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## SITC Research Briefs

### **Title**

Key Leaders in U.S. Science, Technology, and Innovation Policy

### **Permalink**

<https://escholarship.org/uc/item/21r7684h>

### **Journal**

SITC - STI Policy Briefs, 2013(STI No. 6)

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### **Publication Date**

2013-12-01

# POLICY BRIEF

STI No. 6 December 2013

## Key Leaders in U.S. Science, Technology, and Innovation Policy

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**T**he signal characteristic of the U.S. science, technology, and innovation (STI) policy system is that influence, decision-making, and control are widely distributed. Institutions and players jealously guard their prerogatives even when cooperating. There is no single place where STI policy is developed, overseen, or truly coordinated. Rather, STI policy emerges out of the ideas, decisions, and interplay of many actors. The nature of that interplay can shift over time, as influence is determined by a mix of law, political context, and circumstance, and the force of individuals' ideas and personalities. This paper outlines the key leaders and institutions that affect STI policy and their roles, discussing how, when, and why each has played a critical role.

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*The Study of Innovation and Technology in China (SITC) is a project of the University of California Institute on Global Conflict and Cooperation. STI Policy Briefs provide analysis and recommendations based on the work of project participants. This material is based upon work supported by, or in part by, the U.S. Army Research Laboratory and the U.S. Army Research Office through the Minerva Initiative under grant #W911NF-09-1-0081. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the the U.S. Army Research Laboratory or the U.S. Army Research Office.*

## THE PRESIDENT

As the head of the executive branch of the federal government and the nation's most prominent political figure, the president has numerous tools to affect and effect STI policy, including setting priorities and budgets for federal agencies, proposing legislation to Congress and setting the national agenda through public statements (sometimes referred to as "using the bully pulpit"). Perhaps most significantly, the president sets the overall political philosophy for his administration. The role of the federal government in STI policy has been contested terrain from the nation's founding. The president can set the terms of debate over, for example, the extent to which the federal government should be funding applied research designed to aid the development of commercial products and on whether the federal government should be providing money to private companies to promote innovation.

The president, by the nature of his Constitutional position, always plays a critical role in STI policy, if only by giving final approval to budget proposals and providing the overall philosophical context for policy. Generally, STI matters are not a president's signature issue. Some presidents, however, have become out-sized players in STI policy, choosing to leave their mark very clearly in this area. Perhaps the most obvious example is President John Kennedy's commitment to land an American on the moon, which was motivated more by foreign policy concerns than any interest in STI generally or space in particular. Indeed, human space policy, because of its scale and historic connection to foreign and defense policy—two areas that presidents dominate in the U.S. system—has remained an area in which presidential decision-making is paramount.

Presidents can also leave a mark in less high-profile, but still visible ways. Presidents Harry Truman,

Richard Nixon, and Jimmy Carter, for example, were involved in creating new science agencies: President Truman laid down the parameters for the legislation creating the National Science Foundation; President Nixon created the Environmental Protection Agency and the National Oceanic and Atmospheric Administration by Executive Order; and Jimmy Carter proposed the creation of the Department of Energy.

Presidents can also leave their mark on individual agencies. President Bill Clinton, for example, chose to initiate a doubling of the budget of the National Institutes of Health (NIH) and made that a featured part of his agenda. He was prompted to do this partly by the lobbying of a range of groups interested in biomedical research—including scientists and patient groups—and partly to put the conservative Republicans who had taken over Congress on the defensive. Similarly, President Nixon had declared a "war on cancer" in part to gain political traction.

The point is that presidential initiatives in STI policy are almost always based on larger issues and concerns than just STI itself.

## THE OFFICE OF MANAGEMENT AND BUDGET

In virtually all administrations, the Office of Management and Budget (OMB) is the most powerful branch of the White House, and its authority has grown steadily since its precursor agency was created in the early twentieth century. It oversees the preparation of the federal budget, making final recommendations to the President; it must approve agency testimony submitted to Congress; and it reviews regulations before they can become final. Its top officials are political appointees, but it also has a cadre of highly educated career staff, many of them young, who exercise significant authority as "budget analysts." The analysts review each

agency's budget submission and its implementation. OMB is divided into divisions by topic (for example, natural resources), but STI agencies are in many of the divisions, and there is no real effort to review the full range of federal STI activities together. OMB plays a central role in deciding which policies an agency will carry out; its role extends far beyond budget review, narrowly defined.

The director of OMB is always a key player in science policy, by virtue of his role in developing the overall federal budget. The total amount of money for STI is determined mostly by the overall size of the budget rather than by STI concerns. On a day-to-day basis, the career staff and lower-level political appointees of OMB have an enormous impact on STI policy because virtually all policy decisions are reviewed by them. OMB generally, though, does not initiate policy proposals in STI.

## THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY

In name at least, the Office of Science and Technology Policy (OSTP) is the White House office that oversees and coordinates science and technology policy. Its director—a political appointee—in most administrations also carries the title of presidential science advisor. OSTP has a small staff, much of it on loan from federal agencies, and the influence of its director varies widely from administration to administration, depending largely on his personal relationship with the president. Federal agencies often resist OSTP direction. Still, OSTP now works with OMB on reviewing agency budgets, and it formulates cross-agency initiatives in science and technology, such as the new effort in brain science and the efforts to help improve manufacturing. OSTP is also sometimes consulted by other White House entities, such as the National Security Council or the Council of Economic Advisors, when

they are working on issues that have an STI aspect.

## FEDERAL AGENCIES

A wide variety of executive branch agencies develop, carry out, and/or influence STI policy. In day-to-day interactions with industry, universities, states, and often the public, the agencies are the face of the federal government. Their efforts are sometimes coordinated, but more often grow out of the concerns, focus, and cultures of the individual agencies. Agencies perform a range of functions designed to foster or shape STI, including providing research grants to universities and others (e.g., the National Science Foundation); procuring technologies for the federal government (e.g., the Department of Defense); protecting inventions (e.g., the Patent and Trademark Office); regulating commercial and industrial activity (e.g., the Federal Communications Commission); and setting tax policy (e.g., the Treasury Department). Many agencies have overlapping duties, but they carry them out in disparate ways, depending on statute and tradition. For example, six agencies are the primary federal sources for research money for universities, but they distribute money differently—some through peer review, some by formula, and some by selection by career federal employees.

Agency heads are the critical players in both setting and carrying out the federal STI agenda. A creative and effective agency head can reshape his agency and give it additional prominence. For example, Erich Bloch, the director of the National Science Foundation during the administration of Ronald Reagan, helped increase the agency's budget and pushed universities to cooperate more with industry, especially on engineering matters, by offering grants for university centers that required industry backing. Bloch was successful because he had a clear agenda, a forceful personality, and a

plan that he could argue was in keeping with the President's priorities, and he cultivated both White House staff and Congressional leaders.

There are limits to what agency heads can accomplish, though, especially if their work intersects with larger political debates. The White House and Congress keep a particularly close eye on regulatory policy.

## THE U.S. CONGRESS

Congress is the ultimate federal authority in most areas of STI policy, but it tends to take a reactive role—responding to the executive branch and private entities. Congress sets the overall annual budgets for each agency (but it does not always get into program by program detail); oversees the agencies through hearings and other less formal activities; and can create or block agency or even presidential STI policies. Indeed, with the possible exception of some aspects of foreign policy, the executive branch has authority to act only to the extent permitted by the Congress through statute. But Congress generally gives the executive branch a wide berth in STI. Jurisdiction over STI in Congress is broadly distributed among committees, mirroring the structure of the executive branch. While the health of the U.S. STI system is a concern in Congress, few members of Congress make STI their focus or defining issue, and specific STI matters are rarely prominent in election campaigns.

Still, individual Congressional leaders can leave their mark on STI policy. They can create new programs, usually in response to proposals from non-governmental groups or experts, or focus attention and funding on an agency. In recent decades, for example, two leaders on spending committees, Senator Arlen Specter of Pennsylvania and Congressman John Edward Porter of Illinois, working with their Democratic counterparts, pressed for increased funding for NIH. Senator Specter was single-

handedly responsible for NIH getting an additional \$10 billion as part of President Barack Obama's stimulus spending package to counter the recession. Congressional leaders can play this role when they are focused, have a critical committee position, and are well established in their home territories.

## THE FEDERAL COURTS

The federal judiciary is an independent branch of government. While federal judges are nominated by the president and must be confirmed by the Congress, once in office they have lifetime tenure, and they are largely beyond the influence of the Executive and the Legislature. Judges become involved in STI matters when lawsuits, either brought by governments or by private parties, must be decided. Most of the time, courts base decisions on statute (which Congress can change in response), but some rulings are based on the Constitution (which can only be altered by the difficult process of amendment). Courts may affect STI through sweeping decisions, such as the Supreme Court's recent ruling limiting the patenting of genes; or through narrow decisions in individual cases, deciding, for example, who has a valid patent or whether a company is responsible for an injury caused by one of its products.

## STATES

The governmental structure described above is replicated in each of the 50 states, although the precise powers of the Executive (known as the Governor at the state level), Legislature, and courts differ among them. States can play a major role in STI policy. Many offer financial incentives (for example, tax breaks and loans) to attract businesses, and they fund their state universities, sometimes providing money to private universities as well for specific research initiatives. States also regulate busi-

nesses within their borders (to the extent federal law allows them to interfere with “interstate commerce”), and state courts issue decisions based on state law that can affect STI policy. The states compete with each other vigorously for public and private economic resources, and also with the federal government over their legal authority.

