy nexus can be analysed as a dialectical process of the scientification of policy and the politicisation of science. One indicator of the former is that many political problems, like environmental pollution and climate change, have been first recognised and described by scientists. That way, science becomes part of the governing process and plays an important role in defining the problems that it is then asked to solve. Vice versa, knowledge is inevitably judged and valued by society as it enters the public arena. Advisors are selected, not only because policy makers and administration officers need their advice, but because they need their authoritative support for the policies they represent. Science has become one of the actors in the political arena. On the micro-level as well, science-policy interaction is less neatly separated than the two-worlds hypothesis implies. Rather than a one-directional movement of knowledge, we can discern ongoing interaction and negotiation between science and policy. Such negotiations may concern the relation of an advisory body to a government department, the formulation of research questions, the way in which a scientific model is to be built and subsequently used, etc.

This innovation report deals with the science-policy interface and the interactions going on at the interface. Drawing on writings from the rich body of literature of knowledge utilization studies in political science and in science and technology studies we will look at the conditions of science-policy interaction, review concepts, such as boundary work, used to describe science-policy interaction, and go through publications that deal with concepts to understand and manage the science-

¹ Weingart, P. (1999), Scientific expertise and political accountability: paradoxes of science in politics. *Science and Public Policy* 26(3): 151-161; see also Hellström, T., Jacob, M. (2000), Scientification of politics or politicization of science? Traditionalist science-policy discourse and its quarrels with Mode 2 epistemology. *Social Epistemology* 14(1): 69-77.

policy interface. The notion of 'boundary management' could provide an alternative to the criticised linear model of the transmission of science into policy. In the report, particular emphasis lies on the concept of 'knowledge brokering' that plays a key role in LIAISE's Work Package 6 as a strategy of linking science and politics. A reflection on the role of political scientists as analysts and facilitators of science-policy interaction closes the report. Not all of the reviewed articles are new; some are rather classical readings from the science-policy debate. Also, given the broad range of existing publications, the choice of the publications for review is necessarily selective. Nevertheless, we hope to provide the reader with an instructive overview on the topic. In the second part, the innovation report as usual contains a number of short reviews of recent publications from the field of impact assessment. We wish you an interesting read! Comments on the current issue, as well as ideas and topics for future issues are always welcome.

Yours,

A handwritten signature in black ink, appearing to read 'Sabine Weiland', written in a cursive style.

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RESEARCH ARTICLE

Working at the science-policy interface

Reviewed articles:

Cash, D. et al. (2002), Saliency, Credibility, Legitimacy and Boundaries: Linking Research, Assessment and Decisions Making. RWP02_046, John F. Kennedy School of Government, Harvard.

Gieryn, T.F. (1995): Boundaries of science. In: S. Jasanoff et al. (eds.), *Handbook of Science and Technology Studies*. Thousand Oaks, Sage: 393-443.

Guston, D.H. (2001), Boundary organizations in environmental policy and science: an introduction. *Science, Technology & Human Values* 26(4): 399-408.

Hoppe, R. (2010a), From 'knowledge use' towards 'boundary work': sketch of an emerging new agenda for inquiry into science-policy interaction. In: R. in't Velt (ed), *Knowledge Democracy. Consequences for Science, Politics and Media*. Heidelberg, Springer: 169-186.

Hoppe, R. (2010b), Making policy analysis doable and reflexive, in: R. Hoppe, *The Governance of Problems. Puzzling, Powering and Participation*. Bristol, Policy Press: 167-194.

Michaels, S. (2009), Matching knowledge brokering strategies to environmental policy problems and settings. *Environmental Science & Policy* 12(7): 994-1011.

In policy making, government and administration often rely on scientific advice when making their decisions. Recent years have seen a rise of impact assessment of policies. In many OECD countries procedures were institutionalised for better informed policymaking by predicting and evaluating the consequences of regulatory activities. Indeed, an evidence-based approach to public policy is at the heart of modern government. Underlying is the traditional one-directional model of knowledge and information transfer holding that science produces evidence and objective knowledge that needs to be translated into a format – applied knowledge – that policy makers can use.

This model, however, does not adequately represent the interaction and mutual construction of science and policy. Critics argue that it fails to acknowledge the complexities of the science-policy nexus in several respects (Hoppe 2010a, p. 173-74): First, the interplay between principles of advice production and the scientific knowledge deliverers is complex and varied. Knowledge is not unilaterally transferred from scientists and advisors to policy makers. The latter also stimulate certain forms of knowledge. When policy formulates a question that requires knowledge production or advice giving, they are involved in steering scientific work. Second, scientists do not just provide instrumental knowledge that policy makers can use to achieve their goals, but also define problems, suggest and help to define policy goals, and structure trajectories for solutions for policy problems. Third, the ways in which political strategies can be wrapped in the cloak of scientific objectivity adds another layer to the interaction between science and politics. This also includes “the subtle interplay between finding solutions for defined problems or redefining problems to fit found solutions”².

² Hoppe, R. (2002), Rethinking the puzzles of the science-policy nexus: boundary traffic, boundary work and the mutual transgression between STS and policy studies. Paper prepared for the EASST 2002 Conference, 'Responsibility under Uncertainty'. York, 31 July - 3 August, 2002, p. 19.

