ogy Activities (ReaD) that compiles organizational data, researcher data, and research theme data from public research institutions, including universities, and the JST Science and Technology Research Result Database for Enterprise Development (J-STORE) that brings together and processes research results from national government research projects, etc., related patent information (including, since FY2003, some unpublished patents), and report summaries, for presentation in a readily understandable technology resource format.

In addition, as part of the "E-Village Development Plan," a basic outline drawn up in July 2003 for the development of rural villages through computerization, the Ministry of Agriculture, Forestry and Fisheries carries out the digital conversion of research results and other information contributing to the technology development of the agriculture, forestry, and fisheries industries, for wide availability over the Internet. Specifically, this involves the preparation of the Agriculture Information Search System known as Agropedia[14], which integrates and serves as a centralized source for the digital full text information database of reports from the Ministry's experimental research incorporated administrative agencies and national and public experimental research institutions; domestic and international databases of agricultural literature; a database of meteorological satellite images, and a database of research topics being explored at experimental research institutions.

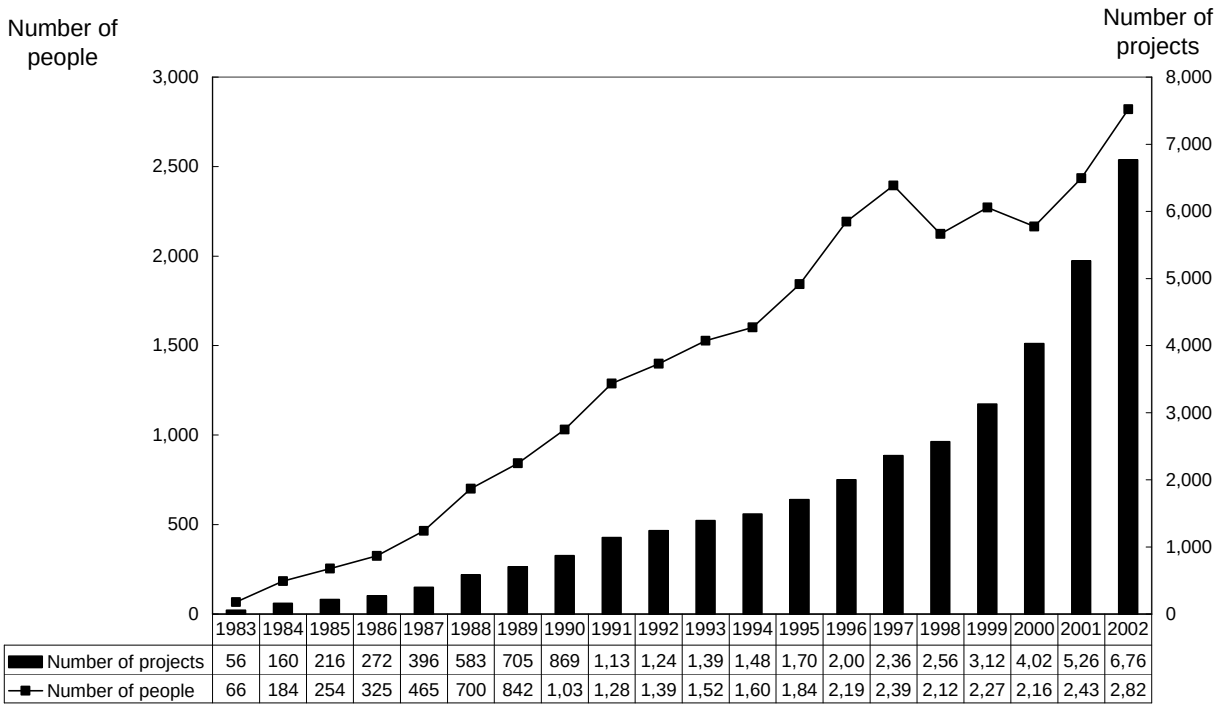
### 3.3.2.3.2 Promotion of Research Exchanges

In recent years, research and development has increased in both sophistication and complexity, and has undergone an increase in the number of fields that are either interdisciplinary or are not included in any traditional discipline. To promote creative science and technology, it is critical to actively promote personnel and material exchanges that extend beyond research institutions, in order to promote the development of infrastructures that allow such exchanges to be carried out, and to efficiently and effectively utilize limited research resources. In addition, research exchanges are critical for the transfer of research results from public research institutions, including universities, to corporations, etc., and to encourage research by public research institutions, including universities, which reflects the needs of the corporations, etc.

#### 3.3.2.3.2.1 Joint Research and Contract Research

To promote research exchanges between industry, academia, and government, the government ministries implement measures such as joint research programs. The number of joint research projects between national universities and the private sector has steadily increased over time, exceeding 6,700 projects in FY2002 (Figure 3-3-12). To promote joint research between the private sector and national universities, etc., the Ministry of Education, Culture, Sports, Science and Technology implements joint research programs with the private sector, etc., in which university researchers and private sector researchers undertake joint research themes, contract research programs that commission research from corporations to national universities, etc., and contract research programs in which national universities and inter-university research institutes provide research guidance for researchers at corporations, etc. In addition to implementing joint research and contract research, the Ministry establishes centers for cooperative research at national universities that carry out technical consultations on R&D and training for engineers in corporations, and also serves as a university-wide contact point for coordination and cooperation with industry. Through FY2003, centers for cooperative research were established at a total of 58 universities.

14 Agropedia: Derived from "Agriculture" and "Encyclopedia."




| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of projects | 56 | 160 | 216 | 272 | 396 | 583 | 705 | 869 | 1,13 | 1,24 | 1,39 | 1,48 | 1,70 | 2,00 | 2,36 | 2,56 | 3,12 | 4,02 | 5,26 | 6,76 |
| Number of people | 66 | 184 | 254 | 325 | 465 | 700 | 842 | 1,03 | 1,28 | 1,39 | 1,52 | 1,60 | 1,84 | 2,19 | 2,39 | 2,12 | 2,27 | 2,16 | 2,43 | 2,82 |

**Figure 3-3-12 Trend in the number of research projects conducted jointly with the private sector**

Government ministries have implemented a number of measures to promote joint research through collaboration among industry, academia, and the government. Examples include the “Effective Promotion of Joint Research with Industry, Academia, and Government” program, with matching funds from the Special Coordination Fund for Promoting Science and Technology, newly begun in FY2002, and the “Project for Research Advancement in Agriculture, Forestry and Fisheries Utilizing Advanced Technologies” implemented by the Ministry of Agriculture, Forestry and Fisheries. In addition, the Ministry of Economy, Trade and Industry implemented the Plan to Develop Integrated Technology in the Energy and Environmental Fields (New Sunshine Plan), the Program for the Scientific Technology Development for Industries, the Program for Joint Regional Research among Industry, Academia, and the Government for Small and Medium-scale Enterprises, and the Program for Joint Research through Coordination between Goernment Agencies and the Private Sector.

The Ministry of Internal Affairs and Communications implemented the “Basic Research 21 for Breakthroughs in Info-Communications Program,” the “Program for Cutting Edge Research and Development,” conducted under the auspices of the NICT, and the “Program for Industry-Academia-Government Development of Advanced Technologies,” within the “Program for Promoting Strategic Information and Communications Research and Development.” The Ministry of the Environment utilizes the Global Environment Research Fund. The above programs serve to promote integrated project research through coordination among industry, academia, and the government.

In addition, measures in the FY2003 tax reforms allow the exemption of a considerable amount of experimental and research expenses for research conducted jointly with, or contracted to, Japanese universities.

#### 3.3.2.3.2.2 Development of the Law for Facilitating Governmental Research Exchange

Restrictions on research and development by the national government had up until now existed in the form of the Government Officials Program and the Property Administration Program; however, insufficient conditions had been placed on the promotion of research exchanges with individuals from the private sector and from abroad. The Law for Facilitating Governmental Research Exchange was established (November 1986) in order to address inadequacies in the legal system, and a Cabinet decision specified "Basic Policies Concerning the Management of Programs related to the Promotion of Governmental Research Exchanges among Industry, Academia, and the Government, and with Other Countries," for the purpose of eliminating problems in the management of research exchanges (March 1987).

In light of the strong push from various corners to promote the incorporation of national research institutions into incorporated administrative agencies, and for collaboration among industry, academia, and government, appropriate amendments were made to the Law for Facilitating Governmental Research Exchange, in order to further ease various systematic constraints placed on research activity by the national government.

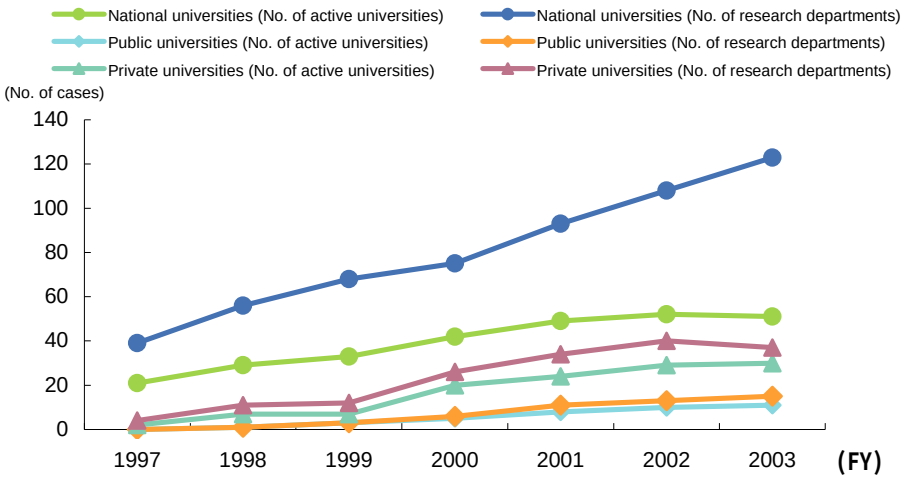
In addition, when the Law on the Special Zones for Structural Reform went into effect in April 2003, special measures in the Law for Facilitating Governmental Research Exchanges were implemented, making it possible to expand the scope of low-cost usage of government-owned facilities within special district regions authorized by the prime minister, relax the conditions of their use, and simplify usage procedures.

#### 3.3.2.3.3 Promotion of Personnel Exchanges

Currently, there are several programs in place to promote exchanges between researchers. Examples include the Government Guest Researcher Program implemented at various government ministries, the Flexible Employment System for Research Personnel that promotes flexible and creative research activities by researchers at national experimental research institutions, and programs to promote research exchanges such as the Program for Multidisciplinary Exchange implemented by the JST.

In addition, the Graduate School Coordination Program contributes to the promotion of personnel exchanges that are for the mutual benefit of universities, national experimental research institutions, corporations, etc. This program strives for coordination between graduate schools and both corporations and national research institutions, and is being utilized with increasing frequency (Figure 3-3-13).

## Figure 3-3-13 Activity in the linked graduate school program




| (FY) | | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|
| National universities | (No. of active | 21 | 29 | 33 | 42 | 49 | 52 | 51 |
| | (No. of research departments) | 39 | 56 | 68 | 75 | 93 | 108 | 123 |
| Public universities | (No. of active | 0 | 1 | 3 | 5 | 8 | 10 | 11 |
| | (No. of research departments) | 0 | 1 | 3 | 6 | 11 | 13 | 15 |
| Private universities | (No. of active | 2 | 7 | 7 | 20 | 24 | 29 | 30 |
| | (No. of research departments) | 4 | 11 | 12 | 26 | 34 | 40 | 37 |

Note: 1.Summary of Program

Graduate students may receive research guidance from research institutes other than their own if their graduate school deems this appropriate due to educational considerations (Standards for Establishment of Graduate Schools, No.13). This linked graduate school system is a systematic implementation of this program.

2.The numbers are as of May 1 of each fiscal year.

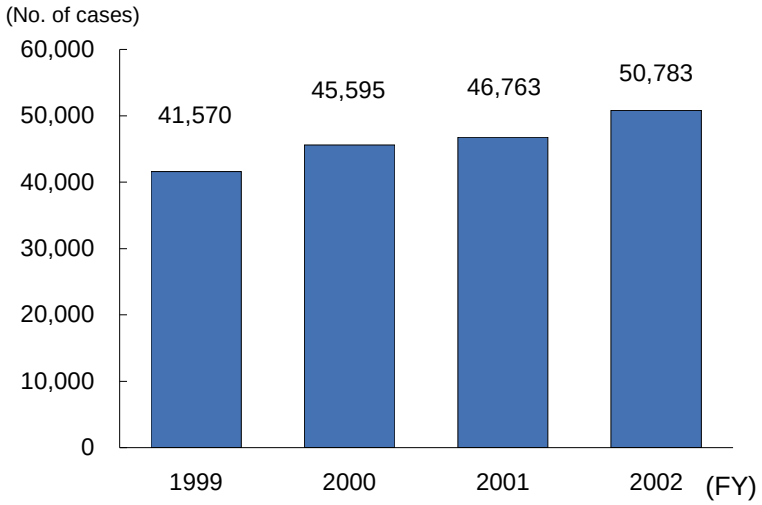
Source: Prepared by MEXT.

To bolster the reforms of the system of collaboration among industry, academia, and government laid down in the Basic Plan, in continuation from the previous year, the nationwide “Third Business-Academia-Government Collaboration Summit” was held on November 17, 2003, sponsored by the Cabinet Office, the Ministry of Internal Affairs and Communications, the Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Economy, Trade and Industry, the Japan Business Federation, and the Science Council of Japan. Taking “Creating Markets through Developing New Technologies” as its theme, top representatives from progressive overseas universities, domestic universities and companies were invited to the summit. Participants joined in practical-minded studies and discussions that included consideration of actual success cases of the fostering and securing of science and technology human resources, and the vigorous promotion of joint R&D projects through collaboration among industry, academia, and government. The participants then adopted the “Joint

Declaration of the "Third Business-Academia-Government Collaboration Summit." In addition, the "Second Conference for the Promotion of Collaboration among Business-Academia-Government" was held in order to achieve increased promotion of collaboration among business, academia, and government. Leaders and prominent managers of enterprises, universities, and public administrations from across Japan attended the conference, at which universities, research institutions, and TLOs introduced many working level activities. Furthermore, outstanding examples of successful collaboration among business, academia, and government that achieved remarkable success and contributed significantly to the promotion of such cooperative activities at universities and companies were recognized at the First Awards Ceremony for Persons of Merit in Business-Academia-Government Collaboration, which included the presentation of the Prime Minister's Award, the Minister of Education, Culture, Sports, Science, and Technology Award, and other awards given by relevant hosts.

Moreover, the implementation of research activity for the private sector, etc., by researchers from national experimental research institutions and faculty of national universities, etc., contributes to the promotion of science and technology in Japan by cooperation among industry, academia and the public sector, and serves as an opportunity to demonstrate and build upon the individual capabilities of researchers. For this reason, it is necessary to manage the authorization of side jobs smoothly in which researchers employed by the national government are engaged in tasks such as research and guidance for the private sector, etc., outside of working hours. Previously, there were few examples in which the authorization of side jobs was given, such as instructors at private universities. Since FY1996, ministries have gradually clarified the fundamental permissibility of side jobs outside of working hours, in cases in which authorization is obtained from the intended place of work, on the condition that there shall be no transfer of subsidies, and that the secondary duty shall have no effect on the performance at the primary place of employment. In the period between FY1996 and FY1999, the number of authorizations for side jobs issued by national research institutions reached in excess of 600 cases. Additionally, the Ministry of Education, Culture, Sports, Science and Technology (formerly the Ministry of Education) has amended the relevant notifications to authorize faculty member at national universities, etc., side jobs, and gradually relaxed the regulations concerning side jobs at for-profit enterprises as well since FY1997. Furthermore, under the programs for the promotion of Special Zones for Structural Reform, decided on by the Office for the Promotion of Special Zones for Structural Reform on October 11, 2002, engaging in side jobs during working hours was made possible as of April 2003 under certain conditions, in cases in which the side jobs are related to collaboration activities among industry, academia, and government, and given the premise that salaries will be reduced. For the period from FY1999 to FY2002, over 180,000 authorizations for side jobs were issued by national universities, including authorizations in the above new cases (Figure 3-3-14).

**Figure 3-3-14 Trend in the number of side job approvals at national universities**




Note: The number of side-work approvals for each fiscal year is based on a criterion of approved days.

