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How does science-based policy advice matter in policy making? The RIU model as a framework for analyzing and explaining processes of scientific knowledge transfer☆

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ABSTRACT

A "linear" scientific knowledge transfer from science ("truth") to political practice ("power") does not seem to be possible. Therefore an alternative understanding of scientific knowledge transfer is suggested: In the RIU-model, scientific knowledge is produced in the science system (Research), and science-based problem solutions are utilized within politics by political actors (Utilization). Between the two spheres there is no "automatic" connection that leads to a linear application of science in policy making. Rather, it highlights the important sphere of "integration", a step that lies between science and utilization. Integration means the orientation of research toward political and practical problems with the aim to describe and solve them (Integration). By the example of a German case study (activities of the German federal environment agency in waste policy) it will be shown (1) what important integration measures are, and (2) how they lead to science-based policy advice that matters in policy making.

> "My view of the connection between the world of climate science and the world of policymaking is that people who are not experts should pay attention to what the experts are telling them. I mean, if you have a heart condition, you pay attention to what your cardiologist tells you."[1]
> Rick Piltz, former senior associate in the U.S. Climate Change Science Program

1. Introduction – the need for science-based environmental policy making

The question, how scientific expertise can have an impact on politics, has been an important area of research for Max Krott. In his earlier works, he developed suggestions for the management and evaluation of inter- and transdisciplinary environmental and sustainability research (Krott, 1994, 2002, 2005a). One main research question for him has always been how environmental research has to be organized in order to gain practical impacts. Based on this he worked on conceptions for policy advice in forest and nature conservation policy (Hubo and Krott, 2012; Krott, 1999, 2005b). One of his most important contributions to the discourse on science-policy interactions is his insistence on the classic idea of political science that politics is based on power and interests, and not necessarily on "enlightenment" from science (Krott, 2012; Krott et al., 2014). Power-oriented actors take decisions that are based on their interests. Scientific rationality can have an influence on political decisions if some powerful "allies of science" have the power to enforce weaker actors to use science-based information (Böcher and Krott, 2016). The idea, that scientific knowledge transfer can be possible even without changing the underlying rationality of power-oriented politics, has become one of the main assumptions for the development of a new model of scientific knowledge transfer, the so-called RIU model (Böcher and Krott, 2010, 2014a, 2014b; Heim and Böcher, 2016; Stevanov et al., 2013). This contribution applies the RIU model to German environmental policy and deals with the question how scientific knowledge transfer can be successful.

Environmental governance of global policy issues, such as climate change or the loss of biodiversity, is crucially dependent on scientific knowledge (Boehmer-Christiansen, 1995; Grundmann, 2009; Gupta et al., 2013; Haas, 2005). Natural science delivers general information and knowledge about environmental problems (Jasanoff and Wynne, 1998). Scientific expertise also provides solutions to potential political problems; these solutions should be based on scientific facts, be understood by stakeholders, be economically feasible, and be implemented on a political level (Böcher and Krott, 2011). Scientific expertise and scientific experts who advise politicians play an important role in environmental governance (Lidskog and Sundqvist, 2004; Miller, 2009; Pregernig, 2014; Pregernig and Böcher, 2012).

Scientific policy advice serves as an interface between science and politics ("science-policy interface") (Hulme, 2009). Therefore, an

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[1] Quotation from "The collision of climate science and politics, part 1 – lecture at American University," http://www.climatesciencewatch.org/2011/11/27/the-collision-of-climate-science-and-politics-part-1-lecture-at-american-university/.

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important research question concerns how scientific knowledge transfer can encourage politicians to use scientific knowledge (Lavis et al., 2003; Turnhout et al., 2016). Many scholars lament the lack of scientific evidence in environmental policy making, as represented by the introductory quotation. The image of science as the "cardiologist" telling the sick patient ("politics") how to handle the problem is often presented in such arguments (Hahn, 1989). This depiction is based on a linear model of scientific knowledge transfer, in which policy-making simply follows scientific evidence (Durant, 2015; Hulme, 2009). Political scientists argue that this simple understanding of science and its direct influence on politics is unrealistic because there are natural incompatibilities between the systems of science and politics (Böcher and Krott, 2016; Miller, 2009). The main question is how scientific expertise that is based on scientific standards (finding the "truth") can influence and change power-oriented politics.

These two contrasting views of the science-policy interface inform this research and support its aim to better explain what leads to a use of science-based information in policy. I suggest a model of scientific knowledge transfer that neither overestimates the possibility of the direct application of science in political practice nor underestimates the use of scientific information in politics. Furthermore, the model helps to analyze environmental policy processes in which scientific expertise is influential, but in a more complex, non-linear manner. It is crucial to analyze the so-called bi-directional integration activities undertaken by institutions such as departmental research organizations, which serve as the interface between science and politics. As well an important driver of scientific knowledge transfer are "allies of science", powerful political actors who are able to push through science-based solutions even against the resistance of other actors.

