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 Construction of Research and Development Systems for Producing Outstanding Results

(1) Maintenance of a Competitive Research and Development Environment

In terms of competitive funding to form a competitive research and development environment, the system reform to maximize its effectiveness was promoted, while the funding was expanded based on the goals set in the Basic Plan.

The competitive funding for each ministry is shown in Table 3-3-1.

Table 3-3-1 Comprehensive table of competitive funding

Name of ministry/agency	Sponsoring institution	Name of program	FY2003		FY2004	
			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	2,250	479	3,033	687
	Institute of Information and Communications Technology	Program for Promotion of Basic Research in the Information and Communications Sectors	630	91	304	34
	Institute of Information and Communications Technology	R&D Program for Utilization of Gigabit Network	112	11	—	—
	Institute of Information and Communications Technology	Advanced technology development for pioneering new communications and broadcasting areas (Telecom incubation)	475	0	748	0
	Institute of Information and Communications Technology	Program for Promotion of Private-Sector Basic Technology Research	10,500	2,245	10,400	2,400
	Fire and Diaster Management Agency	Program for Promotion of Science and Technology Research for Fire Safety and Disaster Prevention	199	28	300	68
Subtotal			14,166	2,855	14,785	3,189 (Upper limit)
Ministry of Education, Culture, Sports, Science, and Technology	Japan Society for the Promotion of Science	Grants-in-Aid for Academic Research	176,500	12,531	183,000	13,553
	Japan Science and Technology Agency	Basic Research Programs	44,689	2,848	46,329	2,958
	Ministry	Special Coordination Funds for Promoting Science and Technology (Chosei-hi)	37,700	3,254	38,600	3,623
	Japan Science and Technology Agency	Development of Systems and Technology for Advanced Measurement and Analysis	—	—	3,300	690
	Ministry	Public Proposal System for Ingenious Technology Development Research	3,562	248	2,366	0
	Japan Science and Technology Agency	Research Program on Development of Innovative Technology	—	—	950	170
	Ministry	Support System for Creation of University-Derived Venture Companies	1,786	369	1,634	337
	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	2,697	177
	Ministry	Grants for future pioneering science research	6,646	0	3,576	0
Subtotal			271,386	19,354	282,453	21,508
Ministry of Health, Labour, and Welfare	Ministry	Health and Labour Sciences Research Grants	38,011	1,561	37,930	1,324
	Pharmaceuticals and Medical Devices Agency	Program for Promotion of Basic Research in the Health Care Sector	6,562	255	2,224	444 (Upper limit)
Subtotal			44,573	1,816	40,154	1,768 (Upper limit)

Name of ministry/agency	Sponsoring institution	Name of program	FY2003		FY2004	
			Budget (million yen)	Indirect expenses introduced (million yen)	Budget (million yen)	Indirect expenses introduced (million yen)
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	3,983	401	4,030	614
		R&D program for creation of new enterprises	1,213	0	735	0
	Bio-oriented Technology Research Advancement Institution	Program for the Promotion of Research on the Integration of Different Fields for the Creation of Bio-oriented Industries	339	3	1,760	329
	Ministry	Technology Development Project for the Creation of Collective Private Agribusiness	560	0	560	0
	Ministry	Research project for utilizing advanced technologies in agriculture, forestry and fisheries	1,973	441	3,000	675
Subtotal			8,067	845	10,084	1,618
Ministry of Economy, Trade, and Industry	New Energy and Industrial Technology Development Organization	New Energy and Industrial Technology Development Organization	5,280	1,062	5,821	1,274 (Upper limit)
Subtotal			5,280	1,062	5,821	1,274 (Upper limit)
Ministry of Land, Infrastructure, and Transport	Japan Railway Construction, Transport and Technology Agency	Program for Promoting Fundamental Transport Technology Research	389	47	445	35
	Ministry	R&D fund support program for the development of construction technology	250	53	250	53
Subtotal			639	100	695	88
Ministry of the Environment	Ministry	Global Environmental Research Fund	2,965	249	3,015	266
	Ministry	Environmental Research and Technology Development Fund	765	117	815	143
	Ministry	Ministry of the Environment Waste Management Research Grants	1,150	54	1,150	138
	Ministry	Project for Development of Technology for Global Warming Countermeasures	—	—	1,634	377 (Upper limit)
Subtotal			4,880	420	6,614	924 (Upper limit)
Total			348,991	26,452	360,606	30,370

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.

Based on the "Reform of the Competitive Funding System (opinion)" prepared by the Council for Science and Technology Policy on April 21, 2003, progress was made on the following reforms during FY2004: further expansion of indirect expenses; posting of program officers with research backgrounds to each funding agency to improve the implementation structure for managing the array of businesses of the competitive funding system consistently, etc.

(Competitive Funding of Each Ministry)

(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 Grant-in-Aid for Academic Research aims to dramatically advance academic research (research based on the free-thinking of researchers) across all fields including the humanities and social sciences as well as the natural sciences, and from basic research through to applied research. The program supports creative and pioneering research that passes a peer review process.

Basic Research Programs aims to produce new technologies that will lead to the development of science and technology and to the creation of new industries Japan Science and Technology.Agency establishes Research Areas based on Strategic Sectors, which Ministry of Education, Culture, Sports, Science and Technology designates on the basis of social and economic needs and under each Research Areas Basic Research Programs strategically promotes basic research mainly in four key research fields.

The Special Coordination Funds for Promoting Science and Technology (Chosei-Hi) is a competitive research fund managed by the Ministry of Education, Culture, Sports, Science and Technology along with the policies of the Council for Science and Technology Policy. Chosei-Hi promotes leading and/or cross-sectional measures to achieve the policy objectives laid down in the Science and Technology Basic Plan. Since 2004, "Research and Development Program for Resolving Critical Issues", which is mission-oriented research and development focusing on policy-inducing effects, have been promoted.

The Public Proposal System for Original and Innovative Technology Development Research and its successor, the Innovative Technology Development Research Project are aimed at encouraging the creation of new industries by further fostering innovative and highly creative technologies of private sectors into more innovative and practical technologies.

The Japan Science and Technology Corporation has been promoting the "Project for the Creation of University-based Start-ups" for the purpose of promoting the return of the fruits of university research to society and the economy through the creation of university-based start-ups and "advanced metrological analysis technology and equipment development" for the purpose of developing the worlds-first advanced metrological analysis technology and equipment development to meet the needs of the world's most advanced researchers.

(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 life science infrastructure research areas, which includes "Research on Human Genome Tissue Engineering;" (3) the areas of research on disease/handicap measures, such as the "Third Comprehensive Cancer Strategy" and "Research on Emerging and Remerging 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

The Ministry of Agriculture, Forestry and Fisheries is implementing 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.

(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 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. In FY2004, the "Project to Develop Technology for Global Warming Countermeasures" was established for the purpose of promoting practical use of basic CO2 emission control technologies.

(2)Improving the Mobility of Personnel through Popularization of the Fixed-term System

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

Aiming towards this kind of improved mobility of researchers, employment of fixed-term researchhers became possible at national experimental research institutions in accordance with "the Law Concerning the Special Measures for the Recruitment, Remuneration and Working Hours of Researchers with Fixed Terms in Regular Service" enacted in 1997. The results to date are shown in Table 3-3-2.

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

	No. of institutions	No. of personnel used
National research institutes	39	1,014
Of which, by invitational type	21	151
Of which, researcher-fostering type	37	863

Note: The number of personnel used indicates the cumulative number as of October 1, 2004.
Source: Survey by National Personnel Authority (October 2004)

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 Fixed Term Appointment of Faculty members at Universities"

	No. of universities, etc.	No. of instructors used
National universities	88	5,485
Public universities	20	292
Private universities	139	2,580
Inter-university research institutions	10	107

Note: In Private universities it is limited to full-time staff.
Source: Survey by MEXT (October 2003)

(3) Increasing the Independence of Young Researchers

If Japan is to aim towards 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.

In consideration of the Basic Plan, which calls for "ensuring the independence of young researchers in order to maximize the abilities demonstrated by distinguished young researchers," the Central Education Council reviewed the status of assistant professors and assistants and compiled the report, "The Future Form of Japan's Higher Education," in January 2005.

Among the proposals made in the report are ① creation of the post of "*jun-kyoju"* (mainly translated as associate professor) in place of "*jo-kyoju"*, ② creation of the post of "*jo-kyo"* (mainly translated as assistant professor) for "*joshu*" whose main job is education or research, ③ deleting the provision of the university establishment standards requiring in principle the subject system or the chair system and instead setting provisions to ensure an organizational system for division of responsibility and cooperation of teachers.

(Support for Creative Research Activities by Young Researchers)

Many of the researchers around the world who produce world-class research results have already conducted research in their 30s that laid the groundwork for later achievements. The relevant government ministries, therefore, promote various efforts to support creative research activities by young researchers during their foundation 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 aged 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 24.3 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 esearch 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 funds to assist young researchers.

(Support for Postdoctoral Researchers)

The relevant government ministries can expand opportunities to improve the quality 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 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 FY2004, this program strives to achieve qualitative results by improving the method for selecting postdoctoral researchers and ensuring appropriate treatment of excellent researchers in accordance with their abilities.

Under Basic Research Program of Japan Science and Technology Agency young researchers, including postdoctoral researchers having flexible ideas and challenging spirits, researches to form intellectual properties and create new technologies.

Various other support programs for researchers are also being promoted, such as the Institute of Physical and Chemical Research's (RIKEN) "Spe-

cial 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 489 postdoctoral researchers 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 138 young researchers as part of the Basic Research Promotion Project of the National Agriculture and Bio-oriented Research Organization (NARO), which aims to create new technologies and research fields. In total, the Ministry adopted measures to utilize 243 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 90 postdoctoral researchers through the industrial technology fellowship program run by the New Energy and Industrial Technology Development Organization (NEDO).

(4) Reform of Japan's Evaluation Systems

To promote science and technology, it is important to conduct appropriate evaluation, which stimulate researchers and encourage outstanding research and development activities. Effective evaluation will increase the efficiency and vitality of R&D activities, facilitate better R&D achievements, and nourish superior researchers. Evaluation also offer benefits to society and the economy, and also serve to provide accountability to the public.

Based on the Basic Plan, the "National Guidelines for Evaluating Government Funded R&D" were decided upon by the Prime Minister in November 2001 to improve the evaluation program further. All ministries and agencies implement effective evaluation with detailed guideline specifying evaluation methodologies under the revised General Guidelines. In particular, based on the guidelines, the Ministry of Education, Culture, Sports, Science and Technology, which accounts for more than 60% of the expenditures related to science and technology, conducts ex ante evaluations of new and existing R&D topics worth more than 1 billion yen by utilizing external evaluation and using them as the criteria for judging the appropriateness of budget requests. The Ministry also conducts interim evaluation and ex post evaluation appropriate. Incidentally, the guideline was revised and a new set of guideline was decided by the Prime Minister on March 29, 2005 on the basis of the results, etc. of the follow-up studies on the progress of R&D evaluation conducted by the Council for Science and Technology Policy in cooperation with ministries and agencies.

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 R&D 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, evaluation 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). As for national university corporations, evaluation of their performance is implemented based on the "National University Corporation Law" (Law No. 111 of 2003) (As for the progress of educational research, the outcomes of evaluation conducted by the National Institution for Academic Degrees and University Education are highly respected). In addition, under the Law for Evaluations of Policies Performed by Administrative Institutions (2001 Law No.86), which took effect in April 2002, it is now mandatory to conduct appraisal evaluation for R&D topics that are expected to incur large costs, given their preceding experience in project evaluation.

(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 the 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" as a program to ensure a timely response to situations requiring urgent measures to be taken during the fiscal year. Emergency investigation and research activities during FY2004 are as shown in Table 3-3-4.

Table 3-3-4 Urgent research and Development subjects

Year implemented	Name of core institution	Name of investigation and research subject
FY2004	National Research Institute for Earth Science and Disaster Prevention	Emergency research on the Niigata-Chuetsu Area Earthquake in 2004
	Japan Agency for Marine-Earth Science and Technology	Emergency research on the Great Sumatran Earthquake and Indian Ocean Tsunami , 2005

With regards to 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.

