



by Jean M. Johnson

JAPAN HOPES TO DOUBLE ITS GOVERNMENT SPENDING ON R&D

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Japan accelerated government R&D funding despite a prolonged economic recession.

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In 1992, Japan's Basic Policy for Science and Technology¹ called for a doubling of the government's R&D budget as soon as possible, and an expansion of funding to improve the research environment. In this policy, the Cabinet recommended a major renovation of facilities and equipment of universities and national research institutes, and an expansion of competitive grants for strategic research. Subsequently, the S&T Plan of 1996 suggested the government invest 17 trillion yen in R&D from 1996-2000, equivalent to \$74 billion in 1987 constant U.S. dollars.² If such an expansion is achieved, annual government R&D investment would be around \$18 billion in the year 2000, approximately double the 1992 budget in constant yen. Thus the 1996 S&T Plan seeks to meet the 1992 Basic Policy.

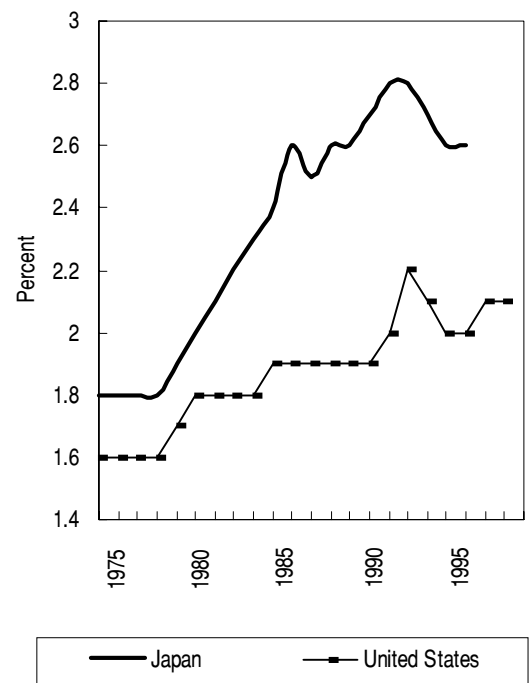
Has Japan under-invested in R&D?

Relative to the size of its economy, Japan's overall R&D investment (both public and private) is about the same as that of the United States. In 1994, Japan invested 2.6 percent of its gross domestic product (GDP) in R&D. In comparison, the United States invested 2.5 percent. In non-defense R&D, Japan's relative investment is considerably larger than that of the United States (see chart 1).

However, the proportion of total R&D *funded by the government* in Japan is smaller than that of any other industrialized country. In 1994, the government support of R&D represented

less than 20 percent of the total; industry supports the vast majority of research in Japan (see chart 2). In contrast, in the United States and European Union countries, government represents 35-40 percent of total R&D. The Japan Council on Science and Technology has estimated that doubling the government R&D budget would increase the proportion of government support of total R&D to approximately 29 percent.³

Chart 1. Nondefense R&D/GDP Ratios



SOURCE: National Science Foundation, Division of Science Resources Studies, *The Science and Technology Resources of Japan: A Comparison With The United States*, forthcoming.

¹The policy was first mentioned in the 18th Recommendation of the Council for Science and Technology (January 24, 1992), a report on the Comprehensive and Basic S&T Policy: Toward the New Century.

