3.3 Reform of Japan's Science and Technology System

3.3.1 Reform of Japan's Research and Development System

3.3.1.1 Building Research and Development Systems to Produce Excellent Results

3.3.1.1.1 Developing a Competitive Research and Development Environment

The Science and Technology Basic Plan sets forth the reform of Japan's science and technology system as a critical policy for creating and utilizing excellent output. To form a competitive research and development environment, the Basic Plan sets a goal of doubling the use of competitive funding during the period that the Basic Plan is in force. In order to maximize its effectiveness, the Basic Plan also calls for system reforms, including the implementation of appropriate evaluation measures and the expansion of indirect expenses. The competitive funding for each ministry is shown in Table 3-3-1.

Table 3-3-1 Comprehensive list of competitive funding

Name of ministry/agency	Sponsoring institution	Name of program	FY2002		FY2003	
			Budget (million yen)	Indirect expenses introduced (million yen)	Budget (million yen)	Indirect expenses introduced (million yen)
Ministry of Internal Affairs and Communications	Ministry	Promotion Programme Strategic Information and Communications R&D	1,350	258	2,250	479
	Telecommunications Advancement Organization of Japan	Program for Promotion of Basic Research in the Information and Communications Sectors	1,120	145	630	91
	Telecommunications Advancement Organization of Japan	R&D Program for Utilization of Gigabit Network	200	26	112	11
	Telecommunications Advancement Organization of Japan	Advanced technology development for pioneering new communications and broadcasting areas (Telecom incubation)	425	None	475	None
	Telecommunications Advancement Organization of Japan	Program for Promotion of Private-Sector Basic Technology Research	10,700	2,199	10,500	2,245
	Fire and Diaster Management Agency	Program for Promotion of Science and Technology Research for Fire Safety and Disaster Prevention	–	–	199	28
Subtotal			**13,795**	**2,628**	**14,166**	**2,855**
Ministry of Education, Culture, Sports, Science, and Technology	Japan Society for the Promotion of Science	Grants-in-Aid for Academic Research	170,300	11,560	176,500	12,531
	Japan Science and Technology Agency	Basic Research Programs	42,689	1,083	44,689	2,848
	Ministry	Special Coordination Funds for Promoting Science and Technology (Chosei-hi)	36,500	2,254	37,700	3,254
	Ministry	Public Proposal System for Ingenious Technology Development Research	5,277	283	3,562	248
	Ministry	Support System for Creation of University-Derived Venture Companies	1,823	401	1,786	369
	Japan Science and Technology Agency	Support System for Creation of University-Derived Venture Companies (In FY2003: Project to Create University-based Start-ups)	–	–	502	104
	Ministry	Grants for future pioneering science research	9,000	None	6,646	None
Subtotal			**265,589**	**15,581**	**271,386**	**19,354**
Ministry of Health, Labour, and Welfare	Ministry	Health and Labour Sciences Research Grants	39,284	796	38,011	1,561
	Pharmaceuticals and Medical Devices Agency	Program for Promotion of Basic Research in the Health Care Sector	7,062	None	6,562	Not yet determined
Subtotal			**46,346**	**796**	**44,573**	**1,561**
Ministry of Agriculture, Forestry, and Fisheries	Bio-oriented Technology Research Advancement Institution	Program for promotion of basic research for creation of new technologies and new sectors	4,010	274	3,983	401
		R&D program for creation of new enterprises	1,591	None	1,213	None
		Program for the Promotion of Research on the Integration of Different Fields for the Creation of Bio-oriented Industries	–	–	339	3
	Ministry	Technology Development Project for the Creation of Collective Private Agribusiness	560	None	560	None
	Ministry	Research project for utilizing advanced technologies in agriculture, forestry and fisheries	1,808	403	1,973	441
Subtotal			**7,970**	**678**	**8,067**	**845**
Ministry of Economy, Trade, and Industry	New Energy and Industrial Technology Development Organization	New Energy and Industrial Technology Development Organization	5,280	1,027	5,280	1,062
Subtotal			**5,280**	**1,027**	**5,280**	**1,062**
Ministry of Land, Infrastructure, and Transport	Japan Railway Construction, Transport and Technology Agency	Program for Promoting Fundamental Transport Technology Research	392	22	389	35
	Ministry	R&D fund support program for the development of construction technology	240	51	250	53
Subtotal			**632**	**73**	**639**	**88**
Ministry of the Environment	Ministry	Global Environmental Research Fund	2,895	174	2,965	249
	Ministry	Environmental Research and Technology Development Fund	765	111	765	117
	Ministry	Ministry of the Environment Waste Management Research Grants	1,050	57	1,150	54
Subtotal			**4,710**	**342**	**4,880**	**420**
Total			**344,322**	**21,126**	**348,991**	**26,185**

Notes: 1. The initial budget amount, which served as the basis for doubling competitive funding during the period of the Second Science and Technology Basic Plan.

2. Figures in each column and in the totals columns are rounded up to the nearest whole number, and may not add up.

3. The "indirect expenses introduced" figures are estimated as of FY2001.

4. Programs besides those given above are under review for potential registration as competitive funding.

Based on the "Reform of the Competitive Funding System (opinion)" prepared by the Council on Science and Technology Policy on April 21, 2003, progress was made on the following reforms during FY2003: (1) further expansion of indirect expenses; (2) posting of program officers with research backgrounds to each funding agency to improve the implementation structure that will be responsible for consistently servicing the array of business of the competitive funding system from the science and technology side; (3) entrusting the funds distribution function to independent funding agencies; and (4) pushing forward the delivery period of research funds.

3.3.1.1.1.1 Competitive Funding of Ministries

(1) Ministry of Internal Affairs and Communications

The Ministry of Internal Affairs and Communications is implementing the "Strategic Information and Communications R&D Promotion Programme." This project aims to actively promote unique and innovative research and development that is in keeping with priority strategic targets in order to create world-leading intellectual assets, increase the level of researchers by creating competitive research environments, and improve research and development capabilities in information and communications technologies.

(2) Ministry of Education Culture, Sports, Science and Technology

The Ministry of Education, Culture, Sports, Science and Technology oversees roughly eighty percent of the total budget for Japan's competitive funding, and administers the following distinctive systems.

The Grant-in-Aid for Scientific Research Program aims to dramatically advance academic research (research based on the free-thinking of researchers) across all fields from the humanities and social sciences to the natural sciences, and from basic to applied. The program supports creative and pioneering research that has gone through a peer review process. About 85,000 new applications were received in FY2004, and about 21,000 of them were awarded.

Basic Research Programs promote basic research that contributes to the creation of advanced technologies, for which the Japan Science and Technology Agency (JST) establishes research areas based on strategic sectors designated by the Ministry of Education, Culture, Sports, Science and Technology on the basis of projected future social demands. Research themes for each area are publicly sought from all sorts of government, academic, and industry research institutions, such as national experimental research institutions and universities. In FY2003, the following were established as two new strategic sectors: (1) Development of a Technological Infrastructure for the Realization of Quantum Information Processing that Introduces Innovations into Information Communications Technology; and (2) Elucidation of a Human Life-long Learning Mechanism Based on the Knowledge of Brain Science with an Intention to Provide a Solution to the Problems in Education.

The Special Coordination Funds for Promoting Science and Technology (Chosei-hi) take the initiative in the coordination and promotion of projects important for science and technology policy, along with policies laid down by the Council for Science and Technology Policy. Since FY2003, the new "Basic Survey and Research on Promotion of Science and Technology" program has been established in order to encourage examination on the future policy for promoting science and technology following the current Science and Technology Basic Plan.

The "Open Competition for the Development of Innovative Technology" invites the public to submit proposals for innovative and highly creative seeds of technology, and subsidizes the de-

velopment of those technologies utilizing the potential of universities in order to foster the proposals into even more innovative and practicable forms.

The "Project for Creation of University-based Start-ups" aims to promote the return of the fruits of university research to society and the economy through the creation of university-based start-ups. The JST promotes the R&D needed to realize business start-ups based on the results of university research.

The Subsidies for Research for the Future Program implemented by the Japan Society for the Promotion of Science promotes university-led academic research with the potential to produce intellectual assets leading to the future development of Japan.

(3) Ministry of Health, Labour and Welfare

The Ministry of Health, Labour and Welfare strives to improve technology standards through the scientific promotion of government measures related to health and medical care, welfare, environmental health, occupational safety and health, and other aspects relevant to the citizens of Japan.

The Grant for Health Sciences promotes research in four main areas, including (1) the administrative policy research area; (2) the comprehensive project research area, which includes "Comprehensive Research for Cancer Control" based on the Second 10-Year Cancer Strategy, and "Research on Human Genome Tissue Engineering;" (3) the advanced health sciences area, which includes "Research on Advanced Medical Technology," which strives to promote research on nanotechnology, and "Research on Emerging and Re-emerging Infectious Diseases"; and (4) comprehensive research on safety management in the drug, food and technology area, which includes "Research on Health Sciences Focusing on Drug Innovation."

(4) Ministry of Agriculture, Forestry and Fisheries

In FY2003, the Ministry of Agriculture, Forestry and Fisheries established the "Program for the Promotion of Research on the Integration of Different Fields for the Creation of Bio-oriented Industries," which aims to create new industries and enterprises through biotechnology and other bio-oriented advanced technologies. Existing programs include the "research project for utilizing advanced technologies in agriculture, forestry and fisheries," which aims to promote in-the-field experiments and research in the agriculture, forestry, and fisheries sector, and the "Technology Development Project for the Creation of Collective Private Agribusiness," which aims to revitalize agribusiness through the creation of new industries. Furthermore, measures for joint research aimed at strengthening basic research that promotes the advanced use of biological functions are implemented by the National Agriculture and Bio-oriented Research Organization.

(5) Ministry of Economy, Trade and Industry

The Ministry of Economy, Trade and Industry subsidizes the New Energy and Industrial Technology Development Organization (NEDO), and implements the "Industrial Technology Research Grant Program" in an effort to develop human resources for industrial technology research and discover potential seeds of new industrial technologies that meet the needs of the industrial world and society by providing research funds to assist young researchers.

(6) Ministry of Land, Infrastructure and Transport

Through the Japan Railway Construction, Transport and Technology Agency, the Ministry of Land, Infrastructure and Transport implements the "Program for Promoting Fundamental Transport Technology Research." This program promotes creative and innovative basic research aimed at generating innovative new technologies

with the potential for breakthrough technological innovation. In addition, the Construction Technology Research and Development Subsidy Program provides research and development subsidies to researchers at universities, etc., in order to promote cooperation with non-construction sectors, to promote innovations in construction technology in broad interdisciplinary areas, and to utilize the innovative results in public works projects.

(7) Ministry of the Environment

The Ministry of the Environment utilizes the Global Environment Research Fund to promote research into global environmental conservation, based on the Comprehensive Promotion Program for Global Environment Research, Monitoring and Technology that is drawn up at the Council of Ministers for Global Environmental Conservation.

The Global Environment Research Fund provides prioritized and strategic promotion for the development and diffusion of environmental technologies, while the Fund for Waste Disposal Science Research is used to promote restrictions on waste disposal and to encourage recovery and reuse, and develops research on all kinds of research into appropriate waste disposal measures.

3.3.1.1.2 Improving the Mobility of Pesonnel through Popularization of the Fixed-term System

In order to train researchers with broad perspectives who are rich in creativity and originality, and to be competitive and dynamic R&D environments, it's important that the mobility of researchers is improved and that researchers have experience at many kinds of research sites.

With an aim toward such improved mobility of researchers, employment of fixed-term researchers became possible at national experimental research institutions in accordance with "the Law Concerning the Special Measure for the Recruitment, Remuneration and Working Hours of Researchers with Fixed Terms in the Regular Service" enacted in 1997. The performance to date is shown in Table 3-3-2.

Table 3-3-2 State of employment under the "Law Concerning the Special Measure for the Recruitment, Remuneration and Working Hours of Researchers with Fixed Terms in the Regular Service"

	No. of institutions	No. of personnel used
National research institutes	36	785
Of which, by invitational type	17	124
Of which, researcher-fostering type	35	661

Note: The number of personnel used indicates the cumulative number as of October 1, 2003.

Source: Survey by National Personnel Authority (October 2003)

For universities and inter-university research institutes, "the Law Concerning the Fixed-Term Appointment of Faculty Members at Universities," enacted in 1997, gives them the discretion to adopt the fixed-term system. The status of the fixed term system adopted on the basis of this law is shown in Table 3-3-3.

Table 3-3-3 State of the fixed-term systems introduced under the "Law concerning the Term of Office for Faculty"

	No. of universities, etc.	No. of instructors used
National universities	65	3,546
Public universities	12	131
Private	119	1,571
Inter-university research institutions	9	73

Source: Survey by MEXT (October 2002)

The Basic Plan calls on the nation's research institutions "to prepare plans showing suitable policies for hiring re-searchers based on a fixed-term and public canvassing basis." The Ministry of Education, Culture, Sports, Science and Technology informed all relevant institutions in February 2002 of the "Basic Guidelines for Improvement of Researcher Mobility," decided upon by the Council for Science and Technology Policy in December 2001. The nation's research institutions are expected to actively try to improve researcher mobility by introducing a fixed-term system and implementing public canvassing.

3.3.1.1.3 Increasing the Independence of Young Researchers

If Japan is to aim toward becoming an advanced science- and technology- oriented nation, it is critical to foster and secure exceptional young researchers with abundant creativity who will lead future research activities.

The Basic Plan calls for "ensuring the independence of young researchers in order to maximize the abilities demonstrated by distinguished young researchers."

3.3.1.1.3.1 Support for Creative Research Activities by Young Rsearchers

Many of the researchers around the world who come up with world-class research results have already conducted research in their 30s that lays the groundwork for later achievements. The relevant government ministries, therefore, promote various efforts to support creative research activities by young researchers during their foundational years.

(1) Ministry of Internal Affairs and Communications

Under the "Program for Promoting Strategic Information and Communications Research and Development," established in FY2002, the "research and development program for nurturing young advanced-IT researchers" was instituted with the aim of nurturing young researchers who are age 35 or younger.

(2) Ministry of Education, Culture, Sports, Science and Technology

MEXT is working to expand competitive funding for young researchers by appropriating approximately 20.9 billion yen of the Grants-in-Aid for Scientific Research for young researchers in order to create a system in which young researchers who have flexible mind-sets and a spirit of challenge can conduct independent research.

(3)Ministry of Agriculture, Forestry and Fisheries

The National Agriculture and Bio-oriented Research Organization (NARO) is working through the Basic Research Promotion Project, which aims at the creation of new technologies and new sectors, to institute a young researcher support program that prepares the conditions for objective research by young researchers with flexible thinking and ambition.

(4) Ministry of Economy, Trade and Industry

In FY2000, NEDO started the "Industrial Technology Research Grant Program" for promoting basic and creative research and development by providing research fund to assist young researchers.

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3.3.1.1.3.2 Support for Postdotoral Researchers

Concerning postdoctoral researchers who conduct supervised research, the Basic Plan states that "In the future, the post-doctoral program should be qualita of postdoctoral researchers by having them participate in research projects funded with the expanded competitive funding, as well as promote various other systems to support postdoctoral researchers.

