Chapter 7 Enhancing the Capacity to Promote Scientific and Technological Innovation

Effective, flexible implementation of the policies and measures stipulated in the fifth Science and Technology Basic Plan is important. Efforts are being made to enhance the scientific and technological innovation functions of universities and national Research and Development (R&D) agencies, strengthen the leadership of the Council for Science, Technology and Innovation (CSTI) and secure R&D investment.

Section 1 Reforming Universities and Enhancing their Function

Universities need to effectively and efficiently utilize their human resources, knowledge and funding to play a vital role in scientific and technological innovation.

Fundamental reforms are being planned to increase the contributions made by university education and research to society.

1 University Reform

In order to address the demands of our age of dramatic change, it is absolutely vital to foster diverse and excellent human resources and to develop a rich foundation for the creation of diverse and outstanding knowledge, in order to enable flexible and appropriate responses to whatever changes in circumstances and new problems are encountered. In this effort, it is universities that play the key role. Furthermore, the role of universities is expanding, spanning from making new knowledge available to society through to engaging in industry–academia–government collaborations in order to widely deliver economic, social, and public benefits to society.

Universities, which have an extremely important role in generating science, technology and innovation, face a variety of challenges, such as reforming their management and personnel systems, ensuring stable posts for young professionals, participating in international initiatives to promote the circulation of talented researchers, engaging fully in industry–academia–government collaborations, and promoting diversification of funding sources. To appropriately address these challenges, it is necessary to ensure that personnel, knowledge, and funds within a university are utilized effectively and efficiently.

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) took various initiatives to significantly increase the educational and research standards of Japanese universities and encourage them to engage in innovative research. First, it revised the National University Corporation Act in May 2016 to strengthen the capacity of MEXT-designated national universities to offer world-class education and research opportunities (i.e., establishment of a "designated national university cooperation system"). In an effort to enable national universities to more effectively utilize their assets, MEXT relaxed its regulations to enable national universities to rent their land to third parties and revised the law enabling national universities to use certain amounts of their non-public source revenues (e.g., donations) to acquire profitable financial instruments.

In addition, the "Basic Approach to TAKUETSUDAIGAKUIN PROGRAM (tentative)" was formulated at the "Experts Meeting on TAKUETSUDAIGAKUIN PROGRAM (tentative)" in April 2016. MEXT plans to expedite this discussion by a "commissioned project to promote the TAKUETSUDAIGAKUIN

PROGRAM (tentative)" in which studies will be conducted in FY2017 to make general decisions regarding public invitation and screening processes (see Chapter 4, Section 1, Paragraph 1(3)).

MEXT also formulated "Guidelines for Fortifying Joint Research Through Industry-Academia-Government Collaboration" in November 2016 to encourage collaboration between these sectors. The guidelines promote adoption of cross-appointment systems to enable university faculty members to work full-time at multiple organizations by allocating their time to various duties (see Chapter 4, Section 1, Paragraph 2(3)).

In addition, MEXT is implementing a "program for Excellent Young Researchers" to reward promising young researchers engaged in novel research with stable research environments in which to conduct independent research. The program also offers these researchers new career opportunities at industry, academia and national R&D agencies across Japan (see Chapter 4, Section 1, Paragraph 1(1)).

Section 2 Reforming National R&D Agencies and Enhancing their Function

National R&D agencies are planning to implement structural reforms to enhance their functions in accordance with long-term plans formulated to meet the requests of the national government and the international community. The reforms will enable these agencies to fully exercise their advanced management capabilities, engage in basic research which is difficult for the private sector to pursue, develop fundamental technologies that facilitate verification tests and help in the formulation of technical standards, allocate R&D funds to other organizations and serve as driving force in the innovation system.

