5.3 A History of US STI policy

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Abstract

In the US, the basics of the federal government's science and technology promotion system were established soon after the Second World War. Public investment in science and technology increased particularly rapidly after the so-called "Sputnik Shock" following the successful launch of the world's first artificial satellite by the Soviet Union in 1957. The direction of science and technology policy has since changed drastically to fit changes in the political and economic environment in both the US and abroad. However, with the passing of time, maintaining US competitiveness in a globalized world has become a major priority, and the importance of innovation has become a point of emphasis.

Keywords

Cold War, basic research, multi-funding, innovation

1 The establishment of the US system for the promotion of science and technology

Before the Second World War, private companies and foundations were the main source of funding for research and development at universities and other institutions in the US. However, with the start of the Second World War, the federal government's investment in science and technology increased dramatically. The National Defense Research Council (NDRC) was established in 1940, and began funding military research. Founded in 1941, the Office of Scientific Research and Development (OSRD) held broader

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authority and absorbed the NDRC. The OSRD was headed by Vannevar Bush, an electrical engineer and science administrator from the Massachusetts Institute of Technology (MIT). As the command center for the wartime mobilization of science and technology, the OSRD signed contracts with companies and universities in the US, including MIT, to conduct research on radar, atomic bombs, and antibiotics.

In November 1944, Bush received a request from President Roosevelt for a study on how the federal government should support scientific research after the end of the war, resulting in the publication of the report, "Science, the Endless Frontier," in July 1945. The report emphasized the importance of federal investment in science, particularly basic research. The premise of the report was the so-called "linear model," that is, a linear process leading from basic research to practical application. Although this model is often criticized today, the report was highly praised at the time. This report is of great historical significance insofar as it presented the ideas that would form the basis of postwar US science and technology policy. The report also sparked a debate in Congress, which led to the establishment of the National Science Foundation (NSF) in 1950.

Nonetheless, at the time, discussions on US science and technology policy tended to focus on the fields of nuclear power and space development. In the field of nuclear energy, the Atomic Energy Commission (AEC) was established in 1947 to replace the Manhattan Project, which had mobilized scientists and companies across the country to develop the atomic bomb during the Second World War. Although the US continued pursuing nuclear power development for military purposes after the war, at the end of 1953, President Eisenhower gave a speech at the United Nations General Assembly advocating "Atoms for Peace," which led to the start of nuclear power generation for peaceful purposes. Meanwhile, in the field of space development, the US army, navy, and air force developed their own missile technology and conducted research and development for the purpose of scientific observation. However, the Soviet Union's successful launch of the Sputnik 1 satellite on October 4, 1957, ahead of the US, caused uproar in the country. In 1958, the National Aeronautics and Space Administration (NASA) was established, and the space race with the Soviet Union began to unfold.

The "Sputnik Shock" had a major impact on US science and technology policy. Science and technology budgets in a wide range of fields, including space development and basic research, began expanding rapidly. Moreover, immediately following the launch of Sputnik 1, the first Presidential Science Advisor and the Presidential Science Advisory Committee (PSAC; later the President's Council of Advisors on Science and Technology [PCAST]) was formally established, indicating the increased weight and position of science and technology policy within the federal government. The founding of NASA, together with the existing National Institutes of Health (NIH), AEC (now the Department of Energy [DOE]), NSF, and the Department of Defense, completed the framework for the current multi-funding system, which supports US science and technology from multiple perspectives (Figure 1). While the Department of Defense accounts for the largest share of US federally funded research, the Defense Advanced Research Projects Agency is a noteworthy institution (organization) that was established during the Cold War and remains in operation today. Although DARPA is an agency within the Department of Defense, it is independent of the military research agencies. In order to develop long-term, cutting-edge defense technologies, highly autonomous program managers provide funds to universities and private companies to conduct research at these agencies. In many cases, their results have been used in the private sector, and include the Internet, GPS, and drone technology.