(1) Ministry of Education, Culture, Sports, Science and Technology

Through the Japan Society for the Promotion of Science, MEXT has been promoting since 1985 the "Research Fellowships for Young Scientists" program that supports postdoctoral researchers who possess superior research abilities so that they can proactively engage in their research. Since FY2003, by focusing support as a general rule on postdoctoral researchers who are active at locations other than their alma mater research departments, this program strives to achieve qualitative results, such as cultivating creativity and broad views through the selection of diverse research environments.

Various other support programs for researchers are also being promoted, such as the Institute of Physical and Chemical Research (RIKEN) "Special Postdoctoral Researchers Program," which provides a place where highly creative young researchers can proactively conduct research upon their own initiative at RIKEN's research facilities.

(2) Ministry of Health, Labour and Welfare

The Ministry of Health, Labour and Welfare has adopted measures to support and utilize 541 post-doctorals through its Health and Welfare Sciences Research Promotion Project.

(3) Ministry of Agriculture, Forestry and Fisheries

The Ministry of Agriculture, Forestry and Fisheries has adopted measures to utilize 147 young researchers as part of the Basic Research Promotion Project of the National Agriculture and Bio-oriented Research Organization (NARO), which is aimed at creating new technologies and research fields. In total, the Ministry adopted measures to utilize 176 postdoctoral researchers.

(4) Ministry of Economy, Trade and Industry

The Ministry of Economy, Trade and Industry provided support and adopted measures to utilize a total of 170 postdoctoral researchers through the industrial technology fellowship program run by the New Energy and Industrial Technology Development Organization (NEDO).

3.3.1.1.4 Reform of Japan's Evaluation Systems

To promote science and technology, it is important to conduct appropriate evaluations, which stimulate researchers and encourage outstanding research and development activities. Effective evaluations will increase the efficiency and vital-

ity of R&D activities, facilitate better R&D achievements, and nourish superior researchers. Evaluations also offer benefits to society and the economy, and also serve for accountability to the public.

The Basic Plan sets forth reforms of the evaluation system as one of its pillars for developing a science and technology system that will deliver excellent results. Based on the Second Basic Plan, the "National Guidelines on the Method of Evaluation for Governmental R&D" were decided upon by the Prime Minister in November 2001 to improve the evaluation program further. All ministries and agencies implement effective evaluations with detailed guidelines specifying evaluation methodologies under the revised General Guidelines.

In addition, the Cabinet Office, in cooperation with related ministries and agencies, developed a government R&D database system that brought together in a single, cross-ministerial system data on researchers, funds, accomplishments, evaluators, and evaluation results for government-funded individual research and development topics. Along with storing data, the system is being used for data analysis by the Cabinet Office and related ministries and agencies.

For other actions in this area, evaluations of the performance of incorporated administrative R&D agencies are now being implemented based on the Law on the General Rules of Incorporated Administrative Agencies (1999 Law No.103). In addition, under the Law for Evaluations of Policies Performed by Administrative Institutions (2001 Law No.86), which took effect in April 2002, it has been made mandatory to conduct appraisal evaluations for research and development topics that are expected to incur large costs, given their preceding experience in project evaluation.

3.3.1.1.5 Flexible, Effective, and Efficient Program Management

Flexible, effective, and efficient program operations and the efficient use of funding are necessary in accordance with the characteristics of research and development. For this reason, at the national experimental research institutions, efforts are being made to fully utilize organizational structures that allow mobile and flexible changes based on internal measures. These changes are aimed at responding to progress and changes in research and development, including the priority allocation of funding at the discretion of institute directors, etc., in response to research performance, and the placement of researchers and establishment of research periods in line with research topics.

The Ministry of Education, Culture, Sports, Science, and Technology uses the Special Coordination Funds for Promoting Science and Technology (Chosei-hi) to position "Urgent Research and Development" within the "Promotion of Advanced Research," in order to ensure a timely response to situations requiring urgent measures to be taken during the fiscal year. Emergency investigation and research activities during FY2002 are as shown in Table 3-3-4.

Table 3-3-4 Promotion of advanced research (urgent research subjects)

Year implemented	Name of core institution	Name of investigation and research subject
2003	National Institute of Infectious Diseases	Emergency research on diagnostic and testing methods for Severe Acute Respiratory Syndrome (SARS)
	Earthquake Research Institute, University of Tokyo	Emergency research on the 2003 Tokachi-oki Earthquake
	National Institute of Animal Health, National Agriculture and Bio-oriented Research Organization	Emergency Research on Measures to deal with Highly Pathogenic Avian Influenza (Note)

Note: Specified as added research in FY2003

Furthermore, to address situations in which teachers at national universities, etc., are engaged in re-search commissioned from corporations or other outside bodies, the Ministry of Education, Culture, Sports, Science and Technology moved in FY1998 to merge the three expense categories into a single new accounting item (research expenses for partnerships between universities and industry, etc.) in order to encourage a flexible response to changes in expense items that occur as research progresses or as research plans change.

As regards research presentations at study meetings, Section 30 of the Japanese Patent Law stipulates that "the fact that the person having the right to obtain a patent" "has made a presentation in writing at a study meeting held by a scientific body designated by the Commissioner of the Patent Office" shall be deemed as an exception to lack of novelty of invention. The Japan Patent Office (JPO) has been making this provision applicable to research activities at universities.

3.3.1.1.6 Utilizing Personnel and Developing Diversified Caree Paths

To reinvigorate research activities, universities and research institutions are expected to make active efforts to ensure the involvement of diversified personnel.

"On Policy for Promoting the Internationalization of Scientific and Technological Activities," a report released on January 2003 by the Internationalization Promotion Committee of the Science and Technology Council, raises the promotion of international exchange among researchers as a policy that should be given priority encouragement. The report also speaks to the need to invite distinguished foreign researchers to Japan, and to promote young researchers to take long overseas research sojourns.

Furthermore, in its second recommendation, "Aiming to foster and secure research personnel in order to increase global competitiveness," released in June 2003, the Council for Science and Technology's Committee on Human Resources made suggestions for moving toward the realization of environments in which diverse personnel can demonstrate their full abilities and concentrate on their research. These suggestions included the fostering of creative and competitive environments that encourage diversity, and the promotion of participation by female researchers and encouraging them to demonstrate their abilities.

Based on these reports and recommendations, the Japan Society for the Promotion of Science is enhancing its researcher exchange programs, includ-

ing its overseas research fellowships and postdoctoral fellowships for foreign researchers. Since FY2003, the Grants-in-Aid for Scientific Research Program has been flexibly managed to support female researchers by allowing them to resume research funded by the program after one-year maternity leave interruptions. In like manner, the Japan Society for the Promotion of Science in July 2003 began permitting interruptions and extensions of fellowships at the request of young researchers for the purpose of childbirth and child-rearing.

Various career paths must be opened up so that researchers can become involved, as their aptitude permits, in a wide spectrum of R&D-related work, including the planning and management of research and development, and other management tasks.

In light of these needs, the Japan Society for the Promotion of Science and the JST established in FY2003 the program manager position for people with research experience who will hold responsibility for part of he business chain of the competitive funding system.

3.3.1.1.7 Achieving a Creative Research and Development System

To create excellent research results and to realize a research and development system capable of pioneering a new era, the heads of research institutions of a certain size need to use superior concepts and leadership to promote organizational reform at their R&D institutions, and to create Centers of Excellence (COEs) with international appeal.

Toward this end, the Special Coordination Funds for Promoting Science and Technology (Chosei-hi) have been used since FY2001 for supporting the start of the “Strategic Fostering Research Centers of Excellence” program. The program fosters and supports R&D institutions that make creative and pioneering attempts to build novel R&D systems and reform organizations operations and whose highly successful efforts influence other R&D institutions.

In FY2003, two institutions were selected for fostering under the program, as shown in Table 3-3-5.

Table 3-3-5 Fostering strategic research centers (Targeted institutions)

	Name of targeted institution	Concept
2001	Research Center for Advanced Science and Technology, The	Open laboratory for human- and society-focused advanced science and technology
	Graduate School of Engineering, Osaka University	Plan for Frontier Research Center
2002	Graduate School of Medicine, Kyoto University	Formation of an open medical research center of excellence through harmonization of advanced fields
	Incorporated Administrative Agency: National Institute of Advanced Industrial Science and Technology	Innovation Center for Start-ups
2003	Graduate School of Medicine, Tohoku University	Formation of an advanced biomedical engineering center of excellence
	"Sousei" Creative Research Initiative, Hokkaido University	Plan for a Hokaido University research and business park
	National Institute for Material Science	Specified District Young and International Innovation

3.3.1.2 Promotion and Reform of R&D at Japan's Main Research Institutes

3.3.1.2.1 Universities and InterUnvesity Research Institutes

As one of their directives, Japan's universities and inter-university research institutes are entrusted with the task of securing the academic foundation and improving the academic standards of Japan, with a focus on academic research. The essence of university-level academic research is to give rise to new and richly creative knowledge based on liberal and open ideas, and the independent research activity of researchers. Furthermore, university-level academic research shall be characterized by the goal of advancement in study carried out over a broad range of fields in the areas of humanities, social sciences, and natural sciences, shall possess a respect for the independent nature of researchers as being essential to such progress, and shall function for the integrated promotion of research and education.

Based on reports and suggestions forwarded by the Science Council, the Ministry of Education, Culture, Sports, Science and Technology strives to provide for Japan's foundation for academic research in a planned and prioritized manner, and to proactively implement a comprehensive policy for the nation by increasing research funding, improving research facilities and equipment at universities and inter-university research institutes, nurturing and recruiting exceptional researchers, prioritizing the promotion of basic research, forming COEs, improving the evaluation of research, and developing and expanding upon the science information infrastructure, in order to develop an academic research system that is open to the world, and which is capable of flexibly responding to advancements in scientific research.

Expanding the independence of management at national universities and inter-university research institutes in the areas of budget, organization, and personnel affairs, the National University Corporation Law came into effect in July 2003 with the aim of developing appealing national universities and inter-university research institutes with distinctive identities that actively address education, research, and contributions to society, and establishing management structures that are open to public scrutiny. In April 2004, national universities and inter-university research institutes will be incorporated.

Furthermore, efforts are being made, primarily by the Cabinet Office, to establish universities in Onna-son, Okinawa, with graduate school curricula in science and technology of the highest international standards, that embrace the new

mindset of “internationalism” and “flexibility” as basic concepts, with the aim of getting Okinawa to take part in Japan’s and the world’s scientific and technological advances, and to develop Okinawa into a region of advanced, concentrated brain power within the Asia-Pacific region.

3.3.1.2.1.1 Academic Research at Universities and Inter-University Research Institutes

Researchers at universities nationwide are making use of research at their universities, departments, graduate schools, research laboratories, and research facilities, as well as joint-use inter-university research institutes, without being tied to a specific university.

In an age of advancements in academic research that are characterized in particular by the increasing large scale and sophistication of research techniques, researchers in many research fields are finding it increasingly necessary and efficient to carry out joint research. For this purpose, priority is being placed on the development of joint use infrastructures such as inter-university research institutes, as well as research laboratories and research facilities within universities, in order to expand the infrastructure of research organizations. In addition, efforts are being made to reinvigorate research institutes and give them greater flexibility to respond to the growth of interdisciplinary fields and the existence of social demands, etc., that have accompanied advancements in academic research.

The inter-university research institutes make significant contributions to research advancements in a variety of fields by acting as centers for promoting joint research between researchers employed throughout the nation’s universities, and by providing a place for the joint use of facilities, equipment, and materials that are unique or large in scale. Projects such as the B-Factory project of the High Energy Accelerator Research Organization (KEK) and SUBARU, optical-infrared telescope, project of the National Astronomical Observatory of Japan (NAOJ) also promote cutting-edge international research. As part of the university education system, the inter-university research institutions carry out research and education in an integrated manner that is typified by the acceptance of graduate students. By the end of FY2003, a total of 13 inter-university research institutions and 16 research laboratories had been established.

Research laboratories devoted to research in designated specialized fields have also been established at universities. These research laboratories carry out specialized research in collaboration with education and research carried out at university departments and graduate schools. At the end of FY2003, a total of 58 research laboratories had been established at the national universities, including 19 research institutions for joint use for the nation’s universities. Research projects such as the neutrino research conducted by the Institute for Cosmic Ray Research (ICRR) of the University of Tokyo have produced research results of the highest international standards.

To secure research funds to promote research conducted at universities, efforts have been made to secure two types of funding, ordinary “fundamental” funds to support basic research activity, and “competitive” funds that are selectively allocated to exceptional research in accordance with appropriate reviews and evaluation of research.

Of these funds, ordinary research expenditures are specifically intended to support research based on researchers’ liberal and open ideas. At national universities, such expenses are incurred as educational research foundation schooling expenditures and travel expenditures for faculty research. At private universities, subsidies are provided for operating costs related to ordinary research expenditures and research projects that respond to strong social demand. In terms of competitive funding, Grants-in-Aid for Scientific Research are being increased with the aim of achieving significant advancements in exceptional research being carried out in a broad range of fields, and capital investments in the Japan Society for the Promotion of Science (JSPS) are

being utilized to implement the Research for the Future (RTTF) program, which prioritizes the promotion of visionary and richly creative research with the potential to produce intellectual assets.

3.3.1.2.1.2 Expanding Support for Japan's Private Universities

Roughly 75 percent of Japan's university students attend private universities, which actively carry out characteristic educational research activity based on the unique spirit upon which each university was created. Accordingly, the Ministry of Education, Culture, Sports, Science and Technology implements the following measures in order to support private universities.

To support operating costs, the Ministry established in FY2002 the "Special Expenses for Advancing Higher Education and Research Levels at Private Universities," with the aim of creating world-class universities. This aid provides prioritized assistance according to the state of each university's efforts in education and research.

To assist in the development of facilities and equipment, the Ministry appropriates funds needed to support the remodeling of facilities to make them multimedia-capable, the installation of on-campus LAN systems, and the provision of the research facilities and equipment needed to implement the "Program for Promoting Advancement of Academic Research at Private Universities," which offers comprehensive support, including facilities and equipment, to excellent research projects.

Furthermore, since April 1, 2002, certain projects related to research commissioned by third parties and undertaken at private universities have been exempted from applicable corporate taxes for profit-earning projects. In addition, in April 2003, the procedure to obtain the approval of the Commissioner of the National Tax Agency for exempting "deemed transfer income" private contributions of property from applicable income taxes was simplified for those who fulfill certain requirements in the case of contributions to educational corporations that found private universities.

3.3.1.2.1.3 Deliberations in the Council for Science and Technology

The Council for Science and Technology conducts research and deliberations in response to inquiries posed by the Ministry of Education, Culture, Sports, Science and Technology regarding matters important to the comprehensive promotion of science and technology, and to the promotion of learning in general; it also provides opinions to the minister. The Subdivision on Science was established within the Council in order to conduct research and deliberations on matters important to the promotion of learning that takes place primarily at universities. In FY2003, the Subdivision on Science put together a report in April on "Making Joint-Use University Facilities into Corporate Bodies," and one on "The State of Attached Laboratories and Research Institutions under the New National University Corporation System." In October 2003, the Subdivision put together a report on "The State of Big Science."

3.3.1.2.1.4 Activities of the Science Council of Japan (SCJ)

The Science Council of Japan (SCJ) was originally founded in 1949, and is the leading organization representing Japan's scientists, both domestically and internationally.