1 National R&D Agency Reforms

The "Act on the General Rules for Incorporated Administrative Agencies" (Act No. 66, 2014) was revised in 2014 in line with the revised "Act on Improving the Capacity, and the Efficient Promotion of Research and Development through Promotion of Research and Development System Reform" (entered into effect in December 2013) and the "Basic Policy on the Reform of Independent Administrative Agencies" (entered into effect in December 2013). This revision led to the promotion of 27 independent administrative agencies to roles as national R&D agencies (as of March 31, 2016), which are expected to facilitate the sound development of the Japanese economy and meet the public interest by making maximum R&D efforts and raising Japan's scientific and technological standards. In addition, the "Act on Special Measures Concerning the Promotion of Research and Development by Designated National Research and Development Agencies" (Act No. 43) passed in May 2016 (entered into effect in October 2016). This act promoted three national R&D agencies (the National Institute for Materials Science, RIKEN and the National Institute of Advanced Industrial Science and Technology) to the status of designated national R&D agencies. Their shared mission is to serve as core organizations in promoting the production, popularization and use of world-class R&D accomplishments and to lead R&D innovation in Japan. The Cabinet subsequently approved the "basic policy to promote R&D by designated national R&D agencies" on June 28, 2016. MEXT then revised the basic policy on March 10, 2017 to introduce new voluntary contract systems designed to expedite R&D efforts.

Section 3 Strategic International Implementation of STI Policies

As R&D activities become increasingly globalized, it is important for Japan to produce results, thereby promoting its scientific and technological innovation and increasing its international presence and credibility. Therefore, Japan needs to promote comprehensive S&T diplomacy by promoting scientific and technological innovation internationally and by actively engaging with the Ministry of Foreign Affairs (via the Science and Technology Adviser to the Minister for Foreign Affairs).

1 Utilization of international frameworks

(1) Activities related to summit meetings

In 2008, the G8 Science and Technology Ministers' Meeting was held under the auspices of the then Minister of State for Science and Technology Policy Fumio Kishida, according to a proposal made by Japan, which held the presidency at the time. Subsequent meetings were held in 2013 and 2015. Through these meetings, Japan intends to actively facilitate international S&T policy discussions between the Japanese Minister of State for Science and Technology Policy and officials from other countries to cooperatively solve global issues using S&T. As chair, Japan held the G7 Science and Technology Ministers' Meeting in Tsukuba, Ibaraki in May 2016. The meeting was presided by then Minister of State for Science and Technology Policy Aiko Shimajiri. S&T discussions held during the meeting were incorporated into an outcome document from the G7 Ise-Shima Summit by the Science and Technology Adviser to the Minister for Foreign Affairs, Teruo Kishi.

The Group of Senior Officials (GSO) was founded following discussions at a 2008 meeting. That group discusses international research facilities, and it's the 8th meeting in South Africa in November 2016, included discussions on the sharing of information on international research facilities and international collaboration frameworks.

The 2016 G20 chair, China, proposed and hosted ministers' STI meetings in Beijing. Japanese Minister of State for Science and Technology Policy Yosuke Tsuruho participated in the meeting.

LCS-RNet, a network of researchers/research organizations that are contributing to individual countries' low-carbon policy-making processes, had its 8th annual meeting in Germany in September 2016. As of 2016, 16 research organizations from nine countries including Japan were LCS-RNet members.

(2) Tokyo International Conference on African Development (TICAD)

The Japanese government has been hosting TICAD since 1993 to facilitate African development. The sixth TICAD—which was cohosted by Japan, the United Nations (UN), the UN Development Programme (UNDP), the African Union Commission (AUC) and the World Bank in Nairobi, Kenya in August 2016—was the first TICAD held in Africa. Prior to the conference, the Science and Technology Adviser to the Minister for Foreign Affairs, Teruo Kishi, submitted a proposal entitled "Enrich Africa through scientific and technological innovation" to then Minister for Foreign Affairs Fumio Kishida. The proposal was integrated into the TICAD outcome document which was adopted, known as the Nairobi Declaration. The declaration specified science, technology, innovation and development of human resources as strategic areas in which comprehensive policies should be formulated to promote 1) structural economic transformation, 2) resilient health care systems and 3) social stability. In addition, the declaration

encouraged international joint research to prevent and better prepare for the spread of communicable diseases and develop resilience against natural disasters.

(3) Asia-Pacific Economic Cooperation (APEC)

Meetings of the APEC Policy Partnership on Science, Technology and Innovation (PPSTI) are held to promote scientific and technological innovation in the APEC region through joint projects and workshops. The seventh, eighth and ninth meetings were held in May 2016 and August 2016 in Peru and in February 2017 in Vietnam to plan PPSTI activities.

In August 2016, the 4th APEC Chief Science Advisor Meeting was held in Peru for the exchange of opinions among science advisors to governments, or the equivalent of such advisors, in the APEC region concerning issues and opportunities related to scientific advice to their governments. Yuko Harayama, an executive member of the CSTI, also attended the meeting.

