

Section 3 Establishment of a World-Class Research Environment and Infrastructure

1 Improvement of R&D Environments at Universities and Public Research Organizations

(1) Development of facilities and equipment at universities

Universities should develop high-quality facilities and equipment with satisfactory functions in order to cope with more advanced and diversified educational and research activities, to attract quality human resources and enhance global competitiveness, as well as to promote industry-university cooperation, local contributions, and internationalization. In addition, the GEJE caused severe damage to universities in the Tohoku and Kanto regions, such as destruction of facilities and equipment and the disturbance of educational and research activities due to power shortages etc. Considering the situation, the government should promote efforts to develop and advance such facilities and equipment, and ensure stable operation.

1) Facilities and equipment at national university corporations

Facilities of national university corporations¹ play an important role as the base for activities, such as creative, advanced academic research; training for creative and quality human resources; and promotion of advanced medical treatment.

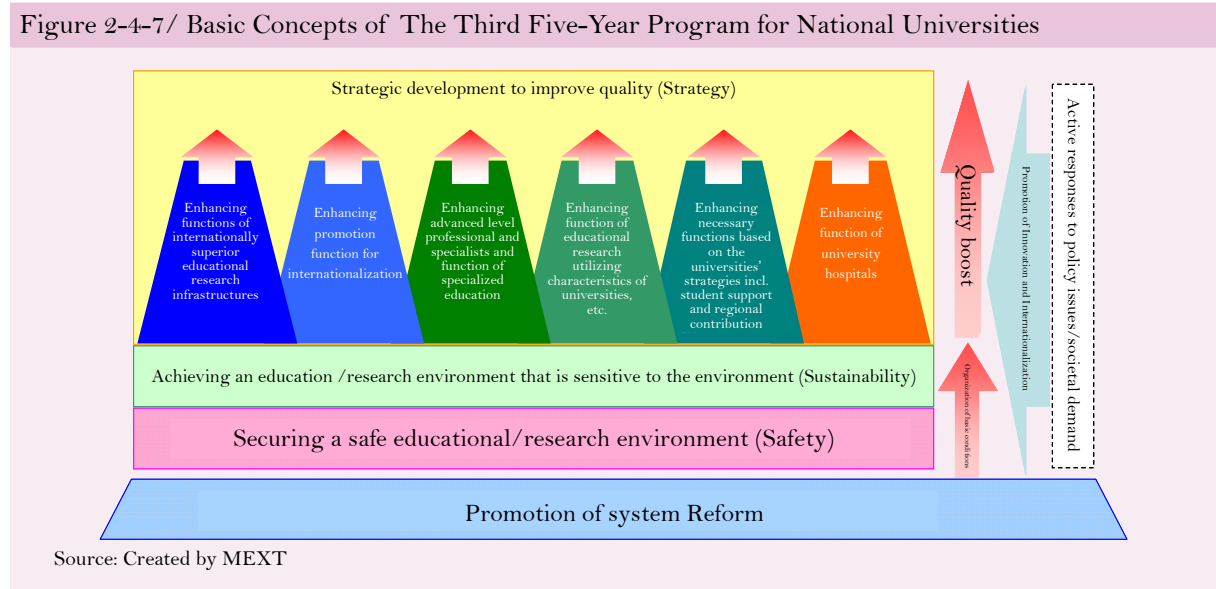
Based on the Second and Third Basic Plans, MEXT developed a five-year plan to improve the facilities and equipment of national university corporations at two stages and promoted systematic and prioritized improvement of the facilities. As a result, a certain progress has been made in the improvement and earthquake-proofing of aging facilities, but those facilities still face problems related to safety and functionality due to further deterioration by aging since then. In particular, university facilities are required to respond to new policy issues and social needs, such as furthering the sophistication and diversification of educational and research activities, globalization of higher education and creation of an educational and research environment that is friendly to the natural environment.