The SCJ's 19th term began in July 2003. Building on the remarkable achievements of the 18th term, beginning with those of the Committee on Japan Perspective and the Committee on New Science Scheme, SCJ drew up action plans for the 19th term, including the setup of eight special committees to functionally respond to short- and long-term assignments that require examination. These committees are proceeding with their examinations, emphasizing comprehensive points of view that cut across departmental disciplines, such as the integration of the humanities and science, and taking care-

ful note of new viewpoints being demanded in today's academic world, such as consideration of perspectives on gender.

The Bill to Amend Part of the Science Council of Japan Law was proposed in February 2004 in the 159th session of the Diet. The Bill was designed to revise the Science Council of Japan's jurisdiction, organization, method of recommending members, and other related matters based on the conclusions concerning the status of the Science Council of Japan that were reached through the deliberations of the Council for Science and Technology Policy, made based on the provisions of Article 17, Paragraph 9 of the Basic Law for Central Government Reform. The Bill was passed and promulgated in April 2004.

(1) Deliberation Activities

Recognizing that Antarctic region observation is an important national project that should be continuously addressed by the whole government, the SCJ submitted to the government in September 2003 a demand for the "Continuation and Enhancement of the Antarctic Region Observation Project." It pointed out that necessary actions must be taken to realize the continuation and enhancement of the project, beginning with the preparation of transport methods such as research ships.

In order to provide a report in reply to the Ministry of Agriculture, Forestry and Fisheries' October 2003 inquiry on the "Content and Assessment of the Multiple Functions of Fisheries and Fishing Communities with Respect to the Global Environment and Human Life," the SCJ set up the Special Committee on the Multiple Functions of Fisheries and Fishing Communities. The committee is currently considering the issue from a wide-ranging perspective that integrates the humanities, social sciences, and natural sciences.

(2) International Scientific Echange

The SCJ represents Japan through its affiliation with many international scientific organizations, including the International Council for Science (ICSU). The SCJ actively works with international programs for scientific cooperation, and strives for coordination with other countries

The Asian Conference on Scientific Cooperation (ACSC) gathered scientists from ten Asian countries to a conference held in Tokyo on an annual basis until FY2000 for the purpose of collaboration and cooperation among Asian countries in scientific research. It was reorganized into an international scientific organization, the Science Council of Asia (SCA), for which the SCJ serves as secretariat, and member countries host its conference in rotation. Conferences are convened annually on the theme of sustainable development in Asia. The third conference was held in Indonesia in May 2003.

In December 2003, SCJ hosted the "International Conference on Science and Technology for Sustainability – Energy and Sustainability Science" in Tokyo. Discussions were held at the conference between relevant Japanese and foreign scientists on the roles that the scientific community should play within the international community in order to build energy sustainability, and specific recommendations were gathered.

The Science Council of Japan also obtains approval from the Cabinet to host important international conferences related to science. These conferences are held in Japan and jointly hosted with relevant scientific research organizations. In FY2003, the Council co-hosted eight such conferences, including the International Union of Geophysics and Geodesy 2003 General Assembly.

(3) Open Lectures and Symposiums

The SCJ sponsors open lectures as a way of giving science results back to the citizens of Japan. The SCJ also actively sponsors symposiums that engage in various scientific issues. The Divisions and Liaison Committees of the SCJ play a

central role in organizing such symposiums in cooperation with various academic institutions.

In FY2003, the SCJ hosted two open lectures and 98 symposiums.

Furthermore, the SCJ jointly hosted with the Cabinet Office and Nippon Keidanren (Japan Business Federation) the "Second Conference on the Promotion of Industry-Academia-Government Collaboration" in Kyoto in June 2003, and the "Third Summit on Industry-Academia-Government Collaboration" in Tokyo in November 2003, in order to promote collaboration between industry, academia, and government. The SCJ also hosted a "Regional Promotion Forum" in Nagoya in November 2003, in Sapporo in December 2003, and in Hiroshima in January 2004.

3.3.1.2.2 National Experimental Research Institutions, Public Experimental Research Institutions, and Incorporated Administrative Agencies

National experimental research institutions, incorporated administrative agencies, and public experimental research institutions are assigned the task of achieving policy targets. It is critical for these organizations to carry out prioritized research and development that centers on basic, pace-setting research to improve the nation's science and technology level. They should also carry out systematic and integrated research that sets concrete targets in line with policy needs. Public experimental research institutions that belong to local governments shoulder the responsibility for carrying out technical development, and providing technical guidance that meets the needs of local industry and their region.

The total FY2003 expenditures related to science and technology, which cover experimental research, personnel, and facilities expenditures for the national experimental research institutions (including the Geographical Survey Institute, the National Geography Institute, the Japan Coast Guard's Hydrographic and Oceanographic Department, and other institutes), incorporated administrative agencies, and public research institutions, were 1.4366 trillion yen.

Moreover, based on the "Reorganization and Rationalization Plan of Public Corporations," public corporations that undertake research activities along with other public corporations will be converted into incorporated administrative agencies after October 2003, thereby putting into place a system in which they can implement more enhanced, effective, and efficient research activities.

3.3.1.2.3 Private Sector Research and Development

It is critical for the nation to reinvigorate the research and development activities of the private sector, which play an important role together with the activities of the national government. Therefore, it is important for the national government to increase the drive for a broad range of private sector research and development activities, based on the fundamental concept of self-reliance among the private sector.

3.3.1.2.3.1 Promoting Private Sector Research Activity through the Taxation System

Measures within the taxation system that aim to promote research and development by the private sector include systems that provides a tax credit on a certain percentage of gross experimental and research expenses, and a tax credit on a certain percentage of experimental and research expenses in joint academia-industry-government research collaborations and commissioned research.

Revisions to the taxation system in FY2004 extended until FY2005 special measures concerning the tax basis for fixed asset taxes on assets used for biotechnology research, following a reexamination of which equipment would be covered by the measures. Necessary measures were also taken to ensure that following their incorporation, national universi-

ties and inter-university research institutes would be covered by special measures concerning the real property acquisition tax and the fixed property tax for corporations subject to Article 34 of the Civil Law that develop facilities on the grounds of national universities for the purpose of joint research with those universities.

Table 3-3-6 shows the current tax measures through April 2004 that are related to the promotion of science and technology, including the measures introduced in this section.

Table 3-3-6 Major preferential treatment for science and technology promotion

Item	Purpose	Description	Applicable law	Date of enactment/ validity
R&D taxation system	Promotion of research and development investment by the private sector, etc.	I. Incremental Tax Credit for Increased Research Expenditures (Optional: Taxpayers may elect either I, II or III.) (1) The research credit is 15% of the excess of research expenses over the base amount. (The base amount is the average of annual research expenses for the three years with the highest expenses in the five tax years preceding the current business year.) The maximum amount is the sum of 12% of the corporation tax liability (Corporate tax). (2) Furthermore, when a corporation incurs special experimental and research expenses for joint research with national research institutes (including independent administrative institutions) and/or universities and colleges, a value equivalent to 15% of that value is added to the upper limit on the tax credit amount in (1) above (but the tax credit amount after the addition is limited to 14% of the equivalent of the corporate tax). (3) Same for individual businesses (Income tax)	Special Taxation Measures Law, Article 10 (income tax), Article 42-4, Article 68-9 (corporate tax), Local Tax Law, Supplementary Provision, Article 8, Item 1.	Enacted in FY1967, effective through FY2005
		II. Proportional Tax Credits for total research expenses (Optional: Taxpayers may elect either I, II or III.) a. Special Tax Credit for total research expenses (1) The tax credit amount is a fixed percentage (10%-12% (FY2003-6) and 8-10% (after words)) of experimental and research expense totals (but limited to a value equivalent to 20% of corporate tax). (2) Same for individual businesses (Income tax). b. Special Tax Credit on joint and entrusted research based on industry-academic-government cooperation (1) For joint experiments and research with, or experiments and research commissioned to, universities and public research institutes, consistent with item a. above, the tax credit amount is a value equivalent to 12% (increased by 3% to 15% as a special measure for FY2003-6) of these experimental and research expenses (but limited to a value equivalent to 20% of corporate tax with the special tax credit from item a. above added in). (2) Same for individual businesses (Income tax).		Enacted in FY2003 (The special measure period is effective until FY2005)

Item	Purpose	Description	Applicable law	Date of enactment/ validity
		III. Tax system to strengthen the technical base of small and medium-sized corporations (Optional: Taxpayers may elect either I, II or III.) (1) The tax credit amount is a value equivalent to 12% (increased to by 3% to 15% as a special measure for (FY2003-6) of test and research expenses at small and medium-size corporations (but limited to a value equivalent to 20% of corporate tax). (2) Same for individual businesses (Income tax) (3) The tax credit amount in (1) above is excluded from the tax base for corporate inhabitants tax (Local tax).		Enacted in FY1985 (The special measure period is effective until FY2005.)
		IV. Special Depreciation for Equipment used in Development Research (1) When specified equipment for development research is acquired and used in domestic R&D, a special depreciation equivalent to 50% of the value at acquisition will be allowable (Corporate tax). (2) Same for individual businesses (Income tax).	Special Taxation Measures Law, Article 11, Item 3 (income tax), Article 44-3, Article 68-20-2 (corporate tax)	Enacted in FY2003, effective through FY2005
Deductions for Donations, etc	Promotion of science and technology	(1) The following donations made by individuals or corporations shall be given preferential treatment: 1. Donations to public interest corporations that are designated by the Finance Minister as being publicly solicited, contributing to the promotion of education or science, and assuredly going to urgent causes (Designated donations) 2. Donations to public interest corporations that promote education or science, significantly contribute to the public interest, and are donated to specified, qualified public-benefit promotion institution in relation to the main activities of the corporation; 3. Donations to specified approved charitable trusts that receive approval of the competent minister as promoting education or science, significantly contributing to the public interest, and filling specified requirements. (2) With regard to donations of spot goods to corporations engaged in businesses in the public interest, and that receive approval of the Director-General of the National Tax Administration Agency as filling the requirements of promoting education or science.	(1) Corporate Tax Law, Article 37, Item 4; Income Tax Law, Article 78, Item 2 (2) Corporate Tax Law, Article 37, Item 4; Income Tax Law, Article 78, Item 2 (3) Corporate Tax Law, Article 37, Item 6; Income Tax Law, Article 78, Item 3 Special Taxation Measures Law, Article 40	Enacted in FY1946 (corporate tax), Enacted FY1962 (income tax) Enacted FY1961 (corporate tax), Enacted FY1962 (income tax) Enacted in FY1987 Approval procedure streamlined in FY2003
Measures for Tax Exemptions on Research Assets of Scientific Research Corporations	Promotion of science and technology	Assets provided to corporations established under Civil Law Article 34 for the purpose of scientific research are exempted from the real property acquisition tax, fixed property tax, special land holding tax, and city planning tax, subject to their direct use in that	Local Tax Law, Article 73-4, Item 1, Article 348, Item 2, Article 586, Item 2, Article 702-2, Item 2	Fixed property tax in 1951, real property acquisition tax in 1954, city planning tax in FY1956, special land holding

		research.		tax in FY1973
Special Measures for Property Taxation Standards related to Biotechnology Research Assets	Reduction of burdens related to prevention of danger and harm to the public	Of the equipment that is required for experiments and research in gene recombination technologies, etc., the tax base for the purpose of fixed property tax is reduced to three-fourths for three fiscal years for new equipment that is acquired for the purpose of taking nonproliferation measures in accordance with the "Law Concerning the Conservation and Sustainable Use of Biological Diversity through Regulations on the Use of Living Modified Organisms."	Local Tax Law Supplementary Provisions, Article 15, Item 22	Enacted in FY1986, effective through FY2003
Tax system for Promotion of Research Exchanges	Promotion of research exchanges, and revitalization of local economies	When corporations subject to Article 34 of the Civil Law develop facilities on the grounds of incorporated national universities for joint research with those incorporated national universities or incorporated inter-university research institutes, the tax on real property acquisitions is reduced to one-half, while the tax base for the fixed property tax is reduced to one-half for the first five years after acquisition, and to three-fourths for the succeeding five years.	Local Tax Law Supplementary Provisions, Article 11, Item 17, and Article 15, Item 24	Enacted in FY1999 (real property acquisition tax), enacted in FY2000 (fixed property tax) (effective through FY2004)

(As of April 2004)

3.3.1.2.3.2 Promoting Private Sector Research Activities through Investment and Loans

To promote research activity in the private sector, fiscal investment and loan systems for technology development are implemented by various government-affiliated organizations. The following section introduces some of the main examples of this.

(1) National Agriculture and Bio-oriented Research Organization

The National Agriculture and Bio-oriented Research Organization was established in October 2003 through the merger of the National Agricultural Research Organization and the Bio-oriented Technology Research Advancement Association, with the aim of promoting experimental research in the private sector concerning the designated industrial technology of biological systems. Using investments and financing from the Industry Investment Special Account and investments from private sources, the Organization provides funds and conditional interest-free loans, as well as referrals for joint research. In FY2003, investments and financing from the Industry Investment Special Account totaled 1.5 billion yen.

(2) Organization for Pharmaceutical Safety and Research

The Organization for Pharmaceutical Safety and Research (OPSR) started operating in October 1987 with the aim of promoting experimental research in the private sector concerning medical products technology and similar matters. Using funds from the Industry Investment Special Account and private sources, the organization provides conditional interest-free loans and funds, and encourages joint research activities. In FY2003, funds from the Industry Investment Special Account totaled 1.3 billion yen.

(3) Other Financial Provisions

To ensure the development of new technologies recognized as being able to contribute to a major improvement in the level of Japan's industrial technology, the Development Bank of Japan implements the New Technology Research and Development Loan Program to provide long-term, fixed, low-interest loans to corporations for development costs related to new technologies.

3.3.1.2.3.3 Promotion of Private Sector Research Activities through Subsidies

A system of subsidies is made available to support research and development aimed at commercialization by the private sector. The main subsidies are as follows:

(1) Subsidies for Pharmaceuticals to Treat Rare Diseases

To support research and development on drugs, etc., for diseases that afflict very few Japanese, subsidies are provided for costs related to experimental research for applicable pharmaceuticals, etc.

(2) Research and Development Project for Advanced Industries in the Agriculture, Forestry, and Fisheries Industries, and the Food Industry

Subsidies are being provided to promote private sector research and development in the biotechnology sector, and to promote the practical application of exceptional research results obtained at incorporated administrative research agencies.

(3) Technology Development Project for the Creation of Collective Private Agribusiness

In order to stimulate agribusiness, support is given for research and development that utilizes the potential of universities and incorporated administrative agencies, and is conducted by private-sector enterprises that assume the task of turning research results into practical applications.

(4) Research and Development Project to Create New Enterprises

As part of the Millennium Project, the Ministry of Agriculture, Forestry and Fisheries used joint research groups that bring together private-sector enterprises, etc., to implement research and development toward the realization of functional crops.

(5) Program for the Support of Research on the Integration of Different Fields for the Creation of Bio-oriented Industries

Orchestrating the R&D ability of industry, academia, and the government, integrative research conducted by researchers from different fields is implemented with an open invitation for proposals from the public, and the building of partnerships is supported.

(6) Technology Developing Project for Strengthening Industrial Infrastructure

To strengthen the technological infrastructure of Japan's food industry, projects are subsidized after themes have been selected based on the evaluations of outside specialists and experts on specific topics canvassed from enterprises, following the government's indication of technological topics.

