New Developments in the Science Policy of Japan

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Even before 1991, when Japan's economy lapsed into its current recession, Japanese scientists (especially university researchers) were troubled by a lack of funds, deteriorating research equipment, and lack of space. In the percentage of public funding devoted to university research, Japan lags behind many other industrialized countries. In 1989, Japan's government spent only 0.16% of its gross national product (GNP) on university research, far less than the 0.36% spent in the United States (for 1988) or the 0.38% in the former West Germany (*1*).

Since 1983, Japan's government budget has become more stringent, exacerbating the trend of insufficient government resources allocated to universities, particularly to national universities. For instance, the total amount of government expenditures for facilities of national universities and other schools, which stood at 154.6 billion yen for fiscal year 1979, fell sharply to 78.8 billion yen in fiscal year 1986. Similarly, the 1983 budget allocated 32.4 billion yen for research equipment, a figure that dropped to 17.9 billion yen in 1988.

University researchers, concerned about deterioration in their research environment, appealed to the Diet, the government, and the mass media for a strengthening of financial support for universities. As a result of their endeavor, newspapers and magazines have been reporting the critical state of affairs in the research environment of universities in sensational terms, such as "university bankruptcy," "coffins of brain: national universities," and the "crisis of national universities," to name a few (*2*). Only recently has the necessity for improving the research environment of universities come to be recognized.

In accordance with growing demands, the government decided to "make efforts to double its own R&D investment as early as possible," although with the proviso of "taking account of financial conditions" in the newly established General Guideline for Science and Technology Policy of April 1992. In July 1992, the Science Council, an advisory body to the Minister of Education, Science and Culture (MESC) on scientific research policy, submitted a report entitled "Strategies for Comprehensive Promotion of Scientific Research with the Prospect of the 21st Century"; in this report, the necessity for a systematic intensification of research infrastructure was pointed out and a recommendation was made to raise grants-in-aid for scientific research to a level of 100 billion yen as soon as possible. Figure 1 depicts the trends in the amount of total grants-in-aid for scientific research; the goal of 100 billion yen set by the Science Council's 1992 report is near at hand.

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Priorities in Scientific Research

Although there is an indication of improvement in the government's budget for science and technology, the source of revenue is limited. It is therefore an urgent task for the government to promote Japanese basic research by distributing the limited funds effectively (Fig. 2). One such measure is to make a substantial increase in grants-in-aid for scientific research as compared with a set amount of research funds, which are distributed according to the number and rank of faculty members. Another is to establish and enrich national interuniversity research institutes, such as the prototypical National Laboratory for High-Energy Physics in Tsukuba, founded in 1971. There are now 14 similar institutes in such fields as space and astronautical science, molecular science, basic biology, physiological sciences, genetics, and fusion science.

In order to improve and enrich research equipment especially for outstanding research institutions, a system for prioritization of funding allocation was introduced in 1993. For fiscal year 1994, 4.6 billion yen has been appropriated to this system. It has now also become a priority to stimulate the development of centers of excellence (COE), a program recommended in a 1992 report from the Science Council. To this end, it is necessary to provide priority funding for scientific research, to upgrade facilities and equipment, and to increase the amount of funding for international scientific exchange, especially for those research institutions that have already made notable achievements or have the potential to do so. A total of 6.1 billion yen is now being requested by MESC for the COE program for fiscal year 1995.

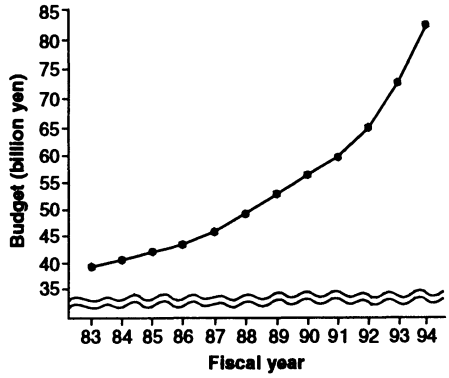

Fig. 1. Trends in the amount of total grants-in-aid for scientific research (*7*). Percentages represent the rates of increase against last year's budget.

Assessing Research Quality

A fair and precise review system plays a key role in the prioritization of scientific research. In recent years, the research review system has become more important because of the need to assess big projects such as accelerator science or space science. If the achievements of researchers are judged insufficient in comparison to their stated goals, such projects need to be halted. From this standpoint, a review was conducted in 1993 on the activities of the National Laboratory for High-Energy Physics and the Institute of Space and Astronautical Science in Sagamihara by outside scientists, including members from overseas (*3*, *4*). In addition, external reviews by outside scientists, including non-Japanese scientists, have been made since March 1993 of the colleges of science and engineering of Tohoku, Tsukuba, Tokyo, Kyoto, and Osaka universities.

