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## 2.2.2 Scientific advice

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### Abstract

Scientific advice is the advice given by individual or groups of scientists to policymakers and decision makers on the basis of their expertise to ensure that appropriate policies and decisions are made on a particular issue. Scientific advice has become indispensable in a variety of policy fields in recent years, and there has been global interest in the nature of the institutions and systems providing such advice. In this paper, I explain the concept and current state of such scientific advice, and set out the role of science in politics and government.

### Keywords

Policy formation, risk assessment, risk management

## 1 Introduction

The relationship between science and society has deepened and become more complex in recent years, and science-based advice has become increasingly important in the policy formation process. In this section, I explain the concept and current state of scientific advice.

Awareness of the issue of the relationship between science and policy formation began to emerge in the 1970s. In 1972, Alvin Weinberg, a nuclear physicist and the director of the Oak Ridge National Laboratory in the United States, pointed out that there is a boundary area between science and politics, and that numerous problems in society today cannot be answered by science alone (e.g., effects of low-level radiation on living things and massive earthquakes). New developments in the relationship between science

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and society also emerged around this time. With the increase of global issues such as climate change, energy, infectious diseases, and cybersecurity in the twenty-first century, there has been a rapid rise in the number of complex and uncertain issues that cannot be addressed by traditional government organizations and sectoral experts, making it difficult to formulate appropriate policies in a timely manner. The position of “scientific advice” in the process of policy formation has expanded to support this increasingly uncertain society, and the role of scientific advisors and policymakers who accept and incorporate scientific advice into policy has become increasingly important.

The Scientific Advisory Board of the UN Secretary-General was established in 2013, and in 2014, the International Network for Government Science Advice (INGSA) was created under the auspices of the International Council for Science (ICSU). INGSA has expanded its activities as a collaborative platform for promoting policy dialogue, capacity building, and research across diverse science advice organizations and state systems around the world.

In Japan, the Great East Japan Earthquake triggered a growing interest in scientific advice. The Science Council of Japan published a revised scientists’ code of conduct in 2013, and the Minister of Foreign Affairs appointed Japan's first science and technology advisor in 2015. Reflecting these developments, the Fifth Science and Technology Basic Plan, approved by the Cabinet in 2016, included a statement on the importance of scientific advice.

## 2 The structure of scientific advice

Scientific advice is advice provided by scientists (including engineers, doctors, and scientists in the humanities and social science fields) or groups of scientists on the basis of their expertise to help governments formulate appropriate policies and make decisions on specific issues. The essence of this is to provide advice based on scientific findings to policymakers and decision-makers. Science is objective and without value judgments, while policymaking and decision-making aim to realize certain values; both have different value systems. While the two sides tend to be estranged as a result of these fundamental differences, the mediating functions (scientific advisors and scientific advisory organizations) that connect the two sides are important to increasing the efficacy of scientific advice.

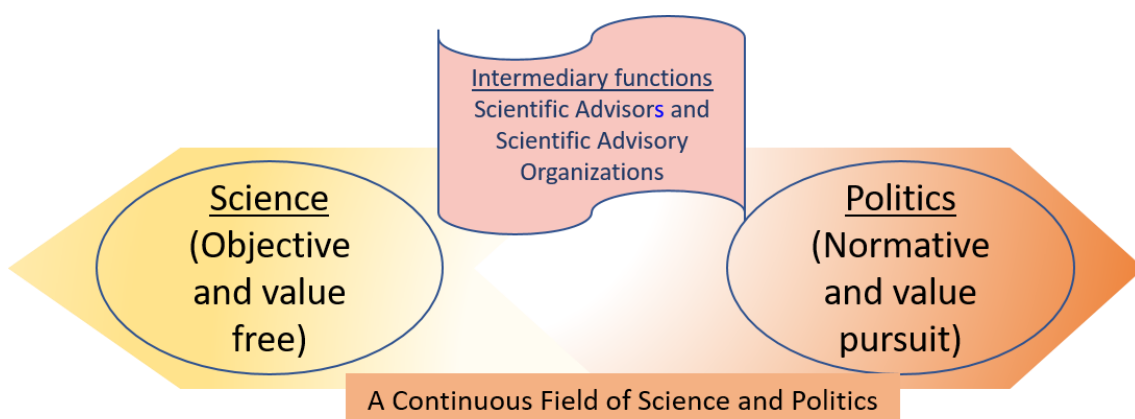


Figure 1. Structure of scientific advice.

### 3 Types of scientific advisors

As discussed above, the mediating function between science and policy- and decision-making is important. Looking at examples from various countries reveals four types of scientific advisors (both individuals and organizations), as set out in a report by the OECD Science and Technology Policy Committee, “Scientific advice for policy formation: The role and responsibility of expert bodies and individual scientists” (OECD, 2015).

