Section 4 ■ Development of Next-Generation Human Resources - Succession of Knowledge -

1 Importance of development and retention of science and technology-related human resources

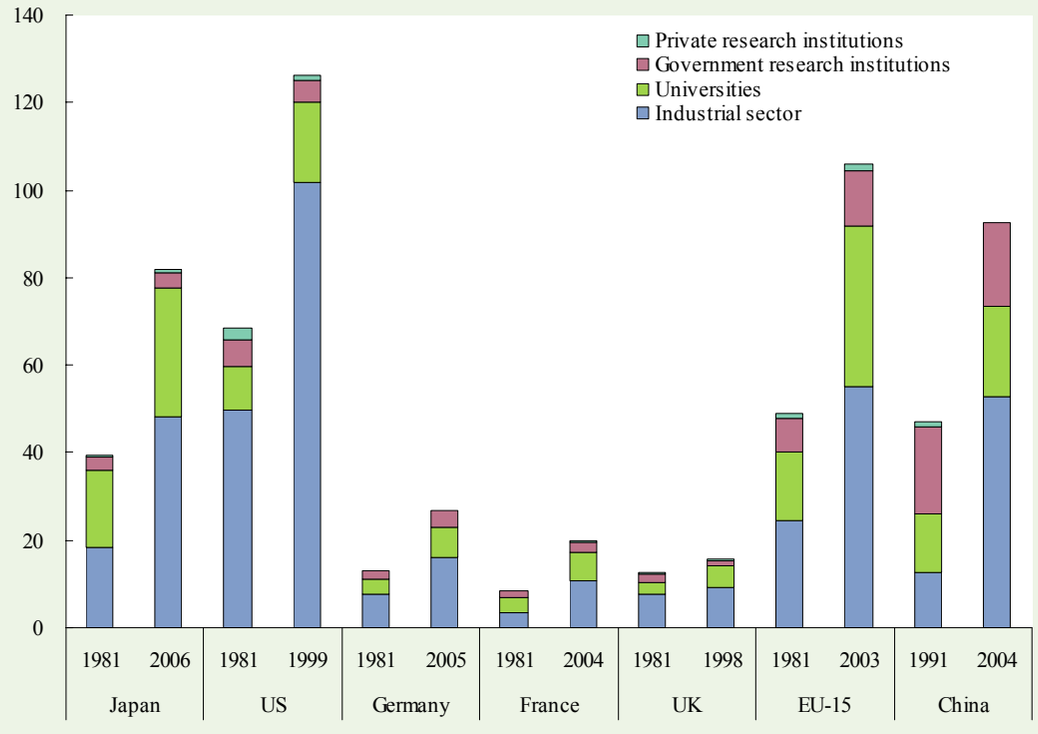
The Third Science and Technology Basic Plan features as a basic tenet "Emphasis on fostering human resources and competitive research environments – Shift of emphasis from 'hard' to 'soft' such as human resources; greater significance of individuals in institutions" and points to the need to shift emphasis to investment intended to develop and utilize excellent human resources.

(1) Other countries' efforts to develop and secure human resources

The numbers of researchers in Japan and other countries have now risen sharply compared with the early 1980s, indicating that the role of researchers as the core human resources in the establishment of a knowledge-based society is expanding (Figure 10).

In this context, countries around the world regard the development and retention of excellent human resources as the centerpiece of their science and technology promotion policies and are implementing a variety of initiatives suited to their own circumstances and challenges.

■ **Figure 10 Trends in number of researchers in Japan and other major countries**