(4) Association of Southeast Asian Nations (ASEAN)

The ASEAN Committee on Science and Technology (COST) and Japan, China and South Korea (COST+3) are cooperating on science and technology. MEXT is taking a leadership role in Japan's contribution to the ASEAN COST+3. In January 2015, the 8th ASEAN COST+3 Meeting was held in Tokyo for the exchange of opinions on cooperation between ASEAN and the three countries. As a framework for cooperation between Japan and COST, the 7th ASEAN-Japan Cooperation Committee on Science and Technology was held in Siem Reap (Cambodia) in October 2016 for the exchange of opinions about Japan and overall ASEAN scientific and technological cooperation in the future.

(5) Other

① Asia-Pacific Regional Space Agency Forum (APRSAF)

Since 1993, Japan has been hosting the annual APRSAF, the largest framework of space cooperation in the Asia-Pacific region. This forum has been used for exchanging information about space activities and utilization in the region as well as for promoting multilateral cooperation. The 23rd APRSAF meeting in Manila, Philippines in November 2016 had more attendees than any other APRSAF meeting held outside Japan. About 580 people from 33 countries and regions, and ten international organizations participated. The number of participants is steadily increasing. One major achievement of the initiatives conducted by the APRSAF is the Sentinel Asia Project. This project aims at reducing damage caused by natural disasters through the sharing of disaster-related information online, including the sharing of Earth observation satellite images. As of February 2017, 89 institutions and 15 international organizations from 27 countries and regions were cooperating in the project. In 2016, a total of 34 emergency observations were provided at times of natural disaster, including flooding in Sri Lanka (May) and flooding in India (August).

② International Space Exploration Forum (ISEF)

The International Space Exploration Forum (ISEF) is a ministerial-level meeting to build support for global cooperation on space exploration. In January 2017, it was announced that Japan would host the second ISEF on March 3, 2018.

③ Global Biodiversity Information Facility (GBIF)

The GBIF is an international organization that engages in the development of information infrastructure and data acquisition/analysis tools for the purpose of collecting data on biodiversity so that the data can be made available worldwide. The 23rd meeting of the GBIF Governing Board was held in Brasilia, Brazil in October 2016, with the participation of member countries and others. The purpose was approval of the budget for 2017 and of the GBIF Implementation Plan 2017-2021.

④ Group on Earth Observations (GEO)

GEO is an international framework pursuing the development of the Global Earth Observation System of Systems (GEOSS) in accordance with the "GEO Strategic Plan 2016-2025" approved at the ministerial-level meeting in November 2015. A total of 210 countries and organizations participate in GEO as of February 2017.

GEOSS is a system for comprehensive Earth observation. It consists of diverse observation systems, including artificial satellites and ground-based observation systems, whose linkage aims for the development of an information base that helps policy-making in eight areas related to social benefits (biodiversity and ecosystem sustainability, disaster resilience, energy and mineral resources management, food security and sustainable agriculture, infrastructure and transportation management, public health surveillance, sustainable urban development, and water resources management) and on global issues related to these eight areas, such as climate change.

⑤ Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) for the purpose of comprehensively assessing anthropogenic climate change and its impacts, adaptation to such impacts, and the mitigation of climate change from scientific, technological and socioeconomic viewpoints. The IPCC published the Fifth Assessment Report (AR5) in November 2014 and is implementing its sixth round of assessments, which started in 2015.

⑥ Innovation for Cool Earth Forum (ICEF)

At the suggestion of Prime Minister Abe, the government holds an international meeting called the Innovation for Cool Earth Forum (ICEF), in Tokyo in every October as an international platform for the promotion of discussion and cooperation among international academic institutions, companies and governments towards solving issues of climate change through innovations related to energy and the environment.

More than 1,000 people from about 80 countries and regions participated in the third annual ICEF conference in 2016.

⑦ ARGO Program

MEXT and the Japan Meteorological Agency (JMA) joined an advanced ocean monitoring system (the Argo Program) to understand the details of oceans worldwide and to improve the accuracy of climate change prediction (See Chapter 3, Section 3, Paragraph 1.).