This paper is structured as follows. First, I outline the analytical RIU (Research-Integration-Utilization) model of scientific knowledge transfer. This model was introduced and further developed by Böcher and Krott based on various research projects that addressed scientific knowledge transfer in environmental and forest policy in Germany (Böcher, 2012; Böcher and Krott, 2010, 2011, 2014a, 2014b; Böcher and Krott, 2016; Heim and Böcher, 2016) and Eastern Europe (Stevanov et al., 2013; Stevanov et al., 2011). It has been used to analyze Austrian research programs for sustainability (Böcher and Krott, 2012a, 2014a), the science-based activities of state forest research institutes in Japan and Sweden (Nagasaka et al., 2016), and was applied to investigate scientific knowledge transfer in watershed management in Indonesia (Dharmawan et al., 2016).

In this paper, a case study from the German Federal Agency for the Environment (UBA) is used to empirically demonstrate the usefulness of this model along with one policy case (European waste policy) illustrating different relationships between research, integration, and utilization. The paper aims especially at demonstrating the importance of "allies" for scientific knowledge transfer in power-oriented political processes.

The conceptual work presented in this paper is based on several research projects pertaining to scientific knowledge transfer in Germany and Austria (Böcher, 2012; Böcher and Krott, 2010, 2014a; Böcher and Krott, 2016). The empirical case study about the UBA was commissioned by the German Federal Agency for the Environment (UBA) with financial means of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

2. Material and methods

The case study is based on a document analysis of internal written materials by the UBA and on 15 expert interviews with different internal actors from the UBA. The empirical research was carried out between 2009 and 2015. Interviewees have been the UBA's Vice President, three UBA Division Leaders, and 11 scientists from different UBA departments. The case was analyzed according to the main criteria of the RIU model of scientific knowledge transfer presented below (see Table 1, section 4.3.4, for an overview). The main goal of the case study was to reconstruct the activities of the UBA in a specific departmental research project that was identified before as being "successful". Successful means that, in political practice, utilization of science-based advice of the UBA could be observed (e.g. by the existence of a new regulation, a new guideline, or a new law based on science-based information by the UBA). The interviewees reported their activities and documented important steps by delivering related internal written materials (for instance, a decree of the BMUB that lead to the start of a research process, the minutes of a workshop, a scientific publication etc.). These written materials served as additional evidence for the reported activities. The RIU model delivered the criteria for the analysis of the empirical materials. These were firstly interpreted as representing activities of research, integration, and utilization and could secondly be further analyzed by the RIU model's subcriteria for each of these activities.

The main hypotheses are:

1) interconnected research, integration, and utilization activities lead to scientific knowledge transfer in environmental policy, and
2) due to their power, political actors serving as external or internal allies of science push through science-based policy solutions.

3. The RIU model of scientific knowledge transfer

The analytical RIU model defines the process of scientific knowledge transfer as the continuous process of research (R), integration (I), and utilization (U), with each following a distinct logic (Böcher and Krott, 2010, p. 28; Böcher and Krott, 2016) (see Fig. 1).

Research is understood as the production of specific knowledge by using scientific methods and standards (Stevanov et al., 2013). The model reflects that high-level research must be regarded as an important precondition for scientific knowledge transfer (Lentsch and Weingart, 2011) because the quality of scientific expertise determines its credibility among and utilization by practitioners (Pregernig and Böcher, 2012, p. 204 f). The legitimacy of using scientific findings in environmental policy increases if these findings rely on "state-of-the-art" science. Therefore, many scholars argue that the quality of the scientific expertise produced is generally an important quality criterion for science-based policy advice (Lentsch and Weingart, 2011). The criteria that are used to assess the quality of research include their reliance on state-of-the-art science (assessing current scientific information), compliance with the procedures of good scientific practice, and cooperation with other scientific institutions and projects (Böcher and Krott, 2012b, p. 19; Böcher and Krott, 2016).

In "linear" models of scientific knowledge transfer, the availability of scientific research alone leads to a direct transfer of scientific knowledge to political practice (Grundmann, 2009, p. 398; Hulme, 2009, p. 101). To better explain the processes that lead from scientific research to political utilization, we developed our analytical non-linear RIU model to further analyze the unique activities shared between the production of scientific expertise and the utilization of science by politicians. We define this interaction between scientific research and utilization in politics and practice as integration, which is an important step in the interaction between research and practical utilization.

Integration is defined as a bi-directional step in the process of interaction between practical utilization and research. During integration, research results that are relevant for political actors are selected using criteria based on practical demands. Meanwhile, practical demands for scientific solutions are interpreted and transformed into scientific research questions (Böcher and Krott, 2010, p. 37). Integration is the exchange of information in response to the demands of those in practice and in evidence gathering; this process directs research toward practical problems with the aim of describing and successfully solving them (Böcher and Krott, 2010, p. 37). Integration connects scientific evidence with the expectations and wishes of politicians without altering or changing the results of scientific research. The interplay between