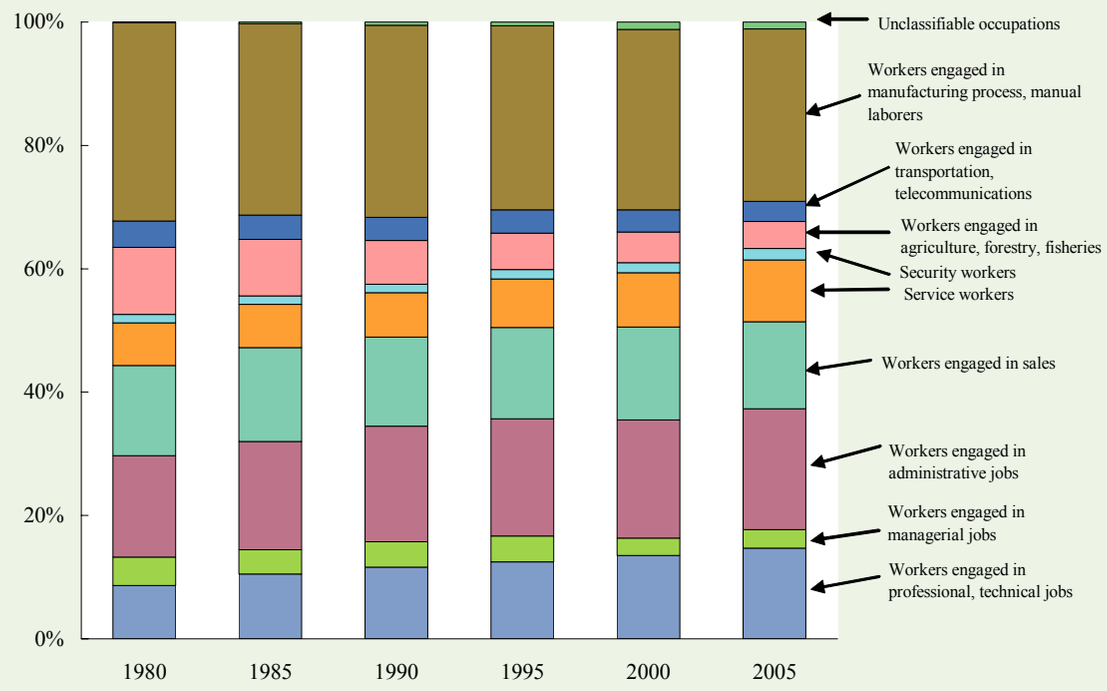


Note: EU-15 comprises Belgium, Germany, France, Italy, Luxemburg, Netherlands, Denmark. Ireland, UK, Greece, Portugal, Spain, Austria, Finland and Sweden.
Source: Figures for Japan taken from "Report on the Survey of Research and Development" by the Ministry of International Affairs and Communications and those for other countries from "Main Science and Technology Indicators" by the OECD.

(2) Japan's viewpoint concerning human resource development and retention

The number of researchers in Japan stood at 820,000 in fiscal 2006, rising more than double from 395,000 in 1981. It is notable that the ratio of researchers working in the industrial sector to the total number of researchers increased particularly sharply (Figure 10). Moreover, the ratio of people engaged in professional and technical jobs, including science researchers and engineers, to the total number of workers has been rising in Japan in recent years (Figure 11).

■ Figure 11 Percentage breakdown of employees by occupation type

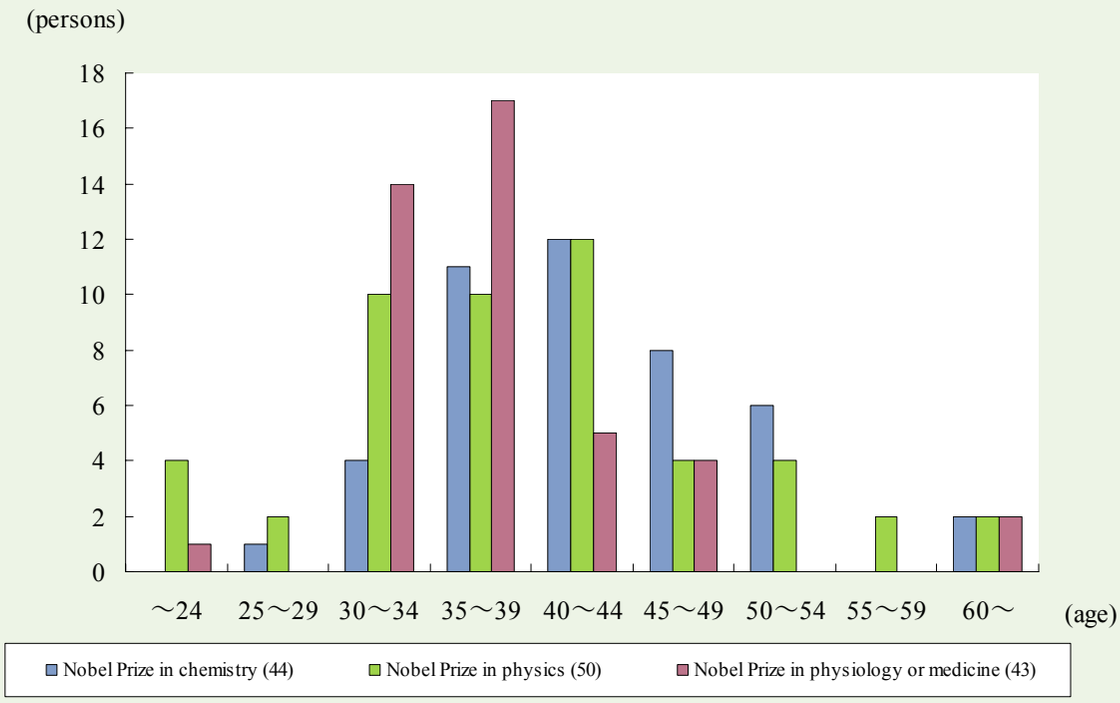


Source: 2006 White Paper on the Labour Economy by the Ministry of Health, Labour and Welfare

In order to ensure the development and retention of human resources capable of supporting Japan's intellectual foundation, it is important to provide young researchers, who are the key to this challenge, with a variety of research opportunities suited to their aptitudes. It is thus desirable to further enhance programs for assisting young researchers in the future.

A survey on at what age Nobel laureates did the work for which they were commended shows that Nobel prize-class achievements are mostly attained when the scientists are in their 30s to 40s (Figure 12).

Figure 12 Distribution of Nobel Prize laureates by age of prize-winning work (1987-2006)



Note: The "age of prize-winning work" indicates the age of the Nobel laureate at the time of the publication of the research paper, etc. that led to the award. The following principles were applied to determine the age.