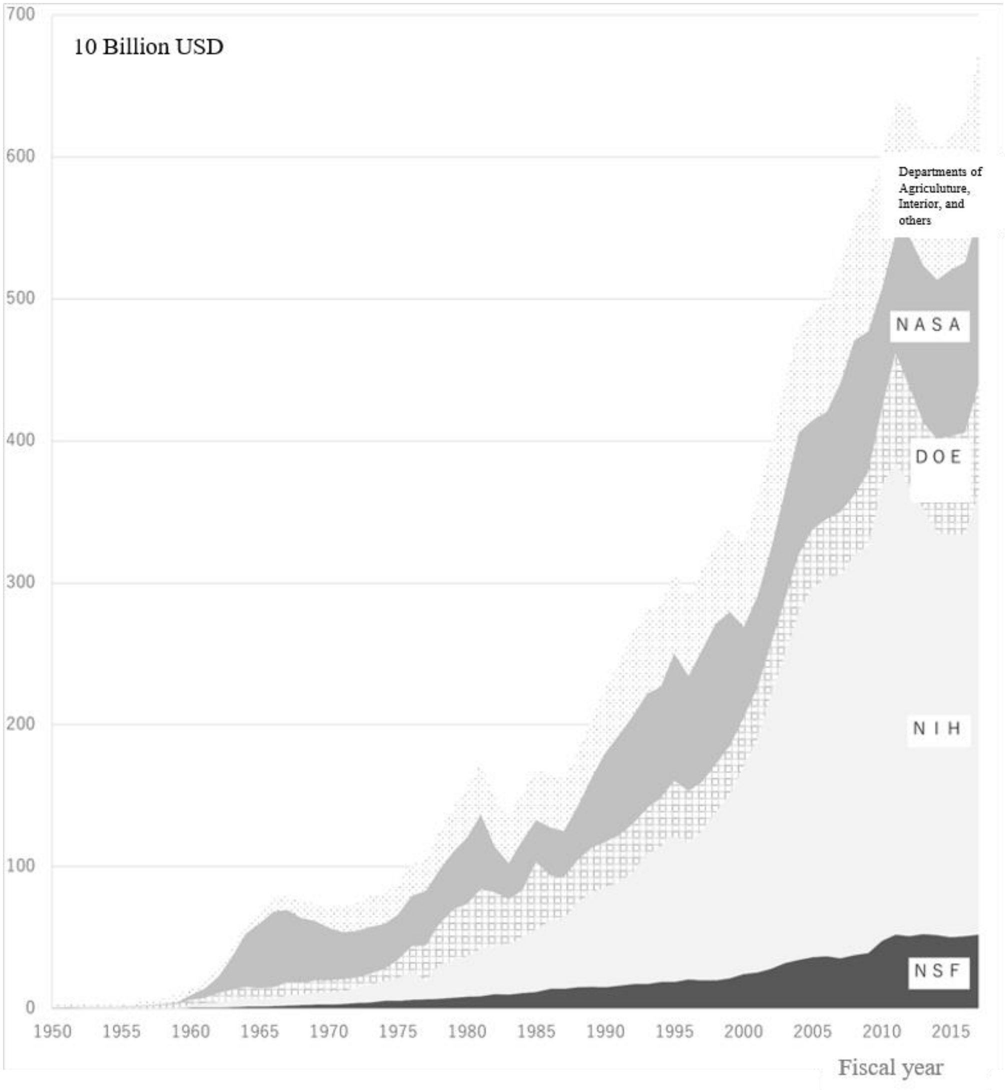

Figure 1: Historical trends in the US federal government's non-military R&D budget.
Source: White House Office of Management and Budget Historical Tables.
Created by the author with reference to https://www.whitehouse.gov/omb/budget/HistoricalsTable9.8

2 *Détente* and the turning point for big science and technology

Around 1970, a major shift in the political environment in the United States occurred, significantly impacting science and technology policy. The Cold War tensions between the East and West gradually eased, while economic and financial problems came into focus. The excessive financial burden of the Vietnam War had already become an issue during the Johnson administration (1963–1969), and the antiwar movement flourished. Amid efforts to solve poverty and urban problems (i.e., the Great Society program, 1965–), these trends accelerated when the Nixon administration came into power in 1969. At the time, the

US recognized that its own military and economic position in the world was in relative decline and that it was no longer able to maintain its global strategy of acting as the banner-bearer of capitalism backed by overwhelming military and economic power. Against this backdrop, the US embarked on *détente* negotiations with the Soviet Union, took steps to normalize diplomatic relations with China, and withdrew from Vietnam. Military and space budgets, which had grown significantly during the Cold War, stagnated as a result.

The Vietnam War and environmental problems made people keenly aware of the fact that science and technology have both positive and negative impacts on society. As the antiwar and environmental movements grew, skepticism and criticism of conventional science and technology and the military-industrial complex gained attention. In 1970, the National Environmental Policy Act was enacted, the Environmental Protection Agency was established, and environmental regulations were steadily strengthened. Internationally, the United Nations Conference on the Human Environment (Stockholm Conference) was held in 1972, and the Club of Rome published a report titled, “Limits to Growth.” That same year, the Office of Technology Assessment (OTA) was established by US Congress. The concept of “appropriate technology,” which calls for technology that is compatible with society instead of nuclear power and space development, also drew attention.

