5.2 A History of STI policy in Japan

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Abstract

In Japan, the fields of nuclear power and space have traditionally occupied a large part of science and technology policy, which has typically been juxtaposed with industrial technology policy and academic policy. However, since the enactment of the Basic Act on Science and Technology in 1995, the Science and Technology Basic Plan has been formulated every five years, and policies involving science and technology in general have gradually come to be presented in a more specific form. Since 2005, countries around the world have placed increasing emphasis on the importance of innovation. The term science, technology, and innovation (STI) has come into use in Japan and continued to grow in importance.

Keywords

Basic Act on Science and Technology, Science and Technology Basic Plan, Cold War, basic research, ministry reorganization

1 Science and technology policy during the Cold War

In Japan, although there were some developments during the period of occupation following the Second World War, such as the establishment of the Science Council of Japan and the Science and Technology Administrative Council (STAC) in 1949, it was not until the San Francisco Peace Treaty came into effect in 1952 that a serious system for promoting policies related to science and technology began to be established. At the end of 1953, the US President, Dwight D. Eisenhower, gave a speech at the United

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Nations General Assembly in which he presented his vision of “Atoms for Peace.” Japan allocated its first budget for nuclear energy in FY1954. Enacted in 1955, the Atomic Energy Basic Law incorporated the three principles of autonomy, democracy, and openness proposed by the Science Council of Japan. In 1956, the Atomic Energy Commission and the Japan Atomic Energy Research Institute were established and the Science and Technology Agency was created to take over the work of STAC and other organizations as an organization responsible for administrative duties related to the promotion of science and technology, including nuclear power. In 1959, the Council for Science and Technology was established as an advisory body to the Prime Minister on science and technology policy. In the nuclear energy field, policies were subsequently put in place to promote the introduction of technology, the development of nuclear-powered ships, and the creation of fast-breeder reactors. In 1967, the Power and Nuclear Fuel Development Corporation was established.

In the space development field, the University of Tokyo established the Institute of Space and Aeronautical Science in 1964, and the Science and Technology Agency established the Headquarters for the Promotion of Space Development. The former was responsible for launching scientific satellites through independent technological development. Meanwhile, the latter was dissolved into the National Space Development Agency of Japan in 1969, when it became responsible for launching applications satellites.

In the field of industrial technology, the Japanese government was involved in both the introduction of technology by private companies and independent technological development during the high-growth period between the late 1950s and the early 1970s. In the early days of the computer industry, for example, the Ministry of International Trade and Industry's Electrotechnical Laboratory, NTT's Telecommunications Laboratories, the University of Tokyo, Kyoto University, and other government and academic institutions were responsible for research and development, while private companies signed contracts with US companies to introduce their technologies. The Ministry of International Trade and Industry (MITI) negotiated on behalf of the industry against IBM, which was holding up basic patents. In this respect, MITI provided subsidies to promote R&D and even led industry restructuring while maintaining protectionist policies as much as possible. Meanwhile, having accumulated a large amount of technology before the Second World War and recruiting talented engineers from the Navy after the war, Japan National Railways surprised the world by completing the Tokaido Shinkansen in 1964, using its own technology in partnership with private companies.

However, during this period of rapid economic growth, pollution emerged as a serious issue. In particular, four major pollution-related diseases—Minamata disease in Kumamoto, Niigata-Minamata disease, Yokkaichi asthma, and Itai-itai disease—made pollution control an urgent political issue, leading to the enactment of Environmental Pollution Prevention Act in 1967, the Air Pollution Control Law and the Water Pollution Control Law in 1968 and 1970, and the establishment of the Environment Agency in 1971.

Japan’s rapid economic growth came to an abrupt end with the first oil shock in 1973, which encouraged the development of nuclear power and the search for renewable energy sources, referred to as “alternative energy sources” at the time. To this end, the Sunshine Project and the Moonlight Project were launched in 1974 and 1978, respectively, for the purpose of research and development of alternative energy and energy-

saving technologies. In 1979, a second oil shock forced Japan's industries to undergo major structural changes, resulting in increasing competitiveness. For example, the automobile industry developed engines that were more fuel efficient and could meet stricter emissions regulations. In the US, the Muskie Act of 1970 was enacted to reduce carbon monoxide, hydrocarbons, and nitrogen oxides emissions to one-tenth of the previous levels. While US automobiles unable to meet these standard, by 1978, Japanese automobile companies found that they could meet all of these standards through various technological developments, increasing their technological competitiveness.