The establishment of the National Personnel Authority Regulation in April 2000, in accordance with Article 103 of the Government Officials Act, enables faculty at national universities and research personnel at national research institutions, etc., to take side jobs as directors and so forth of technology licensing organizations, as directors and so forth of corporations utilizing their research results, as auditors at stock corporations, etc. In addition, according to partial revisions to the rules of the National Personnel Authority, as of October 2002, the authority to approve the taking of side jobs as directors and so forth of TLOs and corporations utilizing one's own research results, and, as of August 2003, the authority to approve the taking of side jobs as auditors of stock corporations, was transferred from the National Personnel Authority to the heads of the relevant authorities, and was also entrusted again to the heads of national universities. Furthermore, the rules of the National Personnel Authority were adjusted under the programs for the promotion of Special Zones for Structural Reform mentioned above. These rule adjustments make it possible to engage in side jobs during working hours under certain conditions, including the premise that salaries will be reduced. Allowable side jobs including working as directors and so forth of TLOs and corporations utilizing one's own research results (as of April 2003), and auditors of stock corporations (as of October 2003) located within the Special Zones for Structural Reform, in cases in which the taking of the side job is based on plans for Special Zones for Structural Reform that are authorized by the prime minister in accordance with the provisions of the Law on Special Zones for Structural Reform (Law No. 189 of 2002). Moreover, because faculty at national universities no longer fall within the scope of the National Public Service Law following the incorporation of national universities on April 1, 2004, faculty may engage in side jobs during working hours under the discretion of each corporation.

When a researcher needs to concentrate on employment as an executive of an enterprise utilizing his research results, the institution may offer the person a leave of absence. So far, this situation has occurred in two cases.

### 3.3.2.3.4 Studies in the Council for Science and Technology

The Committee on the Promotion of Cooperation among Industry, Academia, and Government, situated within the Technology and Research Foundations Division of the Council for Science and Technology has been taking the incorporation of the national universities as an opportunity to look ahead to the future of cooperation among industry, academia, and government in Japan. The Committee studied matters expected of industry and matters that universities should address in the future. In April 2003, it summarized its findings in "Toward the Construction of Industry-Academia-Government Cooperation in the New Age (Council Summary)."

### 3.3.2.3.5 Promotion of the Common Use of Research Facilities

The public use of cutting edge, advanced R&D facilities at national universities, incorporated administrative agencies and public corporations to users are crucial to the effective use of the facilities, as well as the promotion of the cooperation among them.

The Ministry of Education, Culture, Sports, Science and Technology is promoting the public use of the third generation synchrotron radiation facility, SPring-8, constructed by the Japan Atomic Energy Research Institute (JAERI) and RIKEN, which began operation in 1997. SPring-8 utilizes the light (synchrotron radiation), which is emitted from an electron traveling at almost the speed of light when its path is bent by a magnetic field, and it has carried out state-of-the-art research in a variety of fields, including materials science, life science, information/electronics technology, and applications to medical science. Researchers place large expectations on SPring-8, since it is expected to contribute to the research results in a wider range of fields. For this reason, the "Law Regarding Promotion of Common Use of the Synchrotron Radiation Facility (SPring-8)" was established in order to promote its use by opening it to researchers from Japan and abroad.

In addition, based on the "Guidelines for the Effective Utilization and Operation of the Large-scale Synchrotron Radiation Facility, SPring-8" (Enquiry No. 20) issued by the Council for Aeronautics, Electronics, and other Advanced Technologies, the Ministry has been seeking policies for the efficient use and management of the facility, such as the promotion and upgrade of the facility's use and the effective management system.

In FY2003, reform of SPring-8's management system proceeded based on the recommendations given in the "Interim Evaluation Report on the Synchrotron Radiation Facility, SPring-8," prepared in September 2002 by the Council for Science and Technology's Subdivision on Research and Development Planning and Evaluation. In addition, the Organization for the Promotion of Synchrotron Radiation Research adopted approximately 1,180 research proposals for implementation between February 2003 and February 2004, promoting a wide range of research.

## 3.3.2.4 Developing an Environment to Invigorate Research and Development-style Ventures

Because the promotion of private sector R&D through the utilization of research and development-style venture business, and utilization of R&D results at the national government, etc., can encourage individual creativity and swift responses to new demand, which is expected to increase, the government is united in seeking to promote this policy.

The Small Business Innovation Research Program (SBIR) was implemented based on the Law for Facilitating the Creation of New Businesses enacted in December 1998. In this program, the relevant government ministries and agencies coordinate to increase the opportunities to provide small and medium-scale corporations and so forth with subsidies, etc. Subsidies, business commis-

sioning fees and so forth that are intended for small and medium-scale corporations for the development of new technologies leading to the creation of new industries are designated as “special subsidies” and are applicable to this program. In FY2003, six government ministries, namely the Ministry of Internal Affairs and Communications, the Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Health, Labour and Welfare, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Economy, Trade and Industry, and the Ministry of the Environment designated a total of 55 subsidies as “special subsidies.” A target amount of approximately 25 billion yen in funds was supplied to small and medium-scale corporations, through the coordination and cooperation of the government ministries.

### 3.3.3 Promotion of Research Activities in Regional Areas

With increasing concerns over the hollowing out of industry, there is a growing need to promote science and technology at the regional level, in order to activate regional industry and to improve the quality of life for residents in regional areas. Based on this situation, The Science and Technology Basic Law incorporated the adoption and implementation of policies calling on local government authorities to engage in the promotion of science and technology in order to serve as a basic framework for the future of science and technology policy in Japan.

The First Science and Technology Basic Plan stressed the importance of promoting research activities in regional areas, and called for the promotion of coordination and exchanges, etc., among local industries, academia, and governments, in accordance with the Basic Guidelines for Vitalization of Science and Technology Activities in Local Areas, which was approved by the Prime Minister in December 1995. With the increasing importance of promoting regional research, the prefectural governments are actively making efforts to promote science and technology by establishing councils, etc., to deliberate policies for the promotion of science and technology, and adopting outlines and guidelines for science and technology policies individually (Tables 3-3-15 and 3-3-16).

## Table 3-3-15 State of establishment of science and technology councils at the local government level

| Prefecture | Name of science and technology council | Established |
|---|---|---|
| Hokkaido | Hokkaido Science and Technology Council | September 1952 |
| Aomori | Aomori Industry, Science and Technology Council | December 1997 |
| Akita | Akita Council for Science and Technology | August 2002 |
| Iwate | Iwate Science and Technology Promotion Council | April 1989 |
| Yamagata | Yamagata Science and Technology Council | June 1999 |
| Fukushima | Fukushima Science and Technology Promotion Council | May 1997 |
| Tochigi | Tochigi Science and Technology Promotion Council | July 1999 |
| Saitama | Saitama Science and Technology Council | November 1994 |
| Chiba | Chiba Science Council | November 1994 |
| Kanagawa | Kanagawa Science and Technology Council | June 1988 |
| Niigata | Niigata Science and Technology Council | April 1998 |
| Toyama | Toyama Science and Technology Council | November 1983 |
| Ishikawa | Ishikawa Industrial Science and Technology Council | December 1997 |
| Fukui | Fukui Science and Technology Promotion Council | April 1998 |
| Yamanashi | Yamanashi Science and Technology Council | September 1991 |
| Gifu | Gifu Science and Technology Promotion Council | July 1996 |
| Aichi | Aichi Science and Technology Council | February 2000 |
| Mie | Mie Science Academy Representative Conference | April 2001 |
| Kyoto | Kyoto Science and Technology Council | September 1961 |
| Osaka | Osaka Science and Technology Roundtable | December 1986 |
| Hyogo | Hyogo Science and Technology Council | April 2000 |
| Wakayama | Wakayama Science and Technology Promotion Council | January 2002 |
| Tottori | Tottori Science and Technology Promotion Council | March 1999 |
| Shimane | Shimane Science and Technology Promotion Council | October 1998 |
| Hiroshima | Hiroshima Science and Technology Promotion Conference | April 1992 through March 1994 |
| Yamaguchi | Yamaguchi Science and Technology Council | May 1991 |
| Kagawa | Kagawa Science and Technology Council | August 1997 |
| Ehime | Ehime Science and Technology Promotion Council | July 2001 |
| Kochi | Kochi Science and Technology Promotion Council | June 1997 |
| Saga | Saga Science and Technology Council | February 1996 |
| Nagasaki | Nagasaki Science and Technology Promotion Council | October 1998 |
| Kumamoto | Kumamoto Science and Technology Council | September 1999 |
| Miyazaki | Miyazaki Science and Technology Council | August 2001 |
| Okinawa | Council for Promotion of Science in Okinawa | January 1995 |
| Yokohama City | Yokohama City Council for Promotion of Cooperation Between Industry and Academia | October 1999 |
| Osaka City | Osaka City Council for Promotion and Planning of Industry, Science, and Technology | May 2000 |
| Kitakyushu City | Kitakyushu City Science and Technology Promotion Council | November 2002 |

## Table 3-3-16 Enactments of science and technology promotion policies by local governments

| Prefecture | Science and technology promotion policy | Date of enactment |
|---|---|---|
| Hokkaido | Guidelines for Promoting Science and Technology in Hokkaido | March 2000 |
| Aomori | Guidelines for Promoting Industry, Science and Technology in Aomori Prefecture | December 1998 |
| Akita | Basic Concept for Science and Technology in Akita Prefecture | June 2000 |
| Iwate | Guidelines for Promoting Science and Technology in Iwate Prefecture | May 1990 |
| | (New Guidelines for Promoting Science and Technology in Iwate Prefecture) | (Revised November 2000) |
| Miyagi | Guidelines for Promoting Science and Technology in Miyagi Prefecture | March 1999 |
| Yamagata | General Outline of Science and Technology Strategies in Yamagata Prefecture | November 1998 |
| Fukushima | General Outline of Science and Technology Strategies in Fukushima Prefecture | March 2002 |
| Ibaraki | General Outline of Science and Technology Strategies in Ibaraki Prefecture | March 1994 |
| Tochigi | Guidelines for Promoting Science and Technology in Tochigi Prefecture | December 1998 |
| Gunma | Guidelines for Promoting Science and Technology in Gunma Prefecture | March 1999 |
| Saitama | Saitama Technology Policy for the 21st Century | February 1998 |
| Chiba | General Guidelines for Chiba Science Plan | February 1996 |
| Tokyo | Tokyo Metropolitan Government Guidelines for the Promotion of Industrial Science and Technology | February 2004 |
| Kanagawa | General Guideline for Kanagawa Science and Technology Sixth Plan | May 1990<br>(Revised March 2002) |
| Niigata | General Outline of Science and Technology in Niigata Prefecture | March 1998 |
| Toyama | General Guidelines for Toyama Science and Technology | October 1991 |
| | (New Toyama Prefecture Science and Technology Plan) | (March 2001) |
| Ishikawa | Guidelines for Promoting Industry, Science and Technology in Ishikawa Prefecture | February 1999 |
| Fukui | Guidelines for Promoting Science and Technology in Fukui Prefecture | January 1998 |
| Yamanashi | Yamanashi Science and Technology Sixth Plan | Mar-92 |
| | (Yamanashi Plan for Promoting Science and Technology) | (Revised March 1999) |
| Nagano | Guidelines for Promoting Science and Technology and Industry in Nagano Prefecture | April 2000 |
| Gifu | Basic Strategies for Science and Technology in Gifu Prefecture | March 1997<br>(Revised March 2002) |
| Shizuoka | Vision for Promoting Science and Technology in Shizuoka Prefecture | February 2000 |
| Aichi | General Guidelines for Promoting Science and Technology in Aichi Prefecture | March 1999 |
| Mie | Vision for Promoting Science and Technology in Mie Prefecture | July 1999 |
| Shiga | Shiga Science and Technology Plan | March 1995 |
| Kyoto | Promotion Plan for Industry and Technology in Kyoto | February 1995 |
| Osaka | Osaka Research and Development Charter Guidelines for Industry, Science and Technology in Osaka | March 1988 |
| | (Guidelines for Promoting Industry, Science, and Technology in Osaka) | (Revised March 1998) |
| Hyogo | General Guidelines for Hyogo Science and Technology Sixth Plan | March 1991 |
| | (New General Guideline for Hyogo Science Technology Plan) | (Revised March 1998) |
| Nara | Guidelines for Promoting Science and Technology in Nara Prefecture | March 2003 |
| Wakayama | Vision for Promoting Science and Technology in Wakayama Prefecture | March 2000 |
| Tottori | Investigative Report on the Promotion of Science and Technology in Tottori Prefecture | March 1998 |
| Shimane | Guidelines for Promoting Science and Technology in Shimane Prefecture | March 1999 |
| Okayama | Guidelines for Promoting Science and Technology in Okayama Prefecture | March 1998 |
| Hiroshima | Fundamental Principles of the Promotion of Science and Technology in Hiroshima Prefecture | November 1993 |
| Yamaguchi | Guidelines for the Promotion of Science and Technology in Yamaguchi Prefecture | March 1994 |
| Tokushima | Vision for Promoting Science and Technology in Tokushima Prefecture | March 1999 |
| Kagawa | Vision for Promoting Science and Technology in Kagawa Prefecture | March 1997<br>(Revised March 2001) |
| Ehime | Guidelines for Promoting Science and Technology in Ehime Prefecture | March 2003 |
| Kochi | Guidelines for Promoting Science and Technology in Kochi Prefecture | March 1998 |
| Fukuoka | Guidelines for the Creation of a Scientific and Technological Fukuoka Prefecture | March 1999 |
| Saga | Vision for Promoting Science and Technology in Saga Prefecture | March 1997 |
| Nagasaki | Vision for Promoting Science and Technology in Nagasaki Prefecture | June 1998 |
| Kumamoto | Guidelines for Promoting Science and Technology in Kumamoto Prefecture | May 1999 |
| Oita | Guidelines for Promoting Science and Technology in Oita Prefecture | March 2003 |
| Miyazaki | Guidelines for Promoting Industry, Science, and Technology in Miyazaki Prefecture | March 2001 |
| Kagoshima | Guidelines for Promoting Science and Technology in Kagoshima Prefecture | March 2003 |
| Okinawa | General Guidelines for Science and Technology Promotion in Okinawa Prefecture | February 2000 |
| Yokohama City | Guidelines for Promoting Science and Technology in Yokohama-city | August 1999 |
| Kyoto City | Concept for Super Technology in Kyoto City | March 2002 |
| Osaka City | Plan for Promoting Industrial Science and Technology in Osaka City | March 2000 |
| Hiroshima City | Hiroshima City Science and Techonology Policy | June 2003 |
| Kitakyushu City | Blief Guidelines for Promotion of Science and Technology in Kitakyusyu City | August 2003 |
| Fukuoka City | Vision for Promoting Science and Technology in Fukuoka City | June 2002 |

The Second Science and Technology Basic Plan calls for the government to promote research and development activities, including joint research, to develop and retain human resources, and to expand technology transfer functions, etc., for the effective and efficient creation of Knowledge Clusters under local initiatives. In response, the Ministry of Education, Culture, Sports, Science, and Technology launched the "Knowledge Cluster Initiative" in FY2002.

The following sections provide overviews of various policies that are being taken by the national government to support the promotion of science and technology at the regional level.

## 3.3.3.1 Aiming Toward the Creation of Knowledge Clusters and Industrial Clusters

### 3.3.3.1.1 Knowledge Cluster Initiative

A "Knowledge Cluster" is a local technological innovation system organized around universities and other public research institutions that have unique R&D themes and potentials. Business companies inside and outside various regions are also expected to enter into these systems. More specifically, these systems successively drive technological innovation and create new industries through mutual stimulation between technological seeds in research institutions and practical needs in the real business world. Human networks and joint research entities are also expected to be established in this process.

The Basic Plan posits the creation of "Knowledge Clusters" in local areas as a project of importance to the nation.

The Ministry of Education, Culture, Sports, Science and Technology launched the Knowledge Cluster Initiative in FY2002. In FY2003, the project was being run in fifteen full-fledged regions and three trial regions. In specific terms, each region sets up a "Knowledge Cluster Headquarters" staff with specialist science and technology coordinators, utilizes advisors such as patent attorneys, and carries out industry-academia-government joint research at university research centers or other institutions, which are expected to produce new technological seeds in accordance with industrial needs (Figure 3-3-17).