(6) Utilizing Personnel and Developing Diversified Career Paths

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

In the third recommendation, "Toward development of human resources from the viewpoint of science/technology and society," released in July 2004, 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.

In the "Report on the Strategic Promotion of Internatioanl Activities in the Field of Science and Technology," a report released in January 2005 the Council for Science and Technology Committee on International Affairs points out "securing international research personnel and establishing a network" as one of the strategic promotion measures to cope with worldwide competition for excellent researchers, and stresses the importance of inviting excellent foreign researchers to Japan, dispatching young researchers abroad, creating forums for "intellectual exchanges," and developing internationally attractive research and living environments.

Based on these reports and recommendations, the Japan Society for the Promotion of Science is enhancing its researcher exchange programs, including its overseas research fellowships and post-doctoral fellowships for foreign researchers. And, in order to support female researchers who interrupt their research for maternity leave, the Grant-in-Aid for Scientific Research has been employed flexibly so that they can resume research after one-year's maternity leave. In a like manner, the Japan Society for the Promotion of Science in July 2003 is permitting interruptions and extensions of fellowships at the request of young researchers for the purpose of childbirth and child-rearing.

As part of developing various career paths, the Japan Society for the Promotion of Science and the JST have established the program manager position

for people with research experience who will be responsible for a consistent operation for the competitive funding system.

(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 need to use superior concepts and leadership to promote organizational reform, and to create Centers of Excellence (COEs) for personnel training and R&D with international appeal.

In terms of the Special Coordination Funds for Promoting Science and Technology (Chosei-hi), the "Strategic Fostering Research Centers of Excellence" program has been in operation since FY2001. The program fosters and supports R&D institutions that make creative and pioneering attempts to build novel R&D systems and reform organizational operations, whose highly successful efforts influence other R&D institutions.

As table 3-3-5 shows, three institutions were newly selected as institutions to implement the program in FY2004, bringing to 10 the number of institutions engaged in advanced organizational reform.

Table 3-3-5 Strategic Fostering Research Centers of Excellence (Implementing institutions)

	Name of targeted institution	Concept
FY2001	Research Center for Advanced Science and Technology, The University of Tokyo	Open laboratory for human- and society-focused advanced science and technology
	Frontier Research Center, Graduate School of Engineering, Osaka University	Plan for Frontier Research Center
FY2002	Horizontal Medical Research Organization, Graduate School of Medicine, Kyoto University	Formation of an open medical research center of excellence through harmonization of advanced fields
	National Institute of Advanced Industrial Science and Technology innovation Center for Start-ups	Innovation Center for Start-ups
FY2003	Tohoku University Biomedical Engineering Research Organization	Formation of an advanced biomedical engineering center of excellence
	Creative Research Initiative "Sousei", Hokkaido University	Plan for a Hokaido University research and business park
	International Center for Young Scientists, National Institute for Material Science	Specified District Young and International Innovation
FY2004	User Science Institute, Kyushu University	Institute for 'Integration of Technology and Sensitivity' with Research Based upon the Needs of the User
	Consolidated Research Institute for Advanced Science and Medical Care, Waseda University	Formation of Consolidated Research Center for Advanced Science and Medical Care
	Research Institute for Digital Media and Content, Keio University	Research Institute for Digital Media and Content

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

(1) Universities and Inter-University 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 so that national universities and inter-university research institutes could develop themselves as appealing ones 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 were incorporated.

Furthermore, efforts are being made, primarily by the Cabinet Office, to establish a university in Onna-son, Okinawa, with a graduate school curriculum in science and technology of the highest international standards, that embrace the new mindset of "internationality" 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. A bill establishing the Okinawa Institute of Science and Technology Promotion Corporation in September 2005 to prepare for the establishment of the graduate school was approved and enacted during the 162nd ordinary session of the Diet.

(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 reason, a system for joint use of laboratories attached to inter-university research institutes and universities (attached laboratories) has been strengthened and research funding necessary for unique basic research has been increased.

Sixteen existing institutes were reorganized into four organizations (National Institutes for the Humanities, National Institutes of Natural Sciences, High Energy Accelerator Research Organization, and Research Organization of Information and Systems) with corporatization of National Universities, but the inter-university research institutes continue making 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, an optical-infrared telescope, a project of the National Astronomical Observatory of Japan (NAOJ) also promote cutting-edge international research. 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 FY2004, a total of 59 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 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.

Starting in April 2004, budgets for national universities and inter-university research institutes are allotted as subsidies for operating costs without their use being specified. Moreover, after incorporation, individual corporations are allowed to reorganize and abolish their organizations by their own judgment, giving them a more flexible approach to engaging in research activities. Furthermore, a "special education research expense" has been established to give prioritized support to corporations engaged in characteristic and ambitious research programs, making necessary financial support available for strategic, international, and contributing to local communities research activities proposed or requested by each corporation.

(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 supports 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 the Advancement of Academic Research at Private Universities," which offers comprehensive support, including facilities and equipment, to excellent research projects.

Procedures for donations to be allotted to expenses and funds necessary for private school education through the Promotion and Mutual Aid Corporation for Private Schools of Japan (recipient designated donations) were drastically improved in April 2004.

(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 (see Table 3-1-6).

(2) Science Council of Japan (SCJ)

The Science Council of Japan represents Japanese scientists at home and abroad with the philosophy that science is the foundation upon which civilized nations are built. Its purpose is to promote the advancement and development of science and have it reflected and spread in administration, industry and national life. Through its eight special committees (note), the SCJ functionally responds to short-and long-term challenges and is proceeding with studies by giving due consideration to new viewpoints required in today's academic world, such as interdisciplinary, comprehensive viewpoints,

including integration of the humanities and science, and gender viewpoints.

In the course of administrative reform centering on reorganization of the ministries and agencies in FY2001, the Council for Science and Technology Policy deliberated on the status of the Science Council of Japan and as a result of the deliberations, the "Law to Amend Part of the Science Council of Japan," which is designed to revise SCJ's jurisdiction, organization, and method of recommending members, etc., was enacted in April 2004. The Science Council of Japan was placed under the authority of the Cabinet Office in April 2005 and its new organization is scheduled to be inaugurated in October 2005.

The new Science Council of Japan has four functions: policy recommendation, liaison and coordination concerning science, international exchanges concerning science, and communicating with society. As the representative organization of Japanese scientists, it will contribute to the promotion of Japanese science and technology in close cooperation with the Council for Science and Technology Policy.

(Expectations on Japanese scientists)

In April 2004, the Science Council of Japan issued a declaration, "Toward dialogue with society." It calls on scientists to recognize the importance of talking about the significance of science and research in an easy-to-understand language as their social responsibility. As the first step, it calls on scientists to have opportunities to speak to society and then strive to achieve society's awareness and sympathy toward science and technology. To this end, a symposium was held in May 2004. The Science Council of Japan plans toimplement dialogues with local residents and refresh education of elementary and secondary school teachers throughout the country. The SCJ has been calling on the business world, mass media, academic institutions, administrations, etc. toprovide cooperation for such activities.

(Deliberation Activities)

With respect to the Minister of Agriculture, Forestry and Fisheries' inquiry on the "Content and Assessment of the Multiple Functions of Fisheries and Fishing Communities with Respect to the Global Environment and Human Life" on October 8, 2003, the council considered the issue from a wide-ranging perspective that integrates the humanities, social sciences, and natural sciences. On August 3, 2004, the SCJ submitted "Content and Assessment of the Multiple Functions of Fisheries and Fishing Communities with Respect to the Global Environment and Human Life" to the Minister of Agriculture, Forestry and Fisheries on August 3, 2004.

With respect to the Science and Technology Basic Plan, the Science Council of Japan, in cooperation with relevant academic research organizations, will cooperate in analysis and evaluation for the "Survey to Evaluate the Effects of Achievements of the Basic Plan" to be conducted, which is to be led by the National Institute of Science and Technology Policy of the Ministry of Education, Culture, Sports, Science and Technology. Also, In preparation for the 3rd Science and Technology Basic Plan, the SCJ conducted studies from comprehensive and overview based on the results of the analyses and evaluations of the effects of the achievements of 1st and 2nd basic plans, and submitted its opinion, "Recommendations on Important Issues in the Science and Technology Basic Plan," to the Council for Science and Technology Policy on February 17, 2005.

(International Scientific Exchange)

The SCJ represents Japan through its affiliation with 48 international scientific organizations, including the International Council for Science (ICSU) and the InterAcademy Council (IAC). It has been striving for cooperation with various countries by actively taking part in six international academic cooperative projects, including the International Geosphere-Biosphere Programme (IGBP).

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 fourth conference was held in South Korea in May 2004.

In November 2004, the SCJ hosted the "International Conference on Science and Technology for Sustainability – Asian Megacities and Global Sustainability" in Tokyo. The conference adopted a statement proposing what the academic fields can contribute to the measures for Asian megacities and global sustainability.

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 FY2004, the Council co-hosted eight such conferences, including the 16th International Congress of the IFAA Anatomical Science 2004.

(Open Lectures and Symposiums)

The SCJ sponsors open lectures as a way of returning science results 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 FY2004, the SCJ hosted three open lectures and 139 symposiums.

Furthermore, the SCJ jointly hosted with the Cabinet Office and Nippon Keidanren (Japan Business Federation) the "Third Conference on the Promotion of Coordination between industry, academia and government" in Kyoto in June 2004, and the "Fourth Summit on Coordination between industry, academia and government" in Tokyo in December 2004, in order to promote collaboration between industry, academia, and government. The SCJ also hosted a "Regional Promotion Forum" in Kyoto in October 2004, in Fukuoka in December 2004, and in Sendai in February 2005.

Moreover, the SCJ jointly hosted with the Japan External Trade Organization the International Symposium "Boosting Science and Technology through Industrial Collaboration" in Tokyo in November 2004.

(3) 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 levels. 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 FY2004 expenditure 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, was 1.4209 trillion yen.

(4) 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.

(Promoting Private Sector Research Activity through the Taxation System)

To promote research and development by the private sector, systems that provide 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 are provided.

The FY2005 tax reform extended until FY2006 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. The limitation of deductions for donation under income tax was raised to 30% of taxable income.

Table 3-3-6 shows the current tax measures through April 2005 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 or II.) (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 (Corporation tax). (2) Furthermore, when a corporation incurs special experimental and research expenses for joint research with public 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 corporation tax). (3) Same for individual businesses (Income tax)	Special Taxation Measures Law, Article 10 (income tax), Article 42-4, Article 68-9 (corporation 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 or II.) a. Special Tax Credit for total research expenses (1) The tax credit amount is (increased by 2% for FY 2003-6) as a special measure of experimental and research expense totals (but limited to a value equivalent to 20% of corporation tax) (corporation 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 (including independent administrative institutions), consistent with item a. above, the tax credit amount is a value equivalent to 12% (increased by 3% to 15% for FY2003-6 as a special measure) of these experimental and research expenses (but limited to a value equivalent to 20% of corporation tax with the special tax credit from item a. above added in). (corporation tax) (2) Same for individual businesses (Income tax).		Enacted in FY2003 (The special measure period is effective until FY2005)
		III. Tax system to strengthen the technical base of small and medium-sized corporations (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 corporation tax) (corporation 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.)

Item	Purpose	Description	Applicable law	Date of enactment/ validity
		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 (Corporation tax). (2) Same for individual businesses (Income tax).	Special Taxation Measures Law, Article 11-3 (income tax), Article 44-3, Article 68-20-2 (corporation 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.	Corporation Tax Law, Article 37, Item 4, Item 6 Income Tax Law, Article 78 Special Taxation Measures Law, Article 40	Enacted in FY1946 (corporation tax), Enacted FY1962 (income tax) Enacted FY1961 (corporation 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 research.	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 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 FY2005
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 15, and Article 15, Item 24	Enacted in FY1999 (real property acquisition tax), enacted in FY2000 (fixed property tax) (effective through FY2006)

(As of April 2005)

(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

With the aim of promoting experimental research in the private sector concerning the designated industrial technology of biological systems, The National Agriculture and Bio-oriented Research Organization provides funds and conditional interest-free loans, as well as referrals for joint research using investments and financing from the Industry Investment Special Account and investments from private sources.