(7) Subsidies for Research and Development of Creative Technologies

From the perspective of technology development and improving the technological capabilities of small and medium-scale enterprises, subsidies are provided for costs related to the development of creative new products, and the research and development of new technologies.

(8) Subsidies for Cutting Edge Technology Research and Development

The National Institute of Information and Communications Technology (NICT) subsidizes the research and development costs for venture enterprises carrying out cutting edge R&D related to telecommunications technologies that will lead to the creation of new business in the future.

(9) Subsidies for Research and Development into the Improvement of Communication and Broadcast Services for Elderly and Disabled People

The NICT provides private sector corporations, etc., with subsidies for research and development costs necessary for the development of communication and broadcast services for the elderly and disabled.

(10) Program for Support (Subsidy) of Technology Development for Creation of New Industries

To support particularly promising research and development from a regional perspective, and to nurture groups of corporations with world-class technologica
l capabilities, subsidies are provided to private sector corporations, etc., for research and development costs related to technology that contributes to the creation of new industries.

(11) Private Sector Fundametal Technology Research Support Scheme

In order to promote experimental research into infrastructure technologies conducted in the private sector related to the mining, manufacturing, electro-communications and broadcasting industries, public applications are invited for entrustment research contracts. Applications are accepted by the New Energy and Industrial Technology Development Organization for mining and manufacturing technologies, and by the NICT for communications and broadcasting technologies.

(12) Grants for Practical Application of Industrial Technology

To strengthen industrial technology in the private sector, the New Energy and Industrial Technology Development Organization (NEDO) provides financial support on a cost-sharing basis to private sector enterprises for development of practical new technologies aimed at creating new markets or responding to social needs.

(13) Subsidies and Consignment Expenses, etc., Conducted under the Small Business Innovation Program

This program is described under the section entitled, “3.3.2.4, Developing an Environment to Invigorate Research and Development-style Ventures.”3.3.1.2.3.4 Other

A number of measures are being implemented to ensure the availability of superior personnel at small businesses, venture businesses, and other corporations that have just started business operations. These measures include the promotion of personnel exchanges between universities and industry, etc., in order to nurture and produce personnel with an entrepreneurial sprit, to implement model research for courses offered on leading entrepreneurship at universities, etc., to further promote internships at venture businesses, etc. (student enterprise experience program), and to encourage university graduates to go into venture business operations.

Additionally, to support the creation of new businesses through entrepreneurial activities within corporations or through corporate spin-offs, a share conversion and share transfer program is being implemented to ensure the smooth reform of corporation organizations through the use of corporate spin-offs and holding companies, etc. In addition, studies have commenced into the development of a legal system for breaking up companies.

The Law for Promotion of New Enterprises is intended to promote the creation of new enterprises that make use of local industrial resources such as technology or personnel, etc., and offer support for business activities that utilize the new technologies of small and medium-scale corporations, for the development of a general support system from research and development through commercialization, and for the development of facilities that promote the expansion of businesses that utilize research results.

In addition, when preparation by the private sector is difficult because of the need for large-scale and joint-use facilities, the national government is prepared to undertake the preparation of facilities and equipment for joint use with the private sector (Table 3-3-7).

Table 3-3-7 Development of large-scale and expensive joint-use facilities

Ministry or agency	FY of first use	Facility name, Summary of facility or equipment	No. of cases for private-sector use (Unit: No. of cases)							
			FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003
Ministry of Internal Affairs and Communications	1999	TAO. Tsukuba Gigabit Laboratory	—	—	—	15	26	29	55	54
		TAO. Keihanna Gigabit Laboratory	—	—	—	15	28	26	26	14
		TAO. Kitakyushu Gigabit Laboratory	—	—	—	12	28	22	25	19
		TAO. Kyoto Gigabit Laboratory	—	—	—	7	8	12	15	7
		TAO. Okayama Gigabit Laboratory	—	—	—	7	12	29	18	13
		Shared Use Research Facilities established by the Telecommunications Advancement Organization of Japan (TAO) in five locations around Japan as one part of the "Japan Gigabit Network" for the purpose of early attainment of a very-high speed multimedia society. The facilities are broadly open to corporations, universities, research institutions, municipal corporations, etc., and provide an environment for the implementation of research and development of high-performance applications technologies, etc.								
		Hokkaido R&D Center	—	—	—	11	12	16	12	9
		Tohoku R&D Center	—	—	—	12	10	20	21	22
		Tokai R&D Center	—	—	—	14	27	27	20	21
		Kinki R&D Center	—	—	—	15	18	14	12	0
		Chugoku R&D Center	—	—	—	14	14	14	11	8
		Takamatsu, Okayama R&D Center	—	—	—	12	13	13	23	17
		Kyushu R&D Center	—	—	—	14	20	15	11	10
		Shin-etsu R&D Center	—	—	—	14	28	27	9	10
		Hokuriku R&D Center	—	—	—	9	11	12	12	14
		Okinawa R&D Center	—	—	—	11	10	12	10	9
		10 nationwide open facilities for research and development on digital terrestrial television broadcasting on a practical scale were established by the Telecommunications Advancement Organization of Japan (TAO). Furthermore, these 10 facilities are also connected with a nationwide network relay experimental facility used for local broadcasters, with the participation of wide ranging fields in education, welfare, distribution, publishing, and local public authorities, etc., to provide an environment for the implementation of research and development of new technologies and services.								
Ministry of Education, Culture, Sports, Science and Technology	1996	Numerical Space Engine Supercomputer and various servers	1	4	2	0	0	0	0	0
	1997	Snow and Ice Disaster Prevention Test Facility	—	1	3	0	3	6	6	8
		Completed March 1997. Total construction costs: 1.4 billion yen. Two snow-making devices can generate two types of falling snow, the crystalline and globular types. Also equipped with rainfall, sunshine, and wind tunnel devices, to recreate all possible snow and ice phenomena. Low-temperature test facility: Temperature –35℃ to 25℃ Base area: 24m × 7m								
	1997	Synchrotron Radiation Facility (SPring-8)	—	5	14	26	50	62	115	139
		The facility construction was carried out jointly by the Japan Atomic Enegy Research Institute (JAERI) and RIKEN-and is designed for research in a wide range of disciplines using synchrotron radiation that is emitted from an electron traveling at almost the speed of light when its path is bent by a magnetic field. Japan Synchrotron Radiation Research Institute (JASRI), which was designated by law as the Organization for the Promotion of Synchrotron Radiation Research, has conducted facility management and striven to promote its public use.								
	1997	High Enthalpy Shock Tunnel At 80 meters in length, the world's largest free-piston shock tunnel. Maximum pressure 150Mpa, maximum entropy 25MJ/kg.	—	0	1	0	0	0	0	0
	1998 (*1)	Ultra-Strong Magnetic Field Generating Device (powerful field magnet)	16	16	62	73	70	68	83	87
		An advanced facility that uses a world–class 40–ton hybrid magnet and various other magnets for study into magnetic field strength, special expansion, precision, and stability, in order to conduct measurements into electronic properties, material properties, etc.								
Ministry of Health, Labour and Welfare	1975	Special Gas Explosion Test Device Large-scale pressure-resistant facility for testing the safety performance of explosion-proof electrical facilities.	15	10	1	0				
	1982	Equilibrium Performance Measurement Device	1	0	1	1				
		Research facility for explicating equilibrium performance in the human body, loss of balance when subjected to external forces, etc.								
	1988	Centrifugal Loading Device Research facility for explicating earth collapse characteristics	3	0	4	4				
	1997	Tsukuba Primate Center Joint Use Facility Provides quality monkeys uninfected by specific viruses, to promote health sciences research, including research on gene therapy, longevity sciences, brain and nervous system, and intractable	—	0	2	2				
Ministry of Agriculture, Forestry, and Fisheries	1996	Building for engineering experiments related to earthquake resistance and comfortable wood construction	—	1	2	1	1			
		Test facility for seismic resistance of wood structures: Reaction floor, Reaction wall, Actuators (2 units of 300KN, 2 units of 200KN, and 4 units of 100KN)								
Ministry of Land, Infrastructure and Transport	1997	Sudden Braking and Increased Vibration Testing Apparatus with Intra-Pier Continuous Girders	—	0	0	0				
		Involves the use of apparatus to conduct research into earthquake-resistant designs of bridges, by using air bearings to float a 32-meter-long intra-pier continuous girder and the entire supporting bridge structure, including bridge abutments and piers, and then running a freely suspended weight across it to collide and come to a sudden stop against a reaction wall, in order to input data about impact acceleration.								
	1999	Aqua Restoration Research Center	—	—	—	5	3	0	2	
		Researches the preservation of river and marshland ecologies, for the purpose of research and development that facilitates mankind's coexistence with nature.								

Notes: 1. Cases of use in FY2002 are for April 1 to December 31.

*1.Outside use based on joint research contacts. Beginning in FY1998, however, research topics were open to public canvassing, with a committee composed of outside experts based at the institute charged with selecting topics.

3.3.2 Strengthening of Industrial Technology and Reform of the Structure for Co-ordination between Industry, Academia, and Government

3.3.2.1 Promoting Commercialization for the Practical Use of Research Results Achieved by Public Research Institutions

3.3.2.1.1 Introduction

3.3.2.1.1.1 Promotion of Cooperation among Industry, Academia, and Government

The 21st century is being referred to as the "century of knowledge." The creation and utilization of that knowledge is indispensable to Japan's future development, for which the cooperation among industry, academia, and government is an important effort. Cooperation among industry, academia, and government in Japan has made great progress recently. For instance, the number of joint research projects between universities and industry has more than doubled in five years. As of the end of March 2004, 1,236 patent licenses had been secured through Technology Licensing Organizations (TLOs)—specialty organizations that transfer the fruits of university research to industry, of which there were 36 as of end of March 2004. In the past three years, over 330 venture companies have been created that utilize the fruits of university research. As of August 2003, there were 654 such venture companies, of which 614 were university-based start-ups. At the same time, however, the acquisition and execution of patents in Japan is not always sufficient, given the world-class R&D capabilities of Japanese universities. The future cooperation among industry, academia, and government must be promoted further, for which various efforts are being strengthened.

3.3.2.1.1.2 Strengthening Intellectual Property Strategy

In July 2002, the government's Strategic Council on Intellectual Property settled on the Intellectual Property Policy Outline. December of the same year saw the enactment of the Basic Law on Intellectual Property. Based on that law, the Strategic Program for the Creation, Protection, and Exploitation of Intellectual Property—which sets out measures that the government should carry out in a focused and planned manner—was drawn up in July 2003. Various measures are being developed along the lines of this program in order to hasten the strategic acquisition and exploitation of intellectual property by universities, which are the fountainhead of knowledge.

3.3.2.1.2 Promoting Commercialization for the Practical Use of Research Results Achieved by Public Research Institutions

To encourage the practical use of research and development results obtained at universities, research institutions, etc., the JST offers a series of comprehensive programs covering the identification of exceptional research results, support for patent applications, and support for the commercial development of research results that are difficult to commercialize. The JST actively supports the patenting of research results obtained at universities, public research institutions, and TLOs, as well as other technology transfer endeavors, and also runs the Technology Transfer Support Center, which is responsible for foundational work related to these activities, including the education of human resources and comprehensive consulting on technology transfer issues. Under its Research Results Optimization and Transfer Project, the JST also promotes the following efforts based on the research results of universities and public research institutions: the implementation of a test to pursue the rights to intellectual property for patents relating to research results for which applications have been

filed for basic patents; the modeling of new technology concepts from R&D-oriented medium- and small-scale enterprises; and the formation of venture corporations stemming from universities and public research institutions through the promotion of R&D aimed at the creation of new industries. Furthermore, in collaboration with universities, public research institutions, and TLOs, the JST provides development referrals for, and help with, licensing research results. For research results that carry a particularly large development risk, JST offers the Contract Development Project that entrusts the development to corporations as a way of actively supporting the translation of new technologies into practical applications.

The Ministry of Education, Culture, Sports, Science and Technology supports university researchers who are attempting R&D that links basic research and research for product development—a stage of R&D that has insufficient support and is nicknamed "death valley." The Ministry targets researchers whose research results can be expected to lead to entrepreneurial activities in the future and subsidizes their R&D expenses and the management expenses for preparing a business plan toward the establishment of a business. As of the end of March 2004, MEXT has also placed coordinators in 76 universities nationwide, where they serve as bridges between universities and enterprises that are conducting joint research at the universities. By FY2003, MEXT had prepared facilities (dubbed "incubation facilities") at 23 national universities in support of practical research conducted by individuals who plan to use university research results and personnel resources to start up a venture business.

Furthermore, in recent years MEXT has been promoting the opening of special continuing education courses at universities and educational institutions to create human resources who are experts in both advanced technology and management (Management of Technology or MOT) and those who are experts in intellectual property. To foster human resources who are well versed in the securing and utilization of intellectual property, MEXT itself has since FY2002 been training human resources who will perform specialized jobs in the future at research locations, and equipping them with special knowledge about the securing and utilization of intellectual property as part of the "Fostering Talent in Emergent Research Fields," program, which is supported with Special Coordination Funds for Promoting Science and Technology.
"Program to Foster Talent in Emergent Research Fields,"

At RIKEN, researchers were granted permission to have side jobs, and a program for preferential measures in joint research was established in January 1998, with the aim of more effectively linking researchers' research results to practical application.

The Ministry of Agriculture, Forestry and Fisheries is implementing a Technology Results Transfer Promotion Program for the utilization and practical application of acquired patents by the private sector, through appointing coordinators to serve as a bridge between experimental research institutions and private-sector firms.

The Ministry of Economy, Trade and Industry helps translate university research results into businesses through implementation of the Practical Application Research and Development Program for University-based Business Creation, which supports joint research by making matches between industry and academia with the objective of creating practical applications, and through the Dispatch of Management Experts Program for university-based start-ups. Aiming at the creation of 10,000 MOT personnel, METI has since FY2002 also been promoting the improvement of environments for the cultivation of MOT human resources. It does this by supporting the development of curricula and educational materials needed to cultivate MOT personnel at a total of 73 educational institutions such as universities.

In order to provide the appropriate protection of

research results at national and public experimental research institutions and universities, and to support the smooth transfer of research results to industry, the Patent Agency hosts patent promotion fairs to provide opportunities for interaction with industries interested in adopting technologies. These fairs were implemented in 67 cities nationwide in the period between FY1997 and FY2002. In addition, the National Center for Industrial Property Information dispatches, as of the end of March 2004, patent promotion advisors to the 28 of 36 approved TLOs that are currently in operation, and also dispatches intellectual property management advisors to five universities to support the development of intellectual property management departments. In addition, the Patent Agency sponsors international patent promotion seminars for a broad range of researchers and students from universities and public research institutions, which bring together large groups of individuals who are experts in the transfer of technology both in Japan and abroad. The Patent Agency also implements basic and practical training on patent promotion and technology transfer necessary to promote the transfer of research results to industry.

Furthermore, the Law to Strengthen Industrial Technical Ability, which was enacted in April 2000, provides further policies to support the transfer of technology, such as measures to reduce patent fees, etc., for university researchers and university corporations.

To promote the utilization of research results obtained at national experimental research institutions, national universities, etc., conditions have been set to allow optional contracts for the transfer of government-held patents and for setting exclusive licenses. The relevant institutions were notified of these conditions in December 2000 and again in February 2001, and the result should be a greater return of the fruits of research to society.