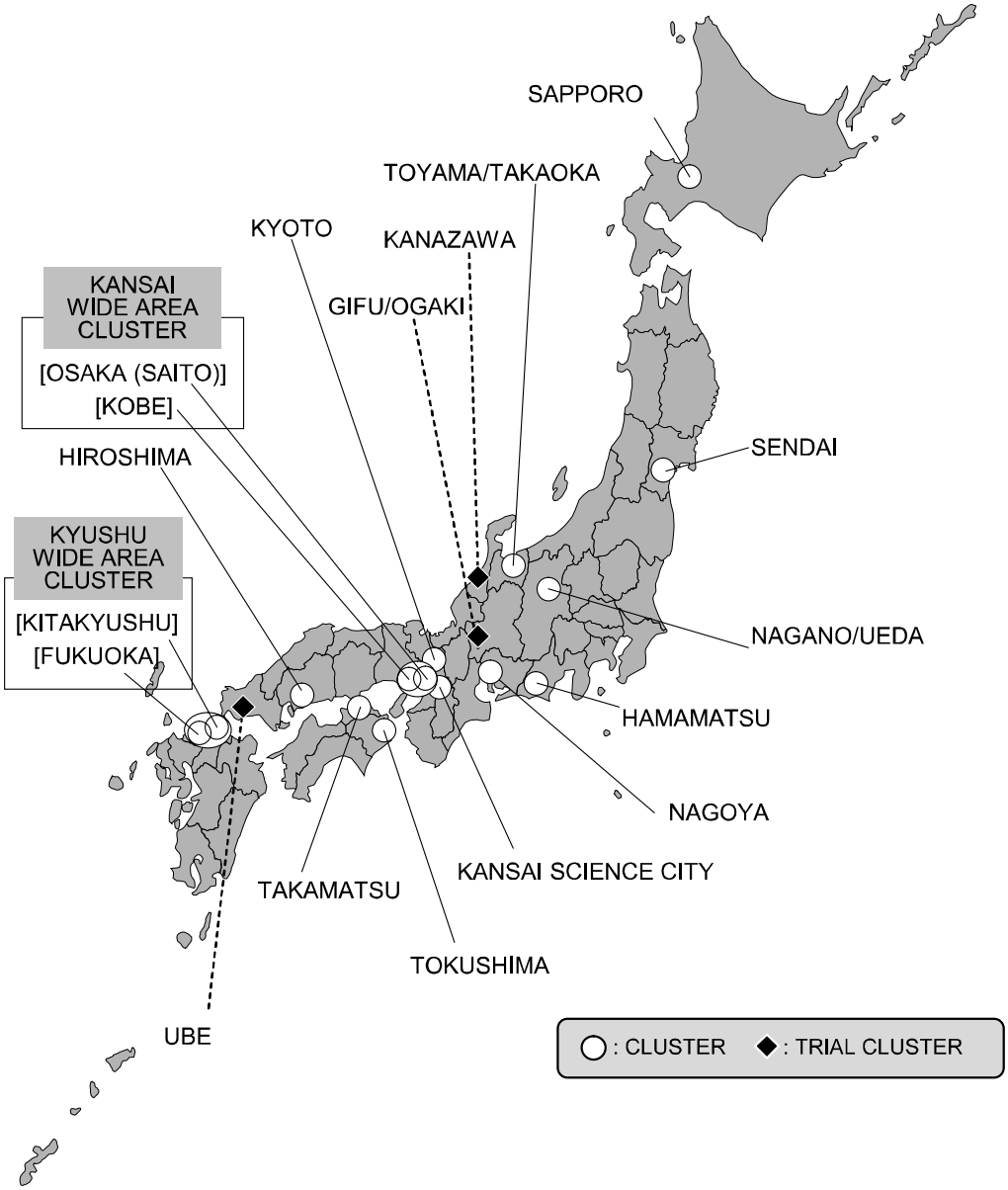



**Figure 3-3-17 Map of Knowledge Clusters**

In addition, the Cooperation for Innovative Technology and Advanced Research in Evolutional Area (CITY AREA) program was implemented FY2002 and was running in twenty-eight areas in FY2003. This program aims to grow the seeds of new technologies by using the "wisdom" of universities, creating new enterprises, and fostering regional R&D-based industries while attaching importance to the unique characteristics of local areas and cities.

### 3.3.3.1.2 The Industrial Cluster Project (Project for Regional Regeneration and Industrial Clustering)

An "Industrial Cluster" is a system that takes the technological innovation of universities and other public research institutions, and of business enterprises in the surrounding area, and encourages wider area cooperation between the univer-

sities, etc., and the business enterprises, and between different enterprises, to create a chain reaction of innovation and creation of new businesses and industries.

The Ministry of Economy, Trade, and Industry's "The Industrial Cluster Project" involves the regional bureaus of the Ministry of Economy, Trade, and Industry as the hubs of the formation of wide-area human networks of industry, academia, and government, including local enterprises, universities, etc., aiming for participation in world markets, and that uses comprehensive and effective implementation of the Ministry's regional measures to support local economies and form industrial clusters that can foster new business enterprises capable of competing in worldwide markets. Specifically, the Ministry currently has 19 such projects around Japan, operating with the cooperation of local public authorities, each forming wide-area personal networks of industry, academia, and government that include 5,000 small and medium-size companies with ambitions to enter world markets, and about 200 universities. These projects are implementedto promote improvements in the quality and volume of information flowing among industry, academia, and government, to supplement business management resources with information about technology, business management, and marketing channels, to support technology development that brings out local characteristics, and to develop entrepreneurial fostering facilities (business incubators) and business environments.

Support for technology development in local areas that leads to practical applications and the development of business incubators will be effective in promoting structural reform of industry and revitalizing the economy, by boosting industrial vitality and creating new business enterprises that will lead to the medium and long-term creation of industry and employment. Outlays of 41.3 billion yen from the FY2003 initial budget have strengthened measures related to the "The Industrial Cluster Project," centering on support for technology development in local areas that leads to practical applications. So far, a promotion organization was developed for each project, networks formed among industry, academia, and government, and efforts moved forward to develop technologies that lead to practical applications. The Ministry plans to continue its comprehensive and effective investment in these kinds of support policies to work toward the regeneration of local economies. (Table 3-3-18).

(Project for Regional Regeneration and Industrial Clustering)

As of April 2003

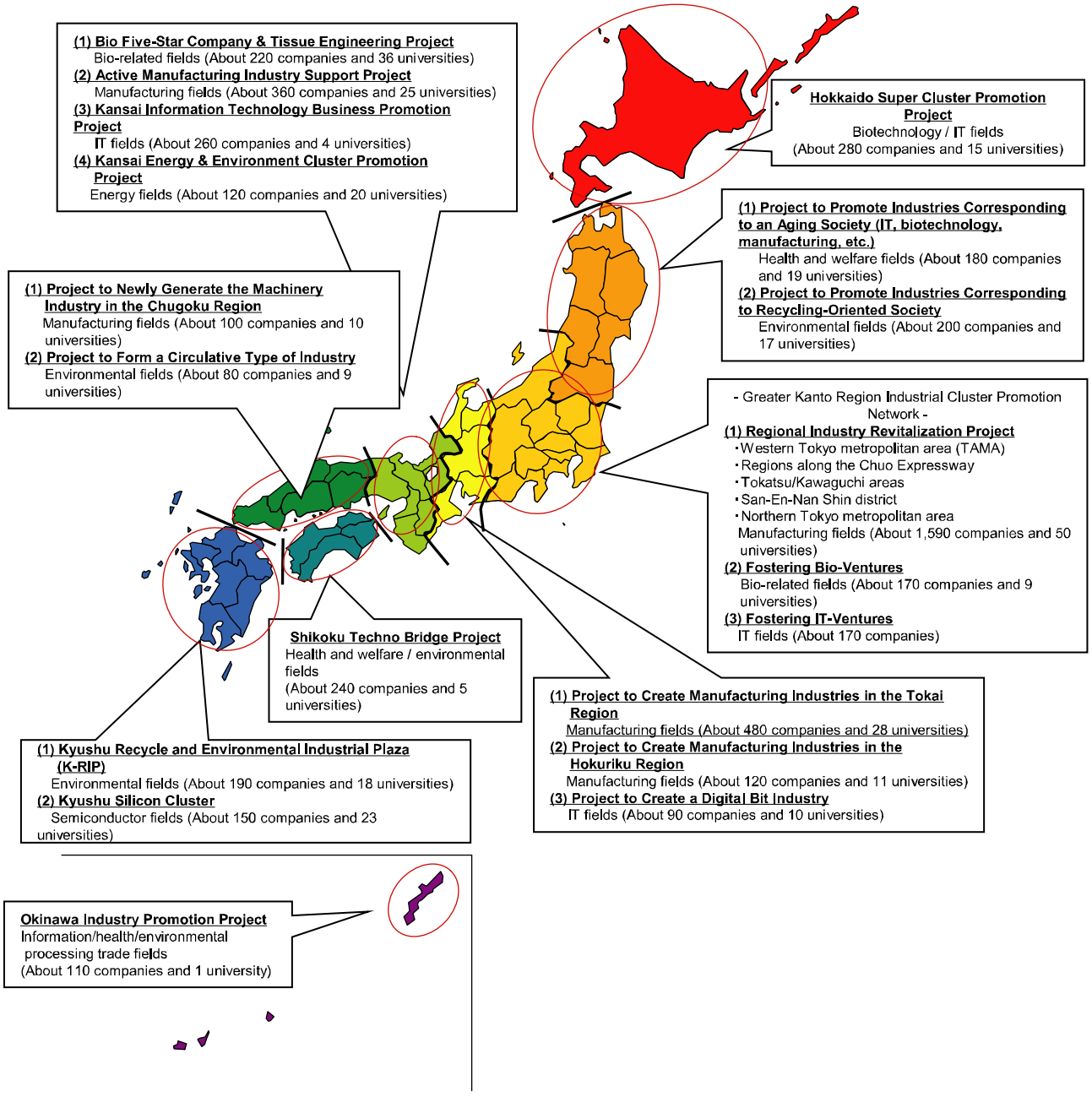



**Figure 3-3-18 The Industrial Cluster Project**

### 3.3.3.1.3Coordination between the Knowledge Cluster Initiative and the Industrial Cluster Project

The Ministry of Education, Culture, Sports, Science and Technology is working to create new technology seeds by promoting joint research among industry, academia, and government in fields of creative basic research, focusing on universities and public research institutions in regional areas. The Ministry of Economy, Trade and Industry is working to open up new fields for businesses, and to create start-ups and new products by promoting collaboration projects among industry, academia, and government, such as technology development that leads to practical applications, focusing on business enterprises.

Both ministries work together to promote the development of systems of collaboration among industry, academia, and government in regional areas, and both aim to revitalize regional economies and stimulate Japan's national economy by working in close coordination to supply feedback on market needs and provide new technology seeds through their programs, which are adjusted to be in close coordination. Specifically, the Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Economy, Trade and Industry, local public authorities, and other relevant entities established the "Committee for Regional Cluster Promotions" for each region, helped the project organizations of both ministries' projects to work together, and promoted joint conferences to announce project results. Furthermore, a nationwide symposium is planned for FY2004 to present summarized versions of the achievements of both ministries' projects in each region. Such activities accelerate collaboration.

### 3.3.3.2 Various Policies on the Promotion of Regional Science and Technology

The relevant national government ministries are implementing a variety of measures aimed at promoting regional science and technology (Table 3-3-19). The following sections introduce some of the main examples concerning research activities conducted by each government ministry.

## Table 3-3-19 Major regional science and technology promotion measures

| Ministry or Agency, related organizations | Item | Outline of measures |
|---|---|---|
| Ministry of Internal Affairs and Communications | Regional proposal-based research and development programs | Canvasses for research and development topics in response to regional needs, and contracts joint research groups consisting of regional industry, academia, and government. |
| Ministry of Education, Culture, Sports, Science and Technology Science and Technology Policy Bureau | Knowledge Cluster Initiative | 13 clusters (15 regions) were selected nationwide to create internationally competitive knowledge-centered systems for technological innovation (Knowledge Clusters). Knowledge Clusters will be organized closely around the knowledge creation bases, which consist of universities or public research institutions. Other related public institutions and R&D firms are also expected to come into this program. Proper attention to the autonomy of local governments should be paid in the whole process. |
| | Cooperation for Innovative Technology and Advanced Research in Evolutional Area (CITY AREA) | The development of a foundation for coordination between industry, academia, and government, which is centered on universities, etc., in the relevant area, is aimed at focusing attention on local areas, attaching importance to the independence of local governments and the exertion of local individuality, and specializing in a particular area. |
| | Projects for development of locally led science and technology basic research | Supports projects run by local authorities for the development of the basic facilities that contribute to pioneering research using regional characteristics and potential. |
| | Promotion of Pilot Research (Special Coordination Funds for Promoting Science and Technology) | Implements pioneering R&D that brings out the character of local areas and that targets areas that require boundary or interdisciplinary research and development across a multiple number of science and technology sectors. |
| | Collaboration of Regional Entities for the Advancement of Technological Excellence (Incorporated administrative agency: Japan Science and Technology Agency) | Aims to establish and reinforce a science and technology foundation that creates new technologies and industries in priority research fields set by the national government. Also explores new research areas through joint research by rallying regional potential in universities, national and other public research institutes, and R&D oriented private companies. |
| | Regional Science Promotion (RSP) Program (Incorporated administrative agency: Japan Science and Technology Agency) | To help support local governments when they improve bases for regional coordination, Japan Science and Technology Agency commissions science and technology coordinators and promotes the creation of new technologies and industries by fostering university research results. |
| | Science and Technology Incubation Program in Advanced Regions (Incorporated administrative agency: Japan Science and Technology Agency) | Aims to create new business projects through technological innovation. At Innovation Plazas located in 8 regions, the Japan Science and Technology Agency promotes the fostering of research results achieved through exchange among industry, academia, and government that utilize creative regional research results, and establish cooperation between local communities and researchers at universities, national research institutions, etc. |
| Incorporated administrative agency: RIKEN (The Institute of Physical and Chemical Research) | Frontier research and regional development | Establishes mergers with regional research potential and conducts R&D on research themes in unexplored areas with regional cooperation. |
| Incorporated administrative agency: Japan Agency for Marine-Earth Science and Technology | Research and development of the coastal environment and its utilization | Conducts research and development in cooperation with local areas concerning locally generated topics and needs related to the coastal environment and its utilization. |
| Ministry of Agriculture, Forestry and Fisheries, Agriculture, Forestry and Fisheries Research Council Secretariat | Projects for promotion of local commercialization research in advanced technologies, etc. | Brings together the research capabilities of industry, academia, and government for efficient commercialization research into biotechnology and other advanced technologies. |
| | Research and development projects for creation of new projects | Brings together private-sector corporations, etc., into joint research groups, to promote research and development linked to the creation of new projects. |
| | Research project for utilizing advanced technologies in agriculture, forestry and fisheries | This project offers R&D funds to suitable projects in the fields of production, growing local seeds of technology or fulfilling regional needs (Competitive research fund). |
| Ministry of Economy, Trade and Industry | Important regional technology research and development systems (regional consortium R&D) | Conducts research and development of regional research consortiums composed of local universities, national research institutes, and private sector corporations, in order to foster local corporate groups that are in possession of world-class, creative, and advanced technologies, which resultantly contributes to the creation of new industries, and encourages independent regional development. |
| Ministry of the Environment, Environmental Policy Bureau | Research Funds for the National Organization for Pollution Prevention (Environment research to meet regional needs) | Implements joint research among national experimental research institutions, incorporated administrative research institutes and other public research institutions on research subjects where local needs are great and investigation into local environmental characteristics are required. |

### 3.3.3.2.1 Research Programs, etc.

To implement basic and pioneering research and development that fulfills regional needs and potential, it is important to promote coordination and exchanges among industries, academia, and governments. For this reason, it is necessary to develop a diverse range of research programs and to strengthen the coordination functions for research and development. In this regard, government ministries have implemented the following research programs.

#### 3.3.3.2.1.1 Ministry of Internal Affairs and Communications

The New R & D IT applications, also known as the Multimedia Pilot Town Project, have been implemented since FY1997 for the purpose of carrying out research and development in research fields that have been developed and provided by local government authorities, etc., in order to achieve telecommunications systems with advanced features that combine basic constituent technologies resulting from research and development in the telecommunications and broadcasting sectors.

In order to support the independence and societal participation of the elderly, the National Institute of Information and Communications Technology (NICT) seeks the cooperation of local government authorities and implements research and development that is aimed at establishing telecommunications systems with advanced features that are sought within the welfare sector.

Moreover, since FY1998, the Ministry has implemented a regional proposal-based research and development program that publicly canvasses regional industry, academia, and governments for research and development themes that respond to regional needs, implements contract research with the aim of improving research and development capabilities at the regional level, and promotes local industry.

#### 3.3.3.2.1.2Ministry of Education, Culture, Sports, Science and Technology

Starting in FY2001, the Ministry began to establish the “Pilot R&D that Brings Out Local Characteristics” within its “Promotion of Pilot Research Program,” which utilizes the Special Coordination Funds for Promoting Science and Technology. This program is designed to bring out the character of local areas, and intended for subjects require boundary or interdisciplinary research and development across multiple science and technology fields. In FY2003, the Ministry engaged in research in four such subject areas.

Moreover, the Japan Science and Technology Agency (JST) implements the Collaboration of Regional Entities for the Advancement of Technological Excellence, with the aim of contributing to the creation of new technologies and industries through joint research that brings together the research potential of local universities, national and other public research institutions, universities, and research and development-based companies toward specific R&D targets in priority research sectors designated by the national government. To help support local governments when they improve bases for regional coordination, the JST also implements the Regional Science Promotion (RSP) Program, which commissions science and technology coordinators and promotes the creation of new technologies and industries by fostering university research results.

In addition, the Japan Agency for Marine-Earth Science and Technology implements research and development on coastal environments and their utilization, with the cooperation of regional areas.

#### 3.3.3.2.1.3Ministry of Agriculture, Forestry and Fisheries

In order to promote technology development directly related to agricultural production, the Ministry of Agriculture, Forestry and Fisheries implements research to promote key agricultural technology systems at the regional level, through

large-scale and integrated research that includes on-site verifications at paddy fields.

