VIEWPOINT

The U.S. CONGRESS *Needs Advice* about Science and Technology

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When will lawmakers recognize the need to re-establish a technical assessment capability?

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Every day, the U.S. Congress faces decisions that involve complex issues of science and technology. For example, the legislature develops and amends environmental regulations. It decides whether and how much to fund research programs aimed at better understanding the environment or developing technologies for a more sustainable future. Legislators must consider the social, regulatory, and other implications of current and emerging scientific and technical developments—from earth-observing satellites to genetic engineering.

For the most part, congressional members and their staffs are not technical experts. As a representative body, Congress must weigh and balance facts, analyses, and opinions that come to them via letters, email, and telephone; through visits made to staffs and members; in meetings in home districts; and through a variety of other mechanisms, such as breakfast and lunch seminars. The biggest challenge is usually not finding data, but filtering and analyzing useful data.

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Members and their staffs can obtain basic facts and figures or modest technical explanations from the Congressional Research Service (CRS) or networks of friends and colleagues. Congressional Science and Technology Fellows sometimes help (*1*). Hearings can provide a formal opportunity to gather input and give interested parties an opportunity to participate. Given the way these sessions are used, however, they often provide little help in developing a balanced and informed view of important technical issues.

Today, the availability of analytical support for Congress is occasional, at best.

Political scientists Edward Schneier and Bertram Gross note that "most legislative decisions are made by men and women who have little direct knowledge of the problem at issue" (*2*). They quote one member as saying, "The best I can do is to devote my time to the major legislation that comes before the House and rely on others for advice in connection with less major legislation" (*2*). Schneier and Gross argue that "informed decisions can be made by uninformed human beings. Indeed they usually are, or at least they are made by persons who lack direct, personal knowledge of the relevant facts.… In a complex world, it is rational and essential for each individual to remain ignorant of the details of most of the components of most of the decisions he or she must make" (*2*). In the simpler, less-technical world of the 18th and 19th centuries, a model of informed decisions made by uninformed decision makers, using adversarial evidentiary procedures drawn from the law, might have been adequate. For many of the decisions that come before Congress today, we need to do better than that.

Of course, it is neither realistic, nor even desirable, to expect members to become deeply knowledgeable about the technical details of the thousands of issues they must address. But, it is realistic, indeed essential, that the information upon which members base their decisions includes impartial balanced analysis that carefully frames the relevant issues, systematically articulates the tradeoffs and other value judgments that must be made, and clearly lays out the likely consequences of alternative choices. In short, informed decision making requires that decision makers understand and use analysis that considers all relevant scientific and technical details.

Today, the availability of such analytical support for Congress is occasional, at best. If the topic considered happens to be one on which the National Research Council (NRC), a think tank such as Resources for the Future, or a university-based policy research group has recently issued a study, then that analysis generally gets used. However, for many important issues, no such study is available, and Congress has to "wing it". Some perspectives may be represented by interest groups; other equally or more important perspectives may never be considered.

Past support

From 1972 through 1995, Congress had a small professional organization designed to provide legislators with balanced analytical support (*3*). After a shaky beginning, the Congressional Office of Technology Assessment (OTA) grew into a small but highly effective unit, which *The Washington Post* characterized in the early 1990s as a "dispassionate, nonpartisan player in the legislative process." Around the same time, *The San Diego Union* noted that "the smallest agency on the Hill is the best in terms of efficiency and thoroughness. It is certainly the least political bunch—this is real sci, not political sci—in the world's most political town." And, in a 1995 editorial, *The Washington Times* observed that "the agency has emerged as the voice of authority in a city inundated with statistics and technical gobbledygook" (*4*).

Various considerations led to the creation of OTA. Congress had a major concern that while the Executive Branch had a great deal of analytical capability to address policy issues on science and technology, Congress itself did not and was often left to the mercy of analysis provided by the Executive Branch or interested third parties. This imbalance did not just arise in the context of legislating. Congress is also responsible for overseeing how the Executive Branch performs its duties. Clearly, effective oversight is impossible without independent capabilities for research and analysis.