3.3.2.2.Developing an Environment for the Transfer of Technology from Public Research Institutions to Industry

Public research institutions must clarify the responsibility of institutions and researchers to explain to society the content and results of their research, and must voluntarily and proactively promote intellectual asset rights for research results, rather than solely relying on research papers.

During the period of the First Science and Technology Basic Plan, each ministry and agency, working from the necessity of strengthening incentives to individual researchers, made efforts to attribute patents obtained during working hours to individuals, in order to encourage their utilization. These efforts, however, did not necessarily lead to increased implementation. As a result, to more effectively encourage the utilization of research and development results, patents are now to be attributed to the research institutions, in line with proposals in the Second Science and Technology Basic Plan. Accordingly, the number of preferential licenses extended to private sector organizations resulting from patents obtained through joint research between national experimental research institutions and private sector organizations has increased with every passing year.

To promote close coordination between national universities and local businesses, and to promote vigorous joint research activities, the Ministry of Education, Culture, Sports, Science and Technology is particularly striving to utilize the research capabilities and so forth of national universities. By March 2004, MEXT had promoted the development of centers for cooperative research at 58 national universities, and developed venture business laboratories at 45 national universities that support science and engineering-oriented graduate students. These venture business laboratories are aimed at the promotion of creative research and development that will result

in the creation of new industries, and the nurturing of creative personnel with an advanced level of specialized professional skill.

The Law for Promoting University-Industry Technology Transfer came into force in August 1998, with the aim of pioneering new business fields, improving industrial technology, and revitalizing research activities at universities by promoting the patenting of university research results and the transfer of technology to industry. 36 TLOs have been approved under this law as of the end of March 2004, and 5,058 patent applications have been filed, also as of March 2004, according to an investigation by the Ministry of Economy, Trade and Industry (Table 3-3-8, Figures 3-3-9 and 3-3-10). Moreover, the Industrial Revitalization Law, put into force in October 1999, reduced TLO patent fees by one half. Following the enactment of the Law to Strengthen Industrial Technical Ability in April 2000, TLOs now have the ability to use the facilities of national universities as offices at no cost.

Table 3-3-8 Approved TLOs (Total of 36 institutions)

March 2004: 36 institutions approved as TLOs, 2 institutions recognized as TLOs

Name of TLO company	Date approved		Name of participating university
Hokkaido Technology Licensing Office Co., Ltd.	Approved	Dec. 24, 1999	Hokkaido University and other universities and colleges in Hokkaido
TOHOKU TECHNO ARCH Co., Ltd.	Approved	Dec.4, 1998	Tohoku University, other national universities, etc., in the Tohoku region
Institute of Tsukuba Liaison Co., Ltd.	Approved	Apr. 16, 1999	University of Tsukuba, others
Center for Advanced Science and Technology	Approved	Dec. 4, 1998	University of Tokyo
The Foundation for the Promotion of Industrial Science	Approved	Aug. 30, 2001	Institute of Industrial Sciences, University of Tokyo
Tokyo University of Agriculture and Technology TLO, Co. Ltd.	Approved	Dec. 10, 2001	Tokyo University of Agriculture and Technology
THE CIRCLE FOR THE PROMOTION OF SCIENCE AND ENGINEERING	Approved	Aug. 26, 1999	Tokyo Institute of Technology
Campus Create. Co., Ltd.	Approved	Feb. 19, 2003	The University of Electro-Communications
	Recognized	Feb. 19, 2003	
Technology Advanced Metropolitan Area Technology Licensing Organization	Approved	Dec. 4, 2000	Tokyo metropolitan area universities
Yokohama TLO Co., Ltd.	Approved	Apr. 25, 2001	Yokohama National University, Yokohama City University, and other universities and colleges in Kanagawa prefecture
Niigata Technology Licensing Organization Co., Ltd.	Approved	Dec. 25, 2001	Niigata University and other universities and colleges in Niigata prefecture
KUTLO (Kanazawa University Technology Licensing Organization)	Approved	Dec. 26, 2002	Kanazawa University and other universities and colleges in Ishikawa prefecture and the Hokuriku region
Yamanashi Technology Licensing Organization Co., Ltd.	Approved	Sep. 21, 2000	Yamanashi University and Yamanashi Medical College
SHINSHU Technology Licensing Organization	Approved	Apr. 15, 2003	Shinshu University, Nagano National College of Technology
HAMAMATSU FOUNDATION for SCIENCE and TECHNOLOGY PROMOTION (January	Approved	Jan. 17, 2002	Shizuoka University and other universities and colleges in Shizuoka prefecture
NAGOYA INDUSTRIAL SCIENCE RESEARCH INSTITUTE	Approved	Apr. 19, 2000	Nagoya University and other universities and colleges in the Chubu region
Mie TLO (Mie Technology Licensing Organization)	Approved	Apr. 16, 2002	Mie University and other universities and colleges in Mie prefecture
Kansai Technology Licensing Organization Co., Ltd.	Approved	Dec. 4, 1998	Universities and colleges in the Kansai region (Kyoto University, Ritsumeikan University, etc.)
	Recognized	Jul. 10, 2002	
Osaka Industrial Promotion Organization	Approved	Aug. 30, 2001	Osaka University and other universities and colleges in Osaka prefecture
New Industry Research Organization (NIRO)	Approved	Apr. 19, 2000	Kobe University and other universities and colleges in Hyogo prefecture
Hiroshima Industrial Promotion Organization	Approved	Oct. 09, 2003	Hiroshima University and other universities and colleges in Hiroshima prefecture
Yamaguchi Technology Licensing Organization	Approved	Dec. 9, 1999	Yamaguchi University
TECHNO NETWORK SHIKOKU CO., LTD.	Approved	Apr. 25, 2001	Universities in the Shikoku region
Kyushu TLO Company, Ltd.	Approved	Apr. 19, 2000	Kyushu University
KITAKYUSHU TECHNOLOGY CENTER CO., LTD.	Approved	Apr. 1, 2002	Kyushu Institute of Technology and other universities and colleges in the Northern Kyushu region
Kumamoto Technology and Industry Foundation	Approved	Aug. 30, 2001	Kumamoto University and other universities and colleges in Kumamoto prefecture
Oita Technology Licensing Organization, Ltd.	Approved	Aug. 26, 2003	Oita University and other universities and colleges in Oita prefecture
Miyazaki TLO	Approved	Mar. 16, 2003	University of Miyazaki and other universities and colleges in Miyazaki prefecture
Kagoshima Technology Licensing Organization Co., Ltd.	Approved	Feb. 19, 2003	Kagoshima University, National Institute of Fitness and Sports in Kanoya, and Kagoshima National College of Technology
Keio University Intellectual Property Center	Approved	Aug. 26, 1999	Organizations on the Keio University campus
Tokyo Denki University Center for Research Collaboration	Approved	Jun. 14, 2000	Organizations on the Tokyo Denki University campus
Nihon University Business Incubation Center (NUBIC)	Approved	Dec. 4, 1998	Organizations on the Nihon University campus
NMS-TLO Center	Approved	Feb. 19, 2003	Organizations on the Nippon Medical School campus
Meiji University Intellectual Property Center	Approved	Apr. 25, 2001	Organizations on the Meiji University campus
WASEDA UNIVERSITY INTELLECTUAL PROPERTY CENTER	Approved	Apr. 16, 1999	Organizations on the Waseda University campus

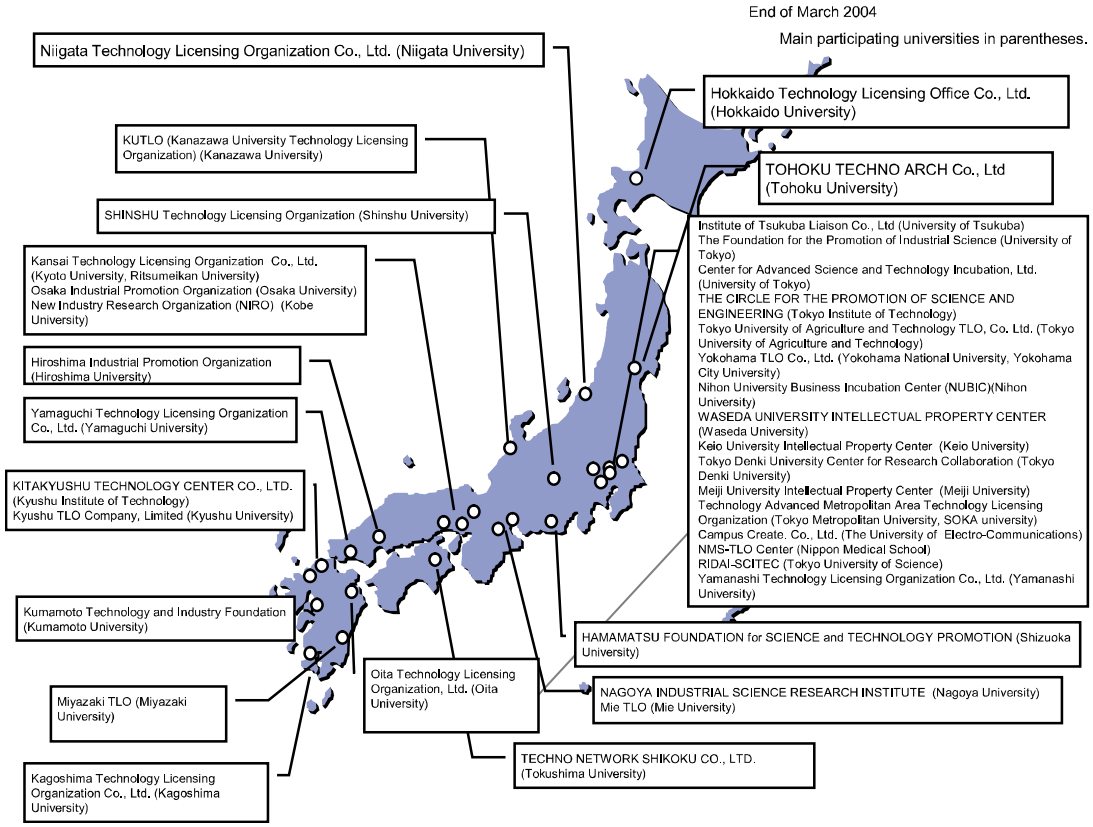


Figure 3-3-9 Distribution of approved TLOs (36 institutions)

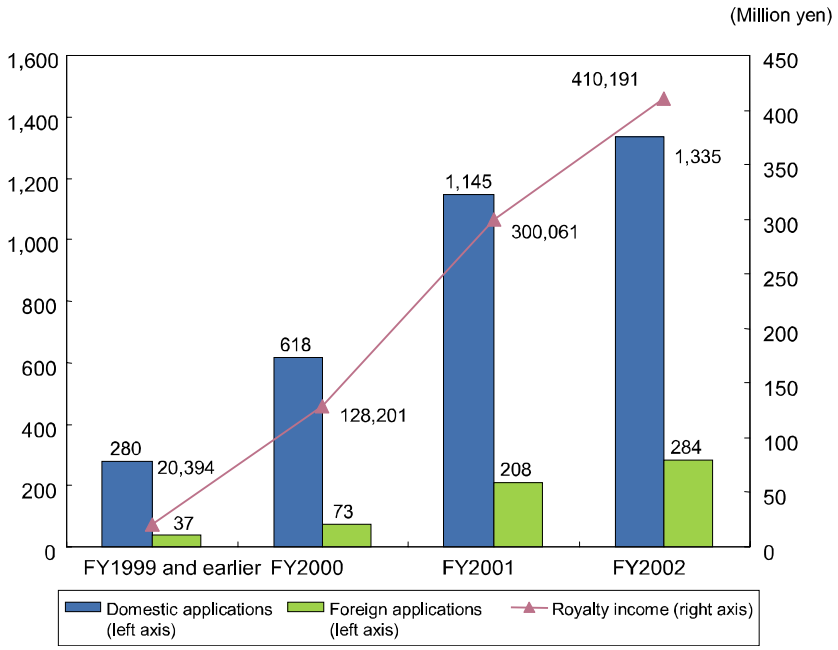


Figure 3-3-10 Trend in approved TLO patent applications and royalty

To support TLO activities, the Ministry of Economy, Trade and Industry has issued subsidies to TLOs since the early enforcement stages of the Law for Promoting University-Industry Technology Transfer. In response to the large burden that foreign patent applications are having on TLOs, METI started in FY2003 to help cover foreign application costs with expanded subsidies. Furthermore, METI drew up the "Guidelines for preparing trade secret management policy at universities," to enable universities to manage trade secrets to an appropriate extent under their own judgment, and to facilitate smooth technology transfer of universities research results to industry. The guidelines are being made widely known to university-connected individuals.
Additionally, Article 30 of the Industrial Revitalization Law (the so-called Japan version of the U.S. Bayh-Dole Act) put into force in October 1999, allows the researcher to whom government-sponsored research has been commissioned to fully own patent rights, etc., gained through research. This change is expected to stimulate greater desire to engage in research, and to promote commercialization of research results in the private sector.

Moreover, the Intellectual Property Policy Outline, etc., pointed out the need to support the development of a system that will allow strategic management of the creation, acquisition, control, and utilization of intellectual property at national, public, and private universities. Together with the incorporation of national universities in April 2004, development of such a system will follow the changeover from the current national government or individual ownership of research results patented at universities to organizational ownership as a general rule. Since FY2002, the Ministry of Education, Culture, Sports, Science and Technology has, through an open invitation for applications, selected 34 model institutions for improvement under the project to improve university intellectual property centers, and nine institutions for support under the "Program to Support Distinctive Intellectual Property Management/Utilization functions. (Figure 3-3-11)."

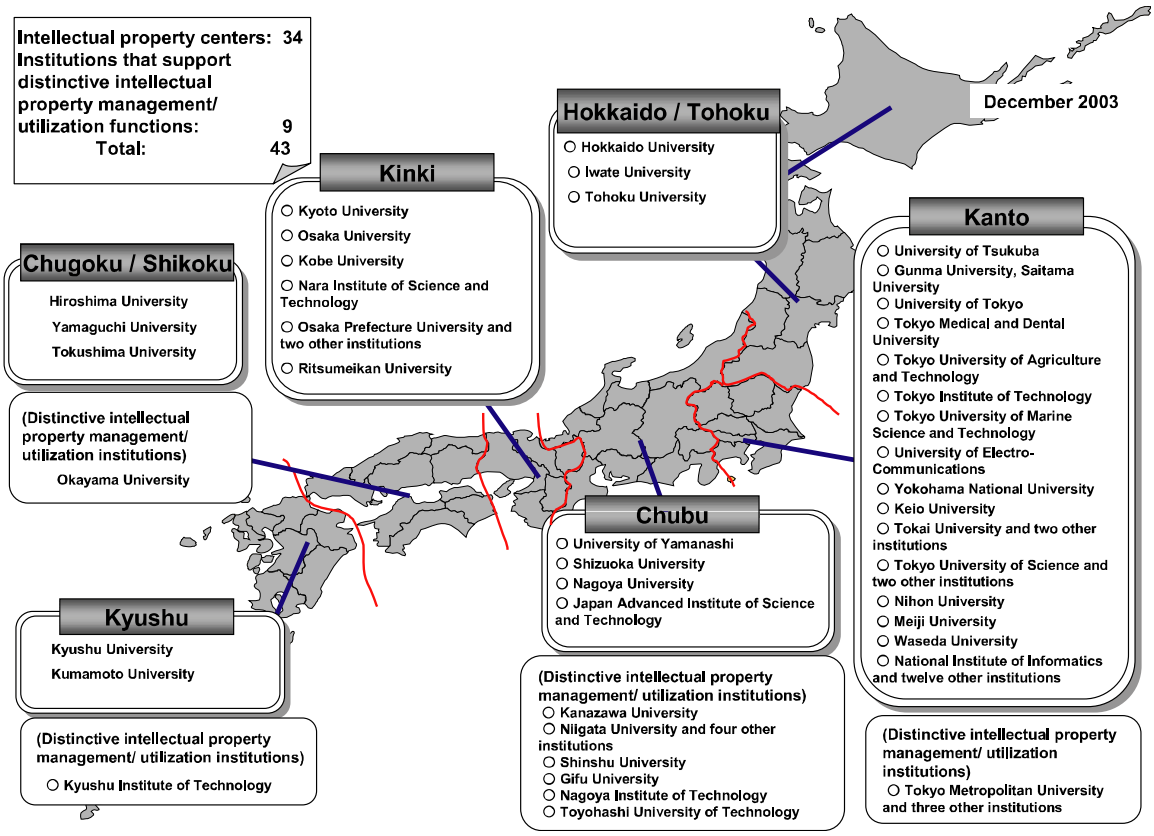


Figure 3-3-11 Regional distribution of university intellectual property

Such system improvements can be expected to further propel cooperation among industry, academia, and government, encourage technology transfers, and revitalize Japan's economy through the utilization of the outstanding knowledge produced at universities.