1) The age of the prize-winning work shall be equivalent to the number reached by deducting the number of the year of the Nobel Laureate's birth from the number of the year when the research paper, etc. that led to the prize award was published.
2) When two or more papers were cited in the commendation, the year when the earliest one was published shall be used in the calculation explained above.
3) When the publication date of the paper, etc. that led to the prize award cannot be precisely determined, the year of the prize-winning work shall be assumed as follows: Work done in the 1990s shall be dated to the year 1995, work done in the early 1990s to 1992, work done in the latter half of 1990s to 1998 and work done in the mid-1990s to 1995.

Source: Survey by MEXT

2 Results of human resource development conducted through research activities

Research activities at university are conducted as one with education.

Education and research activities have the function of not only training academic researchers but also developing human resources capable of playing an active role in various sectors of society.

(1) Reform of graduate schools

Against the background of the diversification of social needs and the realization of a borderless economy and a society based on advanced communications technologies, demand has grown for human resources equipped with advanced expert knowledge and abilities and capable of playing an active role across national borders. Reform of the graduate school system has been vigorously promoted in order to help to diversify the methods and arrangements of education, leading to the establishment of new types of institutions such as graduate universities, the injection of flexibility into the university entrance criteria and the duration of academic programs as shown by the adoption of an early entrance system and the adoption of the Graduate School Coordination Program. The number of graduate school students in Japan has risen about 3.5 times over the past 20 years, although the number is still small compared with the numbers in the United States and Europe.

In recent years, Japanese universities have also been promoting reform measures such as public invitations of research proposals throughout the campus with the use of the president's discretionary expenses of the university president and other measures for prioritized allocation of funds, the provision of support for young teaching staff and the introduction of arrangements for enabling flexible implementation of research programs.

Meanwhile, some universities seek to enhance assistance for young teaching staff and graduate school students by earmarking funds for research assistantship or by introducing a system of commending young teaching staff with innovative ideas and allocating to them research funds.

Besides, some research organizations have started collaborating with other institutions after establishing internal committees and organizations in charge of such collaboration.

The above-mentioned reform measures have contributed to the revitalization of education and research activities at universities and the development and retention of human resources that form the basis of science and technology and academic activities.

(2) Fostering young researchers

(Support for post-doctorals)

Young researchers' experiences as post-doctorals[26] are important for fostering their creativity and independence. A survey conducted on the managers of universities and other research organizations show that many respondents characterized the post-doctoral period as the gateway to

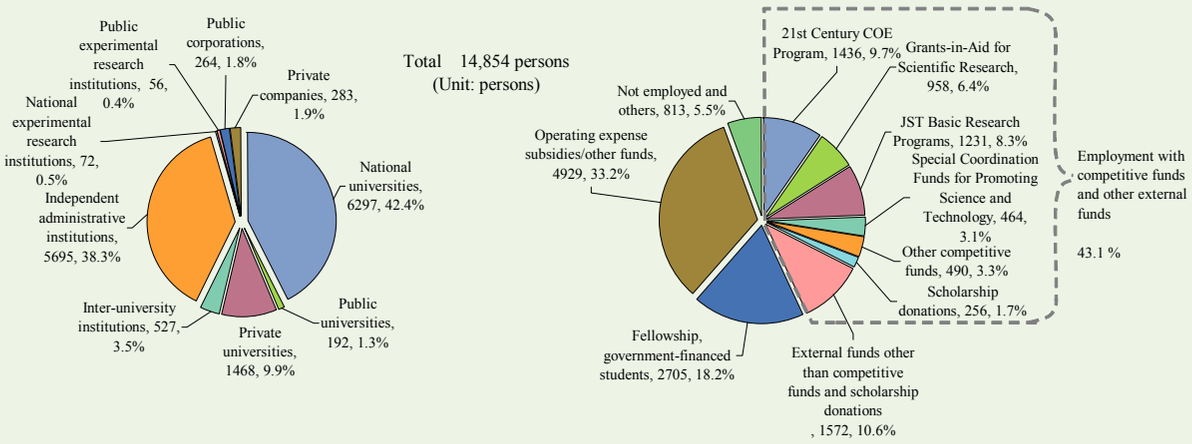
[26] Post-doctorals: Those who, after having completed doctorates, (1) engage in research activities at a research organization such as a university, not as a professor, an associate professor, an assistant professor, or the like, or (2) engage in research activities at a research organization such as an independent administrative agency, assigned to the position for a fixed term and are not in a position such as a leader or a senior researcher of their research group. Both (1) and (2) include those who have terminated their student status but have been a graduate student for a period exceeding the required number of years for completing a doctoral course and have obtained the required credits (generally referred to as "withdrawals upon obtaining required credits").

independence for young researchers or an opportunity to broaden the range of their research.

On the other hand, as the uncertainty over the career paths of post-doctorals remains a problem, it is important to enhance the transparency over the process of employing young researchers, help them become independent and promote career-support efforts, such as providing post-doctorals with career options other than academic research jobs.

According to a survey conducted by MEXT in fiscal 2005, a total of 14,854 post-doctorals and the like were employed as of fiscal 2004, with 57% of them working at universities and 38% at independent administrative institutions. The breakdown by the type of funding showed that 43% were supported by competitive funds and other outside funds and 33% by operating expense subsidies and other internal funds (Figure 13).