For this reason, MEXT developed “The 3rd Five-Year Program for Facilities of National Universities” (endorsed by the Minister of Education, Culture, Sports, Science and Technology) on August 26, 2011 based on the fourth Basic Plan. The 3rd Five-Year Program plans to promote a strategic improvement of the facilities so that each university can display its characteristics and features to the fullest, in light of the vision of each national university’s future. It is especially important to improve the functions of aging facilities, to create a prominent educational and research center and to secure research space for young researchers for the quality improvement of educational and research environments. The program, therefore, plans efforts to develop facilities systematically on a priority basis, secure the safety of facilities including earthquake-proofing, and reduce environmental impact when developing facilities. It also plans to secure the safety and improve the functions of the electricity and water lifelines, which are indispensable to educational and research activities and for the stable operation of the facilities. In addition, the program requires national university corporations to tackle system reform with greater effort, such as by using existing facilities effectively and by securing facilities in cooperation with

¹ Inter-University Research Institute Corporation including Institute of National Colleges of Technology, Japan

businesses and local governments (Figure 2-4-7).

In order to support the facilities that were damaged by the GEJE, expenses necessary for their restoration were included in the supplementary budget in FY 2011 (24 corporations, 37.6 billion yen).



Facilities of national university corporations are the foundation for education and research, and their improvement and development are indispensable. Those facilities have been aging and have recently become obsolete, and their renovation is an urgent issue.

MEXT, therefore, requires each university corporation to formulate a “Master Plan for Facilities” and to improve the facilities as planned with a thorough grasp of existing facilities, and is providing financial support based on the “Master Plan for Facilities.”

Furthermore, MEXT promoted the improvement of educational and research environments by launching a development program for Research Equipments Support Centers (6 corporations, 460 million yen) in FY 2011 in order to provide the support necessary to develop a system for the effective use of facilities, such as the promotion of joint use and the enhancement of technical support systems.

Besides these, MEXT is greatly contributing to the advance of world science by supporting the “Large-Scale Scientific Research Project,” including the “Large-scale Cryogenic Gravitational wave Telescope (KAGRA)¹” and “Exploring Physics beyond the Today’s Particle Theory with Super B-Factor²” which require the development of large and advanced equipment.

In order to support the facilities that were damaged by the GEJE, expenses necessary for their restoration were included in the supplementary budget in FY 2011 (25 corporations, 53.7 billion yen).

¹ This plan includes setting a laser interferometer with orthogonally intersecting 3km-long laser beams in the Kamioka Mine to detect gravity waves, and also constructing an international research base for gravitational wave astronomy whose research includes researching the moment of black hole formation. (Implementing organization: Inst. for Cosmic Ray Res., Univ. of Tokyo)

² It aims at the following: 1) discovering and elucidating physical principles through the observation of very rare phenomenon that occurred only in the early universe by the use of a more advanced Asymmetric Electron-Positron Collider (KEKB), with a crash performance function of 40 times higher than its current performance, 2) elucidating the mystery that antimatter disappeared from the cosmic. (Implementing organization: High Energy Accelerator Research Organization, KEK)

2) Facilities and equipment at private universities

Private universities, which make up about 80% of Japan's higher educational organizations, have a variety of researchers, and thus have played a big role in the development of higher education by vigorously performing characteristic research activities. MEXT is working to enhance private universities' research infrastructure by implementing the "Strategic Research Foundation Grant-aided Project for Private Universities," which provides comprehensive support of research facilities and equipment for excellent research projects.

In order to support the facilities of private universities that were damaged by the GEJE, the expenses necessary for their restoration were included in the supplementary budget in FY 2011 (33.8 billion yen).