(2) 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 is implementing 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.

(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 small numbers of Japanese people, 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, through 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 support for the building of partnerships is given.

(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

In order to revitalize regional economies through the creation of new regional industries/businesses, support is given to high-risk development technology for practical use, such as entry into new fields by small and medium-sized enterprises and start-ups by venture companies.

(11) Private Sector Fundamental 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."

(14) Project to Support Research for Putting Medical Products and Medical Equipment to Practical Use

Private enterprises engaged in practical use-stage research and development of technologies concerning medical products and medical equipment useful for the enhancement of health care are invited to apply for entrustment research contracts through the Pharmaceuticals and Medical Devices Agency.

(Other)

A number of measures are being implemented to ensure the availability of superior personnel in small businesses, venture businesses, and other corporations that have just started operating. 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 corporate 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.

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 and equipment too difficult for the private sector

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	FY 2004
Ministry of Internal Affairs and Communications	2001	Iwate IT Open Laboratory	—	—	—	—	—	—	8	11	14
		Honjo R&D Support Center for Telecommunications	—	—	—	—	—	19	19	17	16
		Hokuriku IT Open Laboratory	—	—	—	—	—	—	29	21	33
		Kitakyushu IT Open Laboratory	—	—	—	—	—	—	12	16	17
		Shared use research facilities were developed and established by the National Institute of Information and Communications Technology (NICT) with the aim of the advancement of local industrial structure by the acceleration of research and development in industry-academia and by the accumulation of research institutes in university areas.									
Ministry of Education, Culture, Sports, Science and Technology	1996	Numerical Space Engine Supercomputer and various servers	1	4	2	0	0	0	0	0	0
	1997	Snow and Ice Disaster Prevention Test Facility 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: 25m × 7m	—	1	3	0	3	6	6	8	8
	1997	Synchrotron Radiation Facility (SPring-8) 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.	—	5	14	26	50	62	100	115	139
	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	0
	1998 *	Ultra-Strong Magnetic Field Generating Device (powerful field magnet) 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.	16	16	62	73	70	68	83	86	87
Ministry of Health, Labour and Welfare	1997	Joint use facilities, NIID Tsukuba Primate Center Health Science Studies on gene therapy, longevity, cranial nerves, and incurable diseases, etc., are promoted using healthy monkeys that are not infected with specific viruses, as a shared source.	—	0	2	2	—	—	—	—	—
	1999	Construction environment simulator (wind tunnel experiment facility) Research facilities used for the clarification of resistance to wind damage of provisional structures and of workability under certain wind conditions.	—	—	—	1	1	2	0	0	—
	2003	Vibration load equipment (dynamic electricity type), etc. Research equipment for measuring pallesthetic sensibility of the body by difference in postures, such as standing, sitting, sitting cross-legged, lying down and sitting in a seat.	—	—	—	—	—	—	0	2	—
	2003	Apparatus for estimating the effectiveness of anti-vibration gloves, etc. Research apparatus for estimating the effectiveness of anti-vibration gloves.	—	—	—	—	—	—	0	1	—
Ministry of Agriculture, Forestry, and Fisheries	1996	Building for engineering experiments related to earthquake resistance and comfortable wood construction 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)	—	1	2	1	1	0	0	1	2
Ministry of Land, Infrastructure and Transport	1997	Sudden Braking and Increased Vibration Testing Apparatus with Intra-Pier Continuous Girders 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.	—	0	0	0	0	0	0	0	0
	1999	Aqua Restoration Research Center Researches the preservation of river and marshland ecologies, for the purpose of research and development that facilitates mankind's coexistence with nature.	—	—	—	5	3	0	2	1	0

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

(1) Introduction

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 National Universities, etc. and Industry has more than doubled in the last 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. In the past three years, over 450 venture companies have been created that utilize the fruits of university research. As of August 2004, there were 916 such venture companies. 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.

(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. The JST also promotes the following efforts based on the research results of universities and public research institutions: the implementation of a test to secure applied patents helpful for achieving practical use of fundamental 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 the development of new technologies considered likely to involve high development risk, JST assists companies developing applications for practical use by providing Risk-Taking Funds (if the development is unsuccessful, there is no requirement for repayment).

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 2005, MEXT has also placed 110 coordinators in 82 universities and technical colleges nationwide, where they serve as bridges between universities and enterprises that are conducting joint research at the universities. Furthermore, MEXT has been promoting the opening of special continuing education courses at universities and educational institutions to create human resources that are experts in both advanced technology and management (Management of Technology or MOT) and those that are experts in intellectual property. To foster human resources that are well versed in the securing and utilization of intellectual property, since FY2002,

MEXT itself has been training human resources that 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.

At RIKEN, in order to facilitate more efficient application of research results to practical use or technology transfer, a system has been established, under which researchers, who have established venture companies on their own, are given preferential treatment in their joint research with venture companies.

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, since FY2002, METI has 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 113 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 and Training dispatches, as of the end of March 2005, patent promotion advisors to the 33 of 39 approved TLOs that are currently in operation.

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.

The National Institute of Advanced Industrial Science and Technology inaugurated 15 venture companies in FY2004 to develop new industries and markets by utilizing their own technology seeds, eased regulations on side business, and enhanced support for intellectual property rights.

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

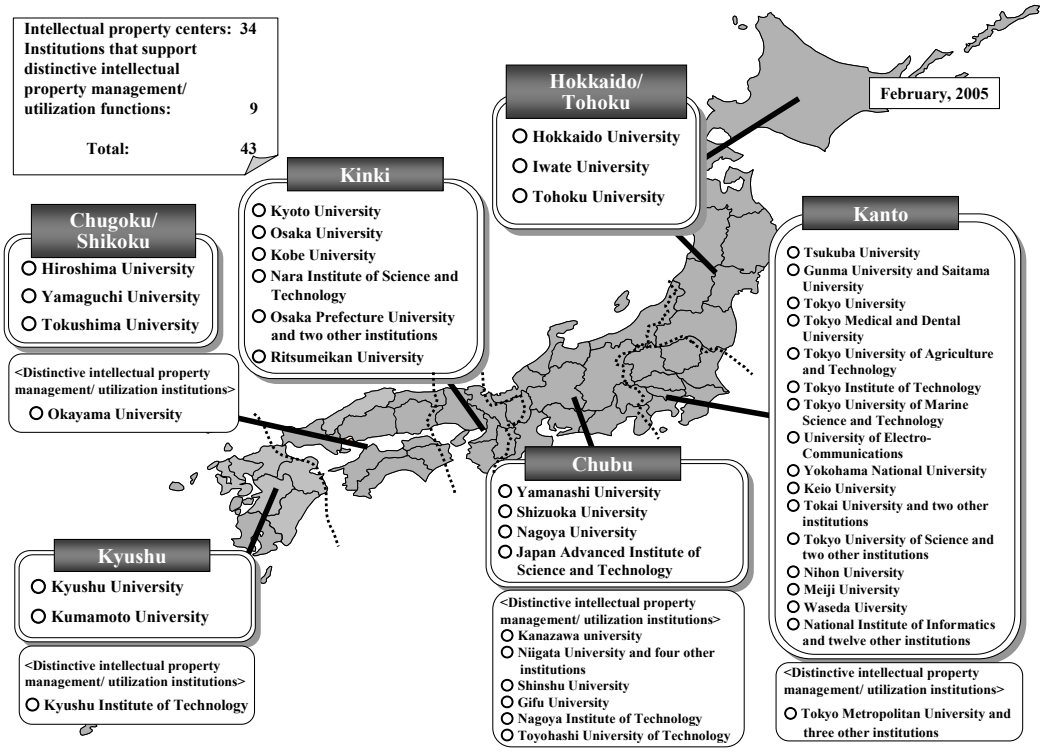
With the aim of realizing a "nation built on intellectual property," the "Basic Law on Intellectual Property" was established in 2002 and various efforts are being made by the whole government to realize the "Intellectual Property Strategic Program" based on the Law.

Public research institutions must clarify the responsibility of institutions and researchers to explain to society the content and results of their research, and must give importance to intellectual property as well as research papers as performance evaluation of their researchers. Currently, the institutions are promoting that patents are to be attributed to the research institutions in principle, in line with proposals in the 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.

In line with the shift of attribution of patent and other university research results from individuals in principle to institutions in principle, the Ministry of Education, Culture, Sports, Science and Technology has established the Research Organization of Information and Systems (34 model institutions, and 9

support organizations with "unique intellectual property management/utilization function support programs" were selected) and is providing support in order to establish a strategic management system for control and utilization of intellectual property, such as patents, produced by universities, the source of "intelligence." Moreover, to promote patent procurement (especially strategic foreign patent procurement) originated from university research, the Technology Transfer Support Center is supporting the related costs.

Table 3-3-8 Regional distribution of university intellectual property centers under the improvement program



Based on the Law for Promoting University-Industry Technology Transfer (Law No. 52, 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, three institutions were approved as TLO in FY 2004. Thirty-nine TLOs have been approved under this law as of the end of March 2005 (Figure 3-3-9, 3-3-10).

Table 3-3-9 Approved / authorized TLOs (Total of 39 institutions)

March 2005: 39 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 Incubation, Ltd.	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 Recognized	Feb. 19, 2003 Feb. 19, 2003	The University of Electro-Communications
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
OMNI INSTITUTE CORPORATION	Approved	Feb. 24, 2005	Nagaoka University of Technology, Nagaoka National College of Technology, University of Hyogo
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 17, 2002)	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 Llicensing Organization)	Approved	Apr. 16, 2002	Mie University and other universities and colleges in Mie prefecture
Kansai Technology Licensing Organization Co., Ltd.	Approved Recognized	Dec. 4, 1998 Jul. 10, 2002	Universities and colleges in the Kansai region (Kyoto University, Ritsumeikan University, etc.)
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
Okayama Prefecture Industrial Promotion Foundation	Approved	Apr. 28, 2004	Okayama University and other universities and colleges in Okayama prefecture
Hiroshima Industrial Promotion Organization	Approved	Oct. 09, 2003	Hiroshima University and other universities and colleges in Hiroshima prefecture
Yamaguchi Technology Licensing Organization Co., Ltd.	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
Nagasaki Technology Licensing Organization	Approved	Oct. 15, 2004	Nagasaki University and other universities and colleges in Nagasaki prefecture
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
RIDAI-SCITEC	Approved	Sep. 30, 2003	Organizations on the Tokyo University of Science campus

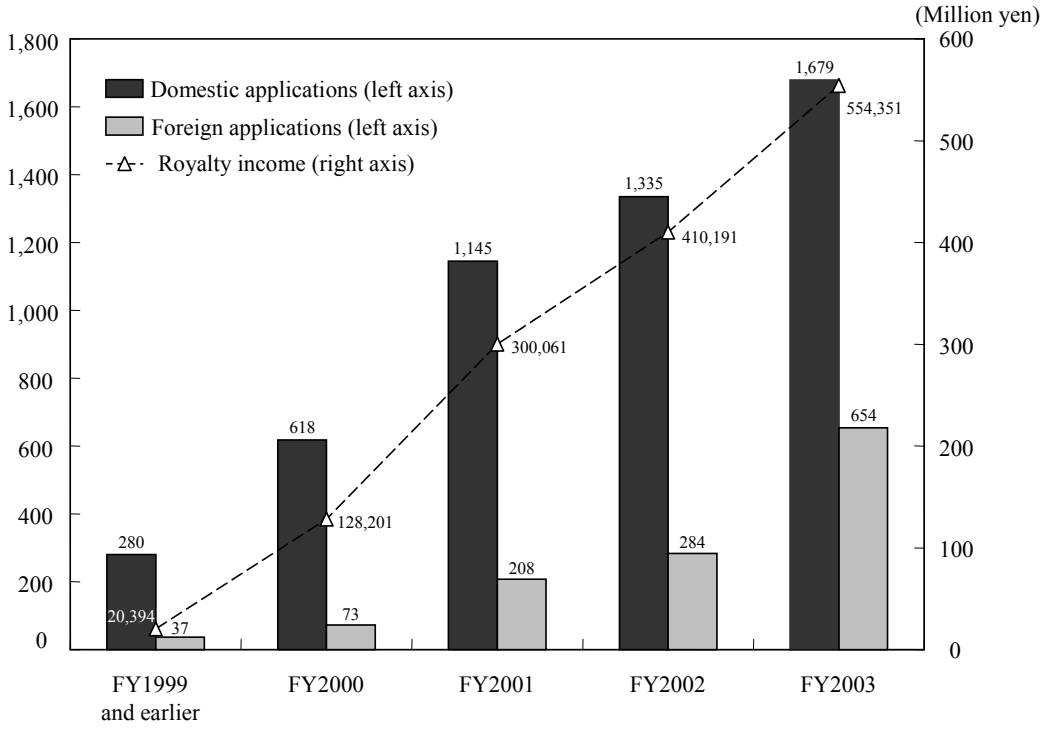


Figure 3-3-10 Trend in approved TLO patent applications and royalty income

To support TLO activities, the Ministry of Economy, Trade and Industry has issued subsidies to TLOs since the enforcement of (the early enforcement stages of) the Law for Promoting University-Industry Technology Transfer. (1998). 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.

