# SCIENCE AND TECHNOLOGY POLICY PROFESSIONALS: JOBS, WORK, KNOWLEDGE, AND VALUES

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## Contents





## Summary

Until recently, science and technology (S&T) policy professionals were trained on the job. Over the last few decades, however, a body of knowledge and skills that professionals in the field can and should draw on in their work has been developed. The jobs of S&T policy professionals often combine administration, analysis, and research. In all these areas, it is useful for them to have read the history of science policy and the literature on research organizations, innovation theory, and human resource development. They should be able to turn an ill-defined policy issue into a problem that can be tested logically with empirical data. They should be able to write quickly and clearly, without jargon, and present their work orally and visually. S&T policy professionals understand and appreciate the transformative power of science and technology—their power to make the world better. As professionals, they have a responsibility to use that transformative power on behalf of all people.

## 1. Introduction

As recently as 1970, there was no profession of S&T policy. Research budgets were small, and government agencies made decisions based on their best judgments, seldom informed by data or analysis. The science indicator enterprise was new, and few countries collected even rudimentary information about their national systems of innovation.

Today, the situation is quite different. Since the 1960s, a wealth of information about the science and technology enterprise has accumulated. The innovation process has been studied from many angles, and the model of how it works has been established, extended, and refined. A young person entering the world of research and innovation policy today with the notion of a career in the field has a lot of knowledge to draw on,

and therefore a lot to learn. Yet the routes into this career are not very different from those that existed earlier. Many young professionals in the field still enter it directly from other activities, and hold degrees in other areas.
This article is written for the young professional in S&T policy. It covers three topics, as follows.

1. What can a young person expect from a career as a S&T policy professional, in the light of what the older generation of such professionals have experienced? The article describes the kinds of jobs they can expect to get, as well as the kinds of work they can anticipate in those jobs.
2. What do they need to know to be S&T policy professionals? The complementarity between policy research and policy practice is key here.
3. Why take up this career? What values do S&T policy professionals embody?

## 2. Careers in S&T Policy

As a preface, a distinction needs to be drawn between two types of career—"amateur" and professional—in S&T policy.

One type of career begins when someone reaches the forefront of research in a field of science or engineering, or more rarely the social sciences. After achieving research notability, those following this path become leaders in their universities, or perhaps professional societies. Then they start "committee careers," sitting on peer review panels, advisory boards, and committees of organizations like the National Academy of Sciences. Eventually they may move into positions on (in the United States) the National Science Board or the President's Council of Advisors on Science and Technology.

There is no formal term for the people in this career path, but since this article discusses the careers of S&T policy *professionals*, here these people will be called "the amateurs." This term is not intended to be derogatory. "The amateurs" are people of great experience, great wisdom, and, often, great vision. Their "day jobs" are elsewhere, however. They move into the world of science policy quite regularly, but they do not "live" there. S&T policy professionals do not differ from the amateurs in background and training, however, just in the kind of work they do.

In contrast to the amateurs, S&T policy professionals are steeped in the knowledge base of the field. They are trained in the techniques of analysis, and carry a different and special public responsibility. The roles of amateurs and professionals in S&T policy are seldom combined, although it is not unknown—one woman serves as director of a division of the American Association for the Advancement of Science (AAAS) and has also been a member of two national science advisory boards in the United States. Another person, a chemist by training, spent a year during her committee career at a policy research unit studying the knowledge base underlying S&T policy. She is currently president of a liberal arts college.

One might imagine that we could divide S&T policy professionals into those who spent their careers in academe and those that spent them in government. Several decades of

real careers, however, indicate that this neat distinction cannot be drawn. The following examples show how people in the field have progressed through their careers. Their careers give the flavor of the exciting work that is available in this fledgling profession.

- Ph.D. in cell biology from Princeton. AAAS Congressional Fellow. Budget examiner and later branch chief at the Office of Management and Budget. Vice president for research and graduate studies at a technological university. Then back to government as head of the Office of Research and Development at the Environmental Protection Agency. She is currently in private consulting, and looking to return to the university.
- B.S. in physics, Ph.D. in political science. Held three university positions before coming to AAAS, at Syracuse, State University of New York, and George Washington Universities. He has been head of the science policy staff at AAAS for more than two decades.
- Ph.D. in sociology, with a dissertation on the shape of scientific careers. Professor at Wake Forest University, and Congressional fellow in the late 1980s. Currently Chair of the AAAS Committee on Science, Engineering, and Public Policy, and working on a book on the careers of the pioneer generation of African-American chemists and chemical engineers.
- The exception that proves the rule! This person has a Ph.D. in economics, and has spent his entire career in the university—in fact at one university, where he is currently Director of the Institute for Policy Research and Evaluation. Throughout his career, he has been a policy analyst, working on one study after another of the effects of federal and state programs on innovation.
- Ph.D. in philosophy. Head of a Center for the Study of Ethics in the Professions. Also primarily an academic, but she came to Washington for two years as a program director at the National Science Foundation. She has worked extensively with engineering professional societies on ethics issues.
- Ph.D. in sociology. Reached full professor status at a technological university before moving to the Office of Technology Assessment (OTA) in the mid-1980s. Since leaving OTA, this person has held two senior positions at the National Science Foundation, spent time at the Office of S&T Policy, and is now vice president at the National Action Council on Minorities in Engineering (NACME).
- Ph.D. in chemistry. Congressional staffer and budget examiner at the Office of Management and Budget, before going to DuPont as a senior manager. She returned to government in the 1990s as Deputy Assistant Secretary at the Department of Energy with responsibility for Department of Energy (DOE) waste management. She is now in the non-profit sector, as program officer for a program of industry studies at a major private foundation.