In addition, the Ministry implements a Regional Advanced Technology Joint Research and Development Promotion Project that carries out research aimed at the efficient and practical use of biotechnology and other advanced technologies, through coordination between industry, academia, and the government. Additionally, as part of the Millennium Project, the Ministry since FY2000 has implemented the Research and Development Project to Create New Enterprises. This program is aimed at the realization of functional crops that prevent lifestyle-caused diseases, biotic pesticides that take the place of chemical pesticides, etc. Furthermore, starting in FY2002, the Ministry began implementing a project that invites proposals from the public. Relying on local initiative, the "Project for Research Advancement in Agriculture, Forestry, and Fisheries Utilizing Advanced Technologies" aims at rapid promotion of experimentation and research in the agriculture, forestry, and fisheries sector that has real relevance to working sites.

### 3.3.3.2.1.4 Ministry of Economy, Trade and Industry

For important research and development themes that respond to regional needs or utilize R&D potential at the regional level, the Ministry of Economy, Trade and Industry implements the Priority Regional Technology Research and Development System primarily through the National Institute of Advanced Industrial Science and Technology (AIST), at which research and development are carried out in coordination with public research institutions, private sector corporations, etc.

Additionally, the Ministry implements the Regional Consortium Research and Development Program, in which regional industry, academia, and governments form joint research systems (consortiums), by utilizing seed technologies accumulated by national research institutions, universities, etc., to promote technology development for the purpose of creating new industries.

### 3.3.3.2.1.5 Ministry of Land, Infrastructure and Transport

Recognizing the importance of actively promoting, through the facilitation of collaboration among industry, academia, and government, a variety of R&D that contributes to the strengthening of global competitiveness, the realization of a safe and secure society, and solutions to environmental concerns, the Ministry held the First Advanced Technology Forum for Land, Infrastructure, and Transportation in February 2003 with 334 participants.

This forum aimed to facilitate regional collaboration among industry, academia, and government, and stimulate greater utilization of research results. Industry, academia, and government members from the Kansai area gathered together with representatives from the Ministry and relevant research institut. The participants were introduced to the Ministry's cutting-edge research results and intellectual property, and were able to converse directly with each other.

### 3.3.3.2.1.6 Ministry of the Environment

The Ministry implements the Regionally Linked Environmental Research Program, which carries out joint research with national research institutions, incorporated administrative research institutions, and public research institutions. This program focuses on research themes for which there is strong
demand at the regional level, and which require study that matches the characteristics of the regional environment.

### 3.3.3.2.2 Promotion of Technology Transfers at Innovation Plazas (Science and Technology Incubation Program in Advanced Regions)

The Japan Science and Technology Agency (JST) aims to create new business projects through

technological innovation. At Innovation Plazas located in 8 regions, JST promotes the fostering of research results achieved through exchange among industry, academia, and government that utilizes creative regional research results, and establishes cooperation between local communities and researchers at universities and national and public research institutions.

### 3.3.3.2.3 Development of Research Facilities

It is important to develop research facilities and other infrastructure with regard to promoting regionally distinct science and technology. The following project serves to support the development of the research facilities.

The Ministry of Education, Culture, Sports, Science, and Technology is promoting the new development of local infrastructure facilities for pilot science and technology, in support of local government programs for the development of infrastructure facilities that contribute to pilot research based on local characteristics and potential (these facilities include fundamental R&D facilities that contribute to the advancement of local research potential).

### 3.3.3.2.4 Strengthening the Activities and Functions of Public Experimental Research Institutions as R&D and Technology Support Organizations

In order to provide R&D and technology support, etc., that leads to the advancement of industries and academia at the regional level, the relevant government ministries are implementing various measures directed at public experimental research institutions. These measures are summarized in Table 3-3-20.

**Table 3-3-20 Strengthening of the activities and capacities of research and development and technology support functions at public research institutions**

| Ministry or agency | Summary of support function |
|---|---|
| Ministry of Internal Affairs and Communications | Adopts local tax grant measures for the research and development activity expenses of prefectural industrial technology centers, sanitation research institutes, agricultural test sites, livestock test sites, forestry test sites, and other public testing and research institutions. |
| Ministry of Agriculture, Forestry and Fisheries | Provides support for prefectural testing and research through the following projects:<br>1. Subsidized projects conducted by prefectural testing and research institutes<br>・Research required for the establishment of core agricultural technology systems for a local area<br>・Research needed for commercialization of biotechnology and other advanced technologies, etc.<br>2. Projects consigned to prefectural test and research institutions, and implemented as part of national testing and research<br>・Quality improvement tests<br>・Insect pest tests, etc. |
| Ministry of the Environment | ・Promotes joint research with the pollution research institutes, etc., of local governments (prefectural or city governments), to contribute toward the preservation and improvement of the local environment<br>・The National Environmental Training Institute offers training for local governmental officers, etc., for the objective of training in analytical relationship technologies, etc. |

### 3.3.3.2.5 Interregional Coordination and Exchanges

The following measures are being implemented in order to encourage coordination and exchanges between the national government and local government authorities, as well as between different regions.

### 3.3.3.2.5.1 Research Exchange and other Programs of the Japan Association for the Advancement of Research Exchange Cooperation

The Japan Association for the Advancement of Research Exchange Cooperation (JAREC) was established in June 1992, based on funds provided by local government authorities, with the aim of supporting research exchanges and promoting regional research about S&T. This association implements various research support programs and nationwide research exchange programs for regions commencing cutting edge or basic research.

### 3.3.3.2.5.2 Industrial Technology Liaison Council

The Industrial Technology Liaison Council was established in 1954 in order to strengthen cooperation among public research institutions and/or with national research institutions in relation to mining and manufacturing technology, to effectively promote experiments and research between institutions, and thus to improve industrial technologies. The council is composed of seven liaison divisions, eight regional councils, and a welfare technology division that is a horizontal organization. The council serves to facilitate research cooperation, research coordination, research exchanges, and information exchanges among public research institutions well as between public and national experimental research institutions.

### 3.3.3.3 Supporting the Concentration of R&D Functions

Policies aimed at the promotion of industry in order to invigorate regional areas have hitherto tended to concentrate on enticing corporations to locate to that area, and on the incidental development of roads, harbors, and other hard infrastructure in the surrounding environment. In recent years, however, this approach has been supplemented by measures supporting the development of research equipment, research facilities and other items in the target regions, and the provision of subsidies and other measures for research and development. The following laws and measures represent an integrated approach to supporting the concentration of research and development functions.

### 3.3.3.3.1 Technopolis Regulation (Law for Accelerating Regional Development Based upon High-Tech Industrial Complexes)

A “technopolis” results from efforts to promote the development of an urban area that integrates industry, academia, and habitation facilities built around a core of cutting edge technology, and represents the concentration of advanced technology-based manufacturing industries within a region. It represents an effort to promote development programs, etc., for research and development facilities and other industrial infrastructures. At the present time, programs in 26 regions have been approved in accordance with the Technopolis Law.

Although the Technopolis Law was abolished with the enactment of the Law for Promotion of New Enterprises, the Technopolis Plans continue to be valid for a certain time period as a special transition treatment.

### 3.3.3.3.2 Key Facilities Siting Law (Law to Promote the Group Siting of Designated Businesses Contributing to More Advanced Regional Industry)

In accordance with the increasing shift to software and service-oriented economic activities,

the Key Facilities Siting Law promotes the traditional regional distribution of plants and combines this with efforts to concentrate service industries that support industry, such as natural science research institutions, the software industry, and the information processing service industry. These measures are aimed at promoting development programs and so forth for various industry infrastructures, in order to promote the upgrading of regional industry. At the present time, programs in 26 regions have been approved in accordance with the Key Facilities Siting Law.

Although the Key Facilities Siting Law was abolished with the enactment of the Law for Promotion of New Enterprises, the Key Facilities Siting Plans continue to be valid for a certain time period as a special transition measure.

#### 3.3.3.3.3 Law for Promotion of New Enterprises

The Law for Promotion of New Enterprises is designed to help utilize Japan's accumulated industrial resources for the creation of new business enterprises. Sections 4 and 5 of the Law for Promotion of New Enterprises stipulates measures for utilizing regional industrial resources in order to develop a business environment that encourages the creation of new enterprises in local areas. Specifically, the Law promotes the development of programs (regional platforms) for comprehensive provision of the technological, personnel, and financial support required at every stage in the creation of new enterprises in local areas, from research and development to investment in business enterprises, and promotes the development of business incubators and leased plant sites in High-Tech Industry Integration Regions and Advanced Research Function Integration Districts.

To date, 33 High-Tech Industry Integration Regions and 34 Advanced Research Function Integration Districts have been designated based on the above law.

#### 3.3.3.3.4 Multipolar Act (Act on the Promotion of Multipolar Pattern National Land Formation)

The development and establishment of regional promotion bases in accordance with the Multipolar Act is designed to develop and establish far-reaching regional bases for promotion in a comprehensive and strategic manner, by concentrating industrial, cultural, scientific, research, exchange, and other functions characteristic of a region, in order to actively support regional development through regional initiative.

#### 3.3.3.3.5 Private Sector Resources Utilization Law (Temporary Law for Promoting the Strengthening of Specific Facilities by Utilizing Private Sector Business Capabilities)

The Private Sector Resources Utilization Law was designed to promote utilization of the capabilities of private sector corporations, in order to develop facilities that enhance the economic and social infrastructure. Of the facilities covered in this law, those related to research and development are R&D and commercialization infrastructure facilities (research cores); industry and academia coordination facilities (research on campus); telecommunications research and development promotion facilities (Telecom Research Parks); agriculture, forestry, and fisheries R&D and commercialization infrastructure facilities; and coastal region revitalization facilities.

#### 3.3.3.3.6 Regional Industrial Concentrations Reinvigoration Law (Law on Temporary Measures for Activation of Specific Regional Industrial Agglomerations)

The industrial concentration of manufacturing industries making parts, molds, prototypes and other products (industrial concentration of infrastructural technologies) has long supported the key industries of Japan, while the concentration of small and medium-scale firms (specified small and medium-scale enterprise concentration) has

served as the basis for the growth of regional economies for producing regions, one-company towns, etc. However, in view of the increasingly severe hollowing out of these concentrations, the Regional Industrial Concentrations Reinvigoration Law aims to invigorate industrial concentrations of infrastructural technologies and specified small and medium-scale enterprise concentrations for the self-supported growth of regional industry. These aims are to be achieved by establishing R&D and experimental facilities, research equipment, etc., for the reinvigoration of industrial concentrations through advancing technologies and opening up new business fields. Also the development of new products implemented by corporations, etc., is promoted, along with the encouragement of new markets and the development of human resources.

### 3.3.3.4 Consolidation of R&D Bases

The current national comprehensive development plan, known as the “National Grand Design for the 21st Century,” places priority on networking and R&D investments directed at organizations representing industry, academia, and the government. The plan promotes the development of the Tsukuba Science City and the Kansai Science City, and sets forth the development of new research and development bases of an international standard that will serve as the nucleus for the establishment of far-reaching international exchange parks.

#### 3.3.3.4.1 Tsukuba Science City

Tsukuba Science City was created as a base to provide research and education of a high standard, and to contribute to the balanced development of the entire Tokyo metropolitan area. It was constructed also as part of a national government policy, in order to promote science and technology and enrich higher education.

Thirty-three national experimental research and education institutions are located in the city, and many private-sector research institutions are also moving in.

Various measures are currently being promoted to develop urban environments, to encourage science and technology, and to form bases for the creation of new industries both in Japan and abroad.

#### 3.3.3.4.2 Kansai Science City

The Kansai Science City is a part of Kyoto, Osaka, and Nara prefectures, and seeks to establish a base for new advancements in culture, science, and research of a creative and international nature that will extend across the 21st century.

The city is experiencing steady development in construction in accordance with the Kansai Science City Construction Promotion Law enacted in June 1987. At the end of FY2003, a total of 76 facilities, including private sector research facilities, were established and operating within the city.

## 3.3.4 Development and Retention of Excellent Researchers and Engineers

### 3.3.4.1 Development of Researchers and Engineers; Reform of Universities

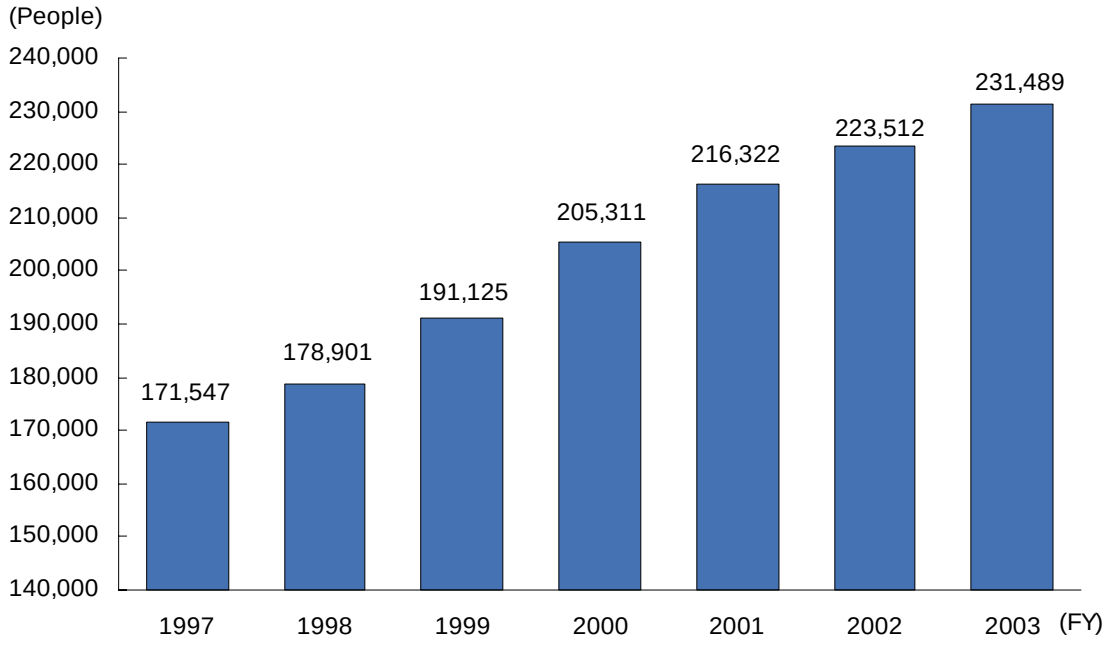
The development of excellent researchers and engineers is an extremely important issue within the reform of the science and technology system. Universities, which play the core role in that development, should step up the cultivation of researchers and engineers who possess abundant creativity and originality, who have broad perspectives, and who have acquired practical abilities. It is expected that universities will make various efforts to improve the quality of their education and research.

#### 3.3.4.1.1 Development of Human Resources at Universities

##### 3.3.4.1.1.1 Development of Hman Resources with Emphasis on Gr-aduate Schools

Graduate schools promote learning that centers on theoretical research, and also play a role in developing researchers and other personnel with advanced expert skills. In Japan, about 80% of the 698 national, public and private universities in Japan have graduate schools attached, for a total of 531 schools (as of May 2003), and the total number of graduate school students at all national, public and private universities has been steadily increasing, to about 231,489 students as of May 2003 (Figure 3-3-21).

**Figure 3-3-21 Trend in the number of graduate students**




Note: The numbers are as of May 1 of each fiscal year.

Source: Survey by MEXT.

With the rapid technological innovations and changes in industrial structure seen in recent years, there is more demand than ever to promote creative and advanced education and research with a focus on the advanced science and technology sectors. So it is important to develop human resources, with special emphasis on graduate schools. The national universities play a major role for science and engineering-oriented graduate schools, and in FY2003, a total of four postgraduate courses were established at four universities, while 40 majors were newly introduced at 12 universities.

Additionally, in order to heighten Japan's R&D capabilities, it is also important to conduct off-campus graduate level education by utilizing the facilities, equipment, and human resources of private research institutions that have high research standards. Because of this, graduate students may receive research guidance from research institutions other than their own if their graduate school deems it educationally beneficial (Standards for Establishment of Graduate Schools, Article 13). The number of collaborative graduate schools that conduct research guidance of graduate students through coordination between graduate schools and private research institutions reached 92 universities (national, public and private) with 175 research courses in FY2003, and the number continues to increase year by year. Furthermore, with a view toward enhancing ties with society, 81 chairs have been established through donations from the private sector in 38 courses at 22 national universities as of January 2004. Moreover, a system of professional schools that specialize in providing practical educations that cultivate high level professionals was established in April 2003. As of FY2003, 10 majors have been established at eight universities.

### 3.3.4.1.1.2 Development of Science and Engineering-Related Human Resources

In order to resolve the diverse problems confronting modern society, and in order to open the path toward a prosperous future society, Japan must create new science and technology. In addition, Japan is expected to exhibit still more leadership and creativity, and to contribute further to international society, toward the goal of becoming a nation of creative science and technology. To support such efforts, it is extremely important for Japan to develop richly creative human resources in the science and engineering fields.

Additionally, it is necessary to strive for the growth of the manufacturing industry, which serves as a vital lifeline for Japan, and thus to promote the fostering of practically-oriented personnel in order to support fundamental technologies for manufacturing.