⑧ Global Research Council (GRC)

The GRC is comprised of the heads of major science and engineering funding agencies from various countries. The fifth annual GRC meeting was held in New Delhi in May 2016, cohosted by India's Science and Engineering Research Board (SERB) and the Research Council UK (RCUK). A total of 51 leaders from 45 countries and three international organizations discussed research support issues and the roles of science and engineering funding agencies. They also approved two outcome documents entitled "Statement of Principles on Interdisciplinarity" and "Statement of Principles and Actions Promoting the Equality and Status of Women in Research."

2 Utilization of international organizations

(1) United Nations system (UN system)

Japan has been participating and actively cooperating in various science and technology projects and activities of the United Nations Educational, Scientific and Cultural Organization (UNESCO), a specialized agency of the U.N.

In UNESCO bodies, such as the IOC, the International Hydrological Programme (IHP), the Man and the Biosphere Programme (MAB), UNESCO Global Geoparks, the International Bioethics Committee (IBC) and the Intergovernmental Bioethics Committee (IGBC), international rules are formulated and projects are implemented towards solving global-scale problems. Japan also helps to promote UNESCO activities by sending experts to contribute to discussions of committees/commissions. Japan has established funds-in-trust at UNESCO as a way of cooperating in science and technology human resources development in the Asia-Pacific region.

(2) Organization for Economic Cooperation and Development (OECD)

The OECD engages in activities related to science and technology by developing statistical data and fostering exchanges of views, experience, information and human resources among the member countries at the following OECD bodies: the OECD Ministerial Council, the Committee for Scientific and Technological Policy (CSTP), the Committee for Information, Computer and Communications Policy (ICCP), the Committee on Industry, Innovation and Entrepreneurship (CIIE), the Committee for Agriculture (AGR), the Environmental Policy Committee (EPOC), the Nuclear Energy Agency (NEA), and the International Energy Agency (IEA).

In the CSTP, information and opinions concerning science and technology policies were exchanged and the role of STI in economic growth, improvements in research organizations, the roles of government and the private sector in R&D and international collaborations in R&D were studied. The CSTP has four subgroups: the Global Science Forum (GSF), the Working Party on Innovation and Technology Policy (TIP), the Working Party on Bio-, Nano- and Converging Technologies (BNCT), and the National Experts on Science and Technology Indicators (NESTI). Typical activities led by Japan as Chair or Vice-Chair are as follows:

① Global Science Forum (GSF)

The GSF discusses ways to facilitate international cooperation on solving global issues. It launched a new project in 2016 to study the socioeconomic impact of research infrastructure and formulate scientific

advice to resolve critical situations.

② Working Party on Innovation and Technology Policy (TIP)

The TIP makes examinations and gives advice on policies related to innovation and technology. These policies are expected to enhance productivity, foster sustainable economic growth, facilitate the creation, diffusion and application of knowledge for both societal and economic goals, and promote the creation of highly skilled human capital.

The TIP implemented a "knowledge triangle" project in 2016 to bring about innovation through collaboration between industry, governments and academia. It also discussed plans to implement "digitization and innovation policy mix" starting in 2017.

③ Working Party of National Experts on Science and Technology Indicators (NESTI)

NESTI supervises, provides advice on and coordinates statistical work and contributes to the development of indicators and quantitative analysis helpful for the promotion of STI policies. Specifically, with regard to science and technology indicators related to R&D spending, science and technology human resources and the like, NESTI has been discussing and examining the development of indicators, methods for researching indicators, and frameworks for international comparisons of indicators.

④ International Science and Technology Center (ISTC)

The ISTC is an international organization established by the four parties of Japan, the U.S.A., the EU and Russia in March 1994, with the aim of providing former weapons scientists from Russia and the CIS, who had engaged in the development of weapons of mass destruction with opportunities to redirect their talents to R&D conducted for peaceful purposes. With the withdrawal of the Russian Federation from the ISTC in July 2015, the ISTC head office was relocated from Moscow to Astana, Kazakhstan. In December of that year, the Agreement on the Continuation of the ISTC was signed by representatives of Japan, the European Union, the European Atomic Energy Community, the USA, Georgia, Norway, Kyrgyzstan, Armenia, Kazakhstan, the Republic of Korea, and Tajikistan.

3 Utilization of research institutions

(1) Economic Research Institute for ASEAN and East Asia (ERIA)

ERIA is an institution that provides policy analyses and recommendations towards promoting East Asian economic integration. Under the three pillars of deepening economic integration, narrowing development gaps and achieving sustainable economic development, ERIA implements research, symposiums and human resources development in a wide range of areas, including innovation policies.

