Michael Böcher · Max Krott

Science Makes the World Go Round

Successful Scientific Knowledge Transfer for the Environment

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To Christian Smoliner,
the most innovative Chief Science
Administrator in Vienna, Austria

Preface

There is a consensus that, when scientific ideas are put into practice, they should contribute to the improvement of environmental solutions. However, although the transfer of scientific knowledge into practice has been the object of many activities, results are poor, and seldom has better science led to better policy.

Three decades ago, we approached the issue of knowledge transfer by consulting and evaluating the Austrian Cultural Landscape Programme, which was one of the first in Europe to conduct transdisciplinary research in an effort to make a difference in the practice of the sustainable use of landscapes. We learned that most of the expectations scientists had about political actors were not met, and that, conversely, political actors did not acquire the information they expected from science. Nevertheless, a few success stories showed that a valuable scientific contribution to practical solutions is not impossible. We analysed the success stories based on political science theory and identified various success factors. By advising the German Federal Environment Agency, one of the key players in Europe in environmental policy support, we had the chance to develop our model further and to generate the RIU (research, integration and utilization) model, which provided the basis for this book.

Today, the RIU model has proved to be useful in the identification of the key factors involved in the transfer of scientific knowledge in European and international cases. Consideration of these factors allows the development of a road map for the professionalization of the scientific support for policy. The RIU model is not an attempt to diminish the importance of numerous innovative institutions and activities involved in the transfer of scientific knowledge from theory to practice, or to substitute them. On the contrary, in that the RIU model presents a professional approach to the identification of key factors involved in knowledge transfer within the spectrum of existing institutions and activities. One hopes that the ability to focus on said factors might improve the effectiveness of those efforts, which are growing rapidly in number. This could even lead to a new profession, one of "integrators": people who build bridges successfully between researchers and political actors.

We want to thank all scientists who have trusted us and given us deep insights into their daily business of research, and into the—often frustrating—efforts to make science relevant for practice. We also thank the political actors who shared with us their experiences in the struggle for solutions for environmental issues. Special thanks also go to the editors at Springer, who were enthusiastic about our topic and who made possible the production of this book.

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Max Krott

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We wish to thank all interviewees for providing us with deep insight into their daily business as it covered research, integration and utilization. We also thank our colleagues for helping us improve our RIU model of scientific knowledge transfer through their criticism and discussion, especially the working group for scientific knowledge transfer at the Chair of Forest and Nature Conservation Policy at the Georg-August-University of Göttingen, Germany, namely Budi Dharmawan, Janina Heim, Do Thi Huong and Kenji Nagasaka.

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Contents

List of Figures

List of Tables

Chapter 1
Making Science Work in Policy and Politics

But Professor, what are you thinking of? No one has yet become popular by being right. Only when being right suits some political party can that happen.

—Arthur Schnitzler (1993; first: 1912)

1.1 Joint Solving of Problems by Policy and Science

The magic promise of policy and science is to improve life for mankind. The basic idea is to handle and solve problems actively instead of accepting the threats and hardship of life. In doing so, science and policy face the great challenges of the world, like feeding people, protecting nature, keeping peace or maintaining health. There is no doubt that such problems are too great to solve for either science or policy by itself, and that the only strategy that can make a difference is for both areas of knowledge to join their efforts.

Science strives to deepen our insight into the complex causes and consequences of problems. Scientific modelling is able to show how climate will change in the future and how temperature, wind and rain will influence forests and agriculture. Based on particular scenarios, political actors better understand the long and short-term consequences of climate change and gather information about the potential usefulness of new political instruments and their effects. Whereas science helps to achieve in-depth understanding of a subject, the everyday life experience and knowledge of an informed layperson are not sufficient to understand world problems and solve them effectively.

Political actors depend on scientific information to design adequate policies, and science alone cannot effectively improve life without relying on strong policy. Political actors only have the mandate and the ability to intervene in societies and economies in order to put science-based solutions into practice. The need for joint action by politics and science is overwhelming; both claim to be aware of the other's potential and of the benefits that their cooperation would bring to both.

Despite the willingness to cooperate, the examples of successful science-based political advice and policy are rare. Scientific knowledge does not flow easily into

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political practice. Scientists and political actors are often not even able to communicate on a specific issue. Sometimes it would almost seem that they come from different planets and speak different languages. Our aim with this book is to form a clear picture of these differences and to look for possible bridges to improve joint problem solving in practice even despite existing communication problems.

1.2 Sharing a Beer with a Politician

Imagine what would happen if a scientist met an old friend who has become a politician. They would sit down to have a beer and exchange the experiences they have had with the effects of climate change on society. The researcher might talk about his new outstanding climate model. The model describes multiple dimensions of climate change combining mean temperature with maxima and minima over time. "This is very nice", the politician says, "but tell me one thing: Will the climate become warmer or colder in the next 10 years?" "It depends," will be the scientist's answer, "it depends on what you focus on, the maxima or the mean temperature". "What a pity", the politician thinks, "My colleagues and I cannot attend a seminar to become experts in climate change definitions. What we need is a straightforward message to get people interested and involved."