The National University Incorporation Law (Law No. 112 of 2003) lists the "promotion of diffusion and utilization of research results" as one of the businesses of national universities and has made it possible for national universities to invest in corporations to promote the utilization of research results. The investment in approved TLOs is allowed by a government ordinance.

Incidentally, the revision of the Trust Business Law in December 2004 has made it easy for approved TLOs to use patent rights, etc, as trust assets, raising expectations for a more active return of research results to society.

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

(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 submitssion of research papers to various academic societies and journals, and the disclosure of government-owned patents.

The Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Economy, Trade and Industry, in cooperation with the Japan Science and Technology Agency and the New Energy and Industrial Technology Development Organization, sponsored "Innovation Japan 2004 ~ Fair of University-based 'Intelligence'," a nationwide Industry-academic matching event to disseminate the intellectual property of universities and public research institutions in the field of the most-advanced technologies, such as nanotechnology/materials, health care/biotechnology, information/IT, environmental technologies and manufacturing technologies, to industries, etc.

Furthermore, 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 Database of Research and Development Activities (ReaD) that compiles organizational data, researcher data, research theme data and research resource 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 public research institutions, including universities, etc., related patent information, 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[17], 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, national and public experimental research institutions and the field of agriculture, forestry and fisheries in universities; 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.

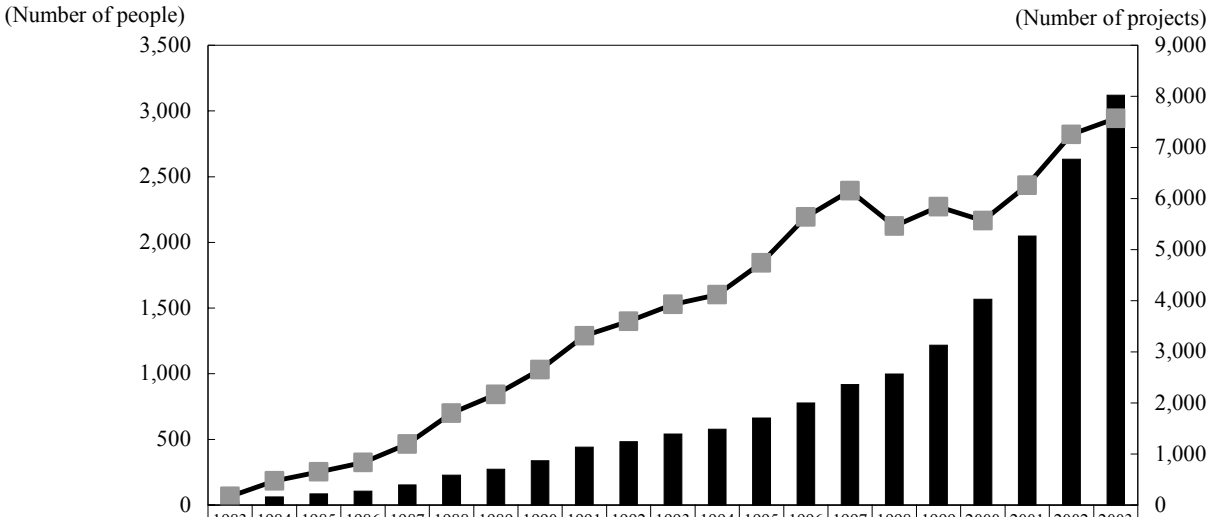
(2) Promotion of Research Exchanges

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 the development of infrastructures that allow such exchanges to be carried out, in order to promote personnel and material exchanges that extend beyond research institutions, 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.

(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 8,000 projects in FY2003 (Figure 3-3-11). Since the incorporation of national universities in April 2004 has made it possible for national universities to engage in flexible coordination between industry, academia and government activities in accordance with their individuality and characteristics, they are expected to further promote joint research and contract research programs.

17 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	2003
Number of projects	56	160	216	272	396	583	705	869	1,139	1,241	1,392	1,488	1,704	2,001	2,362	2,568	3,129	4,029	5,264	6,767	8,023
Number of people	66	184	254	325	465	700	842	1,031	1,288	1,398	1,527	1,602	1,843	2,192	2,394	2,124	2,271	2,165	2,435	2,821	2,944

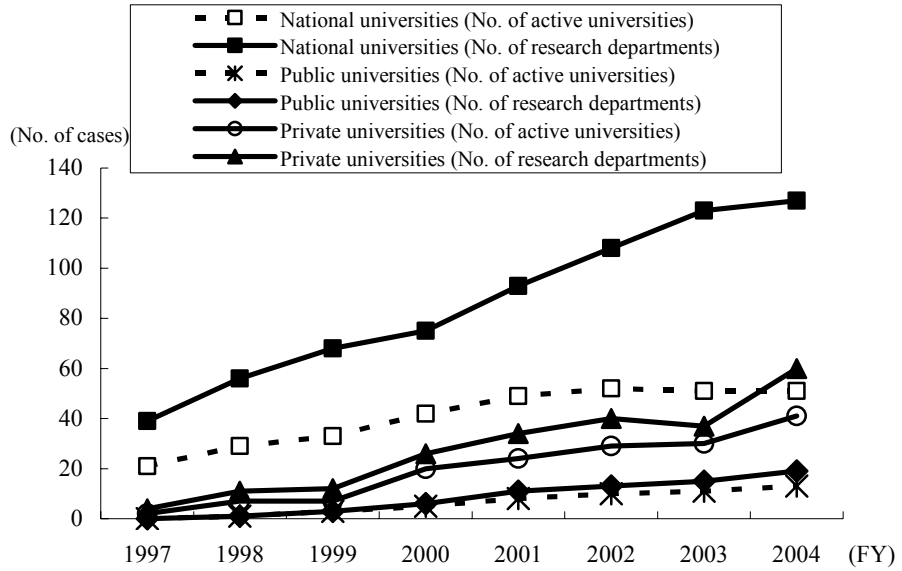
Figure 3-3-11 Trend in the number of research projects conducted jointly with the private sector

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 Practical Application Research and Development Program for University-based Business Creation, promotion of coordination between industry, academia and government research through the most-advanced R&D test bed network established and operated by the National Institute of Information and Communications Technology 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.

(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 3-3-12).



(FY)		1997	1998	1999	2000	2001	2002	2003	2004
National universities	(No. of active universities)	21	29	33	42	49	52	51	51
	(No. of research departments)	39	56	68	75	93	108	123	127
Public universities	(No. of active universities)	0	1	3	5	8	10	11	13
	(No. of research departments)	0	1	3	6	11	13	15	19
Private universities	(No. of active universities)	2	7	7	20	24	29	30	41
	(No. of research departments)	4	11	12	26	34	40	37	60

Figure 3-3-12 Activity in the linked graduate school program

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 asystematic 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 "Fourth Business-Academia-Government Collaboration Summit" was held in December 2004, 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 "Learning from Pioneering Cases and Leading to Better Coordination between industry, academia and government Activities" as its theme, leaders of overseas pioneering universities, domestic universities and corporations were invited to the summit and presentations were made on case studies. Participants adopted the "Fourth Business-Academia-Government Collaboration Summit" calling for aggressive promotion of the fostering and securing of science and technology human resources, joint research and development and transfer of research results, university reform, support for regional science and technology promotion, and strategic protection and utilization of intellectual property. In addition, in order to further promote collaboration among business, academia, and government, the "Third Conference for the Promotion of Busine-

ss-Academia-Government Collaboration" was held in June 2004 and working-level consultations were held, and were attended by representatives of universities, research institutions, and TLOs. In the conference, 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 Second 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 (Table 3-3-13).

Awards Ceremony for Persons of Merit in Business-Academia-Government Collaboration in FY2004

Award	Prize-winning example
Prime Minister's Award	Industrialization of photocatalytic technology for self-cleaning building materials, heat release materials, etc.
Ministerial Science and Technology Policy Award	Development and application of metabolome analysis technique
	Development and commercialization of new foods with enriched functional amino acid – GABA (gamma aminobutyric acid)-
	Development of monument-type wind power generator
Minister of Internal Affairs and Communications Award	Gigabit network for research and development (JGN : Japan Gigabit Network)
Minister of Education, Culture, Sports, Science, and Technology Award	Industrial expansion of the Micro Electro-Mechanical Systems (MEMS) using semiconductor micro fabrication technology
	Development and commercialization of form simulation software
	Development of an interferon-sensitive DNA chip
Minister of Economy, Trade and Industry Award	Development of new functional glass by nanostructure control and nano-processing technology
	Promotion of the e-ZUKA TRY VALLEY project
Chairman of the Federation of Economic Organization Award	Development of the ultrafine ink jet
Chairman of the Science Council of Japan Award	Development of cultured skin and cartilage from human cells and tissues
	Development and commercialization of the high-performance oxygenator – Platinum Cube NCVC –

Figure 3-3-13 Recognition of Persons of Merit in Business-Academia-Government Collaboration (FY2004)

The implementation of research activity for the private sector, etc., by researchers from national experimental research institutions and faculties at 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. With regards to faculty members of national universities, they are allowed to engage in side jobs at the discretion of individual universities as the national university incorporation on April 1, 2004 has removed them from being employees subject to the National Civil Service Law.

(4) Response to conflict of interest

In promoting coordination between industry, academia and government, it is extremely important to appropriately deal with any "conflict of interest" that may arise in universities and research institutions on a daily basis. For this reason, the Ministry

of Education, Culture, Sports, Science and Technology set up a "panel to study conflict-of-interest management" in August 2004 so that persons concerned at universities, etc. can share recognition and information on "conflict of interest." In addition, in March 2005, the ministry held workshops focused on "clinical study and clinical tests," in which special prudence is required in dealing with conflict of interest, so that parties concerned can have exhaustive discussions on the matter.

(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 is crucial to the effective use of the facilities, as well as the promotion of 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. 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 an effective management system.

In FY2004, 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 1,120 research proposals for implementation between February 2004 and December 2004, promoting a wide range of research.

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

The promotion of private-sector research and development and the utilization of R&D results within the national government, etc. have played an important role in revitalizing the economy.

In the Small Business Innovation Research Program (SBIR), the relevant government ministries and agencies coordinate to increase the opportunities to provide small and medium-sized enterprises and so forth with subsidies, etc. Subsidies, business commissioning fees and so forth that are intended for small and medium-sized enterprises 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 FY2004, 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 60subsidies as "special subsidies." A target amount of approximately 28 billion yen in funds was supplied to small and medium-sized enterprises, 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 revitalize regional industry and to improve the quality of life for residents in regional areas.

