Chapter 7 Enhancing the Capacity to Promote Science, Technology and Innovation

Effective, flexible implementation of the policies and measures stipulated in the 5th Science and Technology Basic Plan (hereinafter referred to as the 5th 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.

To this end, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) established a "designated national university cooperation system" where the national university cooperation designated by the minister set high-level goals toward the world's best education and research activities. Under this system, six specified national university corporations have been designated as of FY2018.

In addition, MEXT has promoted the fundamental reform of graduate school education through the Program for Leading Graduate Schools and the Doctoral Program for World-leading Innovative & Smart Education. The purpose of these programs is to support universities' efforts to provide doctoral programs that are aimed at equipping students with advanced expertise, broad perspectives, and the ability to come up with original ideas, and fostering them as "Professionals of Knowledge" to promote innovation (see Chapter 4, Section 1, 1(3)).

MEXT also formulated the Guidelines for Fortifying Joint Research Through Industry-Academia-Government Collaboration in November 2016 to promote full-scale organization-to-organization

collaboration among companies, universities and national R&D agencies. At the same time, in order to increase the liquidity of human resources, the government is also promoting the use of the cross-appointment system, which allows researchers to work for multiple institutions and engage in R&D and educational activities under a certain activity management scheme based on dispatch agreements concluded among the organizations (see Chapter 4, Section 1, 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, 1(1)).

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

Under the direction of directors with great management capabilities, national R&D agencies conduct basic and fundamental research (which is difficult for the private sector to cover) and verification tests, develop fundamental technologies that contribute to the establishment of technological standards, and distribute R&D funds to other institutions. These agencies are responsible for their own organizational reforms, and such reforms serve as a driver of the innovation system.

1 R&D Agency Reforms

The "Act on the General Rules for Incorporated Administrative Agencies" (Act No. 103, 1999) was revised in 2014. This revision led to the promotion of 27 independent administrative agencies to roles as national R&D agencies (as of March 31, 2019), 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 of 2016, hereinafter as "NRDA Act") 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 (revised on March 10, 2017). Expert Panel on Evaluation of CSTI compiled "approach of opinions and suggestions to the evaluation of designated national research and development agencies and the content of the next medium- to long-term goals" on July 4, 2017.

In addition, lawmakers amended the R&D Capacity Strengthening Act in December 2018. The title of the law was changed to the Act on the Promotion of Science, Technology, and Innovation Creation. The amended law expanded the scope of R&D corporations that are allowed to engage in investment and enabled them to acquire and hold shares of agency-initiated ventures, while also allowing funding institutions to swiftly establish funds. These amendments are expected to create a virtuous cycle of knowledge, human resources, and funds surrounding R&D agencies, and further stimulate science,

technology, and innovation creation.

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 KISHIDA Fumio, according to a proposal made by Japan, which held the presidency at the time. Subsequent meetings were held in the United Kingdom in 2013, in Germany in 2015, and in Japan (Tsukuba City, Ibaraki) in 2016. 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. In September 2017 the meeting was held in Italy and Ms. HARAYAMA Yuko, a then-member of CSTI, attended from Japan. At the meetings of the GSO[1], which was established based on the discussion in the 2008 meeting, the members shared information concerning international research facilities and international collaboration frameworks. International Research Network for Low-Carbon Societies (LCS-RNet), a network of researchers/research organizations that are contributing to individual countries' low-carbon policy-making processes, had its 10th annual meeting in Tokyo in July 2018. As of 2018, research organizations from 10 countries including Japan were LCS-RNet members.

(2) 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 11th and 12th meetings were held in February and August 2018 in Papua New Guinea to plan PPSTI activities.

(3) 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 9th ASEAN-Japan Cooperation Committee on Science and Technology (AJCCST-9) was held in Cebu (Philippines) in October 2018 for the exchange of

1 The Group of Senior Officials

opinions about Japan and overall ASEAN scientific and technological cooperation in the future. The members of the AJCCST-9 agreed to launch the Japan-ASEAN STI for SDGs Bridging Initiative, a cooperation framework to strengthen the social implementation of the results of Japan-ASEAN joint research projects with an eye to the achievement of SDGs. At the following 21st Japan-ASEAN Summit held in Singapore in November 2018, it was included in the Chairman's Statement that Japan and ASEAN member states would work together to develop smart city networks based on the concept of "Society 5.0" which had been promoted by Japan, as well as that the first multi-stakeholder forum would be held in Thailand in 2019.