The scientist continues his enthusiastic report: "Yesterday I got some new, exciting results showing that temperature has been cooling down throughout the last decade. Such data suggests that my entire model has to be reformulated. We are expecting an improved model soon." "Wow", the politician thinks, "how crazy scientific progress is—models have to be abolished for innovation, while in politics we need to convince people of our arguments and stay with these arguments once they have been agreed on in order to have decisions be approved and to keep them that way."

"My dear friend, tell me where I can get good scientific advice on how to manage forests in order to create an optimal carbon sink." "A scientific answer is not yet available, because the growth rates of tree species under conditions of climate change are not yet sufficiently understood," the scientist replies. "Good scientific evidence will be available in the future only." "My dear scientist", the politician thinks, "I have the unique chance, only this week, to push through in parliament a political programme for subsidising carbon-friendly forestry and I cannot wait for future scientific results."

"Nice to meet you and thanks for sharing a beer", both say. But the scientist goes away convinced that the friend has to deepen his understanding of science in order to apply the scientific message to politics. The thoughts of the politician are similar but inverted: The scientist should learn to think a little more like a politician in order to conduct research that is relevant for practice.

It is an often-suggested strategy that scientists and politicians should adapt to each other a little to promote joint solutions. We will investigate whether this is a promising strategy and whether it is possible at all. Maybe we need to accept the general differences between science and politics and learn how to make these differences benefit science-based policy instead.

1.3 Focus on Individual Strengths

The ideal roles of scientists and of political actors are quite clear. Science and politics are public domain tasks and the ideals of both professions have been discussed in public frequently since their very beginnings.

Scientists see their core mission in producing knowledge that is better than other types of knowledge in respect of several important aspects. Scientific knowledge uncovers secrets of nature, enabling us to explain natural phenomena and to intervene in natural processes. For example, the recognition of potato cultivation as having the potential for valuable nutrient production in Europe, and the description of the appropriate soil to do this and of the plant itself, led to changes in agriculture in Europe in the seventeenth and eighteenth century (McNeill 1999). Scientists make a commitment to apply specific scientific methodology to produce such knowledge effectively and efficiently. The enormous output of scientific knowledge has proven convincingly that science serves its purpose and that political actors can rely on a growing wealth of scientific knowledge about the world and of innovative solutions to its problems.

Political actors pursue a different mission. They act in order to solve problems by using political means. They have created specific political organisations like parliaments, public administrations and courts in order to tackle issues using professional and democratic political procedures. The ideal is to organise a public discourse for agenda setting, apply a democratic procedure in formulating the policies and then to implement them via a legally bound public administration. The whole policy should be evaluated by critical media and the democratic participation of citizens, and it should withstand any challenges before the public courts. Political actors produce decisions and formulate and implement political instruments with the aim of contributing to the solution of issues and problems. Political actors at least claim their ideal-typical role to be solving real world problems.

Scientists' ideal role in knowledge production and politicians' counterpart in problem-solving activity, as described above, are very different in reality, though they are linked and they could support each other strongly. Table 1.1 illustrates the differences between these ideals, for both scientists and political actors.

1.3.1 Different Focus of Scientists and Political Actors

Scientists describe and explain the world, whereas political actors change the world. In order to describe nature, one has to suppose that there is something out in the world that has its own reality that can be observed scientifically. Foremostly, one

Table 1.1 Ideal roles of scientists and political actors

Scientists Produce knowledge scientifically	Political actors Solve problems politically
Focus on describing and explaining the world	Focus on influencing and changing the world
Ask critical questions	Ask relevant questions
Collect all data	Select supportive data
Take time needed for analysis	Take time limited by a window of opportunity
Give reversible answers	Give convincing answers
Accumulate scientific knowledge	Label the knowledge and the world anew
Avoid wishful thinking	Mobilise wishful thinking
Rely on theoretical logic and empirical proof	Rely on persuasion and agreement
Use power to describe and explain the world	Use power to change the world

has to observe in the right manner in order to uncover nature's secrets. Scientists do their job by not disturbing the object of their observation, and by making and recording their observations as precisely as possible. From experience they know that good description requires clear terminology. Reliable and meaningful data can only be produced by knowing what to observe and how to observe it, and by writing down all important observations in a protocol.

Even a purely scientific description of a new phenomenon is highly relevant for political issues. To observe and describe a change in climate is a challenging task and a prerequisite for arriving at the right solution. Scientists have to describe the change in temperature: is it the change in the mean temperature, or of the distribution of temperature over time, or of the maxima and minima? Which region is relevant: local forest stands, regional landscapes, nations, continents? Each focus and defined term will have different and complex consequences for the description and needs scientific consideration.

The goal of explaining climate change opens up a wide area of research. Which factors should be analysed—human factors or natural factors? Which theory should be applied—pure climatology or a combination with biology and maybe even social sciences? Which factors can be observed and which innovative methods are needed to observe them? Where does one gather the resources needed for complex research? Scientists who want to propose descriptions and explanations are confronted with a huge set of challenges. They are fully occupied by solving these scientific questions and seek to produce theoretically sound and empirically demonstrable results.