3.3.2.3 Reform of Structure for Disseminating Information and Research Exchanges Aimed at Strengthening Coordination among Industry, Academia, and Government

3.3.2.3.1 Increasing the Dissemination of Information

To promote the strengthening of coordination among industry, academia, and government, it is essential to bring about a state of common recognition between industry and public research institutions, including universities. For this reason, public research institutions, including universities, are making research results available to the public and providing information in a number of ways, including the presentation of research results, the release of annual reports and other publications, the submission of research papers to various academic societies and journals, and the disclosure of government-owned patents.

To contribute to the creation of new industries, the Ministry of Education, Culture, Sports, Science and Technology utilizes the JST to compile databases covering a broad range of R&D support data and research results data for wide availability over the Internet. Specific examples are the Directory Data-base of Research and Development Technol-

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.

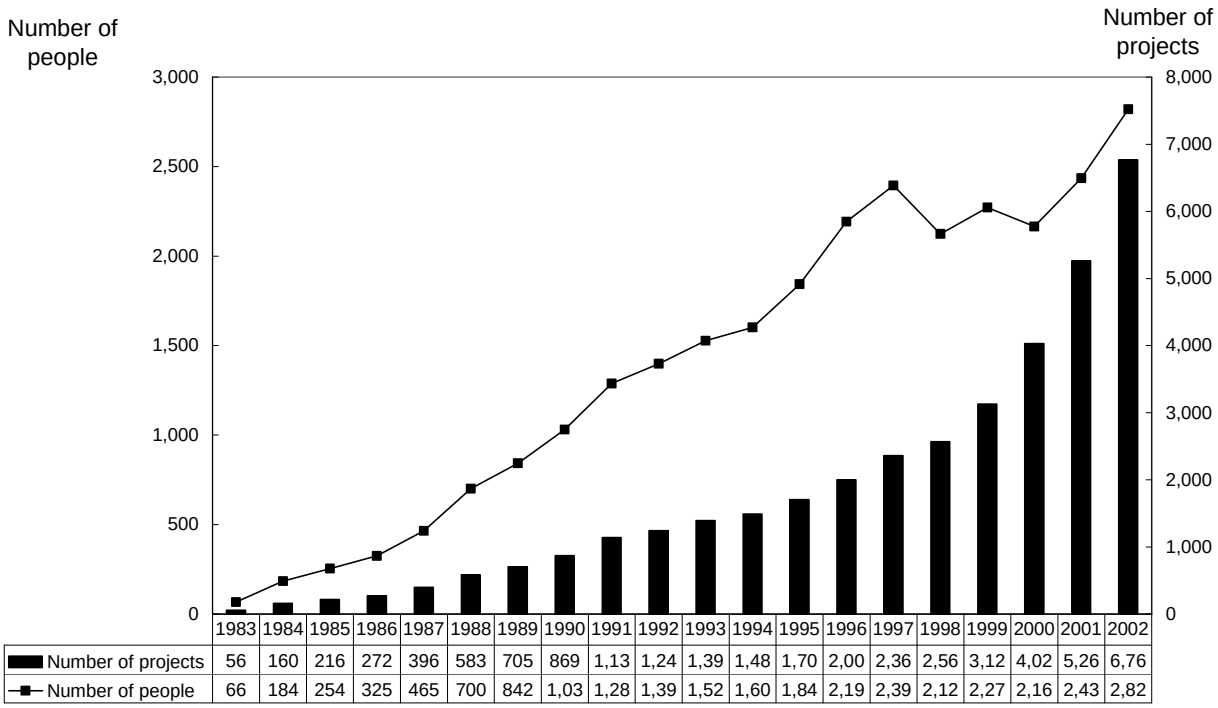
3.3.2.3.2 Promotion of Research Exchanges

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.

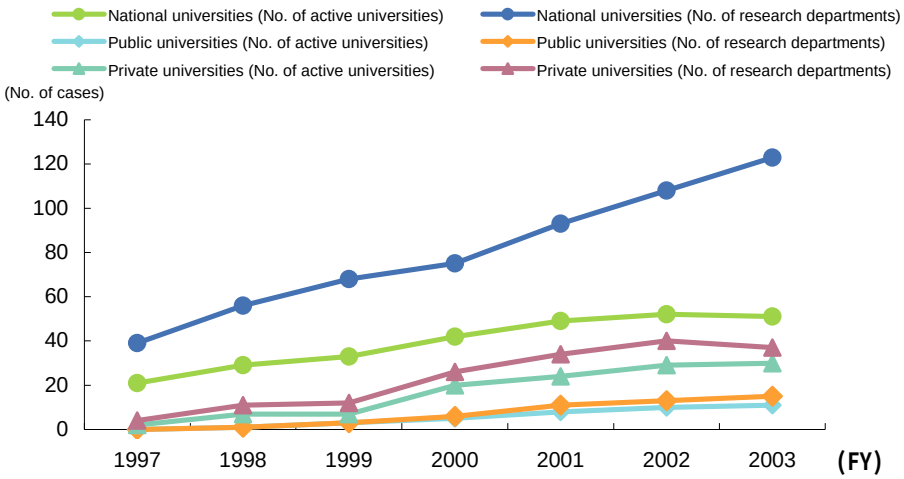
In addition, when the Law on the Special Zones for Structural Reform went into effect in April 2003, special measures in the Law for Facilitating Governmental Research Exchanges were implemented, making it possible to expand the scope of low-cost usage of government-owned facilities within special district 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.

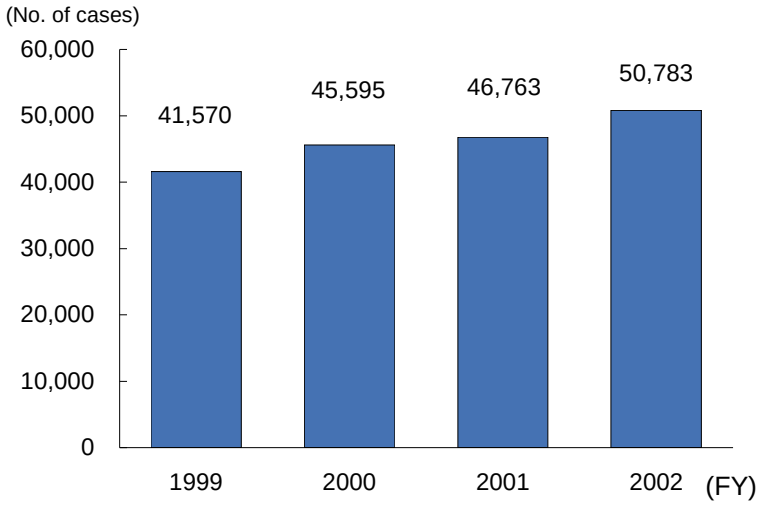
Source: Prepared by MEXT.

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 (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 (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 (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).

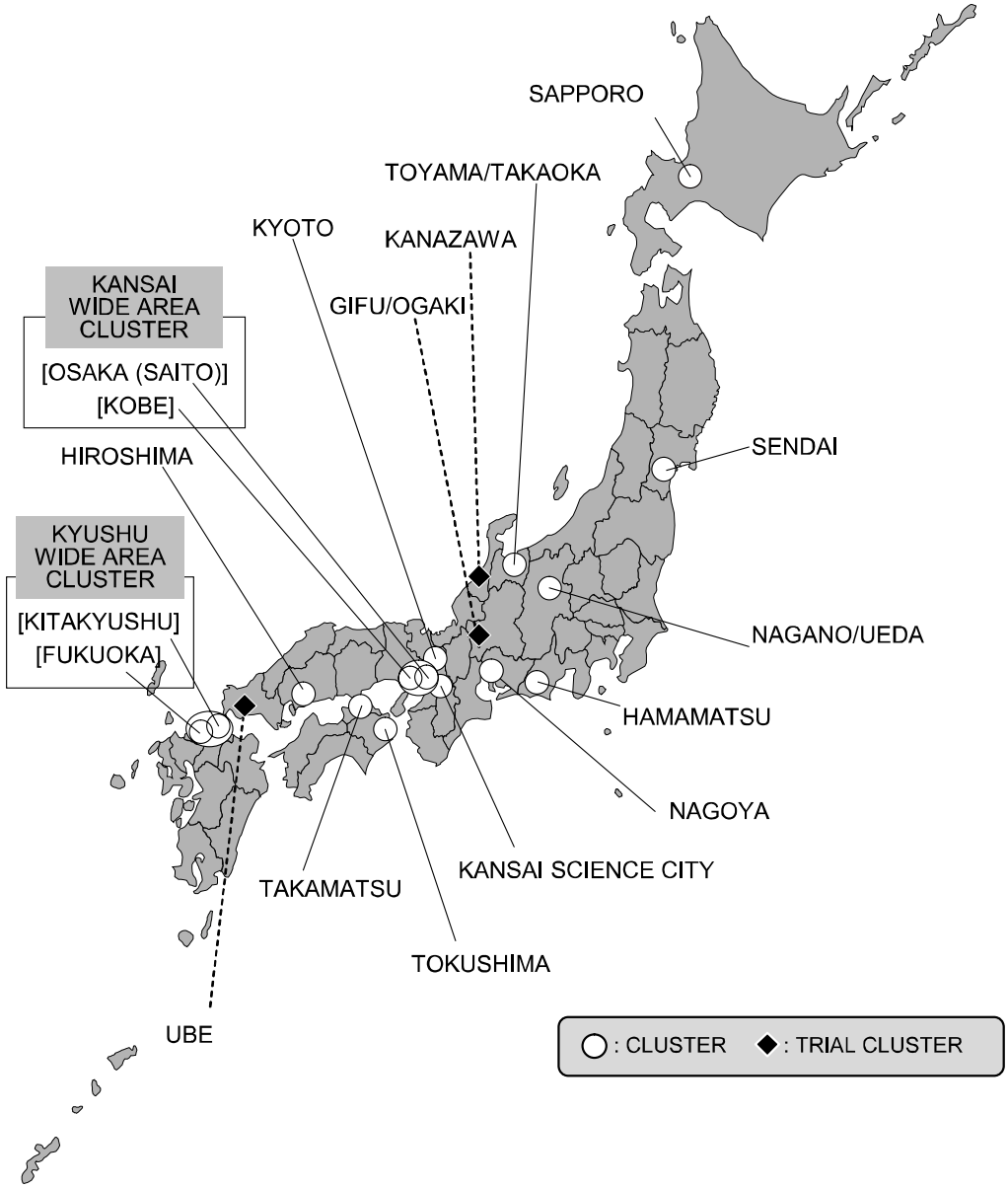


Figure 3-3-17 Map of Knowledge Clusters

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

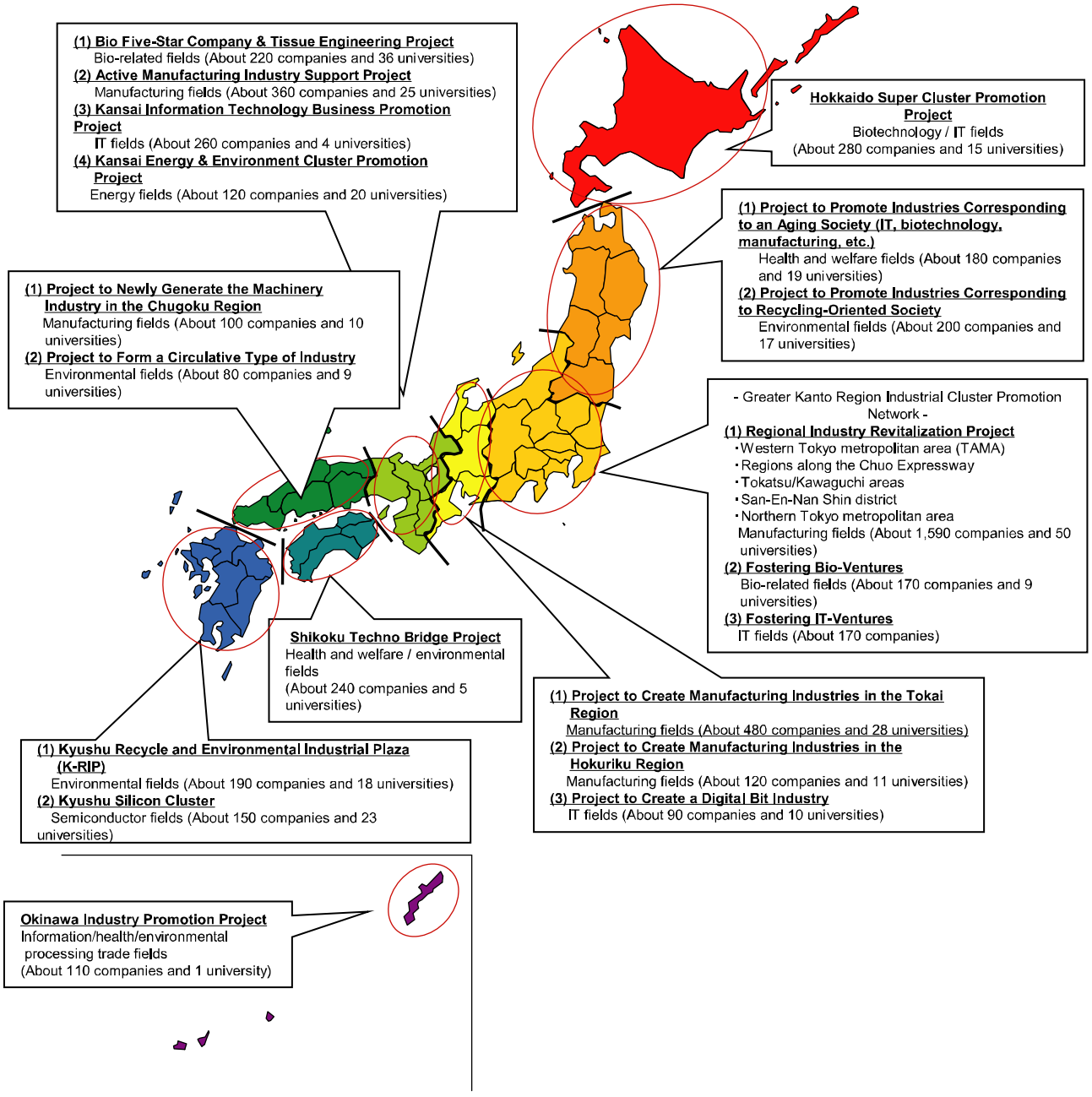


Figure 3-3-18 The Industrial Cluster Project

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: 1. Subsidized projects conducted by prefectural testing and research institutes ・Research required for the establishment of core agricultural technology systems for a local area ・Research needed for commercialization of biotechnology and other advanced technologies, etc. 2. Projects consigned to prefectural test and research institutions, and implemented as part of national testing and research ・Quality improvement tests ・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 ・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