OTA was created as a bipartisan entity of the House of Representatives and the Senate and was overseen by a joint committee with equal membership from both houses and both the Republican and Democratic parties (*5*). Because of the highly political setting in which it operated, OTA rarely reached definitive policy recommendations (except to occasionally note when science did not support a specific conclusion). Rather, it structured problems, developed background analysis on which it believed all parties could agree, and thus informed and raised the level of debate.

At its peak, OTA had a staff of about 140, half with Ph.D.s in the sciences, engineering, and various areas of social science. Studies were commissioned by congressional committees (not individual members) and were approved by the bipartisan, bicameral Technology Assessment Board. In contrast to the NRC studies, in which outside experts do much of the work, OTA studies were conducted by its own full-time staff. However, their plans and work products were reviewed by diverse, external advisory boards whose members were selected to represent a wide range of perspectives and all relevant stakeholders. The advisory boards played a critical function, ensuring that all important perspectives had been identified and discussed in the reports.

At their most successful, OTA reports often helped to define the terms of the debate and, like stipulations in a lawsuit, laid out basic technical facts, which both informed and provided a foundation for subsequent policy discussions. Thus, for example, John Adam noted that both sides in the 1977 congressional debate over coal–slurry pipelines used the same OTA report to support their arguments (*6*). Although the typical OTA report laid out a range of options and discussed pros and cons, sometimes when the em-

pirical evidence was sufficiently compelling, a report made a specific recommendation. Thus, a 1986 report on the transportation of hazardous materials suggested that Congress authorize a national truck driver's license that required training and "special certification requirements for all hazardous materials, including gasoline" (*7*). A few years later, Congress did just that (*8*).

In 1990, Bruce Bimber conducted a study of OTA for the Carnegie Commission on Science, Technology, and Government. As part of this undertaking, he surveyed 35 congressional staff members who were regularly involved with matters of science and technology. Half those respondents rated OTA's studies as "very useful", 41% rated them as "useful", 9% rated them as "somewhat useful", and not one staffer rated them as "not useful". The specific legislative impacts appear in a recent review (*9*).

During the years OTA operated, members often noted the important difference that it was making. For example, in 1972, Sen. Edward Kennedy (D-MA) lamented the fact that about 400,000 children were suffering from lead poisoning and observed, "If Congress had had an Office of Technology Assessment 30 years ago, it is conceivable we would have anticipated this problem and enacted legislation [that] would have spared thousands of children from the grievous effects [of] this poison" (*9*).

Interested parties of all persuasions used OTA reports to frame and inform their arguments and then feed those ideas back into the political debate. Think tanks and the academic community made regular use of OTA reports both as sources for their ongoing work and, in the case of universities, for education.

OTA came to an end in 1995, a victim of the flurry of congressional budget cuts in the early days of the "Gingrich revolution". Numerous factors played into this decision (*9*), particularly the election of many new members who had no idea what the agency did. Further, all the committee chairs had just changed because of the Republican sweep. Recall that only committee chairs—not individual members—could commission OTA studies, and many of the new chairs had no experience using the agency.

Also, some members were upset with OTA because of a few highly contentious studies among the more than 700 that it had produced. Almost all of these controversial studies involved technology and national security. Without doubt, OTA's most controversial studies raised serious technical questions about the likely performance of President Reagan's proposed Strategic Defense Initiative (SDI). The most controversial work was not an OTA report but a background paper prepared for the agency by Harvard University's Ashton Carter (*10*). However, two ensuing OTA reports on this topic were also controversial.

"The declassification review of the 900-page…document on Star Wars took nine months. OTA Director [Jack] Gibbons said the only delay was 'for political reasons, not for technical ones.'… The Pentagon had sent copies to the various armed services and laboratories for review. Even though the Central Intelligence Agency was not involved in the study, [project director Thomas H.] Karas said [that] the Pentagon sent parts of the report to it—hoping, he believes, the CIA would classify it. The CIA said in a letter they saw nothing classifiable. In the end, however, the SDI organization held firm, and three chapters…were never declassified" (*6*).