Figure 13 Employment status of post-doctorals by type of institution and funding



Source: "Survey on Postdoctoral Fellows and Research Assistants (FY2005) August 2006" by National Institute of Science and Technology Policy/MEXT

(Enhancing Quality of Young Researchers through JSPS Research Fellowships for Young Scientists)

The JSPS Research Fellowships for Young Scientists (sponsored by the Japan Society for the Promotion of Science) is intended to provide talented young researchers in Japan with opportunities to devote themselves to research activities concerning themes selected by themselves with a free mind in order to foster and retain researchers. In fiscal 2006, as many as 5,032 researchers were adopted as fellows. This program has contributed to remarkable improvement in the capabilities and potentials of promising, next-generation researchers by attaching importance to the independence of such researchers so as to enable them to devote themselves to research activities.

With regard to the employment status of researchers adopted as fellows under JSPS Research Fellowship (PD), about 40% obtained permanent research jobs immediately after the completion of their fellowship term, with the ratio rising to about 50% one year later, to 70% four years later and to more than 80% 10 years later.

Column 5: “Liberal Research Environment and Consistent Support are Important for Fostering Young Researchers” (Dr. Hiroshi Takayanagi, professor at Tokyo Medical and Dental University)

(3) Cultivating uniqueness and international competitiveness of universities

Since fiscal 2002, MEXT has been implementing the 21st Century COE program, which aims to cultivate the uniqueness and international competitiveness of Japanese universities by providing targeted support for the establishment of world-top-class research and educational centers at Japanese universities so as to raise the standard of research and develop creative human resources capable of making world-leading achievements.

The following are the results of a questionnaire survey conducted in December 2005 on the presidents of all universities to which graduate schools are attached (There are 558 such universities.) regarding the 21st Century COE program and a survey conducted on the selected COE program leaders and committee members in charge of screening and evaluation.

- More than 90% of COE program leaders and screening and evaluation committee members replied that the 21st Century COE program contributes to the revitalization of the education and research environment in Japan as a whole. The presidents of more than three quarters of all universities, including those that do not have projects adopted under the COE program, have replied that the program contributes to the revitalization of the education and research environment in Japan as a whole.

- Many respondents said the 21st Century COE program has contributed to human resource development by playing a significant role in enhancing financial support, promoting internationalization, improving the education and research environment and raising the standard of research. Specifically, each COE has made efforts to promote research activities by students themselves, enhance students’ research motivation through experiences gained abroad, promote student exchange across the boundaries of the fields of majors and laboratories, provision of joint guidance to students on multidisciplinary fields based on teacher collaboration, and to cultivate internationality through the introduction of tasks such as writing papers and making presentations in English.

- With regard to the enhancement of financial support, the number of students adopted as research assistants increased by 2.6 times at the selected COEs compared with when the application was made. In addition, the number of post-doctorals employed increased by 2.2 times. In particular, the number of foreigners employed increased by 2.6 times and the number of people employed from other research organizations increased by 3.2 times, facts that indicates that the 21st Century COE program is helping to improve the level of internationalization and the mobility of researchers.

- With regard to improvement in the standard of research conducted by graduate school students and the level of internationalization, the number of research papers contributed to academic

journals by doctorate course students at the selected COEs increased by 1.3 times from 12,000 to 16,000. About three quarters of those papers were contributed to refereed journals of global standards, indicating that high levels of research are conducted in doctorate programs. The number of presentations made at academic conferences increased by 1.3 times, with the number of those made at conferences held abroad rising as much as 1.5 times.

○ With regard the status of graduate school students after completing their courses, the number of graduate school students employed by R&D divisions of companies increased by 1.3 times compared with before the COE program, indicating that the program helped the development of human resources capable of contributing to industry.

○ With regard to the implementation status of joint research activities, the number of joint research programs with Japanese and foreign universities, research organizations and companies increased 1.5 times, indicating that industry-academia coordination and internationalization have proceeded in research activities.

Column 6: “Concrete Achievements of 21st Century COE Program” (Project for International Center of Research & Education for Materials, Tohoku University)