(2) Promoting the development and shared usage of advanced research facilities and equipment

Public research organizations have so far played a leading role in the development and operation of advanced research facilities and equipment, which require high costs and are appropriate for joint use in extensive areas of S&T. Such advanced research facilities and equipment are very important to produce key R&D findings and to develop personnel, but the way to maintain and manage such facilities has become a matter of concern as financial support for public research organizations has been decreasing. For this reason, the government is taking measures to ensure that public research organizations can sufficiently develop, operate, and promote extensive joint usage of such facilities and equipment. MEXT is steadily proceeding with the development and renewal of advanced research facilities and equipment expected to be used for extensive areas, and is providing support to promote the joint usage of the facilities (refer to Part 2 Chapter 3 Section 1, 5 (2)).

2 Enhancement of Intellectual Infrastructure

In order to promote R&D activities effectively and efficiently, intellectual assets, such as research results and research materials, should be systematized so that they can be widely available for use by researchers. To this end, it is necessary to provide stability within the intellectual infrastructure¹, which supports the basic R&D activities, such as experiments, measurement, analysis and evaluation, in order to maintain both the quality and quantity of research, and to secure its safety and reliability. For this reason, with universities and public research organizations as the core organizations, the development and utilization of intellectual infrastructure is planned to be promoted in cooperation with all organizations concerned. As the development of research materials, measurement standards, measurement / evaluation methods has progressed favorably, the development of intellectual infrastructure is being promoted from the viewpoint of improving quality to meet the various needs of users.

In order to support research in the life sciences field, MEXT is preparing genetic and other resources at the "National Bio Resource Project (NBRP)," while JST is making necessary efforts to integrate databases in the life sciences field at the "Integration Database Project" (refer to Part 2 Chapter 2 Section 3, 2). MEXT is also promoting the development of one and only cutting-edge technologies and instruments for measurement and analysis that can meet the needs of the world's leading researchers as

¹ This includes research materials, such as bio resources, measurement standards, methods for measurement/analysis/test/evaluation, advanced equipment for them and related databases.

well as factory workers (refer to Part 2 Chapter 3 Section 1,5 (1)).

In order to meet the various needs of users, the Ministry of Economy, Trade and Industry is examining how to develop a new intellectual infrastructure with improved qualities. A review was conducted on the achievement of intellectual infrastructure targets in the six focused areas¹, and it showed results² that were greater than the initial goals of reaching the same level as the U. S. in each area.

Regarding measurement standards, the “R&D of the one-to-many type calibration technique,” which was conducted by the National Institute of Advanced Industrial Science and Technology (AIST), developed standards for the safety of medicine and food, some of which have been applied to official methods³. In addition, the “R&D of the real-time calibration technique” has created a path to greatly reduce the access time from the production site with a measurement standard used mainly for the calibration of electrical measuring instruments. AIST also played a key role at the International Avogadro Project⁴ as it performed a density measurement of the world highest precision and set the direction of revisions of definitions for kg, unit of mass, and mol, unit of the amount of substance at the 24th general meeting of Conference General des Poids et Mesures.

Regarding geological information, AIST produced five 1/50,000 geological maps, four marine geological maps, one volcano geological map and one gravity map. It also created a collection of geological information on the coast of Fukuoka as a land-sea seamless geological information on coastal area. AIST also produced a high-precision 3-D geological model for alluvium in the northern lowland of Tokyo. The seamless geological maps⁵ were updated and accessed 12.03 million times. The active fault database, in which segment information on about 200 active faults were revised, received 3.22 million accesses. Besides, 16,782 new items were registered in the geological document database, and 6,442 new items were registered in the geological specimen database.

As for genetic resource information, the National Institute of Technology and Evaluation (NITE) collects, preserves, and distributes the genetic resources, while preparing the information on the resources (systematic placement, information concerning genes, etc.) so as to make it widely available. It also has integrated the databases of major genetic resources in Japan and made it public. In addition, NITE is actively working on the development of genetic resources in Asia in accordance with the Convention on Biological Diversity (CBD). Based on the memorandum of understanding among Asian countries, NITE transfers microorganisms between governments and analyzes them, as well as promotes multilateral interaction for the conservation and sustainable use of microorganism resources.