Consequently, trade frictions in sectors like the steel, automobile, and television industry emerged as a major political issue. In the 1980s, trade frictions between Japan and the US grew even more serious, spreading to advanced technological fields such as semiconductors. The US competed with Japan through pro-patent policies, among others, and tried to create a favorable competitive environment through the 1985 Plaza Accord.

Against this backdrop, Japan attempted to advance its strengths as a technological powerhouse by promoting projects like the 5th generation computer project, but the US remained wary.

2 Emphasis on basic research and the establishment of the Basic Act on Science and Technology

In the latter half of the 1980s, the US not only demanded that Japan correct the trade imbalance, but stepped up its insistence that Japan was developing products based on the results of US basic research. In particular, in the 1988 US-Japan Science and Technology Agreement, the US was acutely aware of this problem and regarded Japan as a peer competitor in the science and technology field. In response to US claims that Japan was "free-riding on basic research," Japan adopted policies emphasizing basic research.

Consequently, the Basic Act on Science and Technology was enacted in 1995. Even without pressure from the US, there was a general consensus in Japan at that time that the country had already caught-up with the advanced countries of Europe and the US in terms of science and technology, and that it now needed to promote creative basic research and contribute as a front-runner on the international stage. The Basic Act on Science and Technology identifies the promotion of science and technology as the responsibility of the national and local governments, obliges the government to formulate basic plans for science and technology, and stipulates that the government should endeavor to secure the expenses required for its implementation "within the limits of the national budget."

Following its review by the Council for Science and Technology, the first Basic Plan for Science and Technology was approved by the Cabinet in July 1996. Significantly, the first plan clearly stated a target of JPY 17 trillion for total expenditure on science and technology over five years. This was received as the Japanese government explicitly affirming the importance of science and technology. The basic idea behind setting this numerical target was to raise the ratio of government R&D investment to GDP to about 1 percent, on par with major Western nations. This target for total science and technology expenditures was eventually achieved.

The First Basic Plan also included various measures to reform the R&D system. Policies included the introduction of a fixed-term employment system at universities, a plan to increase the number of postdoctoral researchers to 10,000, a drastic expansion of research assistants, a significant increase in competitive research funding, the implementation of rigorous R&D evaluation, and the promotion of exchanges between industry, academia, and government. Most of these measures were realized, at least to some extent.

During 1990s, as the new framework for Japan's science and technology policy was being established, a series of major incidents occurred in the fields of nuclear power and space development. In the nuclear energy field, opposition to the siting of nuclear power plants had been growing since the 1970s. In 1974, the radiation leakage accident on the nuclear-powered ship *Mutsu* became a major social issue. In the 1990s, the sodium leakage accident at the Monju fast-breeder reactor 1995, and the Tokaimura JCO criticality accident in 1999, significantly impacted nuclear energy policy. Meanwhile, in the space development field, the first all-stage, self-developed liquid-fuel rocket H-II was successfully launched in February 1994. However, launched by the second such rocket in August of the same year, the satellite Kiku No.6 failed to enter orbit, as did the launch of an eighth rocket in November 1999. The budgets for both nuclear power and space development have since stagnated.

3 Reorganization of ministries and the development of the Science and Technology Basic Plans

The organizational structure in the Japanese science and technology policy field has changed significantly in several respects since the reorganization of ministries and agencies in 2001. First, the Council for Science and Technology was abolished and replaced by the Council for Science and Technology Policy (CSTP), which was established within the Cabinet Office as a "council for key policy" with greater authority and organization than its predecessor, and was expected to serve as a "forum of wisdom" to assist the Cabinet and Prime Minister. The merger of the Ministry of Education and the Science and Technology Agency resulted in the creation of the Ministry of Education, Culture, Sports, Science and Technology (MEXT). Meanwhile, the Council for Science and Technology was founded to unite the various councils that had been established under the two ministries. The Science Council of Japan was transferred from the former Prime Minister's Office to the Ministry of Internal Affairs and Communications. Although it was decided that the CSTP would reform its organizational structure, it was ultimately decided that it would continue as a "special organization" within the Cabinet Office.