The First Science and Technology Basic Plan stressed the importance of promoting research activeties 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 increasing importance placed on 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 3-3-14 , 3-3-15).

Table 3-3-14 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
Miyagi	Miyagi Conference on Guidelines for Promoting Science and Technology	July 1998 through March 1999
Yamagata	Yamagata Science and Technology Council	April 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	January 1995
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 Innovation Strategy Council (Transferred Ishikawa Industrial Science and Technology Council)	Transferred December 2003
Fukui	Fukui Science and Technology Promotion Council → Council for Fukui Production Planning Strategy	April 1998 through March 2004, May 2004
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
Shiga	Shiga Science and Technology Promotion Council	April 2003
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 Prefecture Science and Technology Strategy Council	September 2004
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	May 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
Tokushima	Tokushima Forum for the Promotion of a vision for a Science and Technology	June 1998 through March 1999
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

Prefecture	Name of science and technology council	Established
Kumamoto	Kumamoto Science and Technology Council	September 1999
Miyazaki	Miyazaki Science and Technology Council	August 2001
Kagoshima	Kagoshima Science and Technology Promotion Council	April 2003
Okinawa	Council for Promotion of Science in Okinawa	January 1995
Kawasaki City	Kawasaki City Innovation Promotion Meeting	August 2003
Yokohama City	Yokohama City Council for Promotion of Cooperation Between Industry and Academia	October 1999 through March 2003
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 through March 2004
Hiroshima City	Hiroshima City Science and Technology Advisory Council	October 2003

Table 3-3-15 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 (New Guidelines for Promoting Science and Technology in Iwate Prefecture)	May 1990 (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 (New Toyama Prefecture Science and Technology Plan)	October 1991 (Revised 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 (Yamanashi Plan for Promoting Science and Technology)	March 1992 (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 (Revised October 2004)
Kyoto	Promotion Plan for Industry and Technology in Kyoto	February 1995

Prefecture	Science and technology promotion policy	Date of enactment
Osaka	Osaka Research and Development Charter Guidelines for Industry, Science and Technology in Osaka → Guidelines for Promoting Industry, Science, and Technology in Osaka → Strategies for Promoting Science and Technology in Osaka	March 1988 → Revised March 1998 → May 2005 (Not fixed)
Hyogo	General Guidelines for Hyogo Science and Technology Sixth Plan (New General Guideline for Hyogo Science Technology Plan)	March 1991 (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 (Revised March 2004)
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
Sapporo City	Vision for Promoting Science and Technology in Sapporo City	June 2004
Kawasaki City	Guidelines for Promotion of Science and Technology in Kawasaki City	March 2005
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

(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 potential. Businesses located inside and outside various regions are also expected to enter into these systems. More specifically, these systems successively drive technological innovation and create new industriesthro-

ugh 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 Ministry of Education, Culture, Sports, Science and Technology launched the Knowledge Cluster Initiative in FY2002. In FY2004, the project was being run in 18 regions nationwide. 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 3-3-16).

In addition, the Cooperation for Innovative Technology and Advanced Research in Evolutional Area (CITY AREA) program was implemented in FY2002 and was running in 37 areas in FY2004. 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.

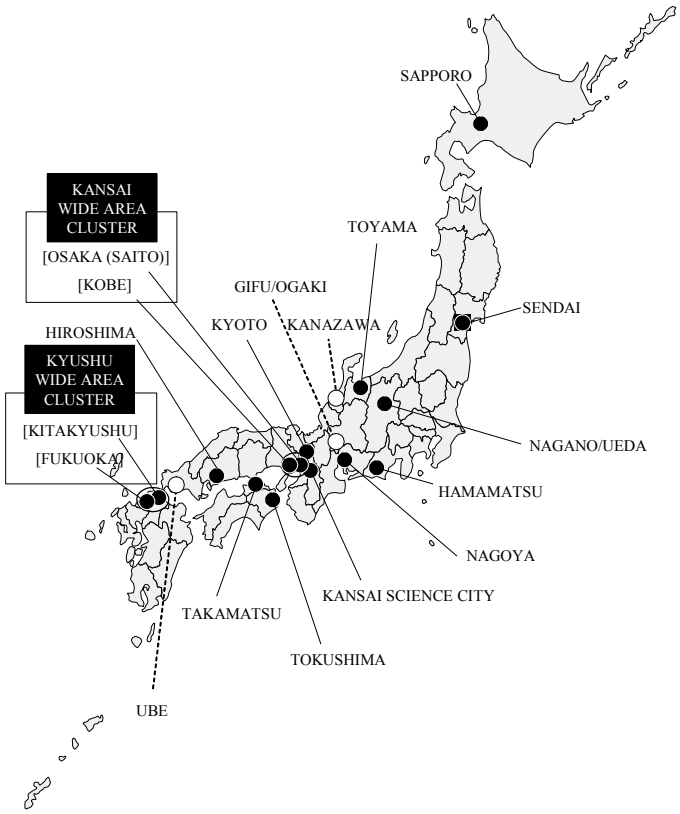


Figure 3-3-16 Map of the Knowledge Clusters

(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 universities, 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 5,800 small and medium-size companies with ambitions to enter world markets, and about 220 universities. These projects are implemented to 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 49 billion yen from the FY2004 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 (Table 3-3-17).

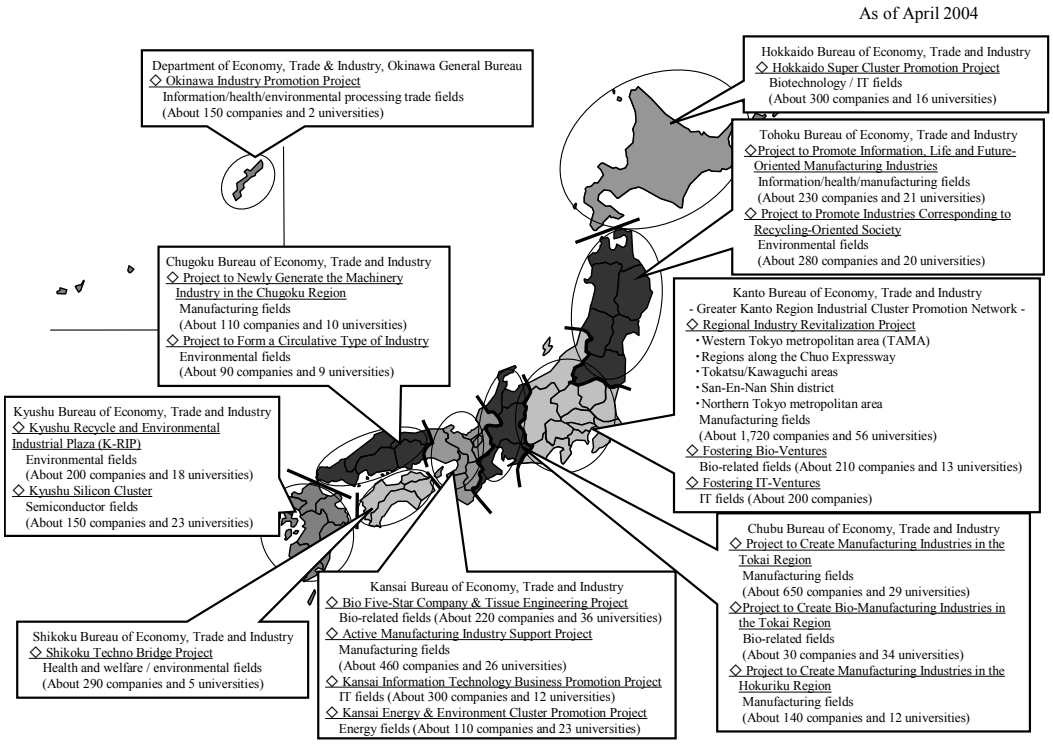


Figure 3-3-17 The Industrial Cluster Project

(3) Coordination 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 to announce summarized versions of the achievements of both ministries' projects and a nationwide cluster forum to discuss methods for promoting cluster policies were held in September 2004. In addition, close collaboration among ministries and agencies concerned is being promoted through the "Coordination Program for Science and Technology Projects" of the Council for Science and Technology Policy and the "Inter-Ministry Liaison Conference on Regional Science and Technology" and the "Regional Block Conference on Regional Science and Technology," both established in October 2004.

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 3-3-18). The following sections introduce some of the main examples concerning research activities conducted by each government ministry.

Table 3-3-18 Major regional science and technology promotion measures

Ministry or Agency, related organizations	Item	Outline of measures
Ministry of Internal Affairs and Communications	Strategic Information and Communications R&D Promotion Programme (SCOPE) (Research and Development Promoting Info-Communications Technology for Community Development)	In the information and communication field, joint research is promoted between small and medium-scale Enterprises and universities, etc., to implement the creation of community-based new industries and to contribute to the promotion of local industry or invigoration of local community.
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)	Through local independence, new technology seeds can be created by utilizing the "wisdom" contained in universities, achieving new industry creation and the development of R&D-type local industries. In addition, it is hoped to establish an independent and on-going industry-academia-government collaboration.
	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 (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 (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 (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.
Ministry of Agriculture, Forestry and Fisheries, Agriculture, Forestry and Fisheries Research Council Secretariat	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	Regional consortium research and development system	Research and development by a joint research system by an Industry, Academia and Government consortium is implemented by utilizing technology seeds and wisdom contained in universities.
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.

(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.

(1)Ministry of Internal Affairs and Communications

The regional information and communications technology promotion-style R&D in the Information and Communications R&D Promotion Program is promoting joint research in the information and communications field between small and medium-sized enterprises and universities engaged in research and development contributing to the creation of local-based new industries, the promotion of local industries or the reinvigoration of local communities

In order to support the independence and social involvement 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.

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

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.

(3) Ministry 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 in paddy fields.

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. Additionally, as part of the Millennium Project, since FY2000 the National Agriculture and Bio-oriented Research Organization 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, and biotic pesticides that take the place of chemical pesticides, etc.

(4) Ministry of Economy, Trade and Industry

In order to create new regional industries and businesses, and to revitalize regional economies, advanced R&D for practical application is being implemented under a strong joint industry –academia-government research system (regional rebirth consortium) utilizing seed technologies and knowledge of universities, etc.

(5) Ministry of Land, Infrastructure and Transport

In order to facilitate coordination between industry, academia and government in various research and development programs that will contribute to the enhancement of international competitiveness, the realization of a safe and secure society, and solution of environmental problems, and to further promote the utilization of research results, the Second Advanced Technology Forum for Land, Infrastructure, and Transportation was held in Nagoya in February 2005, with 339 representatives of local

industry, academia, and governments, as well as representatives of the Ministry and relevant research institutions attending. At the forum, the Ministry's pioneering research results and intellectual property, etc. were introduced, and the participants had face-to-face dialogues.

(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.

(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) Development of Research Facilities

It is important to develop research facilities and other infrastructure with regard to promoting regionally distinct science and technology. 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).

(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 3-3-19.

Table 3-3-19 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 2. Projects consigned to prefectural test and research institutions, and implemented as part of national testing and research ・Quality improvement tests ・Compliant Tests on priority issues
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.

(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.

(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 natio nwide research exchange programs for regions commencing cutting edge or basic research.

(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 as 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

3.3.3.4 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.

(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.

(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 FY2004, a total of 80 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, have broad perspectives, and have acquired practical abilities. It is expected that universities will make various efforts to improve the quality of their education and research.

(1) Development of Human Resources at Universities

(Development of Human Resources with Emphasis on Graduate 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 709 national, public and private universities in Japan have graduate schools attached, with a total of 545 schools (as of May 2004), and the total number of graduate school students at all national, public and private universities has been steadily increasing, to about 244,024 students as of May 2004 (Figure 3-3-20).