As for the safety management of chemical substances, the National Institute of Technology and Evaluation (NITE) collects and coordinates data necessary for risk assessment and makes it public in a database (Chemical Risk Information Platform) and is collecting regulatory information in Asian

¹ The Special Committee on Measurement Standards and Intellectual Infrastructure, a joint body composed of the Industrial Technology Subcommittee of the Industrial Structure Council and the Japanese Industrial Standards Committee (JISC), set six major areas as intellectual foundation overhaul targets: 1) Measurement standards, 2) Geological information, 3) Chemical safety management, 4) Lifestyles and safety, 5) Biological genetic resource information, and 6) Materials.

² 282 types of physical standards, 290 types of standard substances, 1/50,000 geologic maps of 947 sections, about 75,000 strains of microorganisms, about 89,000 DNA clones, information on about 5,900 substances for the Integrated Chemicals Management, information on about 30,000 product accidents, etc.

³ The Japanese Pharmacopoeia, the Japanese Standards of Food Additives, etc.

⁴ The project aims to establish the next-generation standards for mass/amount of substance using enriched, single-crystal silicon of high quality.

⁵ On the basis of the 1/200000 map, the geological maps for the whole country are integrated with a uniform standard, which makes it possible to be viewed on the Web site.

countries. NITE has also developed methods to assess risks in accordance with the “Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc.” (Act No. 117 of October 16, 1973) and has performed risk assessment.

Regarding product safety information, NITE collects information on product accidents, investigates their causes and makes the results public in a database.

In order to provide data on genomes and genes of agricultural, forestry and fishery products for breeders and researchers at universities and private companies, the Ministry of Agriculture, Forestry and Fisheries (MAFF) is preparing a convenient database that integrates such data and is developing a higher-order analysis system for massive amounts of genome fragment data produced by the next-generation genome analyzers. MAFF collects, preserves, assesses and provides genetic resources related to the industries of agriculture, forestry, and fisheries as part of the Gene Bank Project and also preserves and provides genome resources, such as DNA of rice.

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has organized and provided “Basic Map Information¹,” which is a core measure of the “Basic Plan for the Advancement of Utilizing Geospatial Information.” MLIT is also conducting surveys and research on the use of geospatial information.

3 Enhancement of Research Information Infrastructure

Research information infrastructure is regarded as a critical lifeline for research activities. Therefore, improving it in response to the rapid progress of information and communications technology is essential for securing the international competitiveness of Japan's R&D. The government is taking concrete actions toward this end, such as developing and upgrading networks between research organizations, and building and providing databases.

(Enhancement of networks)

Computer networks, which make up the basic system of our modern society, were first developed at R&D labs and then used in various areas. It is required to further improve the performance of these networks for progress in developing cutting-edge R&D.

The National Institute of Information and Communications Technology (NICT) has established and has been operating the next-generation communications network testbed (JGN-X) in order to promote R&D and to operate verification tests of next-generation network technologies (refer to Part 2 Chapter 3 Section 1, 2 (2)).

The National Institute of Informatics (NII) developed a science information network as the infrastructure that supported the overall science research and educational activities of our country's universities. The network achieved higher speeds, more functionality and greater reliability, and started its new operation as SINET 4² in April 2011.

The Ministry of Agriculture, Forestry and Fisheries (MAFF) establishes and operates Ministry of Agriculture, Forestry and Fisheries Research Network (MAFFIN), a research network that mutually

¹ Criteria for defining locations of geospatial information on digital maps

² The Science Information Network 4 is the world highest level network that is able to be connected at the maximum speed of 40 Gbps.

connects the research organizations related to agriculture, forestry and fisheries. As of the end of March 2011, a total of 92 organizations were connected through MAFFIN. As MAFFIN is linked to the Philippines, this network is now used as a backbone for the distribution of research information overseas.