#### (a) Council on science and technology policy

This is a government’s highest-level deliberative body for science and technology policy, and often includes innovation policies in its deliberations. In many cases, the members are not only drawn from academia but from industry; in some cases, relevant ministers are also members. Examples include the President’s Council of Advisors on Science and Technology (PCAST) in the US, the Council for Science and Technology (CST) in the UK, and the Council for Science, Technology and Innovation (CSTI) in Japan. In many cases, these are established as part of a governmental organization; in others, such as Germany’s Commission of Experts for Research and Innovation (EFI), they are independent of the government. These are organizations that basically focus on advising on policy for science.

#### (b) Deliberative councils

Deliberative council is a gathering of experts (not only scientists, but also stakeholders and so on) who deliberate on a specific policy area or issue. In some councils, knowledge from the natural sciences plays a central role, such as in the fields of health and medicine and the environment, while in others, such as finance and diplomacy, this is not always the case. For example, in Japan, private advisory bodies with names such as “study group” or “roundtable discussion group” are often set up under ministers or bureau heads.

#### (c) Academies of science

Each country has its own academy of sciences, where representatives of the scientific community gather. Examples include the National Academy of Sciences in the US, the Royal Society in the UK, and the Science Council of Japan. Academies of science often function both as scientific advisors to the government and society, presenting the will and views of scientists, and as institutions that honor scientists who have made noteworthy achievements (in Japan, the latter function is performed by a separate institution, the Japan Academy). When national academies of science prepare their advice, they usually start by establishing internal committees to deliberate. Although their activities are typically funded by government budgets, they usually provide advice independent of the government. In addition to academies of science,

scientific advice may also be provided by societies and associations of individual academic disciplines, public and private think tanks, and public research institutes.

(d) Individuals who provide scientific advice (“scientific advisors” and so on)

Some countries appoint individuals as scientific advisors to provide scientific advice to government leaders. These include the UK’s Government Chief Scientific Adviser (GCSA), the US President’s Science Advisor, and Australia’s Office of the Chief Scientist. These scientific advisors play a key role as a nexus between the world of politics and the world of science. In particular, they are supposed to be able to provide timely scientific advice when an urgent response is required, such as when a disaster occurs. In some cases, a scientific advisor is assigned to advise the head of each ministry. However, many countries do not have a science advisor, such as Germany and France. Japan did not typically appoint a science advisor until September 2015,<sup>2</sup> when Kishi Teruo was appointed as the first Science and Technology Advisor to the Minister of Foreign Affairs.<sup>3</sup>

## 4 Policy for science and science for policy: The subject matter and content of advice

We have discussed the structure and types of scientific advice, but what kind of advice is based on scientific knowledge? Depending on its content, there are two types of scientific advice: namely, policy for science advice and science for policy advice. Originally introduced in 1964 by Harvey Brooks, the founder of Harvard University’s Science and Technology Policy Program, this distinction was disseminated internationally through venues such as the OECD and ICSU. “Policy for science” is advice for science and technology policy or science, technology, and innovation (STI) policy, while “science for policy” is advice not only for science and technology policy but for all manner of policy fields such as medicine, environment, energy, and education. In both cases, evidence is the main basis for the content of the advice; however, for policy for science, in addition to evidence, scientists’ broader knowledge is an important basis for scientific advice. Here, scientists’ broad knowledge refers to their outlook on the future development of their field of expertise and its impact on society and the economy, as obtained through the expertise and experience they have developed over their careers.

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<sup>2</sup> As an exception, between 2006 and 2008, Kurokawa Kiyoshi was appointed as Special Advisor to the Cabinet (in charge of science, technology, and innovation) under the first Abe and Fukuda administrations.

<sup>3</sup> Ministry of Foreign Affairs press release, “Appointment of Ministry of Foreign Affairs Counselor (Science and Technology Advisor to the Minister of Foreign Affairs),” September 24, 2015.

Table 1. Subjects and content of scientific advice

Category of Scientific advices	Policy for Science	Science for Policy
Targets	Field of Science and Technology Policy or STI policy	Multiple Policy Fields (Medicine, Environment, and others)
Main basis of advice contents	Evidence(science-based) and Broad Knowledge from Scientists	Evidence(science-based)

Scientists' broad knowledge refers to their outlook on the future development of their field of expertise and its impact on society and the economy, as obtained through their accumulated expertise and experience. Given that objective evidence-based examination is limited to the formulation of science and technology policy, subjective judgment and discussion based on scientists' experience and achievements are required. On the other hand, the "science for policy" advice required in areas such as drug reviews and environmental regulation should, at least in principle, be based primarily on objective evidence. However, it goes without saying that even in these fields, policymaking is ultimately based on the comprehensive consideration of a variety of factors, including subjective judgments.