For these reasons, the Ministry of Education, Culture, Sports, Science, and Technology promoted measures in FY2003 that include the: (1) reorganization and reform of undergraduate courses of study, and establishment of new graduate school research courses and majors; (2) upgrading and modernization of experiment and training equipment in science and engineering departments; (3) promotion of internships at manufacturing sites, etc.; (4) promotion of practical education at engineering-related departments centered on manufacturing; and (5) improvement of venture business laboratories that develop educational programs to stimulate the creativity of students and educational programs through industry-academia cooperation for the purpose of developing people with a rich entrepreneurial spirit.

### 3.3.4.1.1.3 Promotion of General Education

With the continuing progress and complexity of our society, it is critical for universities to provide general education. This is because university students of any major subject must be encouraged to respond independently to changes, look for their own future challenges, and develop the capabilities to take on challenges and make flexible and comprehensive judgments from wider perspectives. For this reason, the Ministry of Education, Culture, Sports, Science and Technology in FY2003 is supporting the active promotion of general education

by universities through the implementation of necessary measures such as budgetary arrangements and information sharing, with the aim of expanding such education at universities. Universities are actively promoting general education courses by establishing courses of study with interdisciplinary and comprehensive content, as well as establishing classroom study incorporating internships and volunteer activities.

### 3.3.4.1.1.4 Support for Graduate Students

To develop an environment in which exceptional graduate students can confidently proceed with their education, the Ministry of Education, Culture, Sports, Science and Technology works to support students in a number of ways, including the expansion of research scholarships provided by the "Research Fellowships for Young Scientists Program" of the Japan Society for the Promotion of Science (JSPS). Another is the expansion of teaching assistant (TA) programs for graduate students who excel. By having the TAs run educational assistance programs out of the educational concern of the Ministry, TA programs provide training opportunities to graduate students who will become future teachers and researchers and help assure undergraduate students receive individual and careful attention from their teachers. The Ministry also works to expand the scholarship program of the Japan Scholarship Foundation (starting in FY2004, the Japan Student Services Organization), which loans scholarships to exceptional students who need financial assistance with their studies in order to nurture personnel with the will and abilities to lead the next generation (Figure 3-3-22).

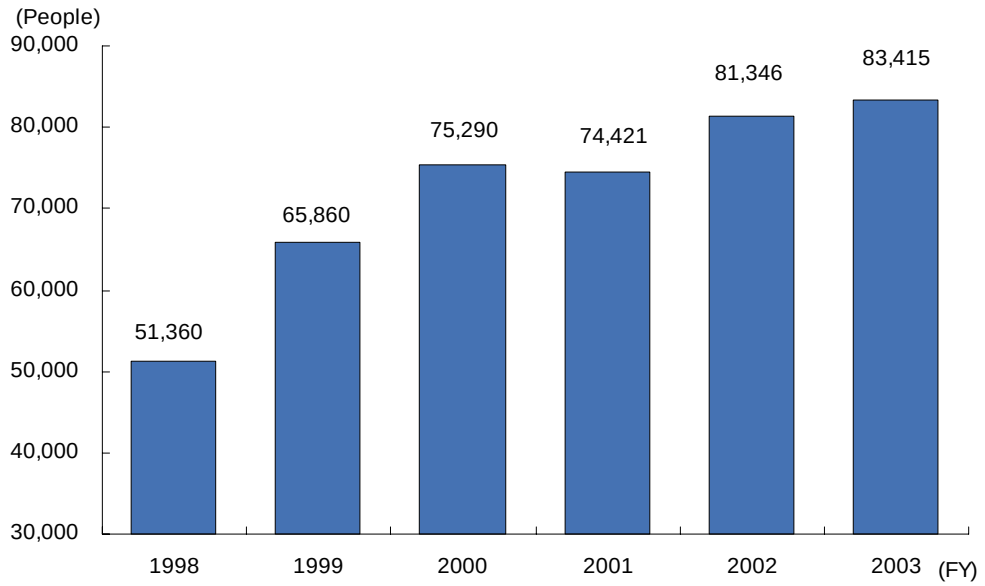



**Figure 3-3-22 Trend in the total number of people (graduate students) receiving scholarships from the Japan Scholarship Foundation**

Notes: 1. Figures include the number of scholarships budgeted each fiscal year.
2. From FY2004, the scholarship program is implemented by the Japan Student Services Organization.
Source: Survey by MEXT

In addition, research assistants are also promoted. Students with advanced standing in doctoral programs at graduate schools are made to participate in high-profile research projects undertaken by national universities, inter-university research institutes, and private universities. This develops the students' abilities in carrying out research and also enhances the research system.

Moreover, to promote the research of scientists who have obtained competitive funding, the competitive funding system is being revised so as to allow the employment of doctoral students as a research expense. It is expected that the young researchers will develop into full-fledged researchers through participation in this research. By making it widely known that in the future competitive funding can be used for employment, and by expanding competitive funding, it is expected that employment will increase even more, contributing to the training of young researchers.

### 3.3.4.1.1.5 Assistance for Foreign Students

The number of foreign students enrolled in Japanese institutions of higher education reached about 110,000, including about 29,000 graduate students, as of May 1st, 2003 (Figure 3-3-23).

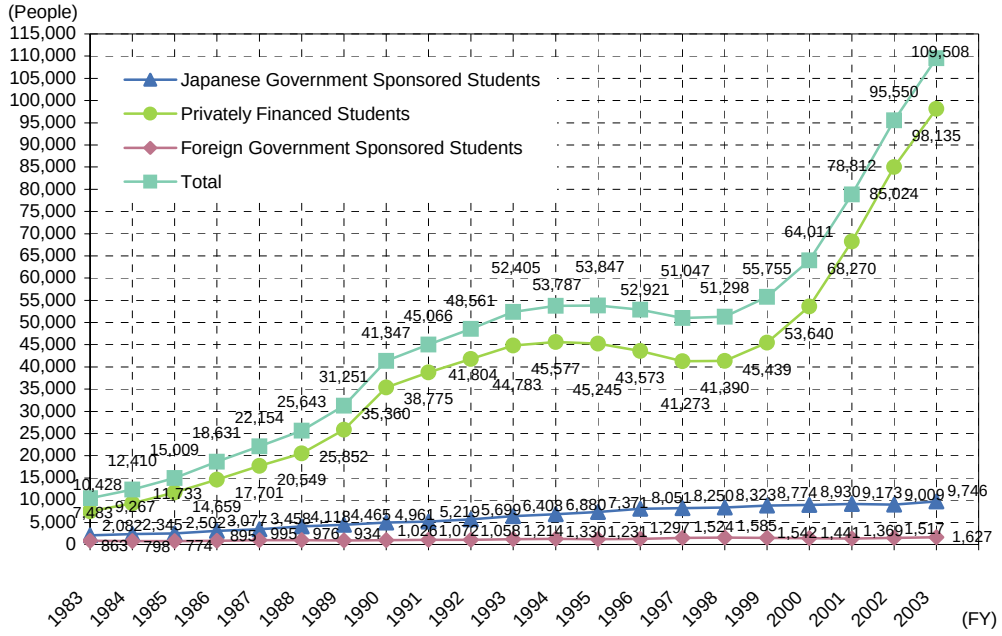



**Figure 3-3-23 Trend in the number of foreign students in Japan (As of May 1 for each year)**

Note: Foreign government sponsored students are from Malaysia, Indonesia, Thailand, Singapore, the United Arab Emirates, Kuwait, Uzbekistan, Laos, Vietnam, Cambodia, Mongolia, Myanmar, China, Bangladesh, and the Republic of Korea.

Built upon the 1983 “Declaration Concerning Foreign Students Policy towards the 21st Century,” the Ministry of Education, Culture, Sports, Science and Technology seeks to accept 100,000 foreign students in the beginning of the 21st century. Based on the “Plan to Accept 100,000 Foreign Students,” the Ministry of Education, Culture, Sports, Science and Technology has been working on expanding the acceptance of foreign students and implementing comprehensive policies concerning foreign students.

These efforts resulted in good prospects of achieving the “Plan to Accept 100,000 Foreign Students” during 2003. As a result, the Foreign Student Section (Chairman: Tsutomu Kimura, President, National Institution for Academic Degrees and University Evaluation) was newly established in November 2002 under the auspices of the Subdivision on Universities of the Central Council for Education. The Foreign Student Section carefully considered new exchange student policies and prepared a report in December 2003 in the name of the Central Council for Education.

The report indicated the importance of the following points as basic directions for new exchange student policies: (1) promotion of study abroad by Japanese students, shifting the emphasis from acceptance of foreign students to mutual exchange; (2) enhancing the system for accepting foreign students and ensuring quality; and (3) strengthening the support system through the establishment of the Japan Student Services Organization.

Specific policy recommendations included: (1) establishment of a long-term study abroad system for Japanese students that would enable them to obtain degrees at foreign universities and establishment of a student loan system; and (2) enhancement of bases for strengthening the provision of information and consultation functions overseas. The report also called for each university to (a) draw up clear guidelines for accepting foreign students and sending Japanese students abroad; and (b) be thorough in managing the school register of foreign students.

### 3.3.4.1.2 Development of Human Resources at Colleges of Technology

Colleges of technology were established as institutions for higher learning that implement five-year programs designed to develop human resources with practical skills. The education results produced by these colleges of technology have been highly praised by industry and other corners. To fulfill the critical role of these educational institutions designed to develop practically skilled personnel with a rich capacity for creativity, the Ministry of Education, Culture, Sports, Science and Technology is striving to: (1) upgrade education and research activities, such as improving curriculums and educational techniques, etc., as well as promoting coordination with industry and increasing expenditures directed at advanced manufacturing activities, such as the manufacturing of robots, (2) establish new majors in order to respond to advancements in science and technology, and (3) promote the reorganization of courses of study in order to appropriately respond to societal demands, and to develop and expand upon these courses of study in FY2003.

### 3.3.4.1.3 Development of Human Resources at Specialized Training Colleges

In order to develop human resources who will become the assets demanded by society, the Ministry of Education, Culture, Sports, Science, and Technology is implementing measures to upgrade the educational content at specialized training colleges. These measures include developing new educational methods—such as e-learning and distance education between schools—that respond to issues that must be coped with urgently; the development of programs in cooperation with industry and academia; and the provision of financial assistance for the development of large-size education equipment and information processing-related facilities.

### 3.3.4.1.4 Development of Human Resources at High Schools

Along with newly designating "Super Science High Schools," where curriculums that emphasize science and mathematics are being studied and developed, efforts for the planned development and expansion of science education equipment, such as experimental equipment in schools, are now in progress. Moreover, efforts are being taken to expand facilities and equipment for experimentation and practice, to promote industrial education that responds appropriately to changes in society.

## 3.3.4.2 Fostering Engineers

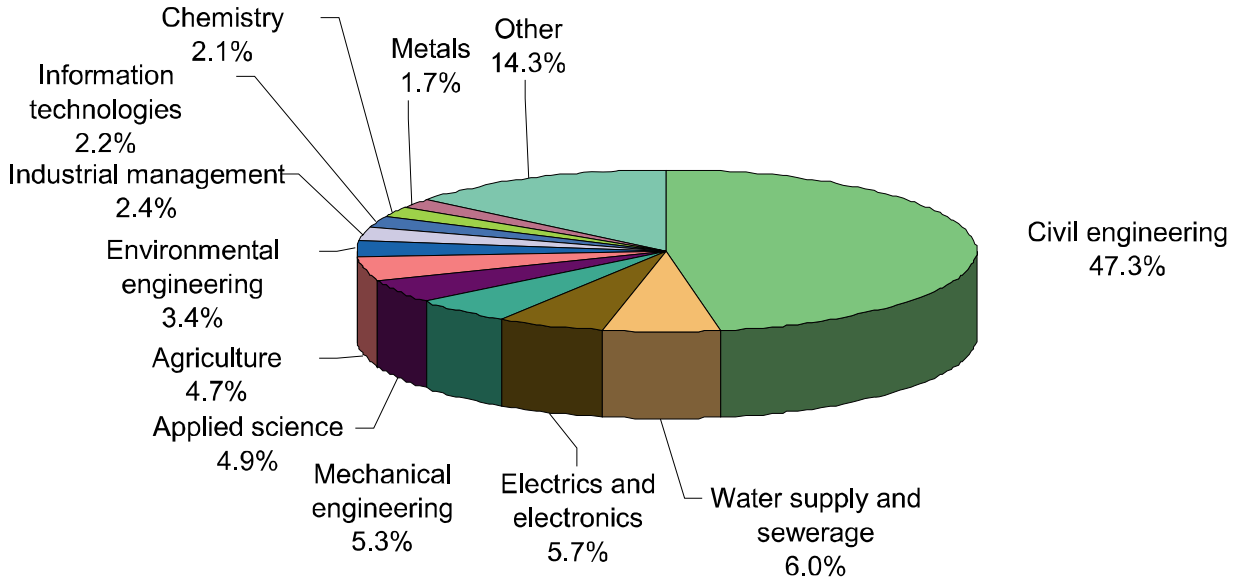
To become a science and technology-based country, it is necessary to create industrial frontiers and strengthen international competitive power through technological innovation, as well as to strengthen the technological foundation. For this purpose, efforts are being made to foster sufficient leading engineers through the following policies.

### 3.3.4.2.1 Professional Engineer System

The Professional Engineer System was established with the enactment of the Professional Engineer Law in 1957 (revised in 1983). It aims to contribute to the improvement of science and technology and the development of the national economy through sound engineering, by conferring the qualification of "Professional Engineer" on those who posses advanced and specialized abilities in applying science and technology to planning and design work.

Those who apply to become a Professional Engineer are required to pass the national examination that is given in 20 fields of specialization, and become registered as a Professional Engineer. The examinations are held annually for both Professional Engineer and Associate Professional Engineer (Engineer in Training). In FY2003, the test resulted in 28,808 individuals being certified as Associate Professional Engineers, and 1,678 being certified as Professional Engineers. As of the end of December 2003, there were a total of 54,164 people registered as Professional Engineers, and 10,561 registered as Associate Professional Engineers. The distribution by sector is shown in Figure 3-3-24.

**Figure 3-3-24 Distribution of professional engineers by field of specialization (as of the end of December 2003)**




In June 2003, the Council for Science and Technology submitted to the Minister of Education, Culture, Sports, Science and Technology a report, "Review of the Technological Sections of the Professional Engineering Test," which addressed the establishment of a new section on nuclear energy and radiation. The Ministry of Education, Culture, Sports, Science and Technology revised the technological sections and test subjects of the professional engineering test in line with this report. The revised test will be implemented in FY2004.

### 3.3.4.2.2 Mutual Exemption of Engineering Qualification

Based on the Osaka Action Agenda adopted at the APEC summit meeting of 1995, work has been progressing on the "APEC Engineer Mutual Recognition Project" for the promotion of mutual acceptance of engineer qualifications within the APEC region. Japan has actively participated in studies for this project, toward the realization of mutual recognition of the Professional Engineer qualification with corresponding qualifications overseas.

In November 2000, the "APEC Engineer Manual" was published based on the results of studies at APEC. As of June 2003, there were 11 participating economies in the register, including Japan.

In October 2003, Japan and Australia signed a mutual recognition of the Professional Engineer qualification framework, the first example of bilateral mutual recognition under this project.

### 3.3.4.2.3 Supporting Continuing Professional Development

It is indispensable that individual engineers always remain current with the latest outcomes and capabilities of technology through Continuing Professional Development (CPD), and improve the technical capability to strengthen domestic technical infrastructures, and the Ministry of Education,

Culture, Sports, Science, and Technology actively supports this policy. Based on such awareness, the Japan Science and Technology Agency opened the Web Learning Plaza to the public on October 1, 2002. The Web Learning Plaza[15] provides Internet-based self-study educational materials.

15 Address: http://WebLearningPlaza.jst.go.jp

## 3.3.5 Establishing Channels for Communication between Society and Science and Technology Activities

Only when the significance of science and technology and its relation to daily life are well understood by citizens can long term utilization and progress in science and technology can be made. The support of citizens must be essential to the promotion of science and technology. Furthermore, science and technology should fundamentally progress in accordance with the interests of citizens. The individuals engaged in science and technology should always bear in mind this.

Efforts should be made to ensure a deep understanding of science and technology among citizens so that people can judge various societal issues in a scientific, rational, and independent manner.

### 3.3.5.1 Promoting the Study of Science and Technology

In Japan, many observers indicate that the younger generation and many other members of society are growing further alienated from science and technology. In order to improve this situation, it is extremely critical to foster an interest and awareness of science and technology among the younger generation, and to create an environment that fosters science and technology-oriented human resources of a high standard.

#### 3.3.5.1.1 Promotion of Science and Industrial Education at the Elementary and Secondary Education Le-vel

The development of the socio-economy of Japan has been largely supported by science and technology. In light of the major role played by science and industrial education in such efforts, it is necessary to strive to further enhance such education.