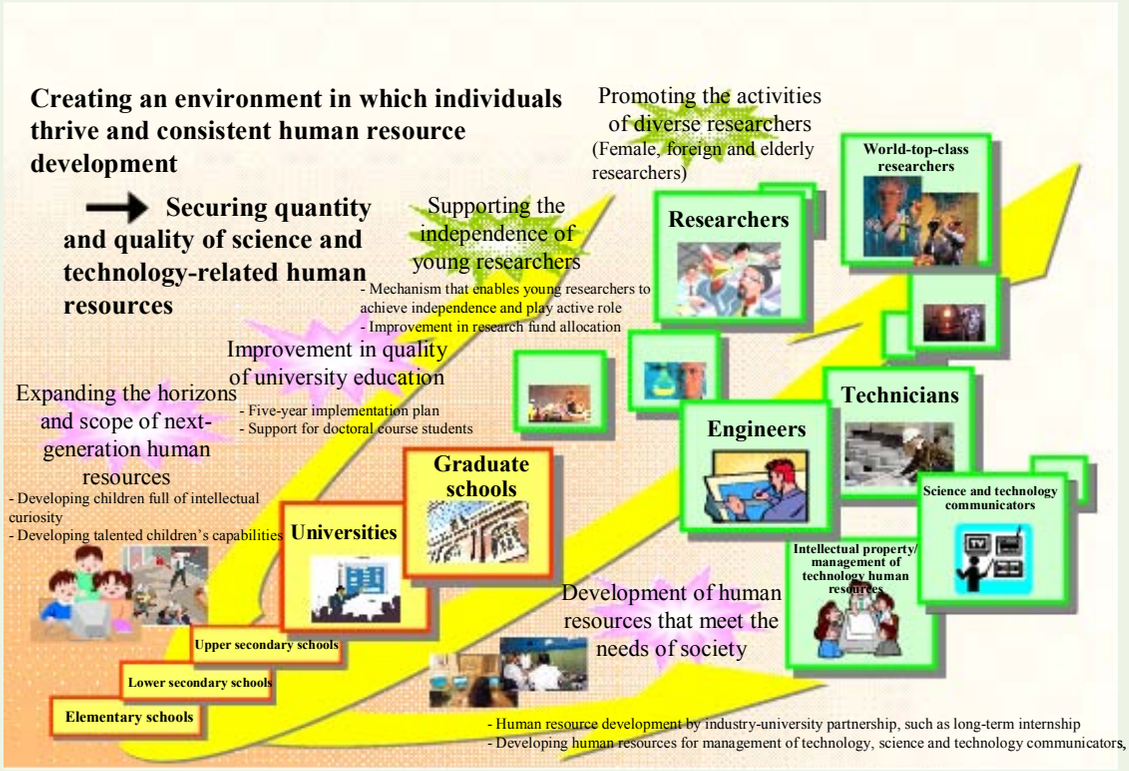
3 How to develop and retain human resources

Amid intensifying global competition for “knowledge,” concern is growing about Japan's ability to secure sufficient human resources related to science and technology in terms of both quantity and quality as the country faces problems such as the aging of society and a population decline.

Therefore, it is a very important issue for Japan how to develop and retain human resources that form the basis of science and technology and academic activities and enable them to play an active role in various sectors of society.

The Third Science and Technology Basic Plan points out the importance of implementing consistent comprehensive efforts from elementary and secondary education to undergraduate/graduate courses in universities and adult education through the following measures: enhancing science and mathematics education, cultivating a favorable working environment for young researchers, female researchers and foreign researchers, strengthening the human resource development function of universities and human resource development by industry-university partnership (Figure 14).

■ **Figure 14 Development and securing of human resources and promotion of activity**



Source: MEXT

(1) Support for independence of young researchers

(Increase in competitive funds for young researchers)

In order to support young researchers who have made no notable achievement in the past but who are recognized as talented and capable of conducting research based on their own ideas, it is effective to set aside a certain proportion of competitive funds as a quota for young talents (Table 15).

In order to further enhance efforts to foster young researchers who can think flexibly and have a spirit that enjoys challenge, it is necessary to provide budding researchers with opportunities for becoming independent and venturing into new research areas, establish a system that allows further development of the capabilities of researchers who have made achievements by taking advantage of such opportunities and expand the amount of research funds intended for young researchers.

Table 15 Major competitive research funds for young scientists in Japan

Competent Ministry	Distributing Organ	Program Name		Target Researchers	Period
Ministry of Internal Affairs and Communications (MIC)	MIC	Strategic Information and Communications R&D Promotion Programme	Research and Development through Encouraging Researchers and their Collaborations (SCOPE-R) (Promotion of young advanced information technology researchers)	Up to age 35	Up to 3 years
Ministry of Education, Culture, Sports, Science and Technology (MEXT)	MEXT/ Japan Society for the Promotion of Science (JSPS)	Grants-in-Aid for Scientific Research	Grant-in Aid for Young Scientists (S)	Up to age 42	5 years
			Grant-in Aid for Young Scientists (A)	Up to age 37	2 to 4 years
			Grant-in Aid for Young Scientists (B)		
			Grant-in Aid for Young Scientists (Start-up)	Persons hired by a university, etc. as a researcher for the first time	2 years
			Grant-in-Aid for JSPS Fellows	JSPS fellows	Up to 3 years
	MEXT	Special Coordination Funds for Promoting Science and Technology	Support Program for Young Fixed-Term Researchers	Fixed-term researchers up to age 35	Up to 5 years during the fixed term
			Program to Create an Independent Research Environment for Young Researchers	Researchers who have earned a doctoral degree within the past 10 years	5 years
	MEXT	Innovative Nuclear Research and Development Program	Nuclear Science and Technology	Up to age 40	Up to 3 years
Ministry of Health, Labour and Welfare (MHLW)	MHLW	Health and Labour Sciences Research Grants	Promotion of young researchers	Up to age 37	1 to 3 years
	National Institute of Biomedical Innovation	Program for Promotion of Fundamental Research in the Health Science	Research by Young Individual Researchers Based on Creative Ideas	Up to age 37	Up to 3 years
Ministry of Agriculture, Forestry and Fisheries (MAFF)	National Agriculture and Food Research Organization	Program for Promotion of Basic Research for Creation of New Technologies and Sectors		Up to age 39	3 to 5 years
Ministry of Economy, Trade and Industry (METI)	New Energy and Industrial Technology Development Organization	Grant for Industrial Technology Research		Under age 39 (Under age 44 for researchers of social sciences, etc.)	4 years or 2 years
Ministry of the Environment (MOE)	MOE	Environmental Technology Development Fund	Feasibility study research area	Up to age 40	1 year
		Environment Waste Management Research Grant	Promotion of young researchers	Up to age 35	Up to 3 years
		Global Environment Research Fund	Domain of innovative research	Up to age 40	1 to 2 years