In fact, the focus of federal support for science and technology shifted significantly in the 1970s. In the space development field, the Apollo program’s manned landing on the moon in 1969 brought an end to the space race with the Soviet Union. Budgets were drastically reduced, resulting in the subsequent space shuttle program running into difficulty. In 1971, President Nixon launched the “war on cancer” and adopted a policy of intensive investment in medical research. This policy rapidly enriched the life sciences research base in the US, and provided a foothold for the country to later take the lead in this field. Meanwhile, in the energy sector, the oil shock of 1973 prompted a surge in R&D investment, and the AEC underwent a reorganization that resulted in the creation of the Department of Energy in 1977.

The nuclear field stagnated in the 1970s, with many of the new construction projects planned in the 1960s cancelled. This was largely due to the tightening of regulations in the nuclear field in response to the environmental movement and other factors, as well as the rising cost of construction, which made nuclear power uncompetitive compared to other energy sources. In response to this trend, there was a movement in the nuclear industry to rationalize regulations by conducting probabilistic risk assessment for nuclear reactors. However, in the wake of the Three Mile accident in 1979, nuclear power stagnated further and new construction ground to a complete halt.

The trend to quantitatively assess science and technology risks, and establish regulations to manage them appropriately, strengthened in the environmental, food safety, and pharmaceutical fields. However, such risk assessments involve a high degree of uncertainty, and risk management based on these assessments must be conducted from a comprehensive perspective, making dealing with risks in science and technology complex and difficult. This issue is often discussed with reference to the concept of “trans-science,” defined by physicist Alvin Weinberg in 1973, as the domain of questions that can be asked of science but cannot be answered by science alone. In the 1980s, the concept of regulatory science gained increasing recognition as a science needed for policymaking and implementation in the field of regulatory administration.

3 Emphasis on industrial competitiveness and the end of the Cold War

The relative position of US economic power on the world stage had been in decline since the 1970s, and trade frictions with Japan in particular had become a major political issue, a trend that intensified in the 1980s. Indeed, frictions became more serious in the textile, steel, and automobile industry, as well as in semiconductors and other advanced technologies, and the damage to the US economy increased. Therefore, in the 1980s, the US began to emphasize the strengthening of industrial competitiveness, and its science and technology policy followed this direction. Since the 1980s, the question of how to utilize the knowledge of national laboratories and universities has become an urgent issue for strengthening industrial competitiveness, with various laws enacted accordingly.

First, enacted in 1980, the Bayh-Dole Act made it possible to attribute to universities and individual researchers patents generated as a result of research and development conducted by universities using funds from the federal government, further stimulating industry-university collaboration. The same year, the Stevenson-Wydler Technology Innovation Act was enacted to promote national technology transfer, stipulating that national laboratories should establish technology transfer offices and be able to conduct development on contract from the private sector. In 1986, this law was amended to become the Federal Technology Transfer Act (FTTA), which further developed technology transfer measures, such as Cooperative Research & Development Agreements (CRADAs) with private laboratories and the ability to transfer researchers to the private sector.

When President Reagan took office in 1981, the policy of strengthening competitiveness was further clarified. In 1985, the report of the President's Council of Advisors on Industrial Competitiveness (commonly known as the "Young Report") was released, presenting policies such as strengthening the patent system. In the 1980s, there were a series of cases in which Japanese companies were forced to pay large amounts of compensation in court cases involving patent infringement. The US extended these pro-patent policies to the international arena. When the World Trade Organization (WTO) was launched in 1995, the TRIPS Agreement came into effect to bring about international harmonization of intellectual property rights.

While aiming to strengthen industrial competitiveness, President Reagan emphasized the need to increase military power, and decided to promote the Strategic Defense Initiative (SDI) and the space station program. However, the occurrence of the Challenger space shuttle accident in 1986, resulted in the US space program facing a major ordeal. Amidst a host of domestic problems, big science and technology in the US began showing signs of stalling.

With the end of the Cold War and the inauguration of President Clinton in 1993, research and development expenditure in the military sector was curtailed dramatically. At the same time, policies related to big science and technology underwent a major shift. The space station project was originally intended to demonstrate the unity of the capitalist camp during the Cold War. However, once Russia and other countries decided to participate in the project in 1993, it took on a different character—becoming a symbol of international cooperation. Meanwhile, in 1993, the Superconducting Super Collider (SSC) project, which was under construction in Texas, was cancelled due to lack of funding. In the nuclear fusion field, international cooperation had been advancing the International Thermonuclear Reactor (ITER) project since before the end of the Cold War, but the US strengthened its stance to reflect its own financial situation in planning such a vast science and technology project.