Science education at the elementary and secondary education level emphasizes observation and experimentation, topic learning through pro-active investigation of topics, and learning through problem solving. Expanded efforts are also being made to foster in children scientific ways of looking at and thinking about the world around us.

Starting in FY2002, the Ministry of Education, Culture, Sports, Science and Technology has been implementing the “Science Literacy Enhancement Initiative,” which integrates policies related to science and technology education. Specifically, the Ministry, in cooperation with the JST, is implementing efforts such as “Super Science High Schools,” where curriculums that emphasize science and mathematics are being studied and developed, and the “Science Partnership Program,” which provides opportunities to children to come into contact with science and technology, and enriches teacher training by promoting collaboration between universities or research institutions and schools. In addition, the Ministry is proceeding with efforts to develop digital materials for science and technology education that make use of the latest research results, and to develop systems for providing these materials to schools. The Ministry is also moving ahead with efforts on the planned development and expansion of science education equipment, such as experimental equipment at schools. Moreover, decisions have been made for the future promotion of efforts such as the “Science Literacy Enhancement Schools Program,” a model for the promotion of science and technology education, which will endeavor to raise children’s intellectual curiosity and spirit of inquiry through an emphasis on observation and experimentation in elementary and junior high schools.

Students synthesizing a pharmaceutical preparation (“Experiencing the science and technology that supports our lives”) with the Fukuoka University of Education under the “Science Partnership Program”

At the same time, in the area of industrial education, practical, hands-on learning has been further expanded in order to adequately respond to progress in an industrial society. To achieve this objective, training sessions and other meetings are being held in order to train instructors in new industrial tech-

nologies, and efforts are being made for the planned development and expansion of industrial education facilities and equipment at the high school level, in keeping with the new courses of study. In addition, the “Aspire to be a Specialist!” program was newly implemented in FY2003 for schools that conduct education that introduces advanced technologies and skills in order to foster future specialists.

The prefectural and district boards of education are making good use of scientists, engineers, and other individuals who do not have a teacher certificate—but who do have exceptional knowledge and experience—to serve as special part-time teachers in order to support opportunities for children to learn directly from experts in their respective fields.

Additionally, instruction in specialized subjects has been enhanced by making it possible for junior and senior high schools teachers who have greater expertise and skills in teaching specific subjects to provide instruction in science and other subjects at elementary schools.

### 3.3.5.1.2 Technical College Education

With the unprecedented growth of science and technology in recent years, there have been major changes in the makeup of basic scientific knowledge that students need to acquire at the university level. There has also been an increase in the number of issues that require ethical judgments, including global environmental problems and life science fields, such as genetic engineering. For this reason, students specializing in disciplines other than science and technology must also acquire knowledge related to the natural sciences, and must foster an ability to make judgments in a broad range of fields based on this knowledge. Those students who are majoring in any subject within science and technology must acquire a broad range of scientific knowledge and ability to make judgments above and beyond their major of choice.

In light of this situation, it is critical to strive to cultivate in students an ability to make judgments and so forth from a broad perspective, by expanding the realm of general education. With the support of the Ministry of Education, Culture, Sports, Science and Technology, universities are actively engaged in efforts such as the establishment of courses of study with interdisciplinary and integrated content, in addition to courses of study made up of seminars with small groups of students, and classroom study that incorporates internships and volunteer activities.

### 3.3.5.1.3 Increasing the Public’s Understanding of Science and Technology

The Ministry of Education, Culture, Sports, Science, and Technology is implementing measures to promote the increased understanding of science and technology, through the holding of public lectures on science and technology at universities and colleges, and through the development and expansion of the University of the Air that offers courses in science and technology. The Ministry also supports symposiums and science lectures targeted at either young people or adults in the general population to disseminate information about the latest research trends, etc. In addition, classrooms and other facilities at elementary and junior high schools, or at universities and specialized training colleges, are opened up on weekends to hold scientific experiment classes for children. Furthermore, in order to expand upon and effectively utilize the functions of science museums, the Ministry is implementing a variety of pilot programs with coordination and cooperation among museums, schools, and other related institutions, and is also implementing programs to introduce the successful results of these programs on a nationwide level. Additionally, the Ministry is implementing specialized training for curators and other museum specialists employed at natural science museums, etc., in or-der to improve their level.

The National Science Museum conducts education and diffusion of information activities—such as science classes and experimentation courses for young people and children—that serve to deepen understanding of science and technology. The Museum is also moving forward with the improvement

of the new Building exhibits, which introduce exhibits with an explanation system that utilizes the latest information technology.

The Japan Science and Technology Agency (JST) operates the National Museum of Emerging Science and Innovation (MeSci). This museum takes advantage of visual and hands-on participatory exhibits to introduce in an easy to comprehend manner the most advanced and recent science and technology, usually thought of as very difficult to understand. The museum also acts as a general base for the dissemination of information to promote understanding of science and technology, and also as a place where scientists capable of generating creative ideas may interact.

In addition, MeSci works on developing new exhibition techniques that allow patrons to gain more familiarity with the most advanced science and technology and also supports science and technology education activities in cooperation with local schools. MeSci also canvasses widely for ideas that are appealing to young people, to be tested and displayed for use in its exhibitions. Furthermore, MeSci supports the development of educational programs in which young people can experience the fun and appeal of building things and of science and technology through experiments or robot technology study at school and at MeSci.

## 3.3.5.2 Establishing Channels for Communication with Society

In order to promote science and technology, it is necessary to deepen the understanding of science and technology by citizens. For this reason, efforts are being made to implement various events related to science and technology, to open up research institutes to the public, and to enhance the functions of museums, science centers, etc. In addition, efforts are being made to expand the opportunities for disseminating science and technology in an understandable manner, using the media and other means. Furthermore, at the regional level, efforts are being made to foster and secure personnel who will shoulder the task of describing science and technology-related matters in an understandable manner, and conveying to experts involved in science and technology the science and technology-related opinions of regional citizens.

### 3.3.5.2.1 Providing Opportunities for Better Familiarity with Science and Technology

It is critical to provide diverse opportunities for the citizens and youth in particular to deepen their familiarity with science and technology, in order to nurture richly creative and independent science and technology-oriented personnel who possess a passion and vision for science and technology, and create a societal environment that embraces a familiarity and strong interest in science and technology.

#### 3.3.5.2.1.1 Efforts Utilizing Multimedia

The Japan Science and Technology Agency (JST) is engaged in the production of visual programs for presentation on the “Science Channel,” which transmits information to the public about science and technology via CS (Communications Satellite) broadcasting and cable TV. The JST also uses the latest computer technology to provide science and technology information through a “Virtual Science Center” where people can experience science and technology virtually.

#### 3.3.5.2.1.2 Other Events

In FY2003, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) implemented a variety of promotion activities, including broadcast of television and radio programs; production, and distribution of commercials; publications; and the sponsoring of various seminars related to science and technology. During commemorative weeks such as the 44th “Science and Technology Week,” the 40th “Atomic Energy Day,” and the 11th “Space Day,” MEXT implemented various nationwide events in cooperation with affiliated organizations. In addition, MEXT conducted PR activities by government publicity through television and radio programs. Approximately 900 events

were held during the Science and Technology Week in FY2003, including the opening of research facilities to the general public, science and technology experiment classrooms, and public lectures. These events were held at research facilities, science museums and other institutions across the country, with the cooperation of various science and technology-related organizations.

### 3.3.5.2.1.3 Support for Hands-on Activities

In FY2001, the "Children's Dream Fund," established by the National Olympics Memorial Youth Center, commenced providing support for children's science activities and other hands-on activities conducted by private-sector groups.

In addition, the National Science Museum registers "Science Volunteers" who can lend a hand as lecturers or give instruction in experiments at events or exhibitions related to science and technology. That information is then provided over the Internet.

Additionally, the Ministry of Education, Culture, Sports, Science and Technology implements preadmission familiarization programs at universities and colleges of technology, in order to share information with youth and society concerning the enjoyment of science and engineering-related fields.

### 3.3.5.2.1.4 Opening of Universities and Research Institutions to the Public

Increasing numbers of university research institutions and inter-university research institutes are opening their doors to the public by introducing their research activities, holding lectures, and other meetings. For example, the National Astronomical Observatory of Japan holds a "Regular Stargazing Program" using the 50 cm Telescope for the Social Education. These meetings are held twice a month for the general public and youth. In addition, the Institute of Industrial Science (IIS), University of Tokyo offers tours for the general public, and junior and senior high school students in particular, as well as exhibitions of research exchanges between industry and academia. These are just two examples of efforts to create universities and research institutions that are open to the public, through concentrated measures on the part of organizations to open up their facilities to the public, carry out exhibitions, etc.

To get the young people and children who will lead the next generation to experience the enjoyment of space and the wonders of the earth, the Japan Aerospace Exploration Agency (JAXA) holds a variety of hands-on learning events throughout the year, including the "Cosmic College" and the "Space School."

Furthermore, the Ministry of Agriculture, Forestry and Fisheries has established the Tsukuba Agriculture Research Gallery, which provides exhibits on up-to-date results and achievements from agriculture, forestry, and fisheries technologies, with the aim of information dissemination and awareness. In addition to permanent exhibits, specially planned exhibits have been held since FY2003. The Ministry also established the Tama Forest Science Garden at the Forestry and Forest Products Research Institute, which provides exhibits on forestry science.

### 3.3.5.2.1.5 Children's White Paper on Science and Technology

In March 2003, the Ministry of Education, Culture, Sports, Science and Technology issued the Children's Fifth White Paper on Science and Technology, entitled "Nanotechnology is Changing the World." This book is based on the Science and Technology White Paper, an annual report on the promotion of science and technology, and is targeted at children and students, with the aim of serving as a trigger for creating interest in science and technology. The book was distributed to elementary schools across the country, prefectural and district boards of education, prefectural and district libraries, science centers, general museums and other institutions.

### 3.3.5.2.2 Creating a Societal Consensus

In November 2003, the Ministry of Agriculture, Forestry and Fisheries held a public conference with universities and graduate students in scientific fields serving as panelists. Discussions covered the potential of genetic engineering technology and challenges to its realization. The conference produced a report entitled "Challenges and Proposals."

### 3.3.5.2.3 Awards for Science and Technology

In addition to promotion and awareness activities, an effective measure for promoting science and technology is to encourage research and development through recognition for inventions and awards for outstanding service in science and technology.

For this reason, the Ministry implements a number of awards, including awards for people with scientific and technological merits (18 recipients in FY2003), awards for people with scientific and technological research merits (39 recipients), awards for people with distinguished service in the promotion of science and technology (31 recipients), awards for people with distinguished service in enlightening people on science and technology (6 recipients), awards for people who have proposed technical ideas in relation to their job (988 recipients), and awards for schools for services in creative education (33 recipients).

In order to address the decreasing interest in industrial technology and the distant trend away from science and technology in the younger generation, since FY1993, the Ministry of Economy, Trade and Industry has been carrying out fact-finding surveys on innovations in industrial technology and other programs, by evaluating and preserving industrial technologies, in order to ensure that these technologies are passed on to the very youth who will be responsible for the future. As a part of this effort, the Ministry supported the "Industrial Technology History Exhibition: Technofesta 21" project, held in August 1997 as a joint effort among industry, academia, and the government. Furthermore, since 1993, the Ministry has implemented a "Dream Chemistry 21" campaign that consists of university chemistry experiments and other activities, with the aim of passing on chemistry technology to the younger generation who will lead in the 21st century.

### 3.3.5.3 Establishing an Ethical Code of Conduct for Researchers and Engineers

The Policy Subcommittee of the Council for Science and Technology (CST) sponsored a "Meeting to Consider Society and Science & Technology in the 21st Century" attended by individuals employed in a broad range of fields. The results of this event were summarized in a report completed in November 2000, which focuses on a "Code of Conduct and Responsibility to Society for Persons involved in Science and Technology," and sets forth that "As group-oriented societal activities, science and technology are a part of society, and must be questioned in terms of their positioning within society and their societal value, not only based on the public support they receive in the form of budgets allocated from the national government and society, but also based on their effect and potential for all aspects of people's daily lives." The report further points out the "need to establish a societal system that readily allows for science engineers to carry out a code of conduct and to carry out their responsibilities," and that the extremely critical issues are ethics education and the strict implementation of safety countermeasures by engineers."

## 3.3.6 Developing a Foundation for Promoting Science and Technology

### 3.3.6.1 Strategic and Prioritized Improvement of Facilities and Equipment

#### 3.3.6.1.1 Improvement of Facilities and Equipment of Universities, etc.

The facilities of national universities, etc., are centers of activity for creative and cutting edge academic research, and for the development of richly creative human resources, and constitute an essential foundation for Japan's aims to become a creative science and technology nation.

The Science and Technology Basic Plan posits the improvement of obsolescent and increasingly cramped facilities at universities and colleges as the most important issue in the development of foundations for the promotion of science and technology. In response, the Ministry of Education, Culture, Sports, Science, and Technology in April 2001 drew up the "Five-Year Program for Emergent Renovation and Building of Facilities of National Universities, etc." (Figure 3-3-25), under which it is implementing the prioritized and systematic improvement of facilities at national universities, etc. and carrying out system reforms aimed at the efficient and flexible utilization of facilities.

In addition, the issue of the improvement and management of facilities in relevance to the incorporation of national universities in April 2004 was studied by a group of experts, who compiled their findings in July 2003 in the "Knowledge Bases: The Enhancement of Facilities of National Universities" report (Figure 3-3-26).

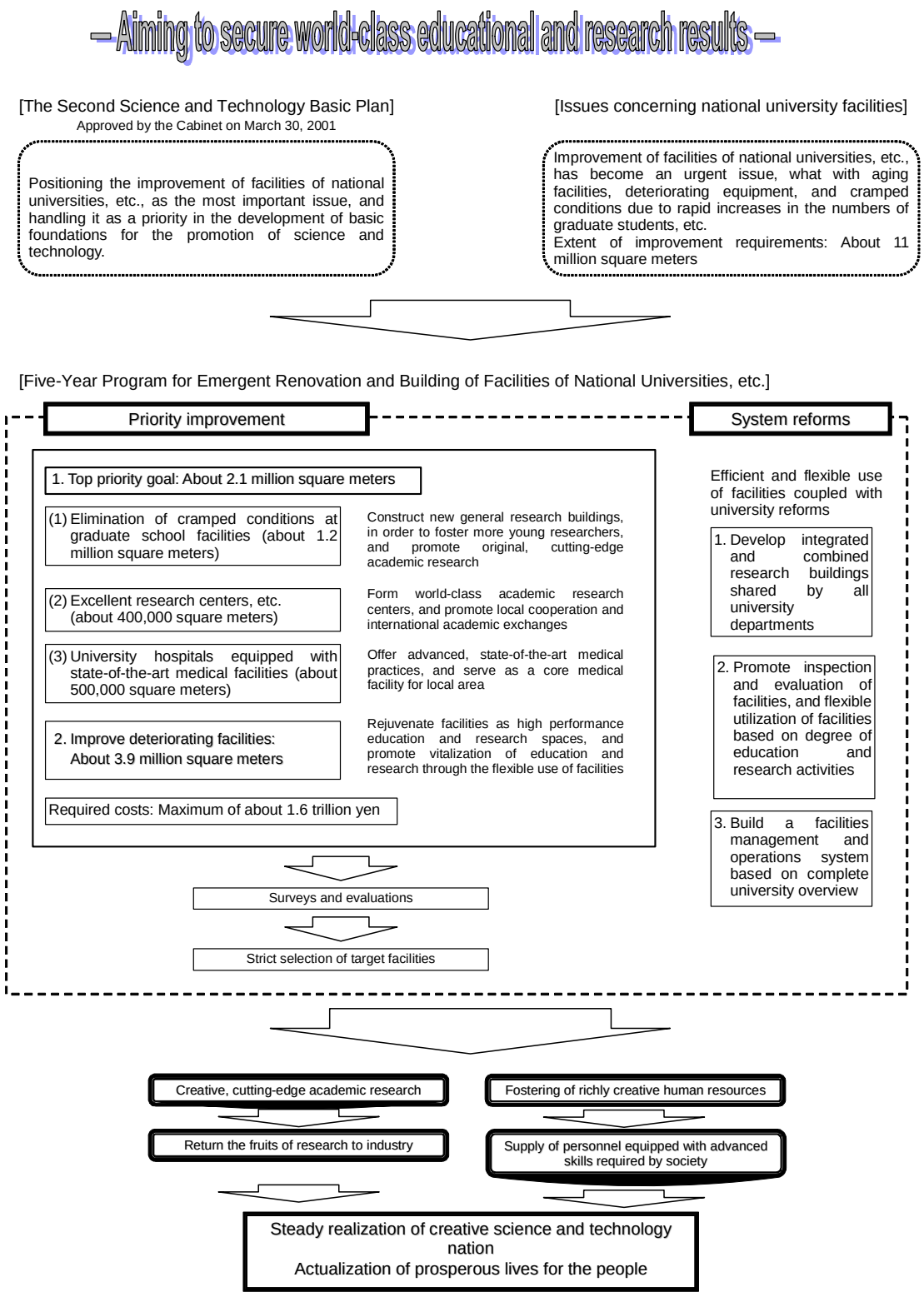



**Figure 3-3-25 Five-Year Program for the Emergent Renovation and Building of Facilities of National Universities, etc.**