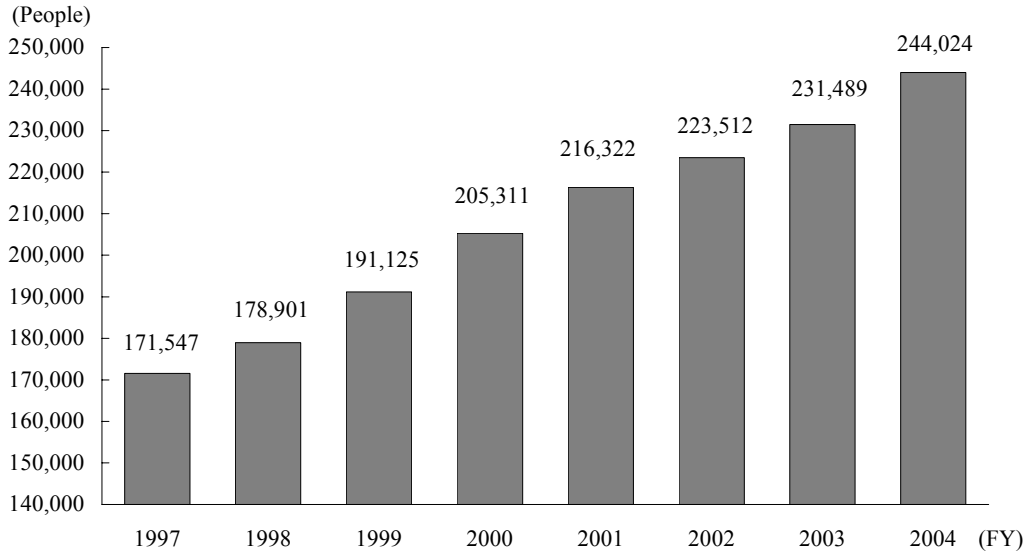


Figure 3-3-20 Trend in the number of graduate students

Note: The numbers are as of May 1 of each fiscal year.
Source: "School Basic Survey" 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 FY2004, a total of eight postgraduate courses were established at five universities, while 72 majors were newly introduced at 18 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 Establish-

ment 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 105 universities (nationnal, public and private) with 206 research courses in FY2004, and the number continues to increase year by year. Furthermore, a system of professional schools that specialize in providing practical education for the cultivation of high level professionals was established in April 2003. As of FY2004, 93 schools have been established.

(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.

Universities are making efforts such as reorganizing and restructuring of departments and establishing graduate courses in graduate schools, to cope with the recent rapid technological innovation and changes in industrial structure. Also, the number of universities and colleges of technology using the Engineer Education Program Accreditation System[18], which is implemented by the Japan Accreditation Board for Engineering Education (JABEE) from the perspective of improving the quality of engineer education in universities and colleges of technology, and ensuring the international suitability and commonality of engineering education, is increasing. In FY2004, 84 programs were newly certified, and the total number of certified programs has now reached 186. The Ministry of Education, Culture, Sports, Science and Technology is also giving support to the upgrading and modernization of facilities for experiments and practice in science and technological departments, and to universities working for industry-academia collaborative education.

(Promotion of General Education)

General Education in universities must provide students a consolidated intellectual basis that can cope with rapid changes in society such as internationalization and progress in science and technology. Universities are expected to help the students to obtain knowledge and intellectual techniques such as thinking process commonly required beyond the borders of specialized fields, and to cultivate a profound insight in relation to the ideal way of existing and living for humans, and ability to accurately understand the realities.

Based on these points of view, the Ministry of Education, Culture, Sports, Science and Technology in FY2004 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.

18 Engineer Education Program Accreditation System: A system in which an external institution examines the contents of engineer education in institutions of higher education such as universities and certifies education programs fulfilling a certain level.

(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 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 ability to lead the next generation (Figure 3-3-21).

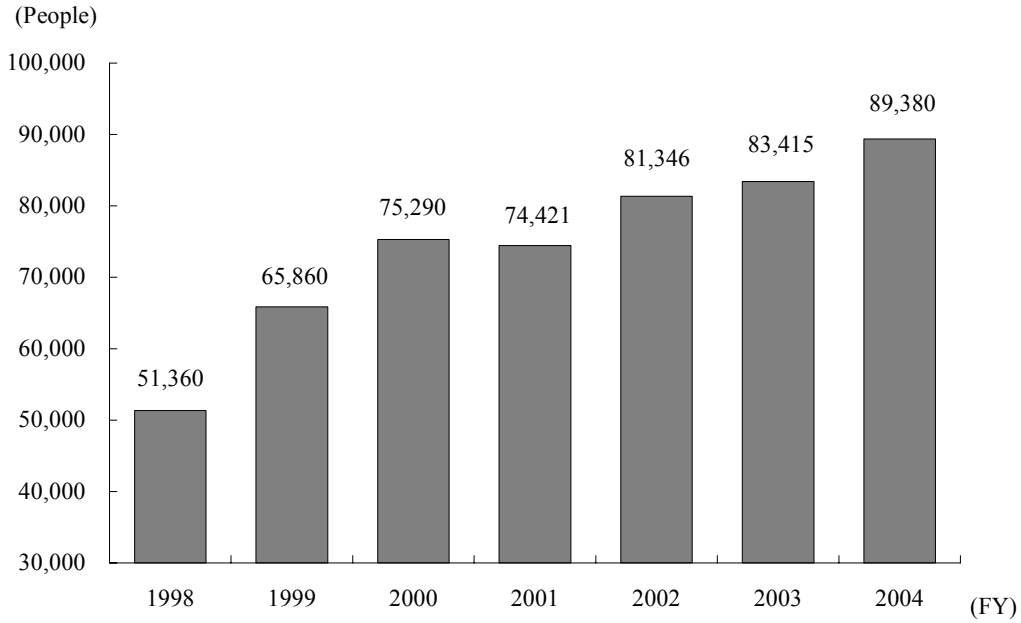


Figure 3-3-21 Trends in the total number of people (graduate students) receiving scholarships from the Japan Student Services Organization

Notes: 1. Figures include the number of scholarships budgeted each fiscal year.
2. Until FY2003, the scholarship program is implemented by the Japan Scholarship Foundation
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.

(Assistance for Foreign Students)

The number of foreign students enrolled in Japanese institutions of higher education reached about 120,000, including about 30,000 graduate

students (Figure 3-3-22).On the other hand, the number of Japanese students studying abroad in universities and other institutions total 79 thousand in 33 major countries (FY2002), according to the statistics from the OECD and other sources.

The Ministry of Education, Culture, Sports, Science and Technology implements its policies in line with the fundamental direction shown in the report by the Central Council for Education in December 2003:① promotion of further exchange of students, such as accepting from and dispatching to foreign countries,② reinforcement of support for Japanese students to study abroad,③ maintaining the quality of foreign students studying in Japan and enhancing the system to accept them.

Specifically, it founded a system for the long-term dispatch of students intending to obtain degrees such as doctors, and a scholarship system using loans for students studying abroad.

Efforts are made to accept foreign students with the focus on a graduate school level, such as a continuous approach to expand the acceptance of government-financed foreign students, as well as the enhancement of support to privately-financed foreign students by providing subsidies to encourage study for high-achieving students with a need for economic aid.

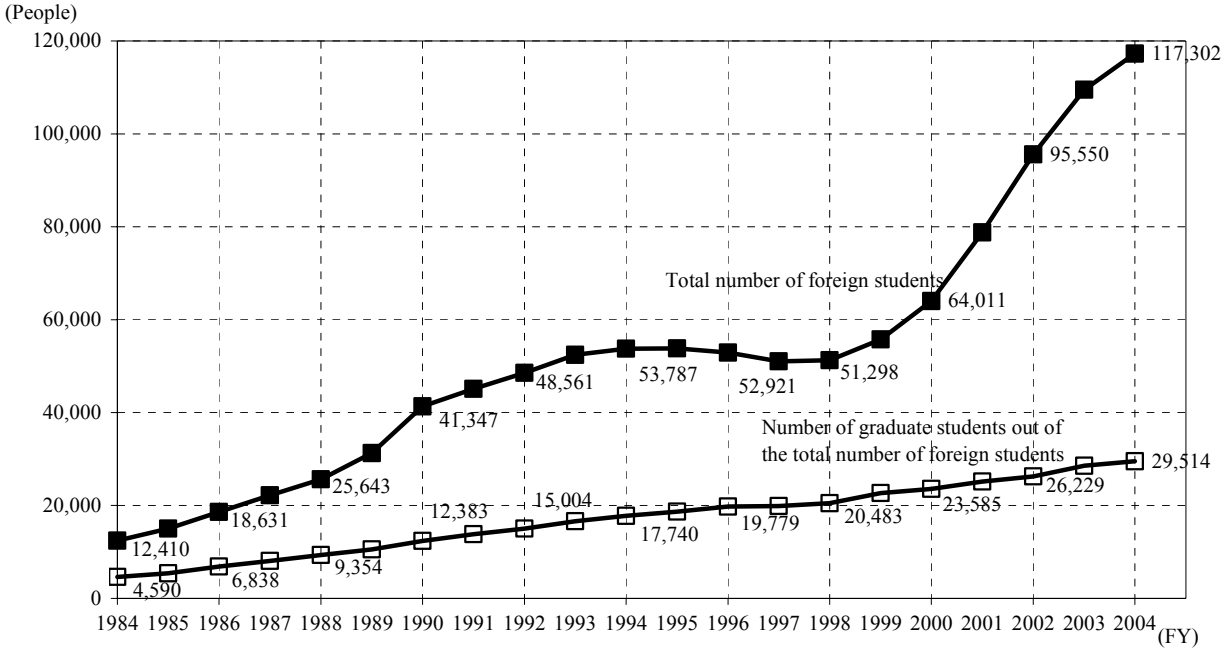


Figure 3-3-22 Trends in the number of foreign students in Japan

Note: As of May 1 for each year.

(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, colleges of technology are striving to expand upon further education, including the enhancement of "community-based" coordination based on the features and characteristics in each area. As for national colleges of technology in particular, 55 colleges of technology across the country were established as a single independent administrative entity, which is assisting efforts to allow more flexibility into school management and to further improve the content of education.

(3) Development of Human Resources at Specialized Training Colleges

In order to support the development of human resources who will become the assets demanded by society, the Ministry of Education, Culture, Sports, Science, and Technology is implementing measures, including the development of e-learning and distance education between schools; the development of programs to respond to social needs; and the provision of financial assistance for the development of large-size education equipment and information processing-related facilities.

(4) Development of Human Resources at High Schools

Along with expanding "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 vocational education that responds appropriately to changes in society. The Ministry implements the "Aspire to be a Specialist" program, which assigns specialized upper secondary schools that will be engaged in advanced research adopting cutting-edge technologies and skills.

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.

(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 possess 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 21 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 FY2004, the test resulted in 22,978 individuals being certified as Associate Professional Engineers, and 3,437 being certified as Professional Engineers. As of the end of December 2004, there were a total of 14,883 people registered as Associate Professional Engineers, and 54,992 registered as Professional Engineers. The distribution by sector is shown in Figure 3-3-23.

Based on 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, submitted by the Council for Science and Technology submitted to the Minister of Education, Culture, Sports, Science and Technology in June 2003, the Ministry of Education, Culture, Sports, Science and Technology revised the technological sections and test subjects of the professional engineering test. The revised test has been implemented since FY2004.