Based on this critique of the linear transfer model of scientific knowledge to policy, this research review takes a closer look at the interface, or boundary, of science and politics, and at the interaction between scientific advisors and policymakers. How can the science-policy interface more adequately be conceptualised?

Conditions of (successful) science-policy interaction

One of the frequently quoted writings in the debate on the science-policy interface is the seminal paper “Salience, credibility, legitimacy and boundaries: linking research, assessment and decision making” by David Cash et al. (2002). It deals with the necessary conditions for transferring information and knowledge across boundaries. Traditionally, scientists, science managers and advisors focussed on *credibility* as the currency of doing policy-relevant research. The question was how to create authoritative, believable and trusted information that can inform the decision making process about the scientific and technical aspects of problems and solutions. Credibility refers to the sources of knowledge which must be deemed trustworthy, as well as to the facts and causal explanations invoked by these sources. On an organisational level, priority was given to creating organisational structures that assure credibility of the information being produced through peer review, rigorous selection of participants etc. Credibility also interacts with agreement on knowledge: it is hard to establish in issue areas characterised by scientific disagreement or uncertainty.

Over the past decades, however, the understanding of the role of scientific knowledge in political processes has become more nuanced. Credibility is still regarded as essential, but other socially mediated attributes in the process of constructing and using knowledge have become equally important (Cash et al. 2002, p. 3-5). *Salience* refers to the relevance of information to decision makers or affected stakeholders. Interesting and relevant topics identified within the scientific community may be of little relevance outside of it. A good example is the Global Biodiversity Assessment, in which the target audience, the parties to the Convention on Biological Diversity, had little interest in the questions that were being asked by the assessors. Timing and scope are also crucial since information arriving at the wrong time (too early, or too late), or being too broad or too narrow to fit the policymakers' agenda can fail to be taken up in the decision making process because of a lack of perceived salience. *Legitimacy* refers to the political and procedural ‘fairness’ of an information producing process. This involves whether it considers the values, concerns, and perspectives of different stakeholders. Political actors judge legitimacy based on who participated and who did not, how information was processed and disseminated, and how decisions were made. As an example of a lack of legitimacy the authors quote the early stages of the Intergovernmental Panel on Climate Change, in which participants from developing countries questioned the absence of scientists and perspectives from the developing world.

To effectively connect knowledge to action, it is essential that this knowledge is considered credible, salient *and* legitimate with multiple audiences (Cash et al. 2002, p.5-6). All three attributes are necessary for the knowledge to make an impact. The danger of focusing only on credibility at the expense of the other attributes was already mentioned above. But even in cases where the actors view information and knowledge as having two of the attributes, they might fail to influence the

decision making process because of a lack of the third. It is difficult to define thresholds for the requisite levels of credibility, salience and legitimacy since they vary across issue areas, political contexts and over time. Cash and colleagues argue that the point is not the threshold levels but the simple fact that they exist. In addition, the three attributes are often dependent on each other. Tensions might exist between them such that efforts to strengthen one attribute will often adversely impact another. For example, efforts to increase credibility by maintaining strong boundaries between science and politics might have the cost of decreasing salience by excluding the policymakers from the scoping or agenda-setting process. Also, efforts to increase legitimacy by increasing inclusiveness can have negative effects on salience since this might lead to a reframing of problems that is considered irrelevant by particular actor groups. Further combinations of mutual influences are possible. Yet efforts to increase credibility, salience and legitimacy can also be complementary: increasing one attribute might result in increases of another attribute. Efforts to increase salience by engaging more stakeholders may also lead to greater legitimacy on the process as greater acceptance and support is achieved. Likewise, increase of salience through engaging more stakeholders may also positively influence credibility by bringing local and other stakeholder knowledge into the process. Based on these interrelations the authors argue that successful connection of knowledge and political decisions is not only dependent on engendering favourable perceptions of credibility, salience and legitimacy, but also on balancing the trade-offs among the three attributes. Neglect of one of them could result in a rejection of knowledge or resistance to proposed actions (ibid., p. 7).

The authors continue to argue that dissonances in the interaction of science and politics often stem from different attributions of credibility, salience, and legitimacy on both sides of the boundary. The challenge is to have in place or to create institutions that work across boundaries and perform an active boundary management to bolster credibility, salience and legitimacy. Before going into details on this aspect, we will have a closer look at various boundary concepts which are used to describe the demarcation line between science and politics but also their connections.

Boundary work, boundary objects, boundary organisations

Boundaries can be found in many places. They may delimit social constructions as functional activities (e.g. knowledge generation, decision making, implementation), knowledge types (e.g. western scientific, traditional, local), academic disciplines (e.g. physics, economics, sociology), political jurisdictions (e.g. nation states), organisational scales (e.g. local, cities, regions, states, supranational), and so on (Cash et al. 2002, p. 7). It is important to note that what demarcates all these spheres is not some essential or transcendental differences but an array of *socially constructed* factors and behaviours (Guston 2001: 399). For this, Thomas Gieryn (1995) coined the term *boundary work*. The concept of boundary work aims to explain how scientists maintain the boundary of their community and hence the cognitive authority of their work. Originally referring to the relationship between science and non-science, the concept of boundary work has since then been applied to the interface between science and politics (Guston 2001) and, more broadly, to organisations that mediate between knowledge and action

the interface between science and politics (Guston 2001) and, more broadly, to organisations that mediate between knowledge and action (Cash et al. 2002).