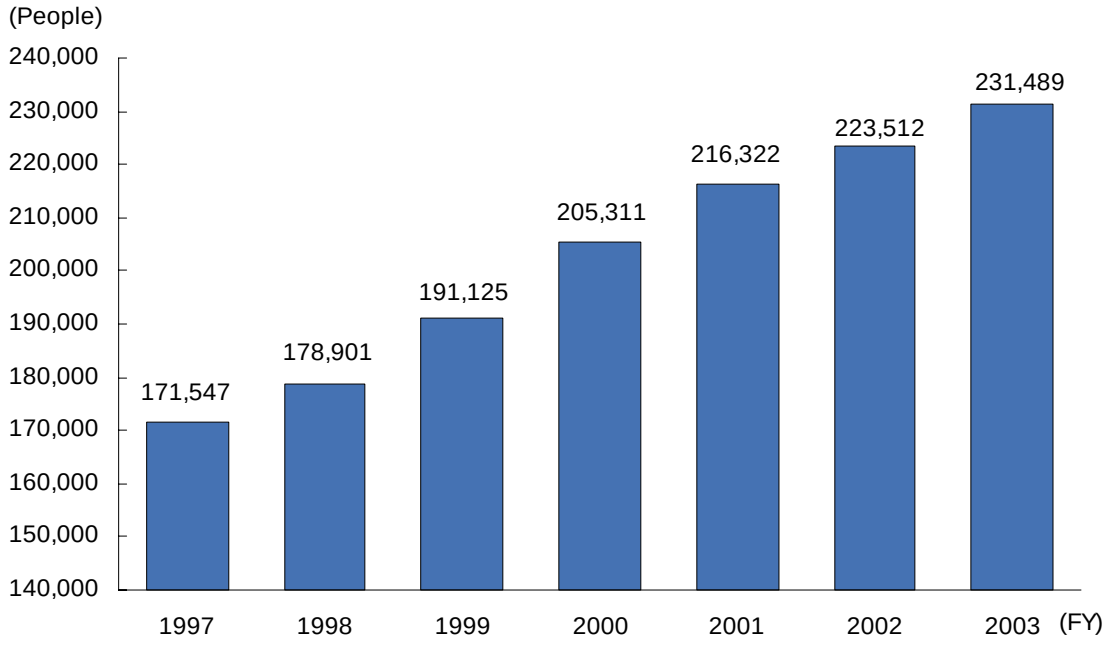
The development of excellent researchers and engineers is an extremely important issue within the reform of the science and technology system. Universities, which play the core role in that development, should step up the cultivation of researchers and engineers who possess abundant creativity and originality, 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).

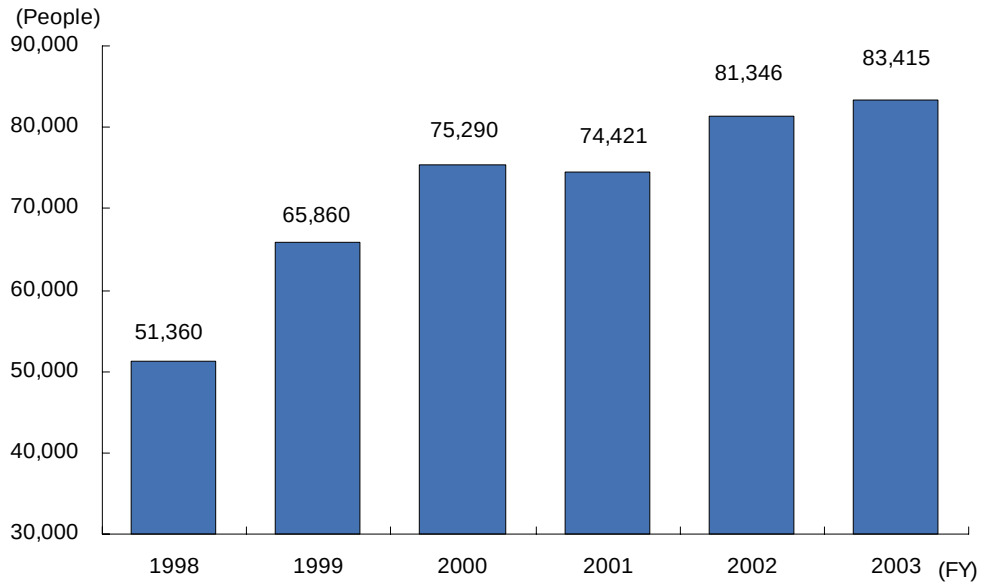


Figure 3-3-22 Trend in the total number of people (graduate students) receiving scholarships from the Japan Scholarship Foundation

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).

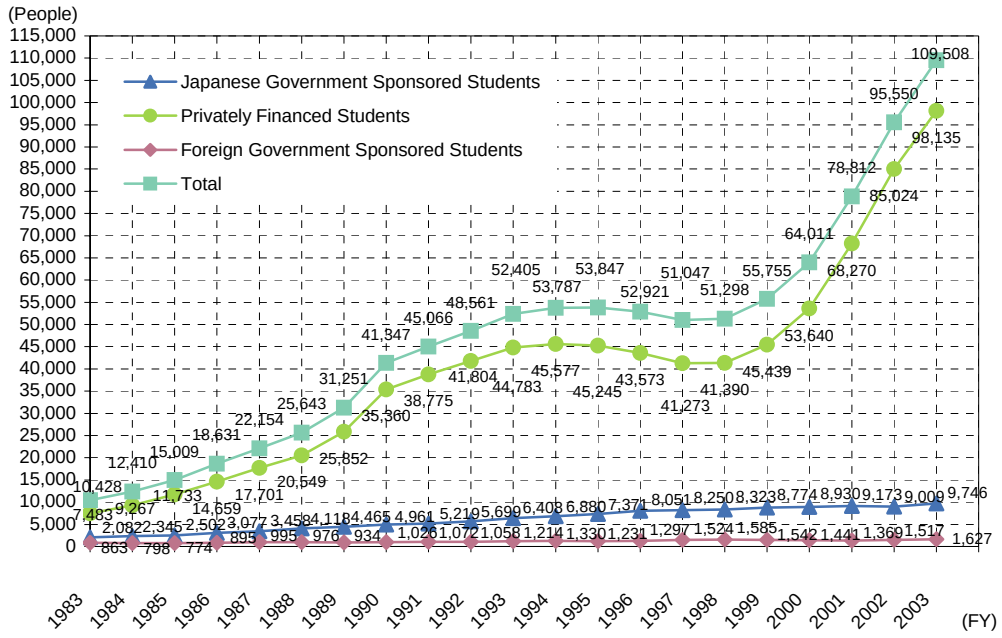


Figure 3-3-23 Trend in the number of foreign students in Japan (As of May 1 for each year)

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

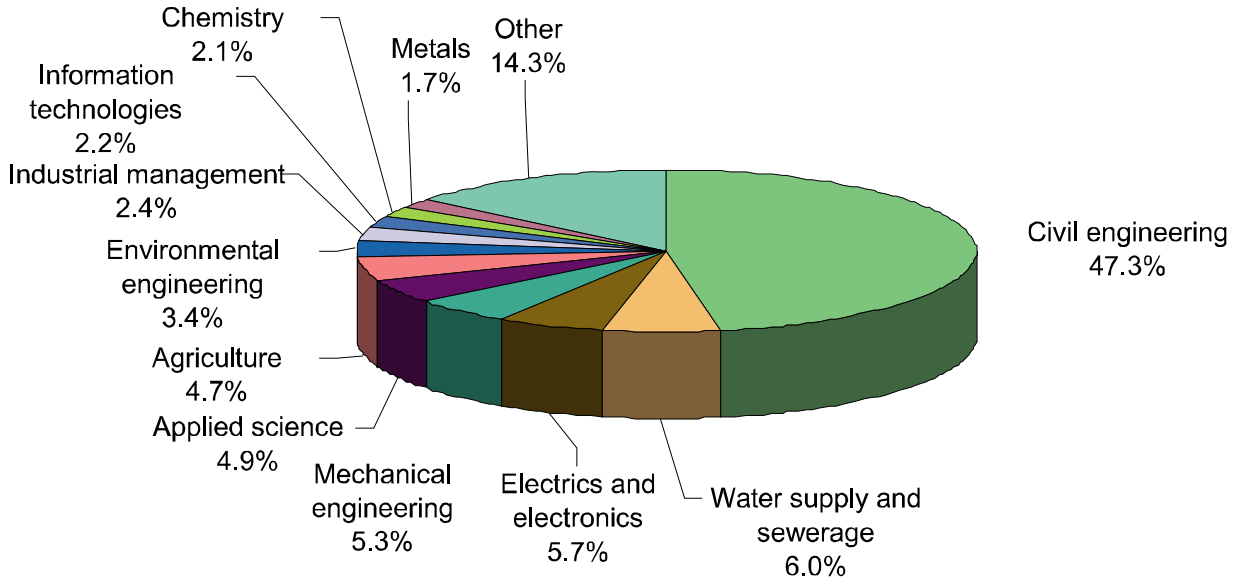
To become a science and technology-based country, it is necessary to create industrial frontiers and strengthen international competitive power through technological innovation, as well as to strengthen the technological foundation. For this purpose, efforts are being made to foster sufficient leading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

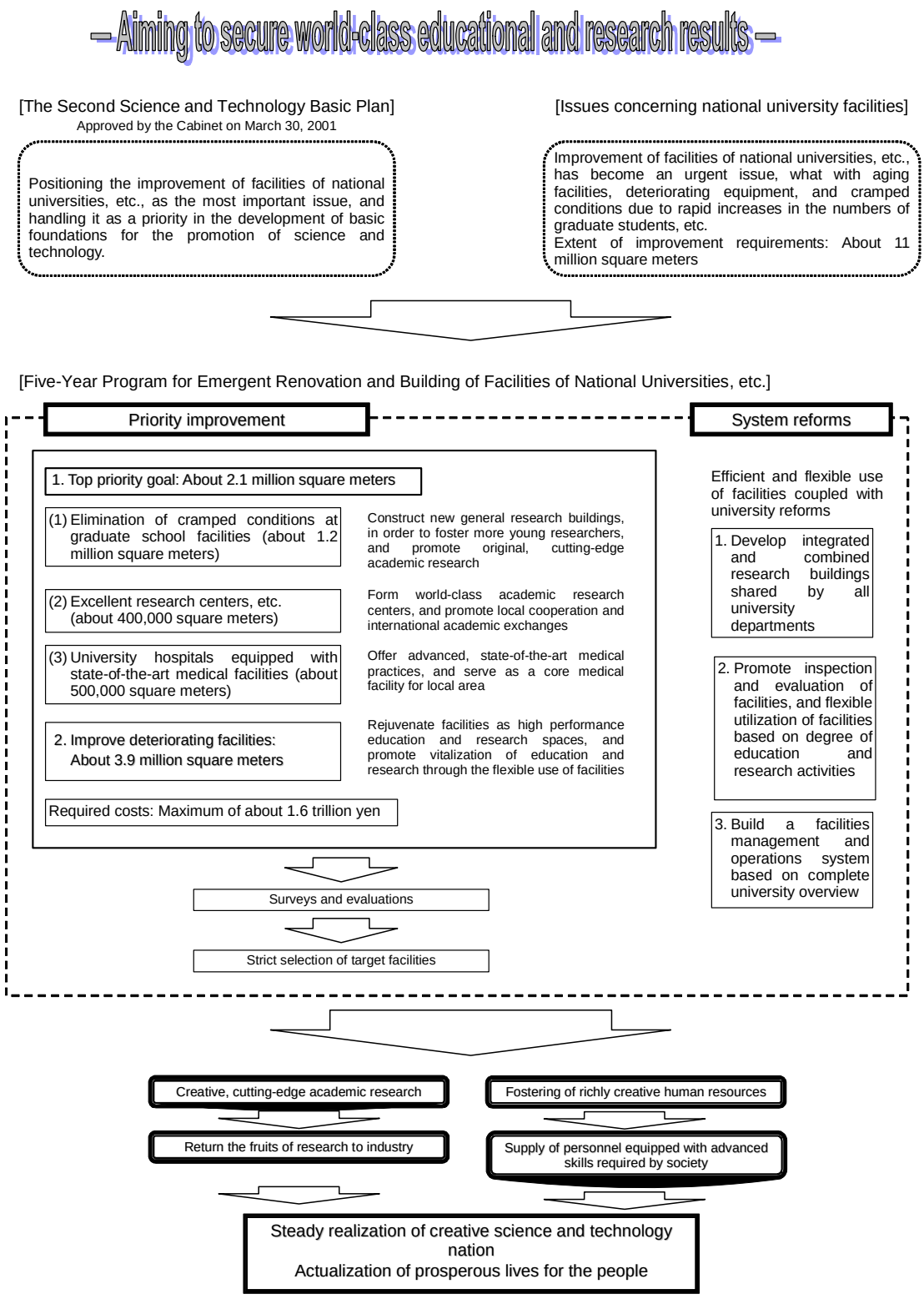


Figure 3-3-25 Five-Year Program for the Emergent Renovation and Building of Facilities of National Universities, etc.