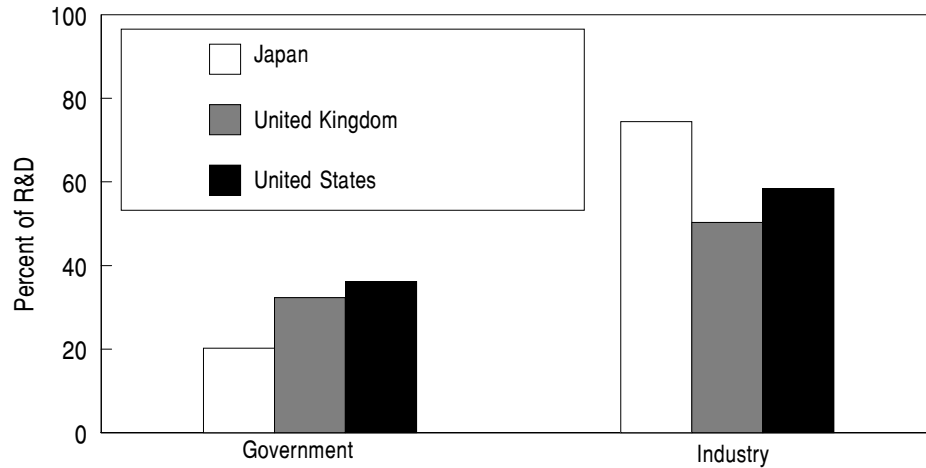
²All dollar amounts in this report are in 1987 constant dollars using purchasing power parity (PPP) conversions.

³Arima, Akito. "Strengthening Japan's Science Base: Developments in Education and Research Infrastructure," presentation in the conference on Science and Science Policy of Japan, Japan Society for the Promotion of Science, March 7th, 1997.

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Japan is increasing its investment in basic research, while cutting back on overall government spending to reduce its national debt.

Chart 2. National R&D by source of funds: 1994



SOURCES: National Science Foundation, *Human Resources for Science & Technology: The European Region*, NSF 96-316, Special Report, (Arlington, VA, 1996); and *The Science and Technology Resources of Japan: A Comparison With The United States*, forthcoming.

Can Japan actually accomplish a doubling of its government R&D budget?

Achieving the suggested investment of \$74 billion in R&D from 1996 to 2000 would require an average annual growth rate of around 10 percent

(approximately \$1.5 billion) in government R&D investment, far higher than past annual funding increases (see table 1). Historically, Japanese government R&D expenditures have grown about 3.9 percent annually, from \$5.5

Table 1. Linear estimation of Japan's proposed increases in government R&D

Years	Millions of yen		Millions of dollars
	Current yen	1987 Constant yen	1987 Constant PPP\$/1
1992.....	2,134,700	1,956,808	9,273
1993.....	2,266,300	2,063,605	9,779
1994.....	2,358,500	2,141,446	10,148
1995.....	2,499,500	2,280,287	10,806
1996.....	2,810,700	2,574,009	12,198
1997.....	3,002,500	2,754,587	13,053
1998.....	3,344,553	3,068,397	14,540
1999.....	3,725,573	3,417,957	16,197
2000.....	4,150,000	3,807,339	18,042
Total 1996-2000	17,033,326	15,622,290	74,030

1/ Market exchange rate conversion of 17 trillion current yen is \$151 billion (103 yen per dollar); \$74 billion is based on the 1987 constant purchasing power parity (PPP) conversion (211 yen per dollar).

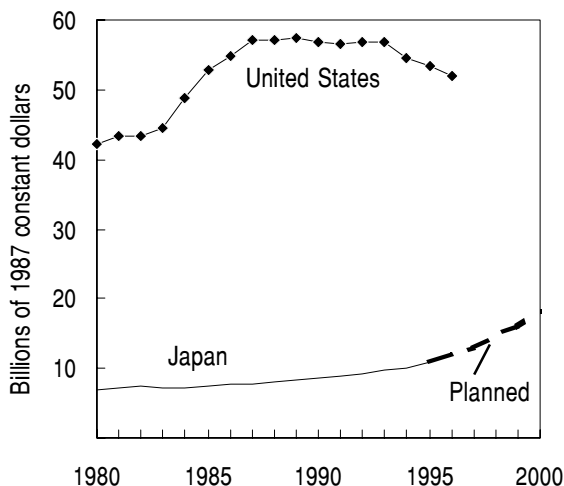
NOTE: To compute 1987 constant currencies, Japan's 1997 deflator of 1.09 was extended to 2000. This assumes no inflation.