The Clinton administration promoted information and communication technology and biotechnology. In respect to the former, private sector-led research and development became more important; for the latter, a policy of doubling the NIH budget over five years was implemented in 1998 with the support of Congress. The Human Genome Project, launched in 1989, has been making steady progress, and the decoding of the human genome was completed in 2003. The Clinton administration also launched the National Nanotechnology Initiative (NNI) in 2000. In the environmental field, the Clinton administration played an important role in the adoption of the Kyoto Protocol in 1997, and actively pursued science and technology policies across a wide range of fields while reining in big science and technology expenditures.

4 Globalization and innovation

When the Bush administration came to power in 2001, the direction of science and technology policy once again changed dramatically. The Kyoto Protocol was unlikely to have been ratified by Congress in the first place, but the Bush administration formally announced the withdrawal of the US. Moreover, in the wake of the 2001 terrorist attacks, the Bush administration drastically increased military sector R&D spending. In space development, a new large-scale plan was announced with a view to manned Mars exploration. Similarly, in the nuclear energy field, the government demonstrated a proactive stance by launching the “Global Nuclear Energy Partnership.”

At the same time, maintaining and strengthening US industrial competitiveness in an increasingly globalized world became a priority for the federal government. In 2004, the Council on Competitiveness released the “Innovate America” report (commonly referred to as the Palmisano Report), which emphasized the importance of innovation in securing US competitive advantage. In response, the National Academies, which were asked by Congress to study the issue, published a report entitled, “Rising above the Gathering Storm,” in 2005. Often referred to as the Augustine Report, it articulated a sense of crisis about the future of US competitiveness and recommended strengthening education and research in science and engineering and improving the innovation environment. This was followed by President Bush announcing the American Competitiveness Initiative in 2006, and the passing of the America Competes Act in 2007. This emphasis on innovation in the United States quickly spread around the world.

From 2009, although the Obama administration did not change the emphasis on innovation, there was a shift in policy direction in many other respects. Military budgets were cut and the space program launched by the Bush administration was cancelled. At the same time, the administration promoted the concept of smart cities and undertook leading initiatives in the fields of information and communication, the environment, and energy, including the establishment of the Advanced Research Projects Agency for

Energy (ARPA-E) within the DOE. It also promoted prominent scientists to the government to place emphasis on science and ensure scientific integrity.

Launched in 2017, the Trump administration's science and technology policy is generally unclear, with an overt tendency to disregard science. As such, unpredictable developments can be anticipated going forward.

5 Conclusion

Although the direction of US science and technology policy has been characterized by significant changes in direction with each administration, longer-term trends can be observed in its history since the Second World War. The position of big science and technology gradually diminished as the military tensions of the Cold War weakened following the détente in the 1970s, and then with the end of the Cold War itself around 1990. As the focus of the federal government's policy agenda shifted from the military to the economy, the goal of ensuring competitiveness has become increasingly important, and the question has become one of how science and technology can contribute to that goal. Against a backdrop of progress in information disclosure and openness in the overall policy formation process, accountability and cost-efficacy are becoming increasingly necessary in science and technology policy. Going forward, US science and technology policy will continue to be shaped by, and be sensitive to, its wider political context.

References

Dickson, D. (1984). *The new politics of science*. University of Chicago Press. https://www.press.uchicago.edu/ucp/books/book/chicago/N/bo3638376.html

Kraemer, S. (2006). *Science and technology policy in the United States: Open systems in action*. Rutgers University Press. http://a.co/2fQtjwi

Smith, B. L. (2011). *American science policy since World War II*. Brookings Institution Press. https://www.brookings.edu/book/american-science-policy-since-world-war-ii/

Wang, Z. (2009). *In Sputnik's shadow: The President's Science Advisory Committee and Cold War America*. Rutgers University Press. https://www.rutgersuniversitypress.org/in-sputniks-shadow/9780813546889

Zachary, P. G. (1997). *Endless frontier: Vannevar Bush, engineer of the American Century*. Free Press. https://mitpress.mit.edu/books/endless-frontier

Ueyama Takahiro (2010). *Akademikku kyapitarizumu o koete: Amerika no daigaku to kagaku kenkyū no ima* [Beyond academic capitalism: American universities and scientific research today]. NTT Publishing. http://www.nttpub.co.jp/search/books/detail/100002069 [In Japanese]

Nakayama Shigeru (2006). *Kagaku gijutsu no kokusaikyōsōchikara: Amerika to Nihon sōkoku no han seiki* [The international competitiveness of science and technology: A half century of conflict between the United States and Japan], vol. 793, Asahi Shimbun.

https://publications.asahi.com/ecs/detail/?item_id=7205 [In Japanese]

Related data sources

- "Science and Technology Abroad in North America,"
  http://www.jst.go.jp/crds/report/worldmap/n_america.html
- "Science Policy in the United States,"
  http://endostr.la.coocan.jp/sci-index.htm