Moreover, since 1984 self-review of the research institutes has been actively conducted. Currently, 9 out of 80 national interuniversity research institutes and institutes attached to national universities have been abolished and 7 have been established.

Research Management and Mobility

In order to activate and energize research institutions, the following improvements are deemed necessary in addition to the intensification of research infrastructure: improving the research system and allowing more flexibility to the management of research institutions, promoting the mobility of researchers, and stimulating review for research institutions and researchers.

With regard to universities, the standards for establishment of graduate schools were revised in 1989. In 1991, the standards for the establishment of universities

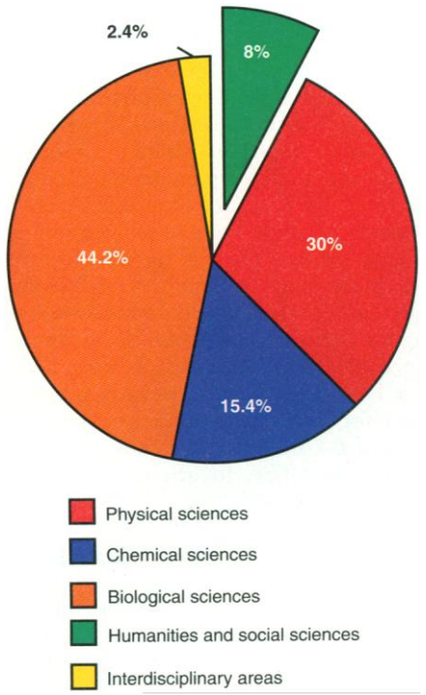

Fig. 2. Percentage of research grants allocated to each field in 1992.

and other regulations were broadened and simplified, and a system of self-evaluation was introduced. It has thus become possible for each university and institution to develop its own unique style of education and research, according to its own ideas and aims (5).

For promoting the mobility of researchers, a system of so-called "mobilized research units" or "mobilized research institutions" was introduced in 1983. The Tsukuba Advanced Research Alliance (TARA), established in July 1994 by Tsukuba University, is one such institution and is expected to cultivate interactions among government, industry, and academic institutions. TARA will have more than 200 faculty members, most of them working on temporary contracts.

Training of Young Researchers

The training of young researchers is a national priority in Japan. A September 1991 survey reported that most researchers were very concerned about providing for creative and innovative young researchers (6). The number of graduate students in Japan is notably small in comparison to that of other industrialized nations. It is now a particularly urgent task to upgrade graduate schools both quantitatively and qualitatively. In the 1991 report from the University Council entitled "Quantitative Improvements of Graduate Schools," it was stipulated that the present total number (approximately 99,000 in 1991) of graduate students (including mature students and foreign students) should be at least doubled by 2000.

On the basis of this report and others from the University Council, several measures have been taken by MESC since 1992 to enrich and improve graduate schools. In 1985, a fellowship program for young researchers, "Fellowships for Japanese Junior Scientists," was established by MESC. This program, administered by the Japan Society for the Promotion of Science (JSPS), provides promising young researchers with scholarships and research grants so as to allow them to concentrate on their research, which they can conduct in laboratories of their choice for a specified tenure. As of 1994, the total number of fellowships is 2100, including 1600 for Ph.D. candidates and 500 for postdoctoral fellows.

International Scientific Exchange

Free exchange and cooperation among researchers across national boundaries is indispensable for the advancement of science. Recent trends in basic research toward large-scale and high-cost projects have furthered the importance of international scientific exchange and cooperation. Various programs to promote international scientific exchange and cooperation are being carried out through such supporting activities as joint international research, exchange of researchers, international research conferences, and exchange of scientific information. For example, the JSPS program Postdoctoral Fellowships for Foreign Researchers, established in 1988, has expanded to grant a total of 225 new fellowships in fiscal year 1994. And also, as of 1994 JSPS will set up a new program that will encourage pioneering and creative scientific research to be carried out in Japanese research institutions through promoting research cooperation between Japanese and overseas institutions.

Japan's science policy is undergoing some important changes, with the growing support of the public. The 1991 survey report (6) found that a large number of Japanese scientists believed Japan's science should be improved in the future even in the most adverse fiscal circumstances. For the advancement of Japan's science, it is essential to invigorate universities and related research institutions by substantially improving their financial support, whether from the government or the private sector, by making their management more flexible, by mobilizing their researchers more, and by making them far more open to other nations. Through the progress of Japanese basic research thus achieved, Japanese researchers can expect to contribute much more to the accumulation of new knowledge as an intellectual property common to humankind.

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