SOURCE: National Science Foundation, Division of Science Resources Studies, *The Science and Technology Resources of Japan: A Comparison With The United States*, forthcoming.

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billion in 1978 to \$10.1 billion in 1994. This rate of growth in R&D occurred when Japan's annual growth in GDP was 4.7 percent (1975-1990). However, in the 1990's, Japan's GDP annual growth rate has been slightly less than 1 percent. Nonetheless, Japan's approved government R&D budgets accelerated during this period of economic recession. In 1996, the Japanese government R&D budget increased 12.5 percent, reaching \$12.2 billion. The Cabinet-approved 1997 R&D budget represents a 6.8-percent increase over 1996. Therefore, the 1996 and 1997 R&D budget increases together effectively meet the desired level of growth. In contrast, government sponsored research in the United States has been declining during the past five years (see chart 3).

Chart 3. Government Funded R&D



NOTE: Data are government budget R&D data.

SOURCES: National Science Foundation, Division of Science Resources Studies, *National Patterns of R&D Resources: 1966* and *The Science and Technology Resources of Japan: A Comparison With The United States*, forthcoming.

If the doubling is achieved, what does it mean for Japan's domestic science?

The additional funding is aimed at strengthening Japan's human and physical infrastructure for basic science, particularly within universities.

Domestically, Japan plans to utilize the additional funding to continue expansion of doctoral programs and attempt to create centers of excellence in research. Until recently, most doctorates in the natural sciences and engineering were awarded by universities to industrial scientists and engineers for research conducted in Japanese companies. In 1986, these doctorates, called *ronbon hakase*, represented two-thirds of all doctoral engineering degrees and over 40 percent of all degrees in the natural sciences. In that year, university-based engineering doctorates numbered 500; *ronbon hakase*, 1,000. With the expansion of university-based doctoral programs and graduate fellowships, however, the proportion of *ronbon hakase* degrees is decreasing. By 1994, more doctoral engineering degrees were earned for research within university labs (1,323) than industrial research labs (1,178). The planned annual funding of 10,000 fellowships for doctoral students and post-docs by the year 2000 would continue this trend.

The main science funding agencies have increased the amount of competitive research funding to universities to improve research facilities and personnel. New programs are facilitating collaboration of scientists from industry, academia, and national laboratories, and employing research assistants and laboratory technicians on fixed-term projects (3-5 years). About a half-dozen strong research institutes have received large five-year infusions of R&D funds to enable them to become centers of excellence in specialized fields, e.g., in brain research, material science, and econometrics. The science funding agencies plan to expand such programs if their funding continues to increase through the year 2000 and beyond.

What are the implications for global S&T?

Japanese science agencies have growing R&D budgets to boost the funding and realization of world class research facilities within Japan and

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abroad. The increase in government-sponsored research in Japan, at a time when other governments have constrained R&D budgets, creates several possibilities for the international science community. In the past few years, Japan has provided additional funds to intensify international research cooperation in basic sciences, e.g., the Human Frontiers⁴ and Human Genome Project and the Ocean Drilling Program. Japan has also increased its contribution to the European Center for Nuclear Re-

search (known by its French initials, CERN) in Geneva, Switzerland, and to the construction of CERN's powerful accelerator, the Large Hadron Collider. If government R&D increases continue, Japan plans to fund more grants for international joint research, expand the number of postdoctoral fellowships for foreign researchers to 2,000, and expand cooperation in developing countries, particularly with researchers in the Asia-Pacific countries.⁵

This Issue Brief was prepared by:

Jean M. Johnson
National Science Foundation
Division of Science Resources Studies
4201 Wilson Boulevard
Suite 965
Arlington, VA 22230

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⁴ Japan's primary support of the Human Frontiers Science Program (centered in Strasbourg) was an international basic science initiative of Prime Minister Nakasone in the mid-1980's.

⁵ S&T Basic Plan, Government of Japan, July 2, 1996, p. 38.

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