As noted, "policy for science" and "science for policy" are conceptually separate. However, although both are part of scientific advice and complement each other, they share a complex relationship and can overlap in real policy settings. For example, the Council for Science and Technology of the Japanese Ministry of Education, Culture, Sports, Science and Technology provides advice on "policy for science" as it reports on science, technology, and academic policies. On the other hand, as these reports include evidence from a scientific standpoint, the Council for Science and Technology Policy can be said to also provide advice on "science for policy."

The concepts of "policy for science" and "science for policy" are further complicated by the ambiguity of the concepts of science and technology policy and STI policy. Although "policy for science" refers to advice on science and technology policy and STI policy, the fringes of STI policy can also include higher education policy, industrial policy, environmental and energy policy, and healthcare policy.

## 5 The role of scientific advisors

Scientific advice aims to provide scientific knowledge to policymaking and decision-making. Thus far, this paper has presented the types and content of such advice. I would like to consider the ideal role of the advisors responsible for such advice. In this respect, there is a model that illustrates the concept of scientific advice as that of an "honest broker." This internationally popular concept was first proposed by the American political scientist Roger Pielke and illustrated with a four-quadrant table. Table 2 presents the typology of scientific advisors, a typology that has been frequently mentioned in international conferences on scientific advice held in recent years.

Table 2. Four types of scientific advisors

		Scientific viewpoints	
		Linear model	Stakeholder model
Democracy viewpoints	Existence of policy options in society	Pure scientist	Issue advocate
	Experts present policy options	Science arbiter	Honest broker of policy options

In Table 2, “pure scientists” are scientists who simply produce scientific knowledge without regard to its application to policy or industry. Next, “science arbiters” are scientists who provide relevant scientific knowledge upon request when there is a specific policy issue. These two types of scientific advisor are premised on what Pielke calls the “linear model” view of science, in which good scientific knowledge leads to good policy formation. In contrast, “issue advocates,” who advocate a particular position on a policy issue, and “honest brokers of policy alternatives,” who present relevant findings together with multiple options, are clearly aware of the application of scientific knowledge to policy formation. This view of science is premised on the “stakeholder model,” which holds that scientific advice is formed by a wide range of stakeholders. Although he does not make a definitive statement, of these four quadrants, Pielke seems to consider the qualities of the “honest broker,” who presents policy options, as most important for a scientific advisor.

## 6 The scientific advice process and its challenges

In order for scientific advice to be effective, certain points must be kept in mind at each stage of the process (see Figure 2). On the political and administrative side, it is important to set agendas and select advisors appropriately. At the stage at which advice is prepared, a mechanism is required to guarantee the independence of scientific advisors and ensure the quality of their advice. Their advice, including its inherent uncertainty and diversity, needs to be communicated and utilized in a timely and accurate manner. All of the processes must be transparent, and legal responsibility needs to be clarified in the event that administrative actions taken on the basis of scientific advice cause damage or other problems. Furthermore, a system for scientific advice in times of emergency should be established.

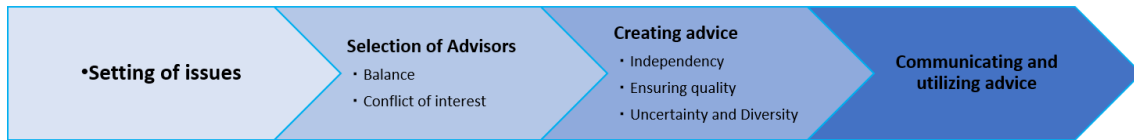


Figure 2. The scientific advice process and discussion points source.

The improper function of these scientific advisory processes may result in the formation of incorrect policy and implementation, as well as undermine public trust in policy formation and science itself. In some cases, there is a risk that the scientific advisor will simply follow the government’s established policy, and there is always a risk that the government will interpret the advice of the scientific advisor to suit its own preferences. It is important to revise the scientific advice process to mitigate these risks. In recent years, countries have established principles, guidelines, and codes of conduct to ensure sound scientific advice. The UK and US have made particular progress in developing a system of codes of conduct, partly because of their respective experiences of the BSE outbreak in the UK in the 1990s and the intervention of politics in science during the Bush administration in the 2000s. Such codes of conduct often stipulate the balanced selection of scientific advisors; appropriate handling of conflicts of interest; appropriate assessment, communication, and management of uncertainties in scientific advice; and transparency and openness throughout the process. However, in respect to the general relationship between scientific advisors and the government, it is worth noting that the UK Code of Conduct clearly states, among other things, that “advisors must respect the democratic mandate of government to make decisions based on a wide range of factors, and recognize that science is only part of the evidence that government should consider in making policy decisions.” In Japan, interest in scientific advice increased in the wake of the Great East Japan Earthquake. In January 2013, the Science Council of Japan released a “Revised Scientists’ Code of Conduct,” outlining various basic principles for scientists to follow when providing advice. Meanwhile, beginning in 2013, the OECD spent two years on a project to review scientific advice, setting out general requirements that effective scientific advice should have. This kind of international scrutiny is expected to make further progress in the future.

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