Although these controversial studies constituted only a tiny fraction of OTA's total output, 12 years later, in an interview with National Public Radio's Robert Siegel, former OTA director Jack Gibbons was still explaining and defending the agency's SDI reports against complaints by former Rep. Newt Gingrich (*11*).

No doubt, conservative annoyance over an alleged lack of balance in a handful of OTA reports was a factor for some members in the decision to end OTA. In the highly partisan environment of 1995, it didn't help that Gibbons had moved to the White House to become science advisor to President Clinton and that he took many of his most senior staff with him. For most members, however, these considerations were secondary. When the final decision was made in mid-1995 not to fund the agency (by a margin of one vote in the House–Senate conference committee), the dominant factors were a desire to demonstrate a strong commitment to trimming budgets, a lack of familiarity with OTA and how its products could be used to support the work of committees, and a preoccupation with other broader political concerns unrelated to the specifics of OTA.

Gaps in analytical support

Now that most of the political dust has settled from OTA's demise, Congress must address a basic need for careful, balanced analytical support to inform its many decisions involving science and technology. Sources of independent, balanced analytical support, which Congress can now routinely command, do not span the full range of response times. A gap remains for studies that require a few weeks to 18 months (Figure 1). CRS provides excellent short-term assistance. NRC is often used for longer-term studies that, except in special circumstances, usually require a year or more.

FIGURE 1

Filling in the analysis gap

The U.S. Congress can routinely command very short- or long-term independent impartial analytical support, but it has no resources for studies that require a few weeks to 18 months. Adapted with permission from Ref. 16.

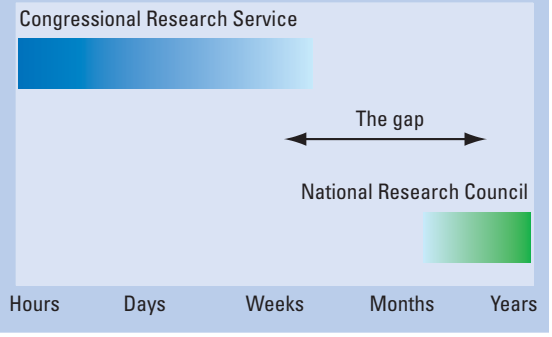
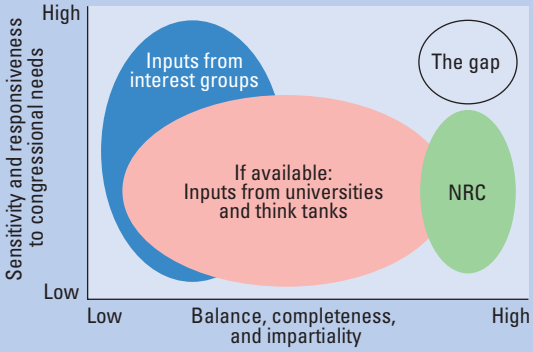


FIGURE 2

Getting the best analysis

The sources of analysis currently available to the U.S. Congress vary widely in their balance, completeness, impartiality, and sensitivity and responsiveness to congressional needs. Adapted with permission from Ref. 16.



Available analyses also vary widely in terms of their balance, completeness, impartiality, and sensitivity and responsiveness to congressional needs. NRC reports are generally well balanced, but because experts perform them, they frequently do not consider the views of the general public. Also, rather than lay out a range of policy options with a discussion of their strengths and limitations, NRC reports often make specific policy recommendations. As a result, Congress may have a hard time using such reports in balancing judgments and making informed tradeoffs.