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

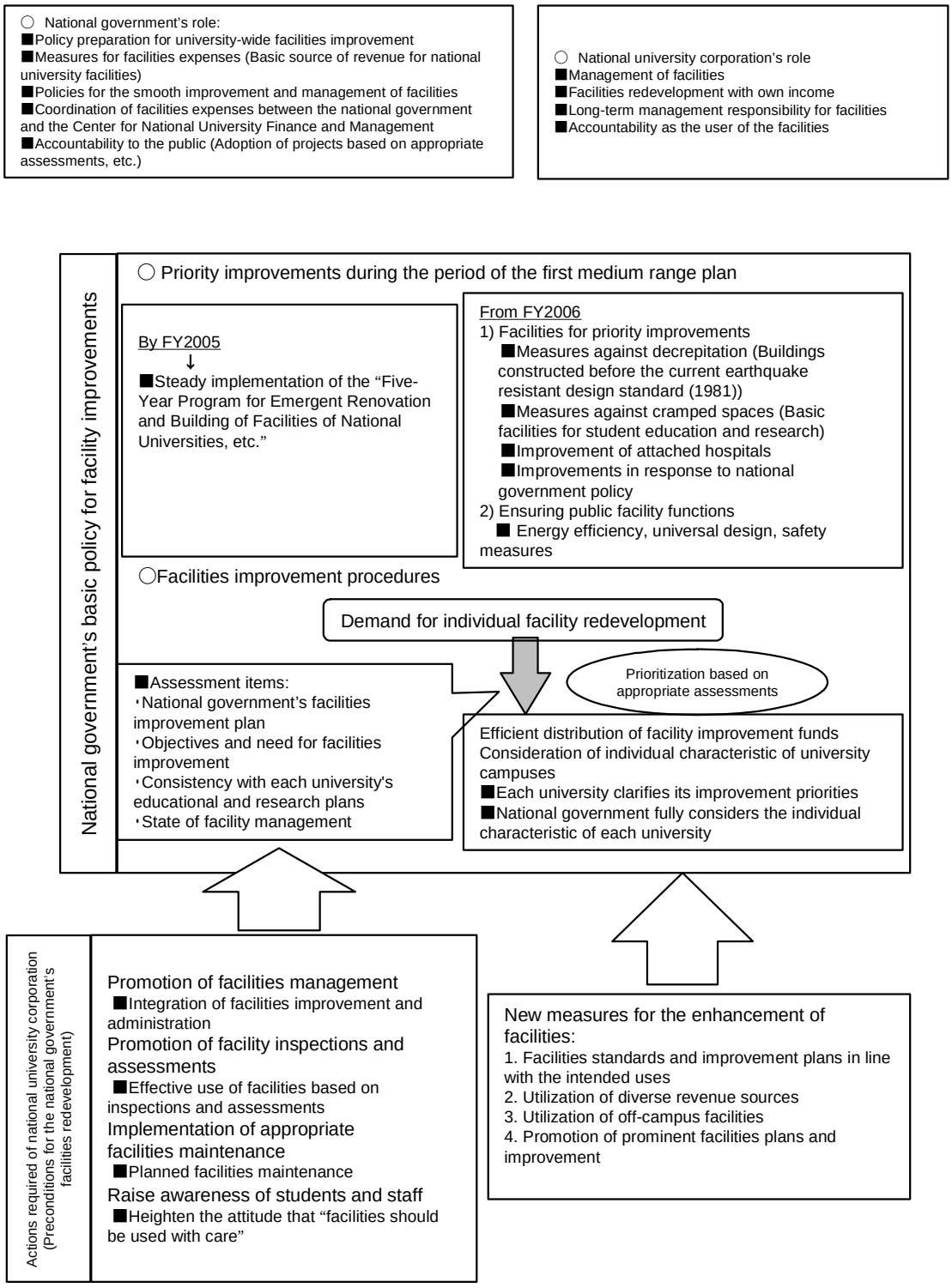


Figure 3-3-26 Knowledge Bases: The Enhancement of Facilities of National Universities

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

of Informatics (NII), in cooperation with national, public, and private universities nationwide, compiles the union catalog databases of academic books and serials in the collection of university libraries. Furthermore, the Ministry of Agriculture, Forestry and Fisheries is creating a reference material management system that includes an information database for books and documents found at the incorporated administrative agencies, including experimental research institutions of the Ministry of Agriculture, Forestry and Fisheries, and is providing access to this database over the Internet.

In addition, constructing databases of secondary information by using computers enables swift, accurate, and easy searching of increasing amounts of information. The Japan Science and Technology Agency (JST) is collecting information from 50 countries related to the science and technology sectors, and is constructing a science and technology document database. This database is being made available through the JST Online Information System (JOIS), which allows for access over the Internet. Furthermore, NII creates databases for academic research, and provides a database service.

Additionally, the JST has created and been operating a joint system that allows for the on-line writing, editing, and publication of research paper periodicals and so forth issued by academic societies, etc.

Moreover, the Japan Patent Office provides and operates the Industrial Property Digital Library (IPDL), which allows users to search and extract patent bulletins and other information over the Internet. The Ministry of Agriculture, Forestry and Fisheries provides the Japanese Agricultural Sciences Index (JASI) of articles published in academic journals related to the agriculture, forestry, and fisheries fields online, and jointly creates and offers information on documents related to the agriculture, forestry, and fisheries fields, in its position of responsibility for information provision from Japan for the International Information Systems for the Agricultural Sciences Technology (AGRIS) and the Aquatic Sciences and Fisheries Abstracts (ASFA) databases prepared by the Food and Agriculture Organization (FAP) of the United Nations.

3.3.6.5.2.2 Information on the Research Infrastructure

The Japan Science and Technology Agency (JST) is upgrading databases essential to the development of bioinformatics and expanding the Institute for Bioinformatics Research and Development that will support promotion of standardization and R&D. JST is also implementing a program to support conversion of the knowledge stock accumulated at national experimental research institutions and other organizations into databases for broad distribution over the Internet.

Furthermore, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) promotes the development of various scientific databases of national universities and the National Institute of Informatics (NII). MEXT also provides subsidies for the creation of databases by university researchers and academic societies.

The Ministry of Agriculture, Forestry, and Fisheries is engaged in development of a system that can coordinate various distributed management databases and allow their linked use over networks.

3.3.6.5.2.3 Information on Research Themes and Researchers

For information on research themes and researchers, the Japan Science and Technology Agency (JST) provides information over the Internet concerning research institutions, research themes, researchers, and research resources. JST's system is known as the Directory Database of Research and Development Activities (ReaD). A system provided by the National Institute of Informatics (NII), known as the Directory of Research Activities and Resources (NACSIS-DiRR), was integrated into ReaD in April 2003.

Information related to agriculture, forestry, and fisheries research subjects has now been converted by the Ministry of Agriculture, Forestry, and Fisheries into databases usable as research planning and

support systems, and these are now available on the Internet.

3.3.6.5.3 Developing an Electronic Library Service at University Libraries

University libraries play an important role as fundamental facilities that support education and research activities at universities, etc. In addition, university libraries are increasingly expected to offer diverse and advanced information services according to the advances of multimedia technology and the growth of the Internet in recent years.

The Ministry of Education, Culture, Sports, Science and Technology is working to enhance and strengthen the digital library function at university libraries by promoting advanced digital library projects at four national universities, including the development of a prototype digital library at the Nara Institute of Science and Technology (NAIST), and by allocating funds to national universities for the systematic introduction of electronic journals (academic journals delivered via computer networks) in fields earmarked in the Science and Technology Basic Plan for the priority distribution of R&D resources.

3.3.6.5.4 International Distribution of Research Information

The Japan Science and Technology Agency (JST) currently provides information through more than 200 categories of databases via the Scientific and Technical Information Network (STN International), originally constructed in 1987 between the Chemical Abstracts Service (CAS) of the United States and the FIZ-Karlsruhe organization of Germany. In addition, research information related to science and technology in Japan is actively being converted into English for transmission over the Internet to foreign countries.

Furthermore, the National Institute of Informatics (NII) is promoting the international distribution of scientific data, through efforts such as information exchange and providing information retrieval services with research institutions and other organizations abroad, using research networks connected to the Science Information Network (SINET).

3.3.6.6 Developing an Infrastructure for Manufacturing

In recent years, the structure of employment has been changing, and business competition and other economic situations have been diversifying and changing structurally due to the advancement of industrialization abroad. These changes have in turn led to a decrease in the percentage of domestic gross production taken up by manufacturing industries. This situation, combined with the difficulty of strengthening manufacturing industrial competitiveness and of ensuring that fundamental technologies for manufacturing are passed on to the future, are causes for increasing concern in Japan.

In order for Japan to respond to this situation, and to ensure healthy growth in the future through the advancement of manufacturing industries that represent key industries for the national economy of Japan, it is critical to nurture a societal sentiment that holds a high regard for capabilities related to fundamental technologies for manufacturing, and to actively promote fundamental technologies for manufacturing.

For this reason, the national government adopted the Basic Plan for Fundamental Skilled Manufacturing Technologies in September 2000, in accordance with the Fundamental Skilled Manufacturing Technologies Law enacted in March 1999. Based on this plan, the national government is comprehensively and strategically promoting measures related to the promotion of fundamental technologies for manufacturing.

3.3.6.6.1 Fostering and Securing Personnel Engaged in Manufacturing

Since manufacturing is implemented through human efforts, actions have been taken such as expanding education for manufacturing, and promoting lifelong learning for manufacturing, in order to

foster and secure personnel engaged in manufacturing.

At the primary and secondary education levels, the Program to Promote and Assist Manufacturing Learning has been implemented since FY2000, which includes initiatives such as the creation of a database of "Manufacturing Study Instructors" who aim to promote study related to manufacturing, and the implementation of workshops for these Manufacturing Study Instructors. In addition, efforts are being undertaken such as the promotion of internships, and the provision of experimentation and training equipment for industrial education at lower and upper secondary schools.

At the higher education level, a number of initiatives were implemented, including: (1) the upgrading of experimentation and training equipment in science and engineering departments; (2) the promotion of internships at production sites, etc.; (3) the promotion of practical education in engineering departments, mainly related to manufacturing; and (4) the development of the education program for nurturing creativity in students, and of the university-industry joint education program. At the regional level, seminars were implemented with the aim of popularizing the internship system, a system in which students use their summer vacations to gain working experience at business enterprises, and internship businesses, which do such things as open up enterprises that accept interns and the schools that will dispatch them and match students with enterprises.

It has become increasingly difficult to secure the skilled technicians who have played a critical role in the economic development of Japan in various fields of industry, and to foster successors to skilled technicians. This situation has arisen due to factors such as the lost interest in manufacturing occurring primarily in the younger generation, the shortage of successors for skilled technicians due to aging, the shift to overseas production bases, and decreasing opportunities for participation in skilled activities as a result of mechanization and automation.

One of the factors contributing to this situation is the lack of opportunities for the younger generation to understand the joy and wonder of manufacturing, as a result of factors such as a lack of experience in manufacturing, and a lack of opportunities to observe manufacturing sites.

To promote research and studies concerning the implementation of effective measures for hands-on education and learning that instill the joy and wonder of manufacturing in the young people who will bear responsibility for the next generation, the Ministry of Education, Culture, Sports, Science, and Technology and the Ministry of Health, Labor, and Welfare joined forces to convene the "Conference on Education and Study for Manufacturing" in FY1999 and FY2000. These Roundtables studied how people experienced in manufacturing skills and techniques should be utilized for education and learning, and published the results in "On the Utilization of Skilled Workers in Education and Learning about Manufacturing for Young People." Based on this report, the Ministry of Health, Labor and Welfare implemented education and learning projects utilizing experienced technicians to teach youths how to build things. Information about the material and curricula used in the education and learning project were provided over the Internet. Utilizing skilled local technicians as instructors, the FY2003 manufacturing education and learning projects were implemented in ten prefectures in order to have schoolchildren experience the joy and wonder of building things. Examples of items made by students at 26 elementary schools in nine of those prefectures during regular or after-school classes included: magazine racks and picture stands made by children in Iwate Prefecture; birdhouses, CD cases, mosaic tiles, and drawstring bags made by children in Miyagi Prefecture; copper reliefs, small round *tatami* mats (Japanese rush matting) and bookstands made by children in Chiba prefecture; personal seals (used as signatures in Japan) and mosaic tile message boards made by children in Tokyo; Ise paper patterns (for dying *kimono* fabrics) and copper reliefs made by children in Mie Prefecture; wooden planters and flower arrangements made by children in Nara Prefecture; universal seats (can be used as seats, stools, or stands) made by

children in Hiroshima Prefecture; and small partition screens and garden chairs made by children in Oita Prefecture.

In four prefectures, items made by students at seven junior high schools during regular or after-school classes included: thin, bordered *tatami* mats (for placing small heating stoves on), photo stands, and personal seals made by students in Miyagi Prefecture; bench tables for schools and sliding bookstands made by students in Aichi Prefecture; and antique mirrors made by students in Nara Prefecture. High school students in Hiroshima Prefecture made paperweights.

In addition, weekend and holiday programs planned for children of elementary and junior high school age and their parents or guardians offer instruction in making *yukata* (summer *kimono*), personal seals, bookstands, penholders, and copper reliefs, among other items, making use of many materials for hands-on experience in manufacturing.

3.3.6.6.2 Merging Information Technology (IT) and Manufacturing Technology (MT) to Reform Production Systems

In order to allow Japan's manufacturing industries, which represent the foundation of the national economy, to maintain and strengthen their competitiveness by means of information technologies, it was decided to establish techniques to scientifically analyze and digitize the skills, know-how, experience and other aspects of skilled individuals, as well as to develop an information system that includes software and databases to utilize the resulting digital data.

The Ministry of Education, Culture, Sports, Science and Technology has been utilizing RIKEN to implement research and development for the creation of an Integrated Volume-CAD system using advanced IT. This system will contribute to the upgrading and improved efficiency of new technology at manufacturing sites, and aims to lead a revolution in the information technology of Japan, in the context of serving as a common foundation for a broad range of technology systems. The system is being developed based on technologies for utilizing the new concept of "volume data." It completely integrates various manufacturing simulation technologies, including product measurement and evaluation technology (CAT: Computer-Aided Testing), and machining technology (CAM: Computer-Aided Manufacturing). The "Digital Master Project" is based on the recognition of the need to objectify the skills of experienced technicians, who are the source of competitiveness, and replace them with reproducible technologies, to the greatest extent possible, in order to maintain and strengthen the competitiveness of Japan's manufacturing industry.

The Ministry of Economy, Trade and Industry is implementing the "Digital Master Project" to develop methods for taking the skills, know-how, and experience of skilled technicians at design and manufacturing sites—which exists as "implicit knowledge"—and turning it into "formatted knowledge" through scientific analysis, using IT to then create software and databases of this knowledge.

Furthermore, to promote the integration of manufacturing and IT at small and medium-scale enterprises, 3D CAD/CAM facilities introduced to prefectural public experimental research institutions were used in FY2000 for training people at small and medium-size enterprises in the use of CAD/CAM, continuing from the previous year.

3.3.6.6.3 Accruing Information Related to Manufacturing

The Ministry of Economy, Trade and Industry has taken three measures to accrue manufacturing-related information. These measures included establishing links through the cooperation of universities, the National Institute of Advanced Industrial Science and Technology (AIST), and other organizations, with public experimental research institutions at the regional level playing the central role, as well as building up a database that assembles technology information on successful cases of manufacturing and cases of technology consultations for public experimental research institutions. This database, known as the Techno-Knowledge Network, was

made available over the Internet in order to provide precise and efficient technology support for small and medium-scale corporations.

In addition, to support the design of innovative products from the vantage point of the elderly, development of a system that automatically calculates the dimensions of the human body from three-dimensional measurements of the shape of the body has begun, and the speeding up, simplification, and cost-reduction of dimensional measurement is being promoted.

3.3.6.7 Promoting Activities of Academic Societies

Academic societies and associations are voluntary organizations made up of researchers of organization such as universities. They play an important role in terms of research evaluation, and also information and personal exchange, beyond the framework of individual research organizations. Major contributions are made to the advancement of academic research through activities of academic societies, such as the dissemination of the latest exceptional research results via academic research meetings, lectures, and symposia, and through the publication of academic journals.

To promote these types of activities by academic societies, Grant-in-Aid for Publication of Scientific Research Results, which is one of the categories of Grants-in-Aid for Scientific Research, are awarded by the Ministry of Education, Culture, Sports, Science and Technology to support activities such as international conferences held in Japan with the participation of overseas researchers; symposia that provide youths and adults with up-to-date information on research trends, and the publication of academic journals.