For political actors, observing the world is also helpful, but this does not constitute the essence of their political tasks. Shaping policy means to make a difference in the real world. Political actors claim to find solutions and change the world for the better. They have to *act*. They try to influence the behaviour of society in general, as well as that of other, specific, political actors. Therefore, political actors observe other actors closely. If political actors are able to alter the thinking, decisions and behaviour of other actors, they will be successful in changing the world.

Political actors devote their attention to the whole extent of the policy process. They try to assert their interests through argumentation as agendas are being set. In the case of climate change, they may look for and form "advocacy coalitions" (Sabatier and Jenkins-Smith 1993) to stress the importance of climate change issues. A key factor in this process is to draw the attention of the media. This means that arguments have to be presented in an interesting manner, which causes a preference for shocking news and perpetually new angles, a situation in which the complexity of scientific discourse plays a minor role. In formulating climate policy, political actors have to organise support for specific goals and instruments. They form coalitions and make efficient use of their power sources. The whole process of politics is highly complex and volatile. Successful engagement in politics requires more daily activity than a political actor can achieve in practice. The consequence is that nearly no attention and time is left for seeking information based on scientific knowledge. Henry Kissinger, the famous political scientist and Secretary of State described the deficit of political actors clearly when he stated in his memoirs (Kissinger 1982) that, during his tenure as Secretary of State, he had had no chance to learn anything new in science and that he relied fully on the stage of scientific knowledge he had reached as a professor when he started the new political job. For Kissinger "the qualities that distinguish a great statesman are prescience and courage, not analytical intelligence" (Kissinger 1982, pp. 168–169).

1.3.2 Asking Different Questions

The idea of science is that, through critical research, scientific descriptions and explanations draw an improving picture of reality. Progress in knowledge is achieved by taking nothing for granted and by asking critical questions repeatedly. No scientific finding is excluded from critical analysis in the future, which might well disprove the original results.

For example, a major result in climate change policy was achieved when scientists identified the deleterious consequences of increasing temperature on forests. Research identified threats for forests in southern areas and predicted a serious decline in their stability. The results were alarming, but scientists did not stop with these results. They investigated further so as to find which factors promoted adaptation to climatic changes, and found that among the huge number of trees growing within a specific forest, there were some species and individuals with a higher genetic adaptability to climate change. Therefore, the statements concerning the level of threat to forest health, which were general in hindsight, are more scientifically differentiated today. To predict the consequences of climate change for forests correctly, any scientific evaluation has to consider species and individual genotypes, in addition to other factors.

Critical questions lead to increasingly specific and complex results. In fact, such results again provide a basis for more critical questions. These questions are welcome by scientists, as they are not only interesting for the individual researcher, but also drive scientific progress in general.

Unfortunately, such critical questions regarding existing results are not helpful for political actors. Their task is to build an informational basis that supports specific actions. To reach a consensus on any problem and its preferred solution requires a focus on argumentation. Such focus is fostered by specific questions. For example, in order to mobilise argumentative support to fight emissions, which are accelerating climate change, it is necessary to ask what the specific harmful emissions are and to ask critical questions that can identify their negative effects. But questions that draw attention to other factors causing climate change, or criticise existing judgments on emissions, weaken the consensual basis for political action. Therefore, political actors love questions, but only selective questions that are likely to deliver supportive arguments for them.

In addition, political actors have a need for strong arguments that they can use within the time limit of a window of opportunity (Kingdon 2003). Critical questions that only future research can answer weaken the ability to make a strong argument and to make a decision within a given short time.

The selection of relevant questions to support specific political positions is not due to the habit of political actors. The reason why relevance takes precedence over other factors is that politicians are tasked with making decisions and achieving results. The political decision process is characterised by a narrowing down of the discourse, step by step, to arrive at a story line that supports specific arguments and results in the preferred decision. The wrong questions are a serious threat for this highly challenging process. Therefore, political actors love questions, but only those relevant to the building of support for their chosen position. To be successful, they cannot be open to all critical questions in the way scientists are.

1.3.3 Collecting Different Data

A basis in strong data is essential for good science. Scientists have to be open to all data produced by empirical methods. Unexpected data or data that contradict the hypothesis are welcome. They enable scientists to identify wrong descriptions or explanations and to look for improved ones. Ignoring such data would mean destroying the potential for science to discriminate between correct and incorrect ideas. While it may be disappointing for a scientist to generate data contradicting his expectations, suppressing or ignoring such data is not tolerated in scientific disciplines. The scientific community has evaluation procedures in place to detect possible failures in respect of this type of impartiality in the process of data processing, and to correct them.

Again, the task of political actors is a different one. To move things forward, they have to achieve a consensus as the basis for accepted data. In the political process, such a basis is feeble and always in danger of collapse. Supportive data strengthen the basis and must be gathered exhaustively, whereas contradicting data