Following the ministerial reorganization, the national universities were incorporated in 2004. National research institutes were similarly incorporated around this time, resulting in significant changes in the R&D implementation structure. The Japan Aerospace Exploration Agency (JAXA) was established in 2003, and the Japan Atomic Energy Agency (JAEA) was established in 2005. Meanwhile, research and analysis organizations and thinktanks producing evidence to support policy formation in the science and technology field were strengthened. While the Ministry of Education, Culture, Sports, Science and Technology National Institute of Science and Technology Policy (NISTEP) had already been established in 1988, in

2003, the Japan Society for the Promotion of Science (JSPS) and the Japan Science and Technology Agency (JST) established the Research Center for Science Systems (RCSS) and the Center for Research and Development Strategies (CRDS), respectively.

The Second Science and Technology Basic Plan was approved by the Cabinet in 2001, around the same time as the reorganization of the ministries and agencies. The most significant feature of the plan was that it emphasized the importance of basic research, while designating priority research and development areas addressing national and social issues. In short, it clearly set out a policy of "strategic emphasis," with priority budget allocations for four fields: life science, information and communication, environment, and nanotechnology and materials. It also made provision for the doubling of competitive funding, underscored the need to further promote industry-academia collaboration, and emphasized the relationship between science and technology and society. Although the plan stated that the total value of government R&D investment over its duration should amount to JPY 24 trillion, the actual amount of investment fell short of this target, reaching only JPY 21.1 trillion.

In the subsequent formulation of the Third Science and Technology Basic Plan in 2006, a vast amount of evidence was prepared and reviewed by various organizations, including NISTEP. The Third Basic Plan maintains the policy of "strategic focus" and the policy of allocating funds to the four focal areas identified by the previous plan. However, the Third Basic Plan introduces the concept of the "strategic priority science and technology" in order to allocate funds in a more precise manner, with sixty-two themes selected. A major feature of the Third Basic Plan was its emphasis on innovation, particularly insofar as it was necessary to link Japan's potential scientific and technological capabilities to the creation of new social and economic value. While the plan called for total government R&D investment of JPY 25 trillion over its five-year duration, in practice, total investment amounted to just JPY 21.7 trillion. Looking at the shifts in science and technology-related expenditures on an initial budget basis over the long term, we can see that while there was an upward trend until 2004, with a flat or gradual downward trend since.