(Establishment and provision of database)

Libraries and many other organizations provide services about source materials for scientific papers, including reading, copying and lending. Creating a database on bibliographic and the location information about source materials owned by those organizations enables researchers to search increasing amounts of information quickly, accurately and easily with a computer.

The National Diet Library archives all publications issued in Japan, creates a database on the materials it collects and archives, and provides the information on the Web site¹.

In cooperation with national, public and private universities across Japan, the National Institute of Informatics (NII) has created and provided a catalog information database on academic books and magazines archived at university libraries. NII also supports the construction of an institutional repository² at each university.

JST is offering an information service, J-GLOBAL, which develops a basic information database about documents, patents and researchers related to S&T inside and outside Japan, and provides information associated with each other. JST is also offering a document information retrieval service, JST Document retrieval system for Academic and Medical fields II (J-Dream II), which develops Japanese-language abstracts of S&T documents for a database and provides the information on the Internet for a fee. In addition, to enhance the dissemination of Japan's research results to the world, JST has been operating Japan Science and Technology information AGregator, Electronic (J-STAGE), an integrated system for the dissemination and distribution of S&T information. J-STAGE supports the entire process of online publishing: submission of research papers to academic journals, peer review, judgment, and the uploading of articles on the Web site to support the internationalization of Japan's academic journals.

The Ministry of Agriculture, Forestry and Fisheries (MAFF) collects and offers information on documents related to agriculture, forestry, and fisheries, as well as information on the locations of books and materials, such as providing the Japanese Agricultural Sciences Index (JASI), a bibliography database on articles of academic journals for agriculture, forestry and fisheries published in Japan. MAFF also builds and provides a full-text information database and a satellite image database, which digitize research reports on agriculture, forestry and fisheries produced by independent administrative organizations for experiment and research, and by national and other public research organizations and universities. A database on research topics currently studied at various experiment and research organizations has also been created and provided.

¹ <http://iss.ndl.go.jp/>

² Archives on the Internet where electrical intellectual outcomes produced by educational research activities at universities and research institutions are stored to transmit for free in principle.

Table 2-4-8 below shows the outlines of the main measures for research information infrastructure implemented in FY 2011.

Table 2-4-8/ Outlines of the main measures for research information infrastructure implemented (FY 2011)

Ministry/Agency	Organization	Subject
Diet	National Diet Library	- Acquisition and development of funds for science and technology-related resources at the National Diet Library
Ministry of Internal Affairs and Communications	National Institute of Information and Communications Technology	- Establishment of advanced networks tested for research and development (JGN-X)
Ministry of Education, Culture, Sports, Science and Technology	Japan Science and Technology Agency	- Establishment, Utilization and Promotion of Basic Science and Technology Information (J-GLOBAL, etc.) - Integrated Database Project - Computerization and Internationalization of Science and Technology Papers (J-STAGE, etc.) - Providing document information on S&T (JDream II, etc.)
	Japan Agency for Marine-Earth Science and Technology	- Information infrastructure operating costs
	National Institute of Informatics	- Development of Scientific Information Network ("SINET 4," 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 preparations
Ministry of Agriculture, Forestry and Fisheries	Agriculture, Forestry and Fisheries Research Council Secretariat	- Operation of Agriculture, Forestry and Fisheries Research Information Technology Center (JASI, MAFFIN, etc.)
Ministry of Land, Infrastructure, Transport and Tourism	Geographical Survey Institute	- Promotion of Global Mapping Project (Development of the time-series data maintenance method)
Ministry of the Environment		- Promotion of the collection, management and provision of Integrated Biodiversity Information
Cabinet Office Ministry of Education, Culture, Sports, Science and Technology Japan Patent Office	Japan Science and Technology Agency National Center for Industrial Property Information and Training	- Improvement of a comprehensive search system for patent and document information
Cabinet Office Japan Patent Office Relevant Ministry/Agency	National Center for Industrial Property Information and Training	- Provision of Research Tool Database (RTDB)