Reference Information: In addition to the programs shown in the table above, there is a program called “Precursory Research for Embryonic Science and Technology (PRESTO Type)” in the “Basic Research Programs” provided by the Japan Science and Technology Agency under the jurisdiction of the Ministry of Education, Culture, Sports, Science and Technology. It is not a system specifically targeting young researchers, but as a result of screening that did not take into account the researchers’ backgrounds or accomplishments, the average age of the selected researchers was 36 (when selected in FY2006).

Source: Created by the Ministry of Education, Culture, Sports, Science and Technology based on materials prepared by the Cabinet Office

(Creating an independent research environment for young researchers)

Although post-doctorals make great contributions to improving the standard of research in Japan and producing research results, they face problems such as instability of positions and uncertainty over their career path. In Japan, graduate school students are often employed as assistants after completing their graduate programs. While this system provides a certain degree of stability to the

positions of researchers, it has been pointed out that it does not sufficiently ensure independence of young researchers or a competitive environment. Therefore, it is necessary to immediately implement personnel system reform at universities and other research organizations so as to establish a career path for post-doctorals and other young researchers, enhance the mobility of human resources and revitalize the research environment.

In fiscal 2006, Japan launched the Program Create an Independent Research Environment for Young Researchers (Special Coordination Funds for Promoting Science and Technology). This program seeks to establish a tenure track system (a mechanism for allowing young researchers to gain experiences as an independent researcher in fixed-term employment before obtaining a steady position through stringent screening) at Japanese research organizations aiming to become world-class research centers by supporting efforts to introduce a mechanism that provides young researchers with opportunities for becoming independent and making successful achievements in a competitive environment.

(Enhancement of financial support for doctoral course students)

In order to encourage talented students to proceed to doctoral courses, it is necessary to cultivate an environment that enables them to devote themselves to academic and research activities without worrying about financial conditions.

According to a survey conducted by the Japan Student Services Organization on "FY 2004 Survey Results on Student Life" (April 2006), about 75% of the academic and living expenses of Japanese doctoral course students are covered by allowances provided by their families, scholarship funds and income from part-time jobs, etc. Figure 16 shows the current status of Japan's financial support programs for graduate school students, including fellowship, teaching assistantship (TA), research assistantship (RA)[27] and scholarship. In the United States, meanwhile, many graduate school students are believed to receive non-repayable grant aid equivalent in amount to their living expenses through fellowship, research assistantship and other financial support programs.

The Third Science and Technology Basic Plan aims to enable about 20% of doctoral course (latter stage) students to receive financial support equivalent in amount to their living expenses. To do so, it is essential to enhance the JSPS Research Fellowships for Young Scientists program and implement financial support measures such as increasing the provision of competitive funds to students, expanding scholarship programs of the Japan Student Services Organization and exempting talented students from tuition fee payment.

[27] Fellowship: Fellowship aid is usually granted directly to students and is sometimes called a "portable subsidy" because the recipient students may engage in research at the graduate school of their own choosing with the use of the funds provided. Fellowship requires the recipients to devote themselves to research and attain excellent achievements, but the recipients do not have to return the funds.
Teaching assistantship (TA): Under the TA program, graduate school students are employed as assistants to the teaching staff of the university and receive a certain amount of grants in exchange for providing seminar guidance, giving instructions concerning experiments and practical training, implementing examinations and providing lessens to undergraduates.
Research assistantship (RA): Under the RA program, graduate school students are employed as assistants for the research activities of the teaching staff of the university and receive salaries and funds to cover tuition fees in exchange for assisting such activities.

Figure 16 Status of financial support for graduate school students

Grant type ⟷ Loan type

Aid Type		Fellowship	Teaching assistantship (TA)		Research Assistantship (RA)		Scholarship
			National universities	Private universities	National universities	Private universities	
Program		JSPS Research Fellowships (Japan Society for the Promotion of Science)	National university special account(Before FY 2003)	Recurring expense subsidies for private universities	National university special account(Before FY 2003)	Recurring expense subsidies for private universities	Scholarship programs (Japan Student Services Organization)
Budget		¥8,254 million (FY2005)	¥4,414 million (FY2003)	¥1,500 million (FY2005)	¥1,843 million (FY2003)	800 million (FY2005)	¥111.1 billion (FY2005)
No. of students aided	Doctoral degrees	3,640 (Budgeted number in FY 2005) (5%)	9,281 (Budgeted number in FY2003) (13%)	9,091 (Budgeted number in FY2005) (4%)	4,267 (Budgeted number in FY2003) (6%)	678 (Budgeted number in FY2005) (1%)	28,363 (Budgeted number in FY2005) (39%)
	Master's degrees/ Professional degrees		4,384 (Budgeted number in FY2003) (3%)				65,573 (Number under budget in FY2005) (38%)