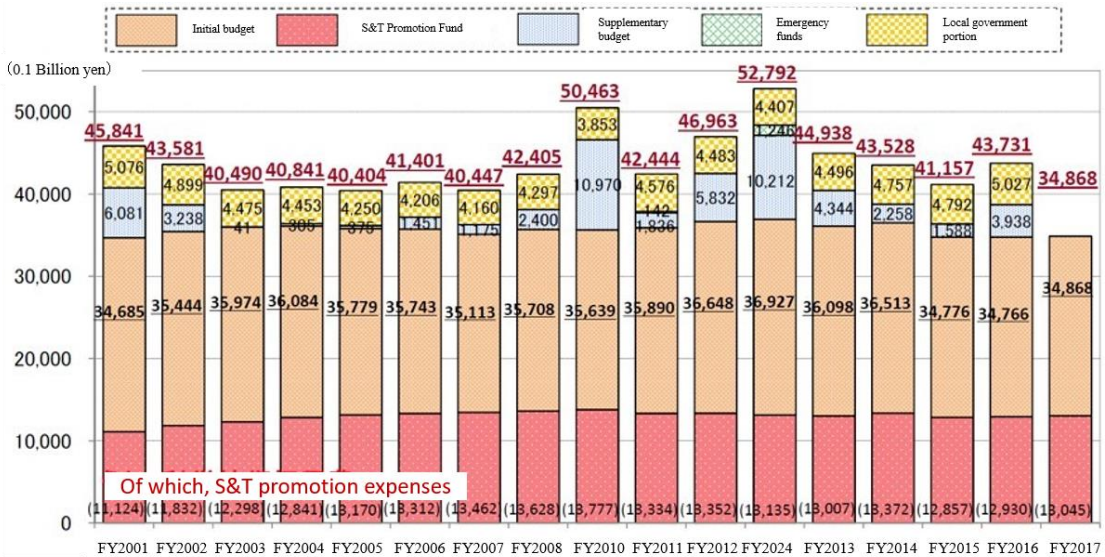

Figure 1. Trends in science and technology budgets.
Source: Cabinet Office data

4 Toward Science, Technology, and Innovation (STI) Policy

The Fourth Basic Plan was impacted by two major environmental changes. One was the change of ruling party in the Parliament from the Liberal Democratic Party to the Democratic Party which put emphasis on political leadership in September, 2009 when deliberation of the next basic plan was about to begin by the special committee of the CSTP. Another is the Great East Japan Earthquake and the accident at the TEPCO Fukushima Daiichi Nuclear Power Plant on March 11, 2011. The draft of the Fourth Bacic Plan was revised in light of the earthquake and accident, resulting in the Cabinet decision being pushed back to August 2011.

The most significant feature of the Fourth Basic Plan was its shift away from the focus on specific fields that had been pursued over the previous decade in the Second and Third Basic Plans and toward a focus on solving social issues. Accordingly, “problem solving” became a keyword, with reconstruction and revitalization following the earthquake positioned alongside “green innovation” and “life innovation” as tasks that needed to be accomplished.

The Fourth Science and Technology Basic Plan also incorporated a description pertaining to the promotion of "Science for Science, Technology, and Innovation Policy” (STI). In line with this policy, the government advanced the Promotion of “Science for Policy” in Science, Technology and Innovation Policy (SciREX) project in order to develop basic data in STI policy fields, conduct research that contributes to policymaking, and develop human resources.

The trend of university reform also moved forward during this period. The Education Act was revised in 2006, and there was a move to include social contribution alongside education and research as a fundamental role of universities. In 2012, MEXT published its action plan for university reform, beginning by “redefining the mission” of national universities. At this time, there was an increase in the number of competitive funds allocated at the university organization level rather than to individual researchers, and each university was required to promote university reform in the course of obtaining these funds. During the third mid-term target period for national university corporations in 2016, three priority support quotas were set for the allocation of operating subsidies, effectively differentiating the missions of national universities. The designated national university system was subsequently launched in 2017.

Launched in 2016, the Fifth Science and Technology Basic Plan inherited the basic concept of its predecessor, which was oriented toward solving social issues. However, the 2016 plan placed greater emphasis on the systematization and integration of technologies in light of the internal and external changes in the environment surrounding innovation and with the aim of realizing an “ultra-smart society.” Meanwhile, given the relative decline in the presence of science and technology in Japan, the government encouraged the reform of the national innovation system, including university and research institute reform, and took measures to implement the PDCA cycle by establishing and following up on indicators expressing the current state of the STI field and the state of policy implementation. Other measures included the

promotion of young and female researchers, the integrated promotion of university and research funding system reform, and the promotion of open innovation.

During the review period for the Fifth Science and Technology Basic Plan in 2014, the scope of the CSTP's jurisdiction was expanded and it was renamed the Council for Science, Technology and Innovation (CSTI). The CSTI has been playing an increasingly important role in Japan's growth strategy in collaboration with the Council on Economic and Fiscal Policy among others, placing even greater emphasis on innovation.

5 Conclusion

Since the enactment of the Basic Act on Science and Technology in Japan in 1995, the scale of government R&D investment has expanded, the organizational structure for STI policy formation has been enhanced, and successive Science and Technology Basic Plans have been formulated based on vast amounts of evidence. The SciREX project was launched in 2011, and efforts to develop more advanced methods of generating evidence and fostering human resources to support the future of the STI policy field are underway. The trend in demanding cost-efficacy and accountability in investments in science and technology is expected to continue gaining momentum, and there is a need to establish a system for evidence-based policy planning.

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