## INDUSTRY

Private companies may play the greatest role in the U.S. STI system, although they are influenced and limited by government funding and policy. Companies perform the majority of the research and development (R&D) in the United States both with their own funds and, especially in the defense industry, with government money. (By deciding which companies and projects to fund, the financial sector—commercial and investment banks, venture capital firms, and so on—can have a major impact on the profile of STI in the U.S. private sector.) Through their R&D, product and process development, and marketing, companies are the primary source of innovation.

Industry also has a major influence on policy. Industry—both individual companies and a wide variety of industry associations—lobby the executive and legislative branches on STI issues and bring cases to court. Industry has enormous influence both because it provides employment and is the basis of economic prosperity, and because through its political arms, it finances political campaigns. But industry is far from monolithic. Different sectors of industry and even different companies within a sector may advocate opposing policies. Witness, for example, the titanic battles between Internet companies and companies that own creative content, such as movie studios and book publishers. Industry’s lobbying efforts may be narrowly self-interested (such as seeking a tax break to benefit a par-

ticular company) or much broader (such as arguing for an increase in the overall level of federal research funding for universities).

In recent years especially, retired industry leaders have become influential leaders in STI policy. For example, former Lockheed Martin Chief Executive Officer Norm Augustine chaired a number of advisory panels that have shaped policy, most notably one that produced the National Academy of Sciences 2006 report “Rising Above the Gathering Storm.” That report recommended increased spending on research and education and the creation of a new agency, the Advanced Research Projects Agency-Energy (ARPA-E) to promote innovation in energy. (The specific proposal to create ARPA-E originated with another member of the panel, Nobel laureate Steven Chu, who later became Secretary of Energy.)

Retired industry leaders have credibility and an aura of power and success from their industry background and access to many officeholders from their days at the helm of powerful companies, but they are not seen as self-interested because they are not representing particular corporations any longer.

## UNIVERSITIES

Universities carry out the bulk of the basic research in the United States. They are relatively autonomous institutions—even the state universities, most of which today get the majority of their money from sources other than state budgets. They are, however, largely reliant on the federal government for their research funding, although that is supplemented by money from industry, private foundations, private donors and tuition.

Universities influence STI policy by largely setting the research agenda—federal funding comes mostly in response to proposals made by academic researchers; by shaping the ideas of their students; and by lob-

bying the executive and legislative branches individually and through associations to promote university interests.

Universities compete fiercely with each other for prestige, faculty, financing, and students, but tend to have similar policy interests, so they diverge less often than industry groups in their lobbying activities. Individual academics can also have a major influence by propounding ideas on what makes nations and companies innovative and competitive that then are adopted by the government and/or the private sector.

## NON-GOVERNMENTAL ORGANIZATIONS

A wide variety of private interest groups (beyond industries and universities) seek to influence STI policy through lobbying, issuing public statements and other means. These non-governmental organizations (NGOs) include scientific disciplinary societies (each field of science has a number of groups that advocate for its interests); groups formed by sufferers of particular diseases such as breast cancer, AIDS, and diabetes (their advocacy has had a major effect on the composition of the budget for medical research); and issue-based groups, such as those advocating for public health or the environment (these advocate for regulatory policy more than funding). These groups can have a large influence on STI policy, and government officials often try to line up support from the NGOs for new policy initiatives.

## FOUNDATIONS

Private foundations are wealthy, endowed tax-exempt institutions that can provide funding to universities and NGOs. They vary in size and prominence. But the major foundations can influence STI through funding initiatives—by funding research on a particular topic like AIDS, or by

focusing grants on young researchers, or by experimenting with different ways to determine how to distribute money—or by promoting particular ideas. For example, while foundations cannot lobby, they can fund environmental groups to increase their advocacy on, say, climate change or on fishing limits. Or they can convene conferences to seed new ideas or partnerships; President Obama’s initiative on brain research, for example, grew in part out of such a conference.

### THE NATIONAL ACADEMIES

The National Academy of Sciences, and its sister organizations the National Academy of Engineering and the Institute of Medicine are private institutions—they pick their

own members, for example—that are chartered by the federal government to provide advice on STI issues. Most Academy reports are commissioned by the federal government. These reports, written by panels of experts assembled by the Academy’s staff, can provide recommendations on funding priorities or policy matters. The Academy is often asked to convene panels to arbitrate disputes over science that have policy implications (for example, what is the “safe” level of arsenic in drinking water). Some reports have been highly influential, such as “Rising Above the Gathering Storm,” a 2006 report referenced above. Each of the academies is headed by a president elected by its members, and those presidents are often leading spokesmen on STI issues.

### CONCLUSION

The highly distributed nature of the U.S. STI apparatus is both a strength—it allows for a diversity of ideas and approaches and healthy competition—and a weakness—it can make fundamental change difficult, especially changes in federal policy. The structure has developed over time, not from any grand design. In general, though, it has allowed the United States a wide degree of flexibility and openness to experimentation in approaching STI issues.

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