4 Promotion of International Activities Related to Advanced Science and Technology

For Japan to assume a leading role in solving global issues and to maintain a strong position in the world, the nation needs to strategically promote STI policies from the perspective of international cooperation. Japan's strength in S&T is especially useful for other Asian countries in solving many of their problems relating to the environment, energy, food, water, disasters and infectious diseases. By assuming a leading

role in addressing problems common to Asian countries, Japan needs to build mutually beneficial relations with them based on mutual trust.

In June 2012, in cooperation with the Japan Science and Technology Agency (JST), MEXT started the e-ASIA Joint Research Program (e-ASIA JRP) with the aims of enhancing R&D capabilities by accelerating S&T research cooperation in East Asia and of conducting multilateral joint research to solve problems common to Asian countries. Within the framework of the e-ASIA JRP, funding agencies from countries in the East Asia Summit (EAS) are promoting collaborative research projects in the following seven fields: health research (infectious diseases and cancer), agriculture (food), alternative energy, disaster risk reduction and management, environment (climate change and marine science), materials (nanotechnology), and advanced interdisciplinary research towards innovation. In the field of health research, the Japan Agency for Medical Research and Development (AMED) has been supporting international collaborative research since April 2015.

In addition, MEXT and the JST established international joint research hubs at organizations in collaborating countries and regions in August 2015. MEXT and the JST then proposed to enable Japanese researchers to be stationed at these hubs regularly and irregularly to work on global and regional issues, work to improve S&T capability that may lead to scientific innovation applicable to society and strengthen research cooperation with collaborating countries and regions. The JST adopted a joint research projects in ASEAN region in 2015. The JST also adopted a research project similar in scheme (in the information and communications technology field) in India in August 2016. JST has been supporting these projects.

The Japanese Ministry of the Environment has been supporting the Asia-Pacific Network for Global Change Research (APN) which was established to improve researchers' capabilities and solve issues common to the nations in the Asia-Pacific region. The APN held its 21st annual intergovernmental meeting in Zhengzhou, China in April 2016. The fifth annual LoCARNet (Low Carbon Asia Research Network) meeting was then held in Indonesia in October 2016 with the theme of "Carrying out the Paris Agreement: Role of research communities in supporting scientific climate policy."

The UN General Assembly unanimously approved the sustainable development goals (SDGs) in September 2015 to address global issues comprehensively. Because scientific and technological innovation is necessary to achieve various goals, S&T-related ministries and agencies have been discussing the potential contribution of scientific and technological innovation for achieving SDGs.

5 Cooperation with Other Countries

(1) Advanced S&T cooperation with Russia

A meeting of the Joint Committee on Science and Technology Cooperation was held between Japan and Russia to confirm the status of progress in S&T cooperation and discuss plans to expand cooperation.

Japanese Prime Minister Shinzo Abe proposed an eight-point cooperation plan at the Japan-Russia Summit in Sochi, Russia in May 2016. Russian President Vladimir Putin praised the plan, and the two leaders agreed to put it into practice. One of the eight points entitled "Cooperation on cutting-edge technologies" stipulates that two countries cooperate in various fields, including nuclear energy,, medical care and agriculture. The two leaders signed multiple documents on the cooperation when President Putin visited Japan in December 2016.

(2) Cooperation with China, South Korea and other Asian countries

Within the framework of Japan–China–South Korea trilateral cooperation, the Minister of MEXT has attended the Japan-China-South Korea Ministerial Meetings on Science and Technology Cooperation. The Japan–China–South Korea Ministerial Meeting on Science and Technology and the Trilateral Director-General's Meeting are held biennially and alternately, and these meetings have resulted in support for research activities through the Japanese–Chinese–Korean Cooperative Joint Research Collaboration Program (JRCP) and Young Researchers' Workshops. In addition to Japan–China–South–Korea trilateral cooperation, Japan is promoting bilateral science and technology cooperation with China and South Korea. For this purpose, the government has been exchanging information and researchers and has been supporting the implementation of bilateral joint research with China and South Korea.

The JSPS supports exchanges between research centers in Asia towards establishing scientific research networks and fostering young researchers by launching the A3 Foresight Program and conducting other activities.