– Policies for the Improvement and Management of Facilities
at National University Corporations –

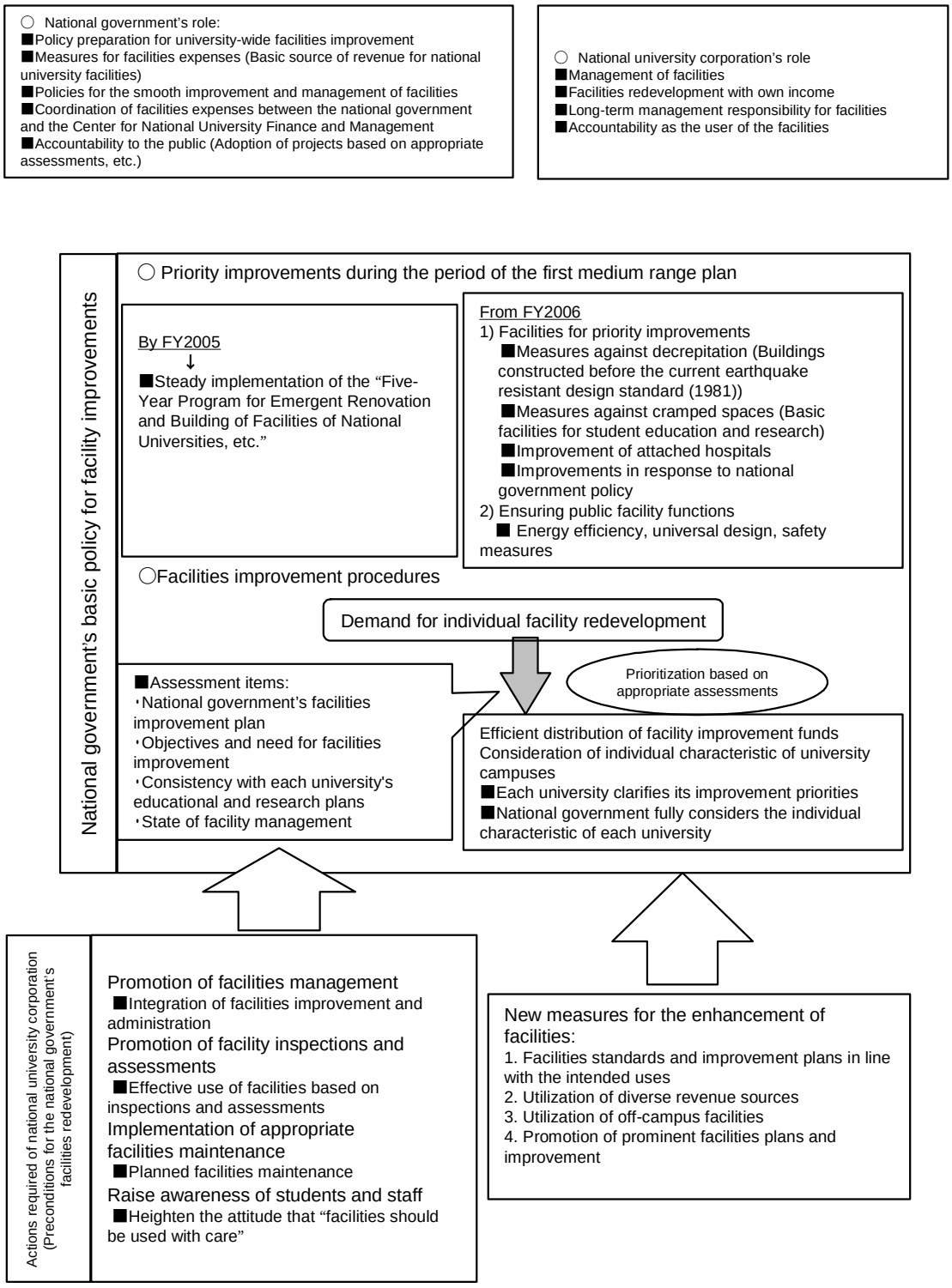



**Figure 3-3-26 Knowledge Bases: The Enhancement of Facilities of National Universities**

For research facilities of national universities, etc., the Ministry is working on efforts such as the expansion of cutting edge research facilities that are necessary for the implementation of research that spurs development and growth in new fields of research.

In support of the development of research facilities and equipment at private universities, the Ministry subsidizes expenditures necessary for large-scale education and research tools, educational equipment, on-campus LAN systems, and IT environments with computers and other equipment in order to promote the advancement of academic research and information processing education.

In particular, the Ministry is promoting assistance for unique education and research projects, such as the "Program for Promoting Advancement of Academic Research at Private Universities," which offers comprehensive support with research facilities, equipment, and funds for top-level research projects undertaken at private universities.

### 3.3.6.1.2 Development of Facilities and Equipment at National Experimental Research Institutions

As facilities and equipment which form the infrastructure for research activities are upgraded and expanded, the development of these facilities and equipment has not only become necessary for the promotion of efficient research, but also has had major effects on affecting the actual results of R&D. The national government is working to maintain and enhance research and development facilities at national experimental research institutions, etc., and focusing on priority research topics. In FY1999, the national government issued a supplementary budget to provide funds necessary for the development of research facilities at national experimental research institutions, etc., which are too old or require upgrading.

As for the upgrade of the facilities and equipment, the Ministry of Education, Culture, Sports, Science and Technology has been promoting a plan to upgrade the world's highest-performance large-scale synchrotron radiation facility, SPring-8, as one of its measures. As of FY2003, 47 beamlines, or approximately 3/4 of the maximum potential of 62 beamlines, are operational or under construction.

Similar plans on large-scale synchrotron radiation facilities have been pursued in Europe and the United States. Europe started the public use of the facility in 1994, and the U.S. started in 1996 respectively, as shown in Table 3-3-27.

| Project | Site | Energy | Open for use |
|---|---|---|---|
| ESRF (Europe) | Grenoble (France) | 6GeV | 1994 |
| APS (the U.S.) | Argonne National Laboratory (Illinois) | 7Gev | 1996 |
| SPring-8 (Japan) | Harima Science Garden City (Hyogo) | 8Gev | 1997 |

**Table 3-3-27 Large-scale synchrotron radiation facilities in the world**

Note: ESRF: European Synchrotron Radiation Facility
(operated jointly by 17 European countries including France, U.K., Germany, Italy and Spain).
APS: Advanced Photon Source.

Additionally, the Ministry of Education, Culture, Sports, Science and Technology is promoting efforts such as the development of the “E-Defense” 3-D Full Scale Earthquake Testing Facility, which aims to dramatically reduce earthquake damage through improvement of earthquake-resistant structures.

## 3.3.6.2 Expansion of Research Assistants

Expansion of the research assistant system, which allows researchers to concentrate solely on research and development activities, is an essential element for the invigoration of research and development activity. The trend in the number of supporting staff per researcher since the adoption of the First Science and Technology Basic Plan is shown in Table 3-3-28.

**Table 3-3-28 Trend in the number of supporting staff per researcher**

| Fiscal Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| Incorporated administrative agencies and others | 0.77 | 0.79 | 0.84 | 0.84 | 0.82 | 0.96 | 0.98 |
| National universities | 0.24 | 0.24 | 0.24 | 0.25 | 0.25 | 0.26 | 0.26 |

Notes: 1. Supporting staff includes assistant research workers, technicians, clerical and other supporting personnel. The values are as of April 1 up until FY2001, and as of March 31 from FY2002.
2. Incorporated administrative agencies include public corporations that the main purpose at the R&D activities and national experimental research institutions. (However, until FY2001, the numbers indicate only national experimental research institutions.)
3. The numbers for researchers at national universities and, until FY2001, independent administrative agencies are for regular researchers.
4. Includes natural science departments only.

Source: Ministry of Internal Affairs and Communications Statistics Bureau. "Report on the Survey of Research and Development"

For this reason, the Japan Science and Technology Agency (JST) has implemented the Cooperative System for Supporting Priority Research at national experimental research institutions and incorporated administrative agencies that conduct experimental research. This program supports the research system by dispatching research partners in order to contribute to the upgrading and streamlining of the creative and fundamental research being emphasized at these research institutions.

It is recognized at national universities and inter-university research institutes that, in order to create high-quality intellectual assets as well as to promote new research and development activities, it is indispensable not only to foster and secure creative researchers who support cutting-edge research, but

also to strengthen research assistance systems. Based on this recognition, two programs have been implemented for research projects and other activities carried out at national universities and inter-university research institutes: (1) a research assistant (RA) program that is designed to employ graduate-school students engaged in the latter part of the study as research assistants in order to develop their research skills and thereby to enhance the overall research system; and (2) a research assistant promotion program that is designed to secure outside personnel with special skills, etc., for effective implementation of research projects and other activities.

### 3.3.6.3 Enhancement of the Intellectual Infrastructure

In order to reliably and effectively promote research, development and other related activities, it is necessary to undertake efforts such as ensuring the stable provision in quality and quantity, as well as ensuring the safety and reliability, of materials, standards, techniques, equipment, and other elements, that support fundamental activities for research and development, including experimentation, measurement, analysis, and evaluation. For this reason, it is necessary to promote organized development of an intellectual infrastructure that includes bioresources and other research materials, various measurement standards, advanced tools for measurement, analysis, and experimentation and evaluation, and various data-bases. Also, the Science and Technology Basic Plan calls for improvements toward the attainment of the world's highest standards by 2010. In response, the Council for Science and Technology, an advisory group to the Minister of Education, Culture, Sports, Science, and Technology, obtained the cooperation of the relevant ministries and agencies to adopt the "Intellectual Infrastructure Development Program," which lays out specific measures for the development of intellectual infrastructure by 2010. The proposed program was presented to the Minister in August 2001. The state of progress of the intellectual infrastructure development has been followed up annually since FY2002.

#### 3.3.6.3.1 Ministry of Internal Affairs and Communications

In the area of measurement standards, the Ministry of Internal Affairs and Communications has established national standards for frequency, and is developing facilities for standard time transmission, as well as working to ensure that transmissions are provided in a stable and consistent manner. The Ministry is also conducting research to improve the accuracy of the standards for frequency and time.

#### 3.3.6.3.2 Ministry of Education, Culture, Sports, Science and Technology

In FY2002 the Ministry began the National Bioresource Project with the aim of developing systems to systematically collect, preserve, and provide bioresources deemed strategically important for the nation to maintain, including experimental plants and animals such as mice, various stem cell lines, and genetic resources, including the genetic material of various organisms.

In addition, the Japan Science and Technology Agency's Institute for Bioinformatics Research and Development (BIRD) upgrades, standardizes, and expands databases that are indispensable to the development of bioinformatics.

The Ministry also conducted a study of the development of advanced measurement and analysis technology and equipment in FY2003, in order to promote the development of the world's first "only one / number one" technology and equipment that can meet the needs of the world's most advanced researchers. The Ministry then took measures to launch a project for the development of advanced measurement and analysis technology and equipment in FY2004.

#### 3.3.6.3.3 Ministry of Health, Labour and Welfare

The Ministry of Health, Labour and Welfare has established "master banks" at the Nation Institute of

Health Sciences (NIHS) and the National Institute of Infectious Diseases (NIID), which are set up to collect and store cultured cells and genes from humans and animals that are necessary for research in the life sciences, particularly in the fields of medicine and pharmacology. The Ministry furnishes these cultured cells and genes to researchers and other experts through the Japan Health Sciences Foundation (JHSF).

At present, plans for merging these master banks into one have been put in place, with the construction of a pharmaceuticals basic technology research facility to serve as a key institution, complete with a research resources supply department, for basic technology related to the development of pharmaceuticals, etc.

Also, in line with the conclusions reached in "On the State of Research and Development Using Human Tissue Obtained During Operations, etc.," a report on human tissue issued by the Health Science Council's Advanced Medical Technology Evaluation Division on December 16, 1998, the Japan Health Sciences Foundation obtained the cooperation of medical institutions to collect human tissue for research use, doing so in careful consideration of bioethical issues, and commenced activities to dispense the tissue as necessary to researchers.

Elsewhere, on the issue of plants having medicinal value, as it has become difficult to secure good quality ones, the National Institute of Health Sciences' Pharmaceutical Plant Breeding Station is engaged in research into technologies for the propagation (micro-propagation) of cloned plants having the same characteristics as the plants they are cloned from, and also systematically collects, preserves, and supplies medicinal plant resources. Moreover, at the Tsukuba Primate Center, the Ministry has bred kanikui-zaru monkeys, and furnished them for research use to researchers in Japan using joint facilities.

### 3.3.6.3.4 Ministry of Agriculture, Forestry and Fisheries

The Ministry of Agriculture, Forestry and Fisheries implements the MAFF Genebank project, in which genetic resources from plants, animals, microorganisms, forest trees, aquatic organisms, etc., are collected, classified and identified, then subjected to characteristic evaluation, multiplication, and preservation. This program also provides national experimental research institutions, the private sector, universities, etc., with genetic resources and genetic resource information. In addition, the Ministry implements the DNA Bank project, which collects, accumulates, and distributes both DNA and DNA information resulting from genome research and other genetic-level research.

The Ministry also established in April 2003 the Rice Genome Resource Center (RGRC) under the auspices of the National Institute of Agrobiological Sciences (NIAS). By collectively managing genome research data and resources, RGRC provides improved convenience and a smooth system of delivering information to the private sector and universities. Through the management and analysis of the information contained in the collectively managed resources, RGRC also provides highly precise associated resources and data.

### 3.3.6.3.5 Ministry of Economy, Trade and Industry

At the Ministry of Economy, Trade and Industry, the Special Committee on the Development of Intellectual Infrastructure, a joint body composed of the Industrial Structure Council Subdivision on Industrial Technology and the Japanese Industrial Standards Committee (JISC), annually revises the objectives for the development of intellectual infrastructure.

The National Metrology Institute of Japan (NMIJ), which is part of the National Institute of Advanced Industrial Science and Technology (AIST), improves and expands national measurement standards, and also makes efforts toward international mutual recognition. In addition, the New Energy and Industrial Technology Development Organization (NEDO) conducts R&D on remote calibration as part of a plan for the period from

FY2001 to FY2005.

To contribute to the infrastructure for biological and genetic resources and related information, the Department of Biotechnology of the National Institute of Technology and Evaluation (NITE) conducts DNA analysis of microorganisms. In FY2003, the department concluded an analysis of *staphylococcus haemolyticus*, and released the data to the public. In FY2003, the NITE Biological Resource Center (NBRC) added approximately 12,000 microbial strains and DNA clones to its collection—now totaling approximately 40,000 items—that it maintains and furnishes to the public.

In addition, the NITE Biotechnology Development Center (NBDC) was opened in the beginning of FY2003. With a mission to investigate gene expression, the center made efforts to add value to biological and genetic resources and information. The National Institute of Advanced Industrial Science and Technology (AIST) is engaged in protein analysis based on the genome information of microorganisms. Its International Patent Organism Depositary (IPOD) accepts and furnishes the deposits of patent-related microorganisms and plant and animal cells.

In terms of data infrastructure for chemical substances risk management, the Ministry collects and coordinates data of hazardous chemical substances. The Ministry also develops simplified testing methods to evaluate the safety of these substances, as well as screening test methods for endocrine disruptors.

For the development of infrastructure for quality life and welfare, the Ministry supports the development of products designed in consideration of human characteristics, through the improvement of 3D data maintenance and the development of methods for evaluating the function and performance of welfare equipment.

Moreover, the Ministry is involved in developing an improved materials database. Concerning geological information, the Ministry also promoted geological surveys that produced 13 new kinds of geological sheet maps in FY2003.

### 3.3.6.3.6 Ministry of Land, Infrastructure and Transport

The Ministry of Land, Infrastructure and Transport deals with a variety of information related to the Geographic Information System (GIS); it prepares GIS framework information, such as digital maps, and develops distribution environments such as provision of data over the Internet, and the expansion of clearinghouses.

### 3.3.6.3.7 Ministry of the Environment

The Ministry of the Environment is engaged in the indexing of environmental pollutants, and in the collection, preservation, and furnishing of microorganisms with environmental cleaning properties, and of novel genetically modified or recombinant microorganisms.

The status for the development of facilities to preserve and provide intellectual infrastructure by government ministries is shown in Table 3-3-29.