Note:
1. The percentage figures in parentheses in the column for the number of students aided represent the ratio relative to all students staying in the relevant programs at national, public and private universities (FY2004). (For reference: The total number came to 162,712 for students in master's degree programs, 7,866 for those in professional degree programs and 73,446 for those in doctoral programs (School Basic Survey 2004).
2. Students may receive two or more types of financial support in some cases.
3. TA and RA are funded not only by operating expense subsidies and recurring expense subsidies for private universities but also by the 21st century COE program.
4. The budget amount for RA at private universities includes financial support for post-doctorals.
5. Since FY2004, the expense of TA and RA against which measures are taken at the National university special account is transferred into the "national university budget subsidy" with incorporation and is operated at the discretion of each university corporation.

Source: MEXT

(Developing human resources that meet the needs of society)

Japan, which aims to become an advanced science and technology-oriented nation, must enable doctorals to play an active role not only at universities and research organizations but also in various sectors of society by taking advantage of their advanced expertise. According to a comparison of data on the employment status of Japanese doctorals and the status of their U.S. equivalents as broken down by employment sector, the ratio of doctorals employed by commercial companies in the United States is almost double the ratio of Japanese doctorals employed by commercial companies.

Moreover, data on annual income by the type of degree earned shows that doctorals earn the most. Doctorals are highly appreciated at companies' R&D divisions in the United States, and such students employed by the industrial sector generally earn more than their equivalents hired by other employment sectors. This situation apparently provides a strong incentive for doctorals to obtain

jobs at companies.

On the other hand, a survey by Nippon Keidanren's Committee on Industrial Technology[28] shows that most Japanese companies have no employment quota for doctorals and that they make employment decisions based on their evaluation of the abilities of individual applicants. Factors regarding which doctorals are recognized by companies as excellent include "expert knowledge/skills," "ability to conduct research" and "logical thinking capability." On the other hand, factors regarding which problems are recognized include "communications skills," "cooperativeness" and "ability to perform business procedures." Attributes companies expect in doctorals include "leadership," "task-setting capability," "management capability" and "spirit that enjoys challenges."

(Human resource development by industry-university partnership)

Industry-university-government joint research not only provides ideal opportunities for young researchers to improve their research skills but also help to foster new research leaders.

In addition, in both university and industrial sectors, awareness is growing that there is a pressing need to develop "advanced expert human resources" capable of understanding the position of their areas of specialty in relation to social activities as a whole, setting tasks in light of practical problems and tackling them.

(Promoting the activities of doctorals in industry)

Japan has been implementing the Project to Promote Diversification of Career Paths for Science and Technology-related Human Resources since fiscal 2006 in order to encourage people with advanced expertise such as doctorals to exercise their capabilities in various sectors outside universities and other research organizations providing organized support to and cultivate a favorable environment for young researchers with regard to career choice.

(Expanding the horizons and scope of human resources)

In order to develop and retain next-generation human resources related to science and technology, it is important to provide opportunities to experience the wonder and delight of science and mathematics at elementary and secondary schools so as to foster interest in science and technology and develop the capabilities of highly-motivated and talented children, thereby expanding the horizons and scope of human resources.

To this end, it is necessary to implement a consistent set of measures such as: to expand opportunities for first-hand learning such as observation and experiments, promote communication between students and researchers/engineers, provide support to high schools that attach importance to science and mathematics education as well as to universities that provide special education programs to a selected group of highly-motivated and talented students.

[28] Results of Survey on Status of Doctorals at Companies (February 2007)

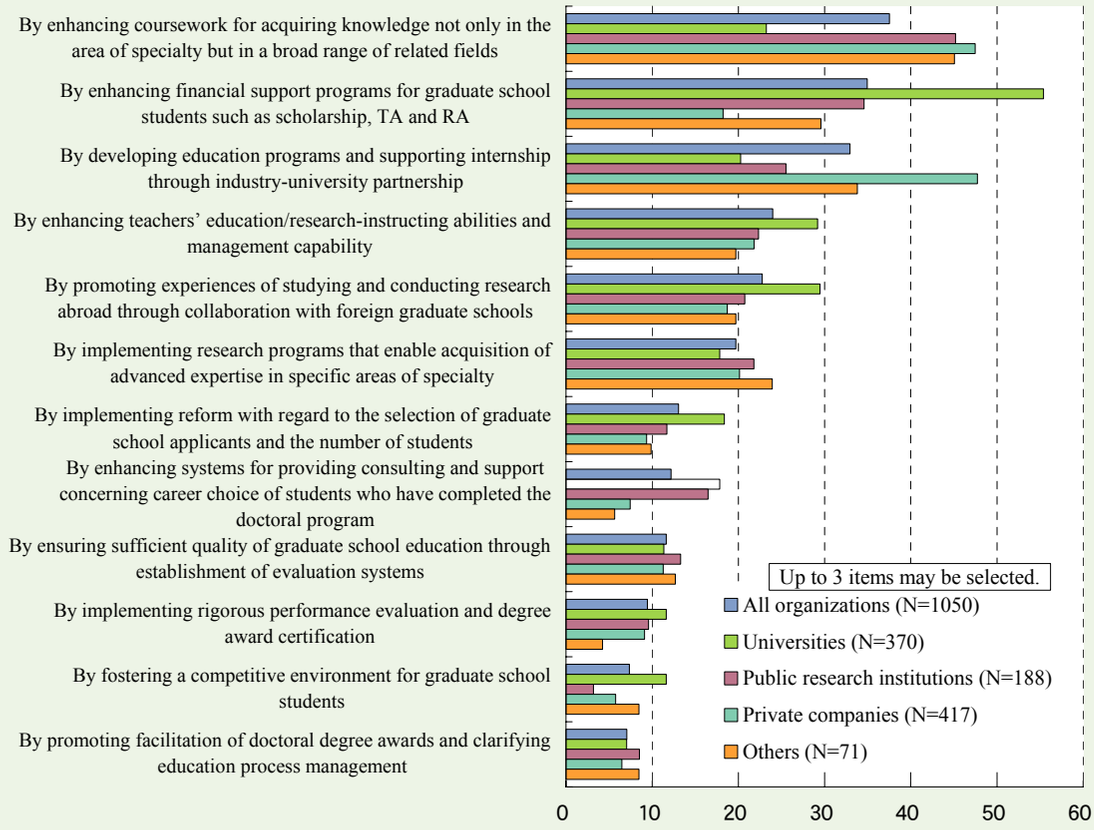
Column 7: “Enhancing Science and Mathematics Education for Next-Generation” (Science Education Assistant Allocation Project)