(3) Cooperation with the United States and European countries

Japan has been actively advancing science and technology cooperation with the U.S.A. and European countries in advanced research areas such as life sciences, nanotechnology, materials science, environmental sciences, nuclear technology and space exploration. Specifically, Japan has held meetings of joint committees on science and technology cooperation based on bilateral science and technology cooperation agreements, has been exchanging information and researchers with the above-mentioned countries and has been supporting the implementation of joint research.

Japan and the United States held the 15th working-level joint committee meeting in Washington, D.C. in July 2016 to follow up the 2015 ministerial-level joint committee meeting and discuss many subjects, including research cooperation in various fields. The Elliott School of International Affairs of the George Washington University hosted the 4th U.S.-Japan Open Forum in Washington, D.C. with the support of the Japanese Embassy in the US and the US Department of State. Representatives of the academic and industrial sectors of the two countries discussed the impact, importance and benefits of S&T in society.

Following consultations with the European Commission, Japan and the EU published the first coordinated call for international joint research projects on ICT topics in October 2012, based on an agreement made with the EU. Joint ICT research started in 2013. The Third coordinated call for joint ICT research was made in October 2015. Japan also convened the Joint Committee on Science and Technology Cooperation with: U.K. and Germany in November 2016, France in February 2017. In addition, when the Science and Technology Adviser to the Minister for Foreign Affairs visited Germany, Austria, France and UK in 2016, he presented Japan's overseas outreach efforts via the Cross-ministerial Strategic Innovation Promotion Program ("SIP Caravan") which was formulated by the Cabinet Office and the Ministry of Foreign Affairs.

In October 2015, the 5th EU–US–Japan Trilateral Conference on Critical Materials was held in Tokyo with attendance by government officials, materials engineers and other experts from Japan, the U.S.A. and Europe, which account for large shares of global demand for rare-earth minerals. High-level government officials of the three economies participated in a workshop for cultivating a shared understanding of the global situation related to the supply of rare-earth minerals, as well as for discussing the development of

rare-earth alternative materials and rare-earth recycling technologies.

(4) Cooperation with other countries

Japan is also holding joint committee meetings, promoting exchanges of information and researchers, and promoting the implementation of joint research with Australia, India, South Africa, Brazil and other countries, based on bilateral Science and Technology Cooperation Agreements.

Human resource development and exchanges, as well as collaborative research, are promoted for the future with emerging countries.

Section 4 Pursuing Effective STI Policies and Enhancing the Chief Controller Function

To enforce the fifth, medium-to-long-term Science and Technology Basic Plan, the CSTI has been annually revising the Comprehensive Strategy on Science, Technology and Innovation since 2016 depending on the status of priority policy implementation. In addition, the CSTI has been strengthening its leadership functions.

1 Following up the Basic Plan

To put the fifth Science and Technology Basic Plan into force in an objective manner, the plan stipulates that progress and outcome of its implementation shall be quantified using indicators and target values. In addition, the basic plan needs to be revised based on issues identified using qualitative and quantitative information. Specific target values and key indicators to be used are specified in the basic plan.

After the CSTI formulated the basic plan, it studied additional, more elaborate indicators (second-layer indicators) and collected data to assess the target values, key indicators and second-layer indicators.

MEXT—which plays a central role in promoting scientific and technological innovation—monitors the progress of the basic plan. To facilitate this task, the ministry created "overhead maps" to visualize implementation status of individual policies stipulated in the plan. MEXT is in the process of determining indicators that will facilitate planning, formulation and evaluation of policies, and measures and projects specific to each map. MEXT plans to formulate effective measures and update current measures while monitoring changes in indicator values specific to individual maps and changes in the environment related to STI policies.

2 National Guideline on the Method of Evaluation for Government R&D

To promote STI policies effectively and efficiently, it is necessary to set clear performance targets, such as policies, measures and implementation systems. It is also necessary to conduct timely follow-ups to ensure progress, and to consider the results when reviewing policies and resource allocation. Finally, it is necessary to plan new policies by establishing PDCA (Plan-Do-Check-Action) cycles. For this reason, the government has been promoting efforts to ensure the effectiveness of PDCA cycles. Specifically, the government has established the National Guideline on the Method of Evaluation for Governmental R&D (hereinafter referred to as the "National Guidelines") instituted by the Prime Minister on December 21, 2016.