The relation between science and non-science (and politics in particular) cannot be described in clear and sharp boundaries. Rather the zones of engagement on both sides are fluid. Boundary work describes how both parties are continuously bargaining with each other about how the exact demarcation line between science and politics should be drawn. The actors on both sides of the boundary define practices in contrast to each other while at the same time attempting to find productive cooperation across these boundaries through a division of labour. Boundary work expresses how expert advice simultaneously demarcates and coordinates science and politics. In this context, Robert Hoppe (2010a, p. 173-74) notes:

“Such boundary negotiation may concern the exact relation between an advisory body and a government department; or the formulation of a question or remit for advice; or the way in which a scientific model is to be built, and subsequently used; [...] or about managing uncertainties; or, finally, conflicts between scientific domains, or between scientific knowledge and other types of knowledge such as experience-based knowledge or citizen knowledge.”

The absence of an essentialist demarcation line between science and politics and the flexibility of boundary work may threaten some important societal values and interests. Nevertheless, scholars have argued that the blurring of boundaries can lead to more productive policy making than the intentional and often practised separation of both spheres (Guston 2001). Factors that contribute to the linking of the two domains include the identification of boundary objects and creation of boundary organisations. *Boundary objects* are products that belong to both the scientific and the political sphere and can be used by actors within both spheres without losing their own identity. For example, a patent on research results can be used by a scientist to establish priority, and simultaneously by a politician as an indicator for the productivity of research. Other examples include indicator systems, econometric or climate models, bi-annual audits, assessment reports, etc. Boundary objects allow for coordination of the activities of both realms and hence provide stability (Guston 2001, p. 400; Hoppe 2010a, p. 183).

Boundary organisations also function as instances of coordination and stability. They institutionally facilitate the science-politics-interactions in a given domain by providing an opportunity structure for the creation of boundary objects. They involve participants from both sides of the boundary. Sitting at the frontier of the scientific and political worlds, boundary organisations are accountable to representatives of both worlds, simultaneously. The construction of dual agency also means that the organisation speaks differently to different audiences. As Guston puts it (2001, p. 405):

“To the scientific principle, it [the boundary organisation] says, ‘I will do your bidding by demonstrating to the politicians that you are contributing to their goals, and I will help facilitate some research goals besides.’ To the consumer [of information and knowledge], who is also a principle, it says, ‘I will do your bidding by assuring that researchers are contributing to the goals you have for the integrity and productivity of research.’”

The boundary organisation hence allows science and politics “to construct the boundary between their enterprises in a way favourable to their own perspectives” (ibid.). For the Netherlands, Hoppe (2010a, p. 182) gives a number of examples for boundary organisations, such as the legally established, highly institutionalised Netherlands Bureau for Economic Policy Analysis (CBP) or the Scientific Council for Government Policy (WRR), merged knowledge organisations like Alterra (for agriculture and environment), and sectoral advisory councils like the Advisory Council for Research on Spatial Planning, Nature and the Environment (RMNO). To some extent, the LIAISE network could also be seen as a boundary organisation – when we think of LIAISE not as an EU research project but rather as an organisation that strives to create linkages between the scientific and policy communities working in the area of impact assessment.

Returning to the above reviewed article by Cash et al. (2002) which argued that concern for and balancing of credibility, salience and legitimation is a necessary condition for transferring information and knowledge across the boundary between science and politics, we can now understand the role of boundary organisations in this. The creation and maintenance of boundary objects as shared products increases credibility by bringing needed expertise from various sources to the table; it increases the probability of producing salient knowledge by engaging the user early in the knowledge production process; and it potentially increases legitimacy by including multiple perspectives in the process and providing greater transparency (ibid., p. 16). In the management of the science-policy-boundary, it is crucial that the boundary organisation actively mediates between the spheres on both sides of the boundary. This also reduces the potential trade-offs between the attributes of credibility, salience and legitimacy. As Cash et al. note, it is characteristic that the mediator acts to make the boundary “selectively porous, allowing bridging the boundary for some purposes (e.g., getting research user needs to researchers), but keeping the boundary solid for others (e.g., keeping the scientific process out of politics)” (ibid., p. 17). In the following sections, we will more closely look at the mediation activities and interactions between science and politics.

Types of boundary work

In his paper “From ‘knowledge use’ towards ‘boundary work’”, Robert Hoppe (2010a) studies various types of boundary work³. In principle, boundary work can be analysed from three different perspectives: as discourses, practices and organisational arrangements. The level of analysis in the Hoppe paper is discourses which means to study the ideas and frames in which boundary work is conceived. The results stem from an empirical study of Dutch actors involved in boundary work, such as modellers, experts, scientific advisors, bureaucrats, politicians, and their thoughts and discourses on their own typical activities.

