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The Art of Science Advice

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Helping to oversee for 17 years expert committee studies carried out by the U.S. National Academies of Sciences, Engineering, and Medicine has given me an appreciation for what might be called the "art of science advice." Before describing what I have learned, let me provide some background on the growing interest by governments in receiving science advice and the science-advising niche that has evolved for the National Academies.

The topic of scientists providing advice to policy makers and the public has always been popular with scientists. Government interest has grown over time, especially during the twentieth century when scientific knowledge and technological applications were seen as highly relevant and often decisive factors on important policy considerations. The rapid advance of science, technology, and innovation (STI) in this globalized century has made it even more compelling. A prosperous and secure future for a country requires enhanced STI capabilities and a strengthened science-policy interface. The International Network for Government Science Advice (INGSA) is a new initiative aimed at strengthening science advising worldwide and described in this issue of Science & Diplomacy.

The 1863 congressional charter creating the National Academy of Sciences (NAS) specified that the institution "shall, whenever called upon by any department of the government, investigate, examine . . . and report upon any subject of science or art" (where "art" in this case meant "the practical arts" or "any human creation").[1]

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In the nineteenth century only a few reports per year were produced, but today it results in approximately 200 reports annually by the National Academies with the majority requested by the U.S. government.

The goal is to produce objective, high quality, and unbiased reports carried out by world-class experts, subjected to rigorous internal review processes and supported by scientific evidence and data. The Academies' most precious asset is its credibility, and so to be seen as a neutral independent advisor, the NAS goes to great lengths to avoid conflicts of interest and nonscientific, self-serving, and political statements. The reports are released to the public and press, and that puts pressure on the government to respond.

My first observation on the "art of science advice" is that scientists who provide advice are often asked to—or choose to—provide advice that goes beyond what science can or can't say about an issue. In recommending specific decisions or actions that can affect people and things people hold dear, value judgments are necessary. Scientists have no special authority or expertise in making value judgments. Nevertheless, it is important in my view for scientists to respond to the questions that decision makers and the public ask even if value judgments are needed. The art is in providing this advice in a responsible way.

Value judgments that are often in play fall in several categories. Distributional value judgments concern fairness of outcomes—what constitutes a fair allocation of costs, benefits, trade-offs, and risks to individual stakeholders, to society as a whole, to future generations, and to things people value. Procedural value judgments concern the fairness of the decision-making process. Evidential value judgments, which often crop up in questions from policy makers, concern what counts as sufficient evidence where there are uncertainties—where to set the standards of proof for justifying a particular policy decision or action. For this category, "how sure is sure enough?" is as much a value judgment as "how safe is safe enough?."[2]

That brings us to what scientists can do when giving advice on policy issues where the public and/or decision makers have asked questions that involve value judgments. First, be clear what science can say with various degrees of confidence from current scientific knowledge, and what science cannot say because of scientific uncertainties. Second, be clear when value judgments are being made and explain the supporting rationale and evidence for recommendations that rely on value judgments that go beyond science. Even if the intent is to be nonpolitical, understanding the politics of an issue is helpful. In evaluating draft reports from expert committees and their responses to reviewers' comments (where I really learned the complexities and subtleties of science advising), the NAS internal review process seeks to make sure that the questions being answered are truly within the statement of task, the supporting scientific evidence meets the highest standards of peer review, and the supporting rationale for findings, conclusions, and recommendations is reasonable, defensible, and clearly explained.

My second observation is that good science advice sometimes needs sound judgments based on the experience of wise individuals even if supporting evidence is not so rigorous and considerable scientific uncertainties exist. That is often the case with important policy questions. Putting together the right mixture of disciplinary expertise, diverse experiences, and wise judgment to produce an objective, high-quality study by an expert committee is more of an art than a science. And telling a good story with persuasive anecdotes to make the case for recommendations is often more influential with political leaders than a dryly written committee report with mounds of data and rigorous evidence. The challenge is to provide the best science advice from the most competent experts with credible supporting evidence and clarity on value judgments and to communicate this advice in a compelling way for the target audience.

My third observation concerns the importance of every country having a robust "science advisory ecosystem." In the U.S. ecosystem, there are many roles for scientists, both inside and outside government. In federal agencies, scientists can serve as chief science advisers, policy practitioners at various levels, and even, at the highest level, policy makers. They can also serve in policy-relevant roles overseeing or carrying out research and development. Scientists outside of government can fulfill many roles. They can serve on committees of the National Academies, the AAAS, and professional societies. They can be employed at U.S. universities and nongovernmental organizations focusing on the science policy process, which can include academic research, public communication, and even lobbying. The U.S. science-policy interface has been enhanced by such initiatives as the AAAS Science and Technology Policy Fellowship program, which over 40 years has given thousands of young and mid-career scientists the experience of working in government. Because of that experience, many young scientists choose to focus their careers on the science-policy interface. "Infiltrating" the government in order to understand policy makers' questions is not a bad strategy for the science community to strengthen the science-policy interface.

My last observation is that every country should be encouraged to seek the independent advice of its nongovernmental scientific community on important public policy issues. The goal is for every country to have high-quality, objective, and credible scientific advice—free of politics and special interests, independent of government control, and conveyed to the public as well as to the government. Recognizing that science advising is a human endeavor and that political leaders necessarily incorporate value judgments and other considerations that go beyond science in their decisions, scientists putting forth their best efforts at providing objective scientific advice can enable wiser decisions. It is in everyone's interest for all countries to have decisions informed by the best scientific information that is conveyed transparently, without bias, and with accurate representation of scientific uncertainties.

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Endnotes

1. I learned of the use of "art" to describe any human creation from National Academy of Engineering President Daniel Mote, who told me "the use of the terms science and art most likely comes out of the first course on technology taught by Jacob Bigelow at Harvard (Rumford Professor from 1816-27 teaching the application of science to useful arts) where in the introduction to his course (notes available over the Internet) he uses the terms science or art to describe all knowledge where science is about what is here, whether people are here or not, or thinking about something or not, and art is everything created by the human mind. …Bigelow's notes and book also introduced the word Technology where he lamented reintroducing this ancient word because he was struggling to find a word to explain applications for human kind."
2. I learned about evidential values and the phrase "how sure is sure enough" from Professor Sheldon Reaven of the State University of New York at Stony Brook when we were colleagues at the University of Tennessee.