After revisions were made to the National Guidelines, MEXT revised the Guideline on the Method of

Evaluation for Government R&D by MEXT (approved by the MEXT Minister) to be consistent with the revised National Guidelines. MEXT's revision supplemented the priority goals of (1) creating scientific and technological innovation and enhancing problem-solving systems, (2) promoting challenging, interdisciplinary and collaborative research, (3) promoting training of and support for young researchers who may lead the next generation and (4) improving the quality of R&D evaluation and avoiding evaluation becoming a burden to researchers. In addition, MEXT is aiming to implement more constructive R&D evaluation which will encourage researchers to perform high-quality R&D effectively and efficiently.

Ministry of Economy, Trade and Industry (METI) evaluates R&D projects before, during and after their implementation and performs follow-up evaluations. Studies are underway to revise the Guidelines for Technology Evaluation by METI to be aligned with the revised National Guidelines.

Incorporated administrative agencies and national universities are evaluated pursuant to the Act on General Rules for Incorporated Administrative Agencies and Act on National University Corporation, (Act No. 112 of 2003). The national R&D agency is evaluated by the competent minister pursuant to the Guidelines for Incorporated Administrative Agency Evaluation, mainly with the aim of maximizing R&D outcomes.

3 Promoting Policies Supported by Objective Evidence

The CSTI and other ministries, agencies and organizations are collaboratively collecting, sharing and analyzing information necessary to formulate PDCA cycles in line with the Science and Technology Basic Plan, and the Comprehensive Strategy on Science, Technology and Innovation, etc. under the framework of existing efforts. The CSTI is also studying comprehensive methods to formulate PDCA cycles.

With the aim of formulating policies for science, technology and innovation by following a rational, evidence-based process, MEXT has been promoting Science of science, technology and innovation policy program (See Chapter 6, Section 1, Paragraph 3.)

MEXT invites the public to submit R&D proposals to be considered for competitive funding from the national government using the Cross-ministerial R&D Management System (e-Rad). The CSTI uses the data collected by e-Rad to formulate objective policies to promote scientific and technological innovation.

The National Institute of Science and Technology Policy has conducted research and analyses based on administrative needs, and has established an information base for the collection and accumulation of data that are necessary for the formulation of STI policies and for research, analysis and study on STI (See Chapter 6, Section 1, Paragraph 3.)

4 Strengthening the Leadership Functions of the CSTI

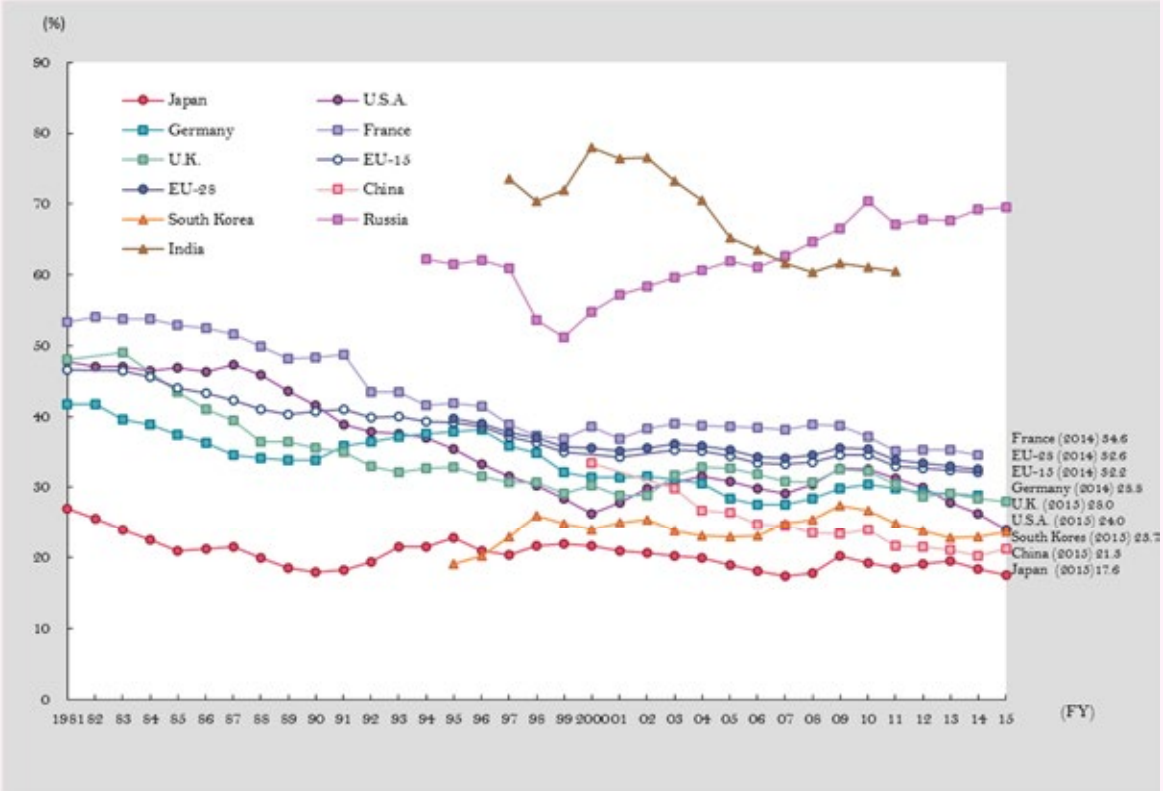
The CSTI will continue its effort to strongly promote the Strategic Innovation Promotion Program (SIP) and the Impulsing Paradigm Change through Disruptive Technologies Program (ImPACT). The leadership functions of the CSTI were strengthened in December 2016. The CSTI and the Council on Economic and Fiscal Policy held a jointly meeting in which the expert panel finalized the report on the "Public and Private Investment Expansion Initiative for Science and Technology Innovation." The CSTI is striving to implement the three actions specified in the initiative: reforming budgeting processes, reforming systems to encourage greater R&D investment, and effectively increase public and private R&D investment using proven methods. To increase R&D investment, the CSTI held a working group meeting to strengthen