The study identifies seven types of discourse on boundary work (Hoppe 2010a, p. 175-76). First, *rational facilitation of political accommodation* is the most common discourse brought forward by actors in very different functions. In the context of the Dutch consensus-type political system, the boundary workers are strong believers in political accommodation. They feed the accommodation process with sound arguments, derived from both scientific expertise and stakeholder knowledge. The role of boundary workers is to facilitate transgression

³ See also Hoppe, R (2008), Scientific advice and public policy: expert advisers' and policymakers' discourses on boundary work. *Poièsis & Praxis*, DOI 10.1007/s10202_008-0053-3.

between knowledge and politics. Second, *knowledge brokerage* is, as compared to rational facilitation, more sceptical about possibilities to link science and policy, partly because of cognitive impairments of politics and administration, but also because of the inevitable gap between science and politics. However, these actors try to make the best of it: they hold that, under favourable conditions, knowledge brokers may exploit opportunities for instrumental learning. Third, boundary workers engaged in the discourse of *mega-policy strategy* perceive themselves a government-oriented think-tank. They verify and critically examine strategic policies and policy believes-in-use in the light of state-of-the-art scientific evidence and argument. Fourth, *policy analysis* is a discourse in which the pragmatic, long-standing policy networks are at the foreground, such as in economic and financial policy. In these networks, boundary workers are policy analysts that provide politicians, civil servants and stakeholders with science-based intelligence for their political judgements and decisions.

Whereas these four discourses have in common the view that the operational codes of science and politics diverge, the following three discourses are rather predicated on views of convergence of the political/societal functions of science and politics⁴. Fifth, actors involved in the discourse of *policy advice* see their role as boundary spanners between policy analysts and politicians. Their task is to advise their principals about the acceptability and feasibility of policy proposals, on the grounds of pragmatic knowledge on 'what works'. Sixth, *post-normal science advice* is a discourse found in sustainability-related policy fields beset with uncertainties and interest conflicts. Policy networks in these areas are volatile. The role of boundary workers hence is to create and institutionalise more stable role and interaction patterns that allow scientists and policymakers to engage in an open and productive dialogue to jointly assess the advantages, disadvantages and uncertainties surrounding sustainability policies. Finally, *deliberative-procedure advice* can be characterised as a discourse that emphasises procedure and process-criteria to allow all involved parties to openly debate, each from their own perspective, policy proposals and their underlying values and uncertainties. Actors engaged in this discourse typically work in advisory bodies or as civil servants.

Overall, it can be said that with the exception of the first discourse of rational facilitation, which is pursued by a diverse set of actors, the other types of boundary discourses appear to be borne by homogeneous sets of actors, depending on their position in the science-policy arrangement. Hoppe (2010a, p. 176-79) continues his article analysing in which way the discourses on boundary work are also linked to the occurrence of types of policy problems. A common typology to distinguish differently structured problems is this: domesticated or structured problems (e.g. occupational health and safety, road maintenance); types of moderately structured problems (with either normative agreement but not certainty on knowledge, e.g. tackling aids, or with knowledge certainty but no normative agreement, e.g. stem-cell research); and unstructured ('wicked') problems (e.g. ethnic integration). Hoppe argues that each problem type can be related to specific boundary discourses.

Policy analysts, knowledge brokers and *policy advisors* are typically dealing with domesticated problems or the choice of appropriate policy instruments in structured policies. *Rational facilitators* and *mega-policy strategists* are more concerned with strategic advice for the mid- to

⁴ Hoppe bases this distinction on the work of Björn Wittrock who drew attention to the dimension of convergence and divergence to describe the relationship between science and politics. Instead of insisting on the presupposed divergence of the two realms, and thus their incompatibility, Wittrock argues that, no matter how different, science and politics follow the same societal functions, namely to lay the foundations for social coherence, cooperation and collective action, see Wittrock, B. (1991), *Social knowledge and public policy: eight models of interaction*, in: P. Wagner (ed), *Social Sciences and Modern States: National Experiences and Theoretical Crossroads*. Cambridge, Cambridge University Press: 333-353, 338.

long-term, rather than instrumental, short-term advice. In these cases, windows of opportunity for policies are often very narrow and, therefore, timing is a crucial issue for these boundary workers. *Post-normalists* and *deliberative proceduralists* are special types since they typically mediate between domesticated and 'wicked' problems. They operate in both spheres, in the technical, specialist culture of domesticated problems and the culture of political and social debate on fuzzy problems (e.g. a medical specialist working at the Health Council confronted by medical issues with ethically unknown or divisive implications). Lastly, rational facilitators, policy strategists or post-normalists may also be found in ad-hoc or temporary advisory committees which are politically inspired institutions, created to deal with controversial or politically sensitive topics. Hoppe argues that these bodies typically deal with unstructured and ethically divisive issues. The seven different types of boundary work discourses hence cover the range of differently structured problems a political system has to deal with.

Subsequently, one of these discourses of boundary work, knowledge brokering, will be investigated in greater detail⁵. This concept is at the focus of the work of the LIAISE Work Package 6 in which science-policy interaction is empirically analysed in a number of 'test cases'.