(2) Drastic enhancement of graduate education

MEXT conducted a survey on researchers working at companies, universities, public research organizations, etc. as to what kind of researchers are needed at the type of organization they belong to and how they view the current status of graduate school education. Regarding attributes and capabilities necessary for researchers, “expertise in a specialized area” was selected as the first priority by the most respondents, at all types of organization. The survey indicated that the second most important element required for researchers is “creativity” at universities, “inquiring spirit” at public research organizations and “problem-solving ability” at private companies.

With regard to the question about how graduate school education should be enhanced in order to foster the kind of researchers required at the type of organization to which the respondent belongs, the most common response, across all types of organizations, was the need for “enhancing coursework for acquiring knowledge not only in the area of specialty but in a broad range of related fields.” The ratio of respondents citing this was particularly high at public research organizations and private companies (Figure 17).

Figure 17 "How do your organizations want graduate school education to be enhanced in order to foster researchers?"



Note: "N" indicates the number of respondents.
Source: "Survey of the State of Japan's Research Activities (FY2006) " by MEXT

(Establishment of education and research centers with international acclaim)

Based on the results of the 21st COE Program mentioned above, MEXT plans to introduce the "Global COE Program," which, while retaining the basic concept of the 21st COE Program, seeks to further develop research centers by providing targeted support. This program will provide funding support for establishing education and research centers that perform at the apex of global excellence to elevate the international competitiveness of Japanese universities. The program will strengthen and enhance the education and research functions of graduate schools, to foster highly creative young researchers who will go on to become world leaders in their respective fields through experiencing and practicing research of the highest world standard.

(Support Program for Improving Graduate Education)

MEXT intends to implement the "Support Program for Improving Graduate School Education," a reform program for doctoral programs and master's degree programs that develop advanced human resources capable of making contributions to various sectors of society by providing targeted support to excellent education initiatives being carried out in an organized and systematic manner.

(3) Securing excellent science and technology-related human resources

It is an urgent task for countries around the world to secure an abundance of excellent human resources, and the adoption of measures for securing excellent resources has become an international trend in recent years, and programs to invite top-level researchers are increasing.

As it is important for Japan to establish bases for securing excellent human resources, MEXT is implementing the World Premier International Research Center (WPI) Initiative, while the Cabinet Office is promoting a plan to establish a world-top-class natural science graduate school open to the world in Okinawa Prefecture as part of efforts to promote the development of the prefecture.

(World Premier International Research Center Initiative)

As a first step toward raising the standard of science and technology in Japan and consistently spurring innovations, which should serve as the engine of future development of the country, it is necessary to enhance the country's basic R&D function and international competitiveness. To this end, MEXT intends to start in fiscal 2007 the World Premier International Research Center Initiative. This program aims to establish centers with "global visibility" that will attract top-level researchers from around the world by cultivating a research environment that meets the global standard through measures such as: extending invitations to top-level researchers from within and outside Japan, introducing a strong management system and performance-based remuneration system, adopting English as the working language and providing vigorous support; and by promoting collaboration with other universities and institutions.

(Plan to establish the Okinawa Institute of Science and Technology)

This plan aims to establish an open-to-the world, world-leading natural science graduate school in Okinawa Prefecture with a view to making contributions to global development of science and technology and developing the prefecture as the leading-edge knowledge cluster of the Asia-Pacific region. Foreign researchers have already been invited to the Okinawa Institute of Science and Technology (led by President Sydney Brenner, Nobel Prize laureate in physiology or medicine 2002), which is the implementing agency of the plan, and seminars and conferences are held there in English.

Column 8: "Examples of World Leading Research Centers"

- Carnegie Mellon University's Robotics Institute
- The University of Arizona's College of Optical Sciences