basic capability of research organs to bring about scientific and technological innovation. The group discussed specific measures that will assist universities and national R&D agencies to acquire funds from various sources and smoothly distribute funds, information and human resources.

Section 5 Ensuring R&D Investment for the Future

The 5th Science and Technology Basic Plan states as follows: With a view to continuing the efforts to promote science and technology, the quality of S&T policies needs to be continuously enhanced. It is necessary to set specific goals for increased government investment in R&D from a comprehensive perspective by taking into consideration various factors, including the following: the fact that many other countries are increasing their government investment in R&D, government funding as a share of all R&D funds in Japan and the need for increased government R&D investment to produce the synergistic effect of promoting private sector investment. Accordingly, the government aims for an increase in R&D investment by the public and private sectors to at least 4% of Japan's GDP. Additionally, the government has set the goal of investing 1% of GDP in R&D. This goal is to be achieved while securing consistency with the Plan to Advance Economic and Fiscal Revitalization stated in the Basic Policy on Economic and Fiscal Management and Reform 2015 (Cabinet decision, June 2015). On the assumption that the nominal GDP growth rate during the period of the 5th Basic Plan is 3.3% on average, the total amount of government investment in R&D during the same period is estimated at 26 trillion yen.

■Figure 2-7-1 / Trends in Government-financed R&D Costs in Major Countries



Note: 1. Humanities and social science were included in this analysis, except for the Republic of Korea up to FY2006.
2. The UK values for FY1981 and 1983 were estimated by the OECD. The UK values for FY2008, 2009, 2010, 2012 and 2014 were estimated by other organizations and those for FY2013 and 2014 are provisional.
3. The German values for FY1982, 1984, 1986, 1988, 1990, 1992, 1994, 1995, 1996, 1998, 2000 and 2002 were estimated.
4. The EU values were estimated by the OECD.
5. The Indian values for FY2006 and 2007 were estimated. It is unknown whether these values take national defense research into account.

Source: Japan: Adapted by MIC (the Statistics Bureau) based on *the Report on the Survey of Research and Development*
India: UNESCO Institute for Statistics S&T database
Other countries: OECD, Main Science and Technology Indicators, Vol. 2015/2.

Reference: Japan 16-1, United States 26-1-1, EU-15 26-2-1, EU-28 26-2-2, Germany 26-3-1, France 26-4-1, U.K. 26-5-1、China 26-6-1, South Korea 26-7-1, Russia 26-8-1, India 26-10

(Government R&D investment)

Government R&D investment in FY 2016 was 4.3731 trillion yen. The breakdown was 3.8704 trillion yen from the central government, including both the initial budget and the supplementary budget, and 502.7 billion yen from local authorities. (For details on R&D investment by the central government (See Chapter 1, Section 4, Paragraph 2.)