Knowledge brokering

In her article "Matching knowledge brokering strategies to environmental policy problems and settings", Sarah Michaels (2009) explicitly focuses on knowledge brokering as a strategy to incorporate knowledge into decision making. Knowledge brokers are intermediaries acting between scientists, who produce knowledge, and policymakers who are prospective users of that knowledge. Knowledge brokering is a two-way facilitative process between science and policy making: policymakers are encouraged to be open to making use of scientific evidence; researchers are encouraged to undertake policy-relevant research and to present it to policymakers in ways that the latter can understand and value the findings.

The term 'knowledge brokers' is borrowed from Litfin⁶ who uses it to highlight the discursive and inherently conflictual dimension of knowledge in the political sphere. Knowing is part of constructing an issue and seeking to address it. Research has shown that policymakers are more inclined and better able to incorporate scientific knowledge when they are involved in creating such knowledge. In this context, co-production of knowledge refers to the interaction of scientists, policymakers and others⁷. Yet policy issues are different, and the related knowledge needs differ. Also, learning styles of policymakers differ, leading them to assign different weights to different forms of evidence. Finally, policymakers act in different political environments with specific external pressures. Consequently, Michaels argues, there is no single form of knowledge brokering.

The article sets out a spectrum of knowledge brokering strategies (Michaels 2002, p. 997-99). Each strategy serves complementary functions and is appropriate for different policy issues or the same issue at different stages in the policy cycle. The strategy of *informing* aims at disseminating information targeted at decision makers, like fact sheets and addresses of web sites. In *consulting*, a counsel is sought to advise on a problem at hand. The broker's role is to locate experts with

⁵ This is however not to say that the notion of 'knowledge brokering' is understood in an identical way in Hoppe's, Michael's and other scholar's accounts of the concept. Vice versa, other scholars might be working on similar topics of policy facilitation but calling it differently. The aim of this review rather is to present several frameworks that could be helpful when thinking about the science-policy interface.

⁶ Litfin, K.T. (1994), *Ozone Discourses: Science and Politics in Global Environmental Cooperation*. New York, Columbia University Press.

⁷ See e.g. Lemos, M.C., Moreshouse, B.J. (2005), The co-production of science and policy in integrated climate assessment. *Global Environmental Change Part A* 15(1): 57-68; Edelenbos, J. et al. (2011), Co-producing knowledge: joint knowledge production between experts, bureaucrats and stakeholders in Dutch water management projects, *Environmental Science & Policy* 14(6): 675-684.

salient expertise and to facilitate appropriate communication. Similarly, the aim of *matchmaking* is to identify the needed expertise and to bring together people who would not otherwise meet. Those with potentially useful expertise may not recognise the value of it to a policymaker; and it is the knowledge broker's task to link them and their work. *Engaging* refers to a strategy in which one party frames the debate through terms of reference for a given policy problem and implements a process of involving other parties with salient expertise, such as technical committees or secondments. The broker may support this through liaison or facilitation. The strategy of *collaborating* involves all parties in jointly framing the interaction process and negotiating substance to address a distinct policy problem. In this case, the broker facilitates collaboration between the parties. Finally, *capacity building* also refers to co-management and co-production of knowledge but emphasises what can be learnt from doing so that is applicable to the various dimensions of the policy problem and its implications. Knowledge brokers strive to create and sustain the abilities of people and institutions for such learning. For this, an iterative approach of evaluation and making adjustments is required. Overall, these six options for linking science and policy⁸ vary in terms of effort and degree of interaction between the involved scientists, decision makers and brokers.

While many publications acknowledge the importance of knowledge brokering to develop more robust public policies⁹, the strength of this article lies in its attempt to systematically assess how different brokering strategies fit within heuristic frames intended to advance political decision making. With a focus on environmental policy making, Michaels (2009, p. 999-1008) builds her analysis on four frameworks of types of policy problems or policy settings scenarios in which a policymaker is operating. They are Lindquist's decision regimes¹⁰, Turnhout et al.'s science policy typology¹¹, Holling's adaptive cycle¹², and Kurtz and Snowden's Cynefin domains¹³. Each of the frameworks has a different emphasis: Lindquist's set of decision regimes is oriented at the policy process; Turnhout's types of policy problems are generated as functions of the policy process and the subject content; Holling's concept focuses on the nature of the content; and in Kurtz and Snowden's framework, the emphasis is on individual ways of sense-making, specifically whether decision makers see data, appreciate its importance and act upon it.

Michaels (2009, p. 1008) distils from these approaches a systematic that identifies specific knowledge brokering strategies fitting for each of the different policy problems or policy settings identified through the four frameworks. Like this, it is possible to identify a shared knowledge brokering strategy common to problems and settings in the frameworks. For example, the strategy of informing may be suitable in a routine decision regime, with well-structured policy problems, in the conservation phase of the adaptive cycle, and in the ordered domain of known causes and effects. The strategy of collaboration is fitting for a fundamental decision regime (that provides opportunities to rethink a dominant approach), with badly structured policy problems, in the release phase of the adaptive cycle, and the Cynefin domain of disorder. The value of this systematic lies in its attempt to match different knowledge brokering strategies with different ways of understanding the range of policy problems and political settings confronting decision makers. It also highlights the fact that the knowledge brokering strategy must fit the targeted policy issue and the policy setting in which it occurs.