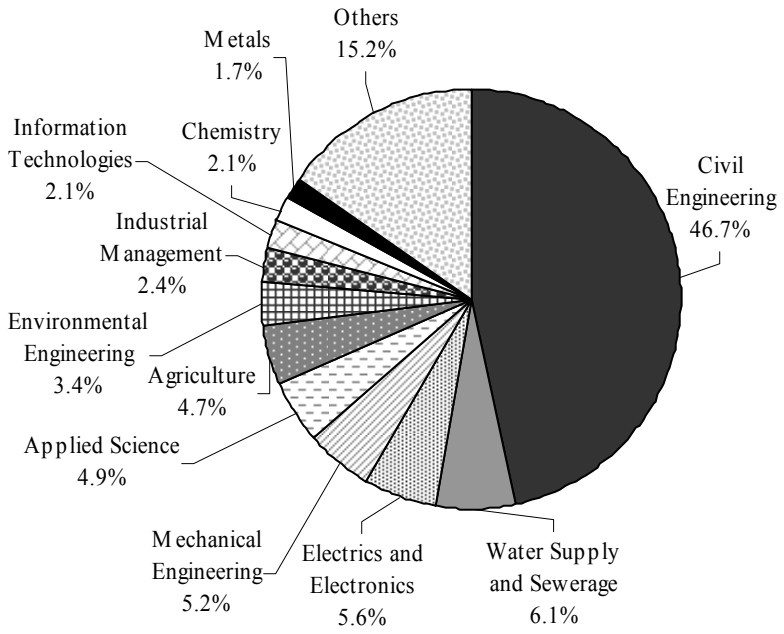


Figure 3-3-23 The distribution of Professional Engineers by the field of specialization (as of the end of December 2004)

(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 aceptance 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 qualifycation 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. In response to this signature, Japan revised ministry ordinances and has been ready to receive Professional Engineer from Australia.

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 this in mind.

Efforts should be made to ensure a deep understanding of science and technology among citizens so that people can judge various social 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 aware- ness 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.

(1) Promotion of Science and Vocational Education at the Elementary and Secondary Education Level

The development of the socio-economy of Japan has been largely supported by science and techno- logy. In light of the major role played by science and vocational education in such efforts, Japan strives 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 Japan Science and Technology Agency, is implementing efforts such as "Super Science High Schools," which is for training future international human resources of science technology, 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 and promote 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.

At the same time, in the area of vocational 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 technologies, and efforts are being made for the planned development and expansion of vocational 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 school teachers who have greater expertise and skills in teaching specific subjects to provide instruction in science and other subjects at elementary schools.

(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 techno- logy 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 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 comprehensive content, in addition to courses of study made up of seminars with small groups of students, and classroom study that incorporates internships and volunteer active- ties.

(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 supp- orts 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. Additionally, the Ministry is implementing specialized training for museum specialists employed at natural science museums, etc., in order to improve their level. Also, by dispat- ching expert staff such as curators working in museums and other facilities to museums (including natural science museums) in foreign countries for training, it is expected that they will obtain sophisticated expert knowledge and

skills in relation to their work.

The National Science Museum conducts educational programs—such as science classes and experimentation courses for young people and children—that serve to deepen the understanding of science and technology. The Exhibition in the New Building, which explains about biodiversity, the history of lives on earth and the development of science and technology through a new explanation system, was opened to the public from November 2004.

The Japan Science and Technology Agency is a pioneer in developing exhibition methods that allows the visitors to feel familiar to and experience state-of-the-art science and technology. It is also engaged in the operation of the "National Museum of Emerging Science and Innovation," a comprehensive base for transmitting information on cutting-edge science technologies. In this National Museum of Emerging Science and Innovation, the latest research results and details, which is often regarded as too difficult, are explained in an easily understood manner by employing methods such as interactive exhibition, experiments and projected images. It also develops and diffuses methods to reinforce the understanding of science technology, and promotes exchanges among researchers. Through these activities, the Japan Science and Technology Agency is trying to activate interactive communication between society and science and technology, as well as fostering human resources for science and technology communication who supp- ort these activities.

Also, in cooperation with the Science Council of Japan, the Japan Science and Technology Agency provided broader opportunities to diffuse knowledge on science and technology. It also implemented practices to evoke social interest on fostering hum- an resources in science technology through the provision of support for participation in international science and technology contests. Furthermore, it implemented business to support science and technology educational activities, through collaboration between science museums and local schools.

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.

(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.

(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, cable TV and the internet. The JST also uses the latest

computer technology to provide science and technology information through a "Virtual Science Center".

(Other Events)

In FY2004, 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 "Science and Technology Week," the "Atomic Energy Day," and the "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. Many events were held during the Science and Technology Week in FY2004, 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.

(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 experiential 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.

(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.

(Children's White Paper on Science and Technology)

Since FY1999, the Ministry of Education, Culture, Sports, Science and Technology issues the "Children's White Paper on Science and Techno- logy" every year, picking up a timely theme such as life science and space development, and explaining it in an easy-to-understand manner using comics. "Children's White Paper on Science and Techno- logy" is released in full on the website of the Ministry of Education, Culture, Sports, Science and Technology. It is also distributed to elementary schools, public libraries and science museums nation wide, and is sold in government publications service centers and other places.

The latest issue, published in March 2005, has "Maritime Science and Technology and Global Environment" as its theme, and explains in an easy-to-understand manner the relation between the ocean and the global environment, the ocean as a frontier in deep waters and polar regions, and the importance of science and technology in the fields of global/maritime observation by using comics, photos and an attached CD-ROM.

(2) 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 develop- pment through recognition for inventions and awards for outstanding service in science and technology.

Therefore, the Ministry of Education, Culture, Sports, Science and Technology gives an award to those who recently made notable achievements on the science and technology fields in Japan. In FY2004, 15 people were awarded for science and technology merit, 35 people for research merit, 31 people for contributions in science and technology promotion, 6 people for contributions in the diffusion and enlightenment of science and technology, 987 people for ingenuity merit, and 26 schools that made notable achievements in fostering the ingenuity of elementary and junior high school students,. From FY2005, this awarding system will be enlarged to include group awards to cope with the increasing number of team research and developments, awards for young researchers, reinforcement of awards to those who contributed to activities to promote understanding, and expansion of the system for awarding those who contributed to preparing environments for research and development such as creation of venture companies and collaboration among industry, academia, and government, and will be implemented as a new system.

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 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 social based 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 socially based system that readily allows for science engineers to carry out a code of conduct and to carry out their responsibilities," and " for which 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

3.3.6.1Strategic and Prioritized Improvement of Facilities and Equipment

(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 positions the improvement of aged 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 3-3-24), 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.

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.

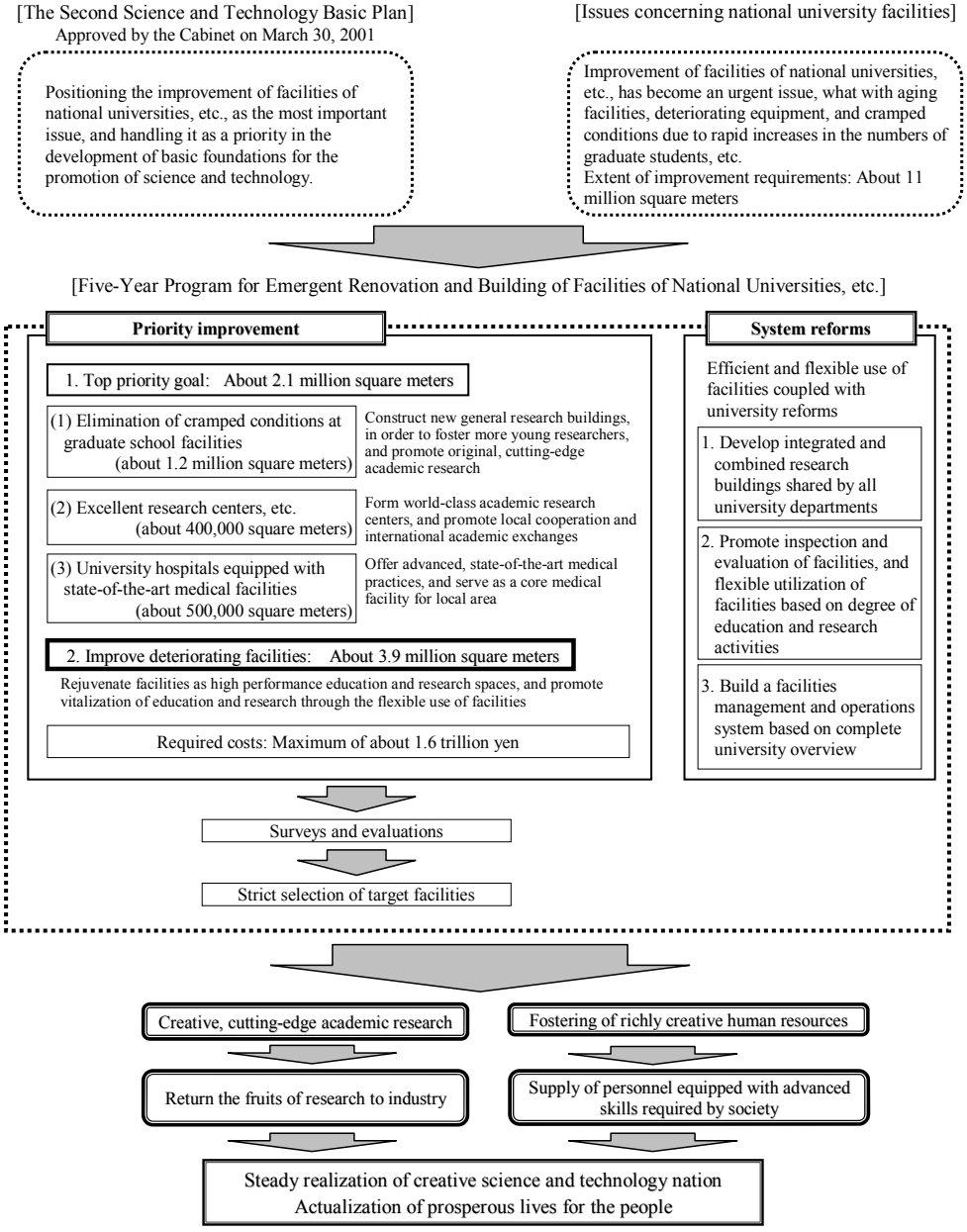


Figure 3-3-24 Five-Year Program for the Emergent Renovation and Building of Facilities of National Universities, etc.

(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 a major effect on 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.

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 FY2004, 48 beamlines, or approximately 2/3 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 3-3-25.

Table 3-3-25 Large-scale synchrotron radiation facilities in the world

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

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 3-3-26.

Table 3-3-26 Trends in the number of supporting staff per researcher

Year	1997	1998	1999	2000	2001	2002	2003	2004
Incorporated administrative agencies and others	0.77	0.79	0.84	0.84	0.82	0.96	0.98	0.88
National universities	0.24	0.24	0.24	0.25	0.25	0.26	0.26	0.27

Notes: 1. Supporting staff includes assistant research workers, technicians, clerical and other supporting personnel. The values are as of April 1 up until 2001, and as of March 31 from 2002.
2. Incorporated administrative agencies include public corporations that the main purpose at the R&D activities and national experimental research institutions. (However, until 2001, the numbers indicate only national experimental research institutions.)
3. The numbers for researchers at national universities and, until 2001, independent administrative agencies are for regular researchers.
4. Includes natural science departments only.
5. National universities refer to the departments of national universities (including graduate schools), national junior colleges, national colleges of technology, laboratories affiliated to national universities (including research facilities), and the Inter-University Research Institute Cooperation. These entities now intend to reinforce their system for research support at their own discretion.

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

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.

(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.

(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.

Independent research and development on measureement, analysis, experimentation and evaluation, and on the state-of-the-art technologies and instruments for them, is not only the basis that upholds the research and development activities. Supported by the fact that the many researches and developments of these kinds themselves receive the Nobel Prize, it is an extremely important task for our country to serve as one of the world's front-runners in the fields of science and technology. However, the degree of dependence to foreign countries for advanced measurement and analysis instruments in Japan is high. In particular, the area of life science relies on foreign companies for most of the instruments for pioneering research (Figure 3-3-27). On the basis of this situation, 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.