Just as with study duration, there is a gap in analytical capability that is simultaneously balanced, complete, and impartial while also sensitive and responsive to the needs of Congress, as illustrated in Figure 2. Analysis performed by universities and think tanks can be extremely valuable, but it is often uneven in coverage, balance, and responsiveness to congressional needs and is frequently not available on topics or in time frames that accommodate lawmakers. Further, it can be very difficult for members and their staff to assess the balance, completeness, and im-

TABLE 1

Six institutional models for providing science and technology advice to the U.S. Congress (*16*).

Model 1. An expanded analytical capability in the Congressional Research Service (CRS), the General Accountability Office (GAO), or the Congressional Budget Office (CBO)

Disadvantages

CRS, GAO, and CBO have other missions and institutional cultures, and incentive structures that may not be compatible with a sustained ability to perform interdisciplinary policy analysis.

Most costs would appear in the legislative branch budget.

Budgets of these organizations that are available to support their traditional missions might be squeezed.

Advantages

Incremental change to an existing and familiar mechanism.

Capability is entirely within the legislative branch and thus completely under its control and dedicated to its needs.

Organizations understand the needs of Congress.

Properly organized, this system could maintain tight bipartisan, bicameral control over the process and systematic review of the work products.

Properly organized, it could provide a range of other technical advice and support to Congress.

GAO has begun to demonstrate the capability to make the necessary institutional and cultural changes.

Model 2. Expanded use of the National Academies complex (including National Research Council [NRC])

Disadvantages

Does not maintain tight bipartisan, bicameral control over the process or the systematic review of the work products.

More likely to produce products that "tell Congress what to do" rather than simply frame the problem and lay out options.

Some political risks to the National Academies–NRC complex that might undermine ability to perform current roles.

Greater distance between the analytical organization and Congress, making it easier to trim or eliminate the budget.

Advantages

An incremental change to an existing and familiar mechanism.

Very high status and prestige.

More distance between the analytical organization and Congress, perhaps making the assessment organization less vulnerable to political attack for unpopular messages.

Some costs might be moved to the legislative branch.

Model 3. Expanding the role of the science and engineering congressional fellowship program

Disadvantages

Because fellows are located on the personal staffs of members or on majority or minority staffs of committees, framing of analysis requests may be influenced by partisan considerations.

Support for fellows is already limited, which might place further demands on the resource base and on the scarce time of fellows.

Advantages

An incremental change to an existing and familiar mechanism.

Engages the services of staff who have substantial technical expertise in commissioning and overseeing analysis.

partiality of such work. Peer-reviewed publication can help but does not assess all the factors that Congress must consider. Analytical input from interest groups can be responsive to congressional needs but is often incomplete, biased, and tells only part of the story. Again, it can be very difficult for members and staffs to assess such inputs.

Improving analytical support

In June 2001, representatives from 18 universities and professional societies convened a workshop in Washington, D.C., to begin a national discussion on the need to create an institution that provides Congress with analyses on science and technology issues (*12*). Since then, several follow-up events and legislative initiatives have taken place. Among them has been an effort led by Sen. Jeff Bingaman (D-NM), which produced a pilot program that explored whether the U.S. General Accountability Office (GAO) might develop a technical assessment capability. GAO completed a first assessment in 2002 on biometric technology of border security and a second assessment this year on cyber security and has requested to work on two more (*13*, *14*, *15*). So far, the signs are promising that GAO will be able to develop an ongoing assessment capability.

Congressman Rush Holt (D-NJ), one of the two Ph.D. physicists in Congress, has twice introduced legislation to re-fund OTA under the existing Technology Assessment Act of 1972. Although these bills, introduced in the last two Congresses, have had strong bipartisan support, clearly the current House leadership is not prepared to allow such a bill to come to the floor. Passage could be interpreted as an admission that the earlier decision to dismantle OTA was a mistake. Senators Bingaman (D-NM) and Joseph Lieberman (D-CT) have introduced a bill in the Senate (S2556) that would establish a permanent analysis group in GAO. Similar legislation has been introduced in the House (HR4670).

Recently, 17 experts in technology and public policy laid out 6 different institutional arrangements that could improve the analytical advice available to Congress (*16*). These arrangements are summarized in Table 1.