⁸ There exist other classifications of knowledge brokering strategies and functions, e.g. knowledge brokers as knowledge managers, linkage agents and capacity builders, see Meyer, M. (2010), The rise of the knowledge broker, *Science Communication* 31(1): 118-127, 121.

⁹ See e.g. Bielak, A. et al. (2008), From science communication to knowledge brokering: the shift from 'science push' to 'policy pull', in: D. Cheng et al. (eds), *Communicating Science in Social Contexts: New Models, New Practices*. New York, Springer: 201-226; Pielke, R. (2007), *The Honest Broker*. Cambridge University Press.

¹⁰ Lindquist, E.A. (1989), What do decision models tell us about information use? *Knowledge in Society* 1(2): 86-111.

¹¹ Turnhout, E. et al. (2007), Ecological indicators: between the two fires of science and policy. *Ecological Indicators* 7(2): 215-228.

¹² Holling, C.S. (1995), What barriers? What bridges?, in: L.H. Gunerson, C.S. Holling (eds), *Barriers and Bridges to the Renewal of Ecosystems and Institutions*. New York, Columbia University Press: 3-34.

¹³ Kurtz, C.F., Snowden, D.J. 2003, The new dynamics of strategy: sense-making in a complex and complicated world. *IBM Systems Journal* 42(3): 462-483.

Policy analysis and facilitation

To conclude this literature review, we will address a meta-level in the consideration of science-policy relations, namely the reflection on the double role that policy analysts have in this setting: to *analyse* the relation and interaction between science and policy, and to *facilitate* their interaction. To this end, it is conducive to briefly look at the changing history of ways in which academic and professional policy analysts have looked at scientific knowledge in designing and evaluating public policies. In his book “The Governance of Problems”, Robert Hoppe (2010b) devotes a chapter to the changing conceptions of policy analysis. He starts off with the classic notion of Harold Lasswell¹⁴ that policy science is about the production and application of knowledge *of* and *in* policy. Policymakers, who want to successfully cope with problems on the political agenda, should be able to mobilize the best available knowledge. This requires high-quality knowledge applied *in* policy. At the same time, policymakers need to know how policy processes come about. This demands optimal knowledge *of* policy. Both knowledge types are intimately linked: the more and better knowledge *of* policy, the easier it is to mobilize knowledge production for and application *in* policy. According to Lasswell, the interdependence between knowledge *of* and *in* policy provides the basis for the policy analyst’s operational task as focusing the attention of all those involved in policy making so as to bring about their maximum rationality.

Belief in scientific rationality was from early on seen as a key to solving societal problems. In traditional political science thinking, the role of policy analysis was seen as ‘speaking truth to power’¹⁵. Better knowledge of causation and know-how about the application of scientific logic in decision making formed the core of policy analysis. This implied replacement of politicians’ and citizens’ knowledge of policy and policy making with a scientifically validated type of general knowledge. From an epistemological perspective, we can distinguish three different currents in technocratic and instrumentally rational policy analysis (Hoppe 2010b, p. 174-77): an *analycentric* approach that claims cognitive superiority based on the scientific logic and consistency built into analytic techniques like cost-benefit analysis, cost-effectiveness-analysis, and statistical decision theory; *neo-positivist* policy analysis that grounds its claim of superiority in causal knowledge that may be applied to the explanation of the emergence of policy problems and the prediction of impacts of certain policy interventions; and *critical-rationalist* policy analysis that, like neo-positivism, claims to hold superior causal knowledge but differs in ways of acquiring it. Here, knowledge acquisition is seen as a process of learning from trial and error: policy making as successive efforts to compare hypotheses (policy content) of experimentally generated impacts (implementation of the policy as a social experiment). Even though the critical-rationalist approach of policy analysis already meant a big step towards a fallibilist and learning conception of rationality, it was criticised on the grounds that experimental design and outcomes are unavoidably mediated by the assumptions, reference frames and ideologies of the involved actors of policy making. Like this, critical rationalism is only suitable for selecting the better of two or more causal hypotheses but of little help in picking the more adequate of two or more problem frames.

¹⁴ Lasswell, H.D. (1971), *A Pre-View of Policy Sciences*. New York, Elsevier.

¹⁵ Wildavsky, A. (1979), *Speaking Truth to Power: The Art and Craft of Policy Analysis*. Boston, Little, Brown and Co.

Over the years, however, belief in scientific rationality was decaying. What followed in the 1980s was the so called post-positivist turn in political science marked, among others, by Lindblom and Cohen’s work