## Table 3-3-29 The state of development of intellectual infrastructure

| Ministry or agency | Fiscal year established | Name of facility | Type of data provided or preserved |
|---|---|---|---|
| Ministry of Internal Affairs and Communications | 1940 | Incorporated administrative agency: Communications Research Laboratory | National frequency standards, and standard time |
| Ministry of Education, Culture, Sports, Science and Technology | 1980 | Incorporated administrative agency: RIKEN (The Institute of Physical and Chemical Research) | Preservation of microorganism strains |
| | 1997 | Center for Genetic Resource Information, at the National Institute of Genetics | Genetic resource database |
| | 1997 | Genetic Strains Research Center, at the National Institute of Genetics | Mice, rice plants, and Escherichia coli |
| | 1997 | Cell Resource Center for Biomedical Research, at the Institute of Development, Aging and Cancer, Tohoku University | Cells for medical use |
| | 1997 | Barley and Wild Plant Resource Center, at the Research Institute for Bioresources, Okayama University | Barley and wild plants |
| | 1997 | Institute of Genetic Resources, at the Faculty of Agriculture, Kyushu University | Silkworms |
| | 1998 | Institute of Resource Development and Analysis, at Kumamoto University | Genetically engineered animals |
| | 1999 | Drosophila Genetic Resource Center, at Kyoto Institute of Technology. | Drosophila |
| | 2000 | Incorporated administrative agency: RIKEN (The Institute of Physical and Chemical Research) | Cultured cell lines and genes of higher animals and plants |
| | 2001 | Laboratory Animal Resource Center, at the University of Tsukuba | Genetically engineered animals |
| | 2002 | Institutes participating in the national bioresource project (Incorporated administrative agency: RIKEN (The Institute of Physical and Chemical | Mice, arabidopsis thaliana, ES cells, etc. |
| Ministry of Health, Labour and Welfare | 1922 | Mediclnal Plant Research Stations, at National Institute of Health Sciences | Seed and cultured cells, etc., of pharmaceutical plants |
| | 1978 | Tsukuba Primate Center, at National Institute of Infectious Diseases | Primates |
| | 1984 | National Institute of Infectious Diseases | Genes (bank) |
| | 1984 | National Institute of Health Sciences | Cells (bank) |
| Ministry of Agriculture, Forestry and Fisheries | 1985 | Incorporated administrative agency: National Institute of Agrobiological Science, etc. | Genetic resources of plants, microorganisms, and animals |
| | 1985 | Incorporated administrative agency: Forestry and Forest Products Research Institute | Genetic resources of forest trees |
| | 1985 | Incorporated administrative agency: Fisheries Research Agency | Genetic resources of fisheries organisms |
| | 1995 | Incorporated administrative agency: National Institute of Agrobiological Science, etc. | DNA |
| | 2003 | Incorporated administrative agency: National Institute of Agrobiological Science, Rice Genome Resource Center | Rice mutant lines, cDND, etc. |
| Ministry of Economy, Trade and Industry | 1882 | Incorporated administrative agency: National Institute of Advanced Industrial Science and Technology, Geological Survey of Japan | Geological data (geological maps of the country at a scale of 1:50,000, etc.) |
| | 1903 | Incorporated administrative agency: National Institute of Advanced Industrial Science and Technology, National Metrology Institute of Japan | National measurement standards, Japan Calibration Service System (Measurement Law), 179 physical standards, 184 reference materials |
| | 1993 | Incorporated administrative agency: National Institute of Technology and Evaluation, Department of Biotechnology | Genome information and biological resources, including microorganisms and DNA cloning of microorganisms for industrial use |
| | 1995 | Incorporated administrative agency: National Institute of Advanced Industrial Science and Technology, National Metrology Institute of Japan | Testing and evaluation methods, etc. |
| | 1996 | Incorporated administrative agency: National Institute of Technology and Evaluation, Chemical Management Center | Comprehensive chemical management information on 3,024 substances |
| | 1998 | Incorporated administrative agency: National Institute of Advanced Industrial Science and Technology, National Metrology Institute of Japan | Physical standards, reference materials |
| Ministry of the Environment | 1983 | Incorporated administrative agency: National Institute for Environmental Studies | Preservation of microorganism strains (1,100 strains) |

### 3.3.6.4 Enhancing the Intellectual Property Rights System, and Active Response to Standardization

To promote creative activities for intellectual property, adequate protection of intellectual property rights (IPRs) is critical. For the purpose of prompt and adequate protection of cutting-edge inventions, the JPO has been working to establish clear patentability criteria for cutting-edge technologies. In July 2003, for instance, the JPO revised the Examination Guidelines for Patents and Utility Models on "methods for treatment of the human body by surgery or therapy, and diagnostic methods practiced on the human body." It has also been extending assistance to other IP Offices by dispatching IP experts, holding local seminars, implementing human resources development programs (e.g. receipt of trainees), and helping enhancing their computerization efforts. To provide more user-friendly technical services, moreover, the Patent Attorney Law has been thoroughly revised. With the revision, the patent attorney examination system has been simplified, and the scope of patent attorneys' services has been expanded. From the perspective of encouraging the exploitation of intellectual property, the National Center for Industrial Property Information has been dispatching patent licensing advisors to local government facilities and technology licensing organizations (TLOs), developing patent licensing databases, and holding international patent licensing seminars/training programs with the aim of developing human resources with expertise in trading intellectual property. The JPO has been taking various approaches to establish a desirable market environment for patent licensing, which include patent licensing fairs held nationwide in Japan.

Additionally, research and development is being carried out under the Program for the Development of International Standards, with the aim of developing international standards in sectors in which the development of international standards is important for strengthening the industrial competitiveness of Japan. As of FY2003, research and development was being implemented on 30 themes under the program.

Furthermore, the International Joint Research Grant Program in the area of International Standards is being used to put into service international collaborative teams that implement research with other countries for the development of international standards. In FY2003, the program was used to put two teams into operation.

In order to promote new developments in the medical materials sector, research and development of technology for evaluating the performance of implant materials (i.e. materials implanted into the body, such as artificial bone or artificial blood vessels) in consideration of domestic and international standardization began in FY2002. One team is being subsidized.

In order to achieve Japanese-originated international standards in the information and communications field, and to promote the strengthening of Japan's international competitiveness, "research and development to acquire [international standards] in technology" is being implemented based on research results solicited on the condition that proposed research should contribute to standardization activities, such as submitting proposals to standardization organizations like the International Telecommunication Union (ITU). In FY2003, four research projects were newly adopted under this program. In addition, due to the recognition that it is important to promote R&D and standardization together as a unit, research and development of ubiquitous network technology and technology for broadband satellite infrastructure is being promoted in consideration of contributions to future international standards. Furthermore, in order to adequately meet market needs, user needs, and technology trends, and to make the rapid and flexible formulation of practical international standards possible, proposals to improve the system and working procedures of ITU are being actively implemented, along with promotion of coordination between ITU standardization and private-sector forums such as the "Digital Home-network Forum," which promotes the networking of residential areas. Moreover,

coordination of standardization activities in Asian countries is being strengthened, and joint proposals for standardization to the ITU are being promoted through the Asia-Pacific Telecommunity Standardization Program (ASTAP).

In advanced science and technology sectors, where the ties between theoretical research and commercialization are rapidly becoming stronger, international competition is intensifying, and cooperation and exchanges between research institutions both in Japan and abroad, and among industry, academia, and government, is progressing, demand is rising for appropriate protection and utilization of intellectual property rights and other research results. However, the lack of rules and low level of awareness regarding the handling of research results is becoming an issue at Japan's public research institutions.

In response to this situation, on December 25, 2001, the Council for Science and Technology Policy adopted "On Handling Intellectual Property Rights and Other Research Results at Research Institutions (opinion)," and presented it to the relevant ministries and agencies. Moreover, the Intellectual Property Working Group, established under the auspices of the Council for Science and Technology, investigates the status of intellectual property at universities, about which it prepared a report in November 2002. The report, after signifying that it is appropriate for intellectual property at universities to revert, as a general rule, to the institution (for national universities, after they acquired independent legal status), called for each university to prepare and publish an intellectual property policy as the basis for handling intellectual property. The report also indicated items that should be considered when preparing campus-wide rules, as well as specifics on the ways of maintaining on-campus systems.

Research and development results can span a large array of tangible and intangible items, from biogenetic resources such as mice and microorganisms, to materials and samples, and various kinds of measurement data. In May 2001 an incident erupted when researchers at RIKEN were indicted by U.S. judicial authorities on the suspicion of violating U.S. laws against economic espionage. The rules for reversion and handling of R&D results are unclear, giving rise to a situation in which the utilization of R&D results for the promotion of further research, or the transfer of results to commercial use, cannot be smoothly carried out. In response to this situation, the Ministry of Education, Culture, Sports, Science and Technology prepared a report in May 2002 by the Study Committee on Handling Research Results, and made it known to various councils. The report pointed out guidelines relating to rules that can be used to promote the reversion and broad utilization of R&D results at research and development sites, and commercial utilization in industry, and it also specified guidelines relating to the management and furnishing of tangible R&D results. Moreover, in July the Ministry drew the attention of Japanese scientists engaged in research at overseas research institutions to matters that require their attention while conducting research activities aboard.

In June 2001, the Ministry of Agriculture, Forestry, and Fisheries established the "Liaison Committee for Study of the Status of Control of Research Results" in cooperation with independent administrative institutions to clarify the rules for handling the results of research in the above research institutions.

Amidst Japan's efforts to expand investment in R&D toward realization of the goal to become a nation of creative science and technology, it is important that expansion of investment in R&D be linked to the creation and assurance of results, and to stronger international competitiveness. For this reason, the Council for Science and Technology Policy established the Expert Panel on Management of Intellectual Properties. The Panel conducted a study and investigation, and in December 2002 it prepared the "Concerning Intellectual Property Strategies" report, which gave suggestions for enhancement of the intellectual property management system at universities, development of intellectual property legislation for the advanced technology sector, and training of personnel who are specialists

in intellectual property. These opinions were presented to the relevant ministers. In addition, starting in FY2002, the Ministry of Education, Culture, Sports, Science and Technology has been engaged in training specialists in intellectual property as one of the "Special Coordination Funds for Promoting Science and Technology" programs. The Ministry also studied and examined issues that should be resolved with immediate importance in order to, in the Ministry's words, "promote R&D, an intellectual property strategy, and a standardization strategy in an integrated manner, as well as to revitalize intellectual property endeavors at universities." The Ministry in June 2003 issued the "Concerning Intellectual Property Strategies" report.

The Japanese government has also been promoting its intellectual property strategy nationwide in various fields, including science and technology. In February 2002, the Strategic Council on Intellectual Property (Chairman: Prime Minister) was set up. In July of the same year, the Council formulated the Intellectual Property Policy Outline. Under the Basic Law on Intellectual Property, which was passed at the extraordinary Diet session in 2002 based on the Policy Outline, the Intellectual Property Policy Headquarters (Chairman: Prime Minister) was established in March 2003. In July 2003, the Headquarters formulated the Strategic Program for the Creation, Protection and Exploitation of Intellectual Property. With the adoption of the Strategic Program, the following three task forces were established to discuss important policy issues in the Strategic Program: Task Force on Strengthening of the Foundation for Right Protection; Task Force on Contents; and Task Force on the Protection of Patents of Medical-Related Acts. Active discussions are now going on in the three Task Forces.

### 3.3.6.5 Developing a Research Information Infrastructure

Amidst the rapid development of advanced computerization, R&D sites are taking the lead by developing a research information infrastructure. In response to the rapid progress in telecommunications, it is critical for Japan to heighten and streamline its R&D in the future by continuously promoting the development of the research information infrastructure, and by collecting and disseminating R&D information through even greater utilization of these infrastructures.

The national government is taking concrete action through efforts such as the provision of computers and development of LANs at research organizations; the development and upgrading of networks between research institutions; the development and provision of databases; the sharing of research information through the use of networks; and the strengthening of electronic library service in university libraries.

An overview of the main measures for the research information infrastructure in FY2002 is shown in Table 3-3-30.

**Table 3-3-30 Main measures for the research information infrastructure (FY2003)**

| Ministry or Agency | Research institute or program | Subject |
|---|---|---|
| Diet | National Diet Library | ·Acquisition and development funds for science and technology-related resources at the National Diet Library |
| Cabinet Office | | ·Strengthening the information collection function of R&D data funded through the government budget |
| Ministry of Internal Affairs and Communications | | · Basic technology R&D for an Asian broadband satellite |
| Ministry of Education, Culture, Sports, Science and Technology | Incorporated administrative agency: RIKEN (The Institute of Physical and Chemical Research) | · Research funds for IT utilization |
| | | · R&D databases |
| | | · Engineer ability development and "failure knowledge database" |
| | Incorporated administrative agency: Japan Science and Technology Agency | · Institute for Bioinformatics Research and Development |
| | | · Science and technology information provision system |
| | Japan Agency for Marine-Earth Science and Technology | · Project for the provision of literature and information |
| | | · Information infrastructure operating cost |
| | National Institute of Informatics | · Development of "Super SINET" |
| Ministry of Health, Labour and Welfare | National Institute of Infectious Diseases | · Budget for the Infectious Disease Surveillance Center |
| | | · Research project expenses for collecting, analyzing, and assessing safety data on biological drugs |
| Ministry of Agriculture, Forestry and Fisheries | Incorporated administrative agency: National Agriculture and Bio-oriented Research Organization | · Operation of Agriculture, Forestry and Fisheries Research Information Center |
| | | · Operation of Computer Center for Agriculture, Forestry and Fisheries Research |
| | | · Construction of digital community for agriculture, forestry, and fishery research information |
| Ministry of Land, Infrastructure and Transport | | · Promotion of collection, management and provision of hydrographic and oceanographic data/information |
| | | · Enhancement of oceanographic observations and hydrographic surveys |
| | | · Development of Geographic Information System (GIS) database for the coastal area |
| | | · Strengthening of the earthquake observation system for Tonankai and Nankai earthquakes |
| Ministry of the Environment | | · Funds for development of basic information for comprehensive ecosystem management |

### 3.3.6.5.1 Improvement of Networks and Computers

Computers and information networks are key systems in our modern society. These were first developed for research and development, and afterwards found a variety of different applications. In order to carry out cutting edge research and development, performance enhancements are necessary for computers and networks.

In terms of developing networks, the National Institute of Informatics (NII) has established and operates the Science Information Network (SINET), which connects organizations such as universities. As of January 2004, a total of 750 organizations were connected to SINET. In addition, "Super SINET," the world's fastest research network, which connects advanced scientific research institutions at a maximum speed of 10Gbps (gigabits per second),

is up and running. Moreover, the Inter-Ministry Research Information Network (IMnet), operated by the Japan Science and Technology Agency (JST), which brings together research institutions under different government ministries, was integrated into SINET at the end of October 2003.

The Ministry of Agriculture, Forestry and Fisheries has established and operates the MAFFIN (Ministry of Agriculture, Forestry and Fisheries Network), which mutually connects research institutions related to agriculture, forestry, and fisheries. As of March 2004, a total of 101 institutions were connected through MAFFIN. With SINET now linked to the United States, the United Kingdom, and Thailand, and MAFFIN linked to the Philippines, these networks are now becoming backbones for the distribution of research information among various countries.

In addition, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) promotes the development of campus information networks (campus Local Area Networks (LANs)), which connect various computers and telecommunications equipment within each university, as well as the upgrading of campus LANs through the adoption of gigabit networks. Furthermore, the Ministry subsidizes private universities for the costs necessary to develop campus LAN systems.

The Ministry of Internal Affairs and Communications invests in the National Institute of Information and Communications Technology (NICT) to develop the Japan Gigabit Network (JGN), which is based on a nationwide ultra high-speed optical network, as well as in joint use research and development facilities. This network will be open and available for use through the end of FY2003, and will serve as a test bed for technologies necessary for the advancement of networks, and for research and development on applications utilizing high-speed networks.

The use of computer simulations has become essential in order to further research and development efforts in cutting edge fields such as the aerospace, environment, life sciences, and substance/materials sectors. These computer simulations are made possible through the use of computer-based calculations, and are positioned as a third research method along with the “theory” and “experimentation” research methods. For this reason, universities, research institutions, and other organizations are adopting equipment such as high performance supercomputers. Since FY2000, MEXT has been playing a central role in the creation of a high-speed network that links the supercomputers and databases of Japan’s research institutions, and in efforts to promote the IT-Based Laboratory (ITBL) concept, which represents a virtual research environment for the implementation of advanced research. MEXT is also playing a central role in efforts such as the creation of the Tsukuba Wide Area Network (Tsukuba WAN), a system of high-speed networks that connects research institutions in Tsukuba Science City that are equipped with supercomputers. Thus MEXT is promoting joint research at Tsukuba Science City in the computational science and technology fields. Additionally, in December 2002, the Ministry of Agriculture, Forestry and Fisheries established the Joint Use Telecommunications Hall, which has the function of serving as a connection base nicknamed Dennokan (or Electronic Agricultural Hall） between the Tsukuba WAN and the Norin Kenkyu Danchi (Norin Research Complex) WAN.

## 3.3.6.5.2 Creation and Provision of Databases

### 3.3.6.5.2.1 Information on Documents

Perusal, copying, lending, and other clearing services for primary information (source materials for research papers, etc.) are being implemented at libraries and a variety of other information service organizations.

In order to create a database of primary information, the National Diet Library (NDL) is preparing a database for collected materials that covers every publication issued in Japan and in the archives of the library. This database is being made available over the Internet. In addition, the National Institute