Model 4. A lean, distributed organization to serve Congress

Disadvantages	Advantages
Requires acquisition of outside resources and thus is subject to the usual political incentives to "spread the wealth around."	Tight bipartisan, bicameral control over the process, and systematic review of the work products.
Analysis performed by staff not directly in control of Congress and thus perhaps less cognizant of its unique needs and sensitivities.	Minimizes the size of the organization within the legislative branch while maintaining great analytical depth and capability.
Greater distance between the analytical organization and Congress, making it easier to trim or eliminate the budget.	More distance between the analytical organization and Congress, perhaps making the assessment organization less vulnerable to attack for unpopular messages.
	Some costs might be moved off to the legislative branch.

Model 5. A dedicated organization in Congress

Disadvantages	Advantages
Similar to the old Office of Technology Assessment, and thus perhaps politically objectionable to some members.	Entirely within the legislative branch, and thus completely under its control and dedicated to its needs.
Most costs would appear on the legislative branch budget.	Tight bipartisan, bicameral control over the process and systematic review of the work products.
Organization must balance the need to employ full-time experts in a wide range of disciplines with the need to limit the budget.	Properly organized, it could provide a range of other technical advice and support to Congress.
As a free-standing unit, financial support would be more vulnerable to shifts in the political climate.	

Model 6. A dedicated organization outside Congress

Disadvantages	Advantages
It may be harder to maintain tight bipartisan, bicameral control over the process or the systematic review of the work products.	A bit more distance between the analytical organization and Congress, perhaps making the assessment organization less vulnerable to political attack for unpopular messages.
Requires acquisition of outside resources and thus is subject to the usual political incentives to "spread the wealth around."	Some of the costs may be moved off to the legislative branch budget.
Greater distance between the analytical organization and Congress, making it easier to trim or eliminate the budget.	
Analysis performed by staff not directly in control of Congress and thus perhaps less cognizant of its unique needs and sensitivities.	

Why consider alternative models? Several congressional members advised participants in the June 2001 workshop not to spend much time in "academic exercises designing optimal institutional arrangements" but rather to work on putting a practical solution in place. Good advice, yet John Kingdon notes that in political settings such as Congress, successful decisions typically result from the simultaneous alignment of three strands of rather independent activity: a political moment that makes action propitious; a set of good policy ideas that have been developed, widely discussed, and supported by policy professionals; and a group of "policy entrepreneurs" who promote those solutions to relevant political decision makers at the critical moment (*17*). Thus, trying to create one ideal process for congressional analytical advice is unlikely to be useful or successful—rarely would a proposal be implemented in its original form. Developing a menu of policy options is the best approach. That gives Congress a richer pallet of ideas from which to assemble a solution.

Only outside stakeholders and groups will persuade Congress to implement new institutional processes.

The message is this: Don't view the models summarized in Table 1 as a menu from which only one design should be chosen as described. Rather, these models set out a range of design possibilities. The best, and politically most feasible, arrangements are likely to involve some combination of several ideas from Table 1. Further, it is probably not wise to think in terms of a "solution". As more congressional members and staffs come to understand that better institutional support is needed to help address issues of science and technology, they will likely work to implement several different strategies. Advancing parallel solutions has two advantages: It will allow Congress to experiment with several strategies, drawing lessons from each, and it should produce arrangements that are politically more robust than a single-solution strategy.

Congressional members respond to their constituents; several members have told my colleagues and me that only outside stakeholders and groups will persuade Congress to create and implement new institutional processes. Thus, it is very important that individual scientists and engineers, as well as their professional organizations, clearly communicate to members of Congress the value of establishing improved arrangements to obtain balanced advice on technical issues.

Congress should draw on the lessons of the past and the experience of others, including the several European Parliaments that have functioning advisory systems ironically modeled on the old OTA (*18, 19*). Once again, Congress must establish a process for obtaining balanced, independent, analytical guidance on complex science and technology policy issues.

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