on “Usable Knowledge”¹⁶. It became accepted that political scientists shape the world they study by the way they define the problems. Consequently, policy analysts can “no longer claim to find ‘truth’ about ‘reality’”¹⁷ but must admit interpretive, hermeneutic and critical approaches to their knowledge stock. We can discern different currents in the post-positivist turn (Hoppe 2010b, p. 177-81): A *relativistic* policy analysis, grounded insights in the incrementalist practice of policy making which is at odds with the idea of a more comprehensive rationality of a Lasswellian political science, holds that the impact of policy analysis is limited. As a ‘science of muddling through’¹⁸, the best policy analysts could hope for is to provide policymakers with clever strategic advice and simplifications. *Critical-theoretical* policy analysis in turn has attacked the relativistic approach for their disregard of the conditions for consensus formation. The latter is seen as a problem solving strategy in its own right, in addition to analytic work, and it is the task of the policy analyst to monitor and foster means of authentic consensus formation. *Forensic* policy analysis regards political practice as flooded by different thinking styles, interpretive frames, and competing belief systems which are expressions of the stakeholders’ identities. The role of the policy analyst is to engage in a process of problem structuring through reflection, action and political dispute. Like this, policy analysis is “a continuous process of tinkering or bricolage between policy analyst/designer, the policy design and its wider environment, in which the policy design ought eventually to function independently of the analyst/designer” (Hoppe 2010b: 181). Finally, *participatory* policy analysis current is heterogeneous in that participatory approaches appeal to relativistic, critical-theoretical and forensic analysts alike. Whereas these analysts value participatory techniques for instrumental and contextual reasons as means to structure debate, there are others who view participation more as an end in itself.

From this overview Hoppe concludes a general shift in conceptions of policy analysis from ‘speaking truth to power’ to a variety of modes of ‘making sense together’. Yet coherence of analytical approaches was lost along the way. To restore some coherence and pragmatism to the field, six major clusters of activities¹⁹ can be distinguished: research and analyse, design and recommend, advise strategically, clarify values and arguments, democratise, mediate. Based on these real types of policy analysis, Hoppe proposes to think of them in terms of *policy analysis styles*, which are combinations of two or more core activities. Six styles can be distinguished, namely

- a *rational style*, research and analysis combined with recommendation and advice;
- an *argumentative style*, research and analysis while also clarifying values and argumentative systems;
- a *client advisory style*, mixing recommendation and advice on a policy problem with strategic advice for a principal;
- a *participatory style*, attempting to introduce the critical clarification of values and arguments into the democratisation of expertise;
- a *process management style*, linking up mediation and strategic advice; and
- an *interactive style*, in which mediation for mutual understanding and consensus building is linked to democratisation efforts (Hoppe 2010b: 188).

This is only an outline in which some adjacent activities are more easily combined than others lying further apart, and more systematic research is needed to substantiate these styles, their underlying theoretical assumptions and empirical relevance. Hoppe argues that the

¹⁶ Lindblom, C.E., Cohen, D. (1979), *Usable Knowledge*. Yale, Yale University Press.

¹⁷ Weiss, C. (1991), Policy research: data, ideas or arguments?, in: P. Wagner et al. (eds), *Social Science and Modern States: National Experiences and Theoretical Crossroads*. Cambridge, Cambridge University Press: 307-332, 321.

¹⁸ Lindblom, C.E. (1959), The science of muddling through. *Public Administration Review* 19(2): 79-88.

¹⁹ The systematic is based on Mayer, I.S. et al. (2004), Perspectives on policy analysis: a framework for understanding and design, *International Journal of Technology, Policy and Management* 4(2): 169-191.



styles of doing policy analysis however point to the need of congruence between problem type, political context and policy-analytic style. As regards the topic of this research review: the science-policy interface, and ways of linking knowledge to action, we can conclude that these styles provide an enriched picture of the role political scientists can play in analysing and facilitating the relation and interaction between science and policy.

IN BRIEF

Chilvers, J., Evans, J. (2009) Editorial: Understanding networks at the science-policy interface. Themed issue of *Geoforum* 40 (3): 355-362.

An increased complexity induced by globalization processes and a growing uncertainty as to the state of the environment led to a politicization of environmental science in the public sphere. For this reason, the editors suggest to extend the science-policy nexus by a third link to society. They argue that the 'science-policy-society interface' has been understudied so far because one of the dimensions is regularly disregarded. However, the indicators of an increasing intertwining between science and society illustrate the need for a more comprehensive study of the science-policy-society triad.

The special issue focuses on better understanding extended science-policy interfaces, on clarifying the theoretical and conceptual challenges associated with such an extension, and on reflecting on related methodological issues. In that regard, the editors clarify the need for an integrated approach towards the term 'network' that takes into account the different epistemological and ontological assumptions of policy and science studies respectively.

The four papers featured in the special issue provide insights into how the extension of the science-policy interface takes place across different spaces and issues. They provide examples of how society intervenes in the dialogue between science and policy, but also point to the need for further research in this area.

Dalal, R.S., Bonaccio, S. (2010), What types of advice do decision-makers prefer? *Organizational Behaviour and Human Decision Processes* 112: 11-23.

The paper presents the results of two multilevel policy-capturing studies aimed at exploring the types of advice decision-makers prefer in various situations. The authors first introduce five types of assistance that can be provided for decision-makers: recommending specifically what they should do, recommending specifically what they should not do, presenting a set of alternatives from which they can choose, giving advice on how they should make their decision, and providing socio-emotional support to them.

In a second step, the variety of situational contexts is described: Decision-makers' motives can range from improving the accuracy of their decisions to maintaining autonomy in decision making; possibly they include a combination of both. Furthermore, individual differences like gender, agreeableness, decision making style, and decision making anxiety might influence the decision maker's preference on how to be advised. Finally, situational differences, e.g. the deliberate request for advice, might account for differences in decision makers' preferences.