These real, live people illustrate the kinds of careers young S&T policy professionals are starting. First, they show the range of disciplinary backgrounds that individuals bring into this field, from the sciences and engineering, through the social sciences, and right into the humanities. Second, they show the movement that takes place between different positions, in different sectors; this includes an in-and-out-of-government pattern that places people in many different kinds of job across government. Third, they

illustrate the wide range of jobs outside government that this field opens up, in private industry, non-profit organizations, and universities.

## 3. The Work of S&T Policy Professionals

What do these people actually do in their work? The mix of tasks varies from job to job, but generally involves some combination of administration and management, analysis, and research.

In their administrative and management roles, S&T policy professionals participate in the decision processes of research-related organizations of various kinds. Their lives may be endless meetings, but they are nonetheless using their knowledge, skills, and conceptual grasp to shape the world. For example, when the author was at the National Science Foundation (NSF) in the 1990s, she was part of the senior leadership team, participating in strategic planning and program development. This work was combined with leading the main jobs of an office: namely, designing a planning and assessment system for the foundation and exploring options in the peer review process. The budget examiners' jobs provide another interesting example: quiet, "behind the scenes," yet highly influential on account of the significance of the quality of information gathering, and of advice to budget decision-makers.

The second job—analysis—is a little harder to define. Indeed, the policy sciences have been trying to define it for decades. A policy analyst brings systematic information to bear on policy decisions. Because the analyst is generally asked to do this on a short turnaround basis, (s)he works largely with existing data and existing research. This calls for thorough knowledge of the databases and literature relevant to the area of analysis. The analyst organizes existing information in a way that responds to policy questions. A key skill is being able to take the fuzzy, ill-formulated question that is in the mind or on the lips of an amateur or a decision-maker and translate that into a problem that can be addressed with data. When the outputs of the analysis process are written, they need to be short, readable, to the point, and practical. More and more frequently, those outputs take the form of oral and visual presentations, so the skills of speaking simply and presenting data visually are becoming steadily more important in this part of the S&T policy professional's work. Analysis is rooted in the work of S&T agencies themselves, but extra-government, non-profit units also get drawn into the work, often through medium-term projects. For example, RAND's S&T Policy Institute and SRI's S&T Policy Program do lots of work directly for the policy analysts inside government.

The fact that the analyst's job is short-term does not mean that it has no conceptual basis. It is very important for us to understand that whether or not we think about any conceptual basis for our work, we are all drawing upon one. If we do not think about these concepts, then we are probably using the received wisdom as our conceptual framework—this, frequently, is the amateur's view of the world. It is a practical necessity of our work that we do not move too far away, in terms of ideas, from the conceptual frameworks of those for whom we work. If we do, they will not follow. It also means, however, that if you want to change a client's conceptual framework, you need to work for a visionary who shares your goal.

In the United States, this last point has recently been illustrated in the relationship between a Congressional staff member and a strong-minded Member of Congress. The staff member wrote speeches for the Member, but we can imagine that they also had many mutually stimulating conversations about the way science policy was developed.

The Member undoubtedly learned from the staff member, and the staff member got the chance to articulate some ideas for delivery by a powerful spokesperson. Our S&T policy world has been changed by the combination of their talents.

An obvious source for an alternative view of the S&T policy world is the conceptual base of the field itself. This brings us to the topic of policy research. Policy research builds the knowledge base that S&T policy analysis uses in its short-term work.

- First, it develops concepts. In our field, the decades-long development of innovation theory illustrates this.
- Second, it develops methods. The methods base of research evaluation illustrates this. For instance, when analysts present patent and publication data, this looks a straightforward task. Their analysis is made possible, however, by decades of development both of databases and of ways of analyzing them (see *Bibliometrics and institutional evaluation*). This development task has been spread across private firms, academic units, and a range of other academic, non-profit, and for-profit organizations that have been engaged in policy analysis over the years.
- Finally, policy research is necessary for the analytic tasks that require long-term empirical studies. Career studies illustrate this point. The large-scale analysis we are accustomed to requires much painstaking work with huge databases, and knowledge of the sophisticated statistical techniques that are necessary to tease patterns out of them. Without policy research, we would know much less in this area (see *Policy-Making Processes and Evaluation Tools: S&T Indicators*). For example, in the United States, gathering data on scientific careers starts with a sample of people who have just received their doctorates. These people then receive follow-up surveys periodically for the rest of their lives. Combining the data from the various surveys into a form that can be used for analysis is a huge task, and the large numbers of people involved require knowledge of sampling methods as well as mastery of statistical techniques like event history analysis.

Thus, the lifestyle of the policy researcher contrasts with that of the policy analyst. Their projects are longer-term and larger scale, and their knowledge base is more cumulative, requiring footnotes into relevant literature.

The projects done at non-profit organizations sometimes contribute to that literature, but policy research also requires an academic base if it is to succeed in its role in the profession. It also requires funding, which has been scarce for this field in the United States during the 1990s.

Luckily, governments in Europe, Japan, and South America invested heavily in the human resources and knowledge base required by S&T policy from the 1980s onward. This means that policy analysts in the United States can draw upon the work of excellent colleagues abroad, as well as their own.

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**Biographical Sketch**

**Susan E. Cozzens** is Chair and Professor in the School of Public Policy at the Georgia Institute of Technology, and Director of its Technology Policy and Assessment Center. She has been a policy analyst for two decades, including a term at the National Science Foundation as Director of the Office of Policy Support. She has also served as a consultant to the National Academy of Sciences, the Office of Science and Technology Policy, and many other US, European, Latin American, and Asian funding and policy agencies. Her co-edited books include *Theories of Science and Society* and *The Research System in Transition*.