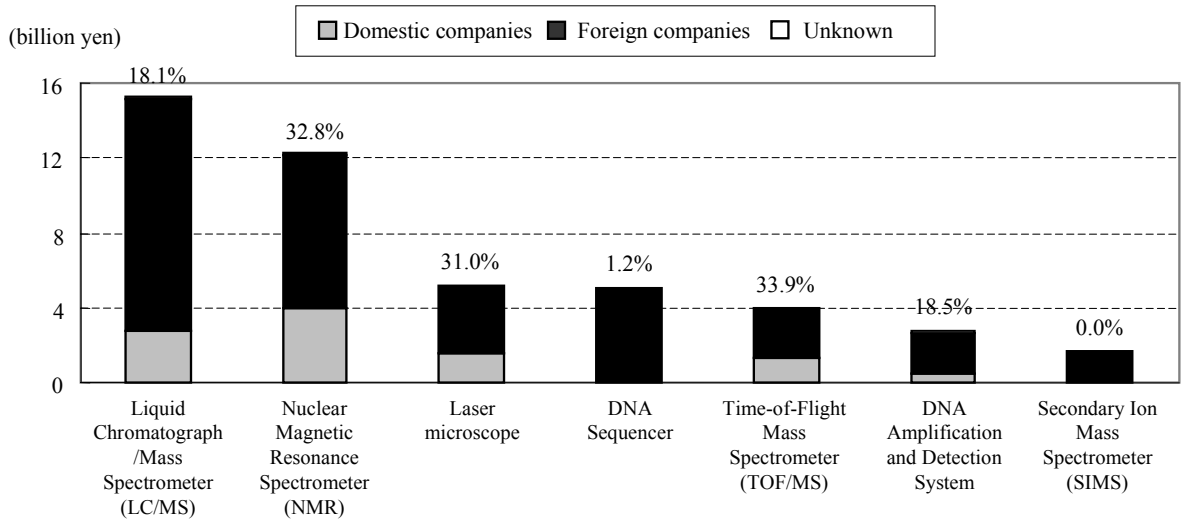


Figure 3-3-27 Shares of major measurement and analysis instruments by domestic and foreign companies (FY2003)

Note: 1. Domestic companies: shares of companies produce and sell instruments in Japan
2. Foreign companies: shares of companies selling instruments produced abroad
3. Figures shown with "%" in the table shows the share of domestic companies in the domestic market.

Source: Prepared by the Ministry of Education, Culture, Sports, Science and Technology, based on the "Kagaku Kiki Nenkan" published by R&D Corp.

(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.

(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.

(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.

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. The standards of 196 physical standards and 196 reference materials are provided by

the end of FY2004. 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. The base sequence of the filamentous bacterium, the Brevibacillus species, and the Rhodococcus species, etc., was identified in FY2004.

In FY2004, the NITE Biological Resource Center (NBRC) added approximately 16,000 microbial strains and DNA clones to its collection—now totaling approximately 56,000 items—which it maintains and provides to the public. Biotechnology Development Center started joint research with the industrial sector and universities as an effort to add high value to genetic resource information from FY2003, and currently conducts four joint research projects. Furthermore, it opened the NITE Patent Microorganisms Depositary (NPMD) in the Department of Biotechnology in FY2004, reinforcing its function as a genetic resource institute. It also established the "Asian Consortium for the Preservation and Sustainable Use of Micro Organism Resources" to establish the world's first framework for multinational cooperation at the government level in Asia for the purpose of cooperative management and use of microorganism resources. The National Institute of Advanced Industrial Science and Technology implements protein analysis based on data obtained from the analysis of the DNA of microorganisms. It also preserves and distributes microorganisms and plant and animal cells related to patents.

In terms of data infrastructure for chemical substance 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. In addition, the Ministry carries out research and development regarding risk assessment methods of chemical substances.

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.

(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.

(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 micro-organisms 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 3-3-28.

Table 3-3-28 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	National Institute of Information and Communications Technology	National frequency standards, and standard time
Ministry of Education, Culture, Sports, Science and Technology	1980	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	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 (RIKEN (The Institute of Physical and Chemical Research))	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	National Institute of Agrobiological Science, etc.	Genetic resources of plants, microorganisms, and animals
	1985	Forestry and Forest Products Research Institute	Genetic resources of forest trees
	1985	Fisheries Research Agency	Genetic resources of fisheries organisms
	1995	National Institute of Agrobiological Science, etc.	DNA
	2003	National Institute of Agrobiological Science, Rice Genome Resource Center	Rice mutant lines, cDND, etc.
Ministry of Economy, Trade and Industry	1882	National Institute of Advanced Industrial Science and Technology, Geological Survey of Japan	Geological data (geological maps of the country at a scale of 1:200,000 and 1:50,000, etc.)
	1903	National Institute of Advanced Industrial Science and Technology, National Metrology Institute of Japan	National measurement standards, Japan Calibration Service System (Measurement Law), 196 physical standards, 196 reference materials
	1993	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	National Institute of Advanced Industrial Science and Technology, National Metrology Institute of Japan	Testing and evaluation methods, etc.
	1996	National Institute of Technology and Evaluation, Chemical Management Center	Comprehensive chemical management information on 3,808 substances
	1998	National Institute of Advanced Industrial Science and Technology, National Metrology Institute of Japan	Physical standards, reference materials
Ministry of the Environment	1983	National Institute for Environmental Studies	Preservation of microorganism strains (1,400 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. The JPO has 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 to enhance their computerization efforts. Moreover, the Patent Attorney Law has been thoroughly revised to provide more user-friendly technical services. 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 and Training 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 includes patent licensing fairs held nationwide in Japan.

The Ministry of Economy, Trade and Industry is carrying out research and development 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 FY2004, research and development was being implemented on 26 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 FY2004, the program was used to put two teams into operation.

From the perspective of promoting the development of new technologies in the fields of IT and environment, research and development on the fundamental technology for mounting low temperature lead-free soldering, with domestic and international standardization in mind, has been started from FY 2004.

In order to achieve international standards in the information and communications field originating from Japan, and to promote the strengthening of Japan's international competitiveness, "research and development targeting international technological standardization" (SCOPE-I) 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 FY2004, three 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, ubiquitous network technology, etc. 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. In the World Telecommunication Standardization Assembly held in October 2004 (WTSA-04), Japan led the discussion on how to consider NGN (next generation network), which is one of the most important standardization tasks for the future 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 (AS TAP).

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. Therefore, the Special Research Committee on Management of Intellectual Properties was established under the Council for Science and Technology Policy, which summarized "Opinions on Intellectual Property Strategy" in May 2004, as a result of survey and inspection on the creation and utilization of outstanding intellectual properties in universities.

The Japanese government has also been promoting its intellectual property strategy nationwide in various fields, including science and technology. In May 2004,

the "Intellectual Property Strategic Program 2004" was decided in the Strategic Council on Intellectual Property (Chief Cabinet Secretary: Prime Minister). The important policy issues for this Program is being studied in three different special research committees, and "Patent Protection for Medical Activities" (by Special Research Committee on the Patent Protection for Medical Activities, November 2004) and other reports were summarized. Also in November 2004, a "Working Group on Japanese Brands" was established, which is studying various measures to build a brand that resembles Japan in the new age.

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 developpment and provision of databases; and the sharing of research information through the use of networks.

An overview of the main measures for the research information infrastructure in FY2004 is shown in Table 3-3-29.

Table 3-3-29 Main measures for the research information infrastructure (FY2004)

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	National Institute of Information and Communications Technology	·Establishment of advanced network testbed for research and development (JGN II)
Ministry of Education, Culture, Sports, Science and Technology	RIKEN (The Institute of Physical and Chemical Research)	· Research funds for IT utilization
	Japan Science and Technology Agency	· Construction of R&D databases (ReaD, J-STORE etc.) · Development of engineer ability and operation of "failure knowledge database" ("Web Learning Plaza" etc.) · Operation of Institute for Bioinformatics Research and Development (BIRD, GBIF etc.) · Operation of Science and technology information provision system (JOIS, J-STAGE etc.)
	Japan Agency for Marine-Earth Science and Technology	· IInformation infrastructure operating costs
	National Institute of Informatics	·Development of Scientific Information Network ("Super SINET" etc.)
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	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

(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 2005, a total of 728 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 now up and running.

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, 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. Furthermore, the Ministry subsidizes private universities for the costs necessary to develop campus LAN systems.

By establishing the Advanced Network Testbed for R&D (JGN II[19]), operated by the National Institute of Information and Communications Technology, the Ministry of Internal Affairs and Communications promotes the pacesetting approaches that create am extensive ripple effect such as improvements in technological capabilities in Japan reinforcement of coordination between industry, academia and government, creation of new business and industries, vitalization of regional activities and effects on fostering human resources, through research and development and demonstration experiments. Furthermore, in order to promote collaborations with research institutes in Japan and abroad, the operation of the U.S.-Japan line started from August 2004.

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 promotes 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.

(2) Creation and Provision of Databases (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. The National Institute of Informatics creates and provides databases on titles and locations of academic books and magazines available at university libraries and other institutions, with the cooperation of institutions nationwide such as national, public, and private universities. It is also engaged in a joint project to establish metadata/database on academic information sources that are transmitted from universities and research institutes in Japan via the Internet. 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.

19 JGN II is a successive project for Japan Gigabit Network (JGN, FY1999-FY2003), which was used by 650 institutions and more than 2,000 researchers in total, and achieved a great success in areas such as improving the broadband infrastructure, revitalizing local economy and fostering human resources in our country.

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) and JST Document REtrieval system for Academic and Medical fields (JDream), 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 (J-STAGE) 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.

(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.

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.

(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). 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) 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 networksconnected 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 competetiveness 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 social 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.

(1) Fostering and Securing Personnel Engaged in Manufacturing

In order to promote fundamental technologies for manufacturing, it is inevitable to foster human resources, having rich creativity, to support it. Various measures are taken in school education and lifelong learning.

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, as well as to implement a study on manufacturing in related subjects based on the curriculum guideline from the elementary school. In particular, specialized upper secondary schools such as industrial high schools, have been serving important roles in fostering specialists that will bear the future of manufacturing industries in our country. In order to further reinforce such efforts the "Aspire to be a Specialist" program has been implemented since FY2003, which concentrates on conducting education that introduces advanced technologies and skills in specialized upper secondary schools.

Activities such as experiencing actual workplace in lower secondary schools and internship in upper secondary schools evokes a willingness to learn among students, and will foster visions for labor and vocation. It is also a valuable opportunity for the students to learn knowledge and skills actually used in the workplace, including offices for manufacturing. These activities are therefore actively promoted by various facilities.

In the fields of higher education, due to the corporatization of national universities and national colleges of technology, the discretion of universities and colleges was expanded, promoting further improvement in uniqueness, vitalization and sophistication of educational content.

It is intended to prepare science and technological departments based on the autonomous and self-directive decisions of each university. Also, a system of professional schools was established in FY2003, for the purpose of improving the quality and quantity of efforts to foster high-level professionals.

Colleges of technology aim to become an attarctive option, by conveying their appeal to manufacturing through approaches such as the "All-Japan Colleges of Technology Robot Contest." They also hold public lectures and experience classes targeted at people in the local communityand elementary and junior high school students.

In special training colleges, the fostering of human resources for manufacturing is promoted through practical vocational education and specialized skill education. The special training colleges are also engaged in the "Program to Support Independence and Challenges by Young People Using Special Training Colleges," which develops short-term education programs utilizing special training colleges, in order to improve the capabilities of those who aim to become a permanent employee but cannot, such as part-time workers.

In the area of lifelong learning, opportunities for career improvement are being amplified through the acceptance of working people at universities and other schools or public lectures. It is also intended to foster human resources for manufacturing by providing children opportunities to experience and learn manufacturing in each region, through app-

roaches such as utilizing citizens' public halls and museums or opening classes in educational institutes to the public.

The situation of employment for young people is still severe, with the number of part-time workers and unemployed increasing. To cope with this situation, efforts to solve the problems of young people are continuously made from an educational perspective, based on the "Plan to develop the capability and promote employment of the younger generation," which was summarized in June 2003 by the four ministries involved. These efforts include approaches in the area of fostering human resources throughout the entire educational activeties at schools, such as the promotion of organizational and systematic career education from elementary schools, and implementation of reeducation for part-time workers.

(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 the new concept of "volume data." It completely integrates various simulation technologies, product measurement and testing 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) 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-sized enterprises.

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.