The authors conclude that decision makers respond most positively to being informed about the alternatives from which they can choose. In certain situations, however, a specific recommendation for one alternative is preferred. In contrast, advice against an alternative as well as social support is being regarded less helpful.

Howlett, M., Newman, J. (2010), Policy analysis and policy work in federal systems: Policy advice and its contribution to evidence-based policy-making in multi-level governance systems. *Policy and Society* 29: 123-136.

The paper deals with the so far under-researched question of what the work of policy analysts at the sub-national level looks like. It does so by presenting the results of a comprehensive survey of the work of policy analysts at the provincial and territorial levels in Canada. By drawing on over 1,600 completed questionnaires, the authors were able to sketch a profile of provincial public servants.

The profile is divided into five different categories, namely demographics and job experience, education and training, day-to-day-duties, techniques, and data employed. Among other things, typical policy analysts at the sub-national level are fairly young and highly educated, but not trained in policy analysis as such and in the more technical problem areas with which they deal. Furthermore, they tend to apply informal analytical techniques like brainstorming or consulting and are characterized by high mobility and short-term work.

The authors put their findings in relation to previous surveys of policy analysts working at the national level and highlight the differences between them. The authors encourage further comparative studies and large-scale surveys so as to obtain a deeper knowledge of policy analysts' contribution to evidence-based policy-making at the sub-national level.

Owens, S. (2010), Learning across levels of governance: Expert advice and the adoption of carbon dioxide emission reduction targets in the UK. *Global Environmental Change* 20: 394-401.

The paper addresses questions about the role of expert advice and knowledge in processes of policy evolution. More specifically, it analyses the shifts in British climate change policy in 2003 with a focus on the role of the Royal Commission on Environmental Pollution, which recommended reducing CO₂-emissions in the UK by 60 % by the year 2050.

Starting from a cognitive theory approach, the author gives an overview about the Commission's purpose and shows where the origins of this policy recommendation are. The paper then gives reasons why the Commission's recommendation was taken up rather rapidly in public policy and identifies a mixture of cognitive and non-cognitive as well as structural and incidental factors at different levels of governance which contributed to the uptake of the Commission's recommendation in this case.

Susan Owens concludes that ideas, evidence, arguments, and framing all mattered in this policy process. But also institutions, interests, and power played an important role. She argues that the Commission played several roles at the same time. In this context, the role of the Commission as knowledge broker is highlighted. By adopting a discursive strategy and showing to be an effective policy entrepreneur, the Commission succeeded in being perceived as a legitimate advisory body.

Runhaar, H., van Nieuwaal, K. (2010), Understanding the use of science in decision-making on cockle fisheries and gas mining in the Dutch Wadden Sea: Putting the science-policy interface in a wider perspective. *Environmental Science & Policy* 13: 239-248.

The paper aims to show that not only scientists and their interaction with decision-makers and stakeholders influence science utilization in the policy process, but other actors as well. The authors argue that this provides useful insights on how to enhance science utilization in policy-making processes.

To illustrate these findings, the example of the policy-making process in cockle fisheries and gas mining in the Dutch Wadden Sea is analysed. Although scientists had tried to contribute to the decision making process by providing information on the effects of cockle fisheries since 1990, their findings were incongruent with the decisions made by policy makers. This changed radically in 2004 when the Dutch parliament agreed to implement the suggestions of an advisory commission (the so called Meijer Commission) that had been established in 2003.

The decision to establish this commission was an outcome of discussions and meetings with stakeholders, scientists and decision-makers which were organized by the environmental research and consultancy company IMSA. Besides, new legislation introduced by the European Court of Justice (ECJ) also helped to transform the process. The authors claim that the changed situation was mainly due to the new roles of intermediaries between scientists, decision-makers and stakeholders, which were defined by the involvement of IMSA and the decisions by the ECJ.

Reframing of the problems can therefore change the interaction processes among the involved actors which can enhance the chances of knowledge utilization in decision-making processes. Moreover, the creation of a more open, interactive science-policy interface can support the usage of scientific knowledge.

Weichselgartner, J., Kaspersen, R. (2010), Barriers in the science-policy-practice interface: Toward a knowledge-action-system in global environmental change research. *Global Environmental Change* 20: 266-277.

The paper deals with the gaps between scientific knowledge production and the application of that knowledge by policy makers. It does so by presenting the results of a case study analysis of 20 scientific assessments from the knowledge domains of vulnerability and resilience which sheds light on the gaps and bridges in the science-policy-practice interface (SPPI) in this research area.

By means of a questionnaire survey sent out to scientists and practitioners, the authors identify significant gaps in the SPPI. These relate to divergent objectives, needs, scope, and priorities of the two groups; social factors such as cultural values, communication, understanding, and mistrust; and structural factors such as different institutional settings and standards.

Assuming that the best way to overcome these gaps would be a collaborative knowledge production of scientists and practitioners, the authors further elaborate on the scope conditions that support and



obstruct, respectively, this kind of collaboration. Consequently, the authors propose a list of suggestions that should help to generate 'socially robust knowledge' in an institutional context that allows for face-to-face interaction between scholars and policy-makers. They claim that the institutionalization of such a collaborative knowledge production would make an important contribution to addressing the theoretical and practical challenges of vulnerability and resilience research.



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