(4) Other

A. 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 25th APRSAF meeting held in Singapore in November 2018 gathered about 385 attendees, including the representatives of the public and private sectors of 29 countries and regions as well as the representatives of nine international organizations. This meeting was attended by four directors and five deputy directors from space agencies in the Asia-Pacific region. They exchanged opinions on new needs and challenges in space activities in line with the meeting's theme, "Innovative Space Technology for Evolving Needs." In response to increasing needs for opinion exchange on the space policies of emerging space exploring countries, a continuation of the previous session focusing on space policies was held. The participants issued a joint statement referring to the improvement of space technology capability in the Asia-Pacific region, the creation of a space policy community, and cooperation with user organizations toward social implementation.

B. International Space Exploration Forum (ISEF)

In order to promote international cooperation in space exploration, ministerial meetings had been held with European initiative since 2009. In this context, ISEF was held in Washington DC in 2014. In March 2018, the second round of the forum (ISEF2) was held in Tokyo, chaired by the MEXT Minister. At this meeting, the members compiled several documents, including the Tokyo Principles for International Space Exploration, which serve as a foundation to facilitate space exploration under international cooperation. During the period, side events were also held for industry and young people. The next round is to be held in Europe by 2021.

C. 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 25th meeting of the GBIF Governing Board was held in Kilkenny, Ireland in October 2018, with the participation of member countries and others. The purpose was approval of the budget for 2019 and of the Implementation Plan.

D. 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 232 countries and organizations participate in GEO as of February 2019.

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 the eight Social Benefits Areas (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.

In 2018, Japan hosted a GEO Plenary for the first time. At this meeting, the members had active discussion on the contribution of Earth observation to SDGs, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction.

E. Intergovernmental Panel on Climate Change (IPCC)

IPCC was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) for the purpose of comprehensively assessing climate change, its impacts, vulnerability, 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 2014 and started its sixth round of assessments. In addition to the publication of the Sixth Assessment Report (AR6) scheduled in the period of 2021 to 2022, the IPCC has released or plans to release the Special Report on Global Warming of 1.5 °C (published in October 2018), the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, the Special Report on Climate Change and Land, and the Special Report on the Ocean and Cryosphere in a Changing Climate (planned to be published in 2019).

F. Innovation for Cool Earth Forum (ICEF)

In order to promote innovations and their spread in the fields of energy and environment, which are key to combining solution of climate change problems and economic growth, Japan, at the proposal of Prime Minister Shinzo Abe, established ICEF in 2014 as a knowledge platform where industry, government and academia leaders in the world hold discussions and promote international cooperation. The forum has been held in October every year.

More than 1,000 people from about 80 countries and regions participated in the 4th annual ICEF conference in 2017.

G. 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.).

H. Arctic Science Ministerial (ASM)[1]

The ASM is a ministerial meeting aimed at promoting research and observations in the Arctic and responding to major social issues. In 2016, the first round of the ASM was held in Washington, DC. The Minister of Education, Culture, Sports, Science and Technology Masahiko Shibayama attended the second round held in Berlin in October 2018 and shared the results of the ArCS[2]. Japan co-hosted the third round with Iceland. Japan proposed and received approval to hold this meeting in Japan in 2020. This will be the first ASM meeting held in Asia.

Second Arctic Science Ministerial (the fifth person from the right in the front row is Minister Shibayama)
Source: MEXT

I. Global Research Council (GRC)

The GRC is an international conference comprised of the heads of Research Councils from various countries. The seventh annual GRC meeting was held in Moscow in May 2018, co-hosted by the Russian Foundation for Basic Research (RFBR) and the National Research Foundation of Korea (NRF). Over 60 agency heads from around 50 countries and two international organizations discussed research support issues and the roles of Research Councils. They also approved an outcome document titled the "Statement of Principles on Peer/Merit Review 2018."

2 Utilization of international organizations

(1) United Nations system (UN system)

A. Science, Technology and Innovation for Sustainable Development Goals (STI for SDGs)

Toward the achievement of the UN Sustainable Development Goals through Science, Technology and Innovation ("STI for SDGs"), the Advisory Board for the Promotion of Science and Technology Diplomacy (chaired by Science and Technology Advisor to the Minister for Foreign Affairs KISHI Teruo) submitted the Science, Technology and Innovation to Achieve the SDGs and its Guiding Tool, the STI Roadmap: To Think, Proceed and Create Together with the World to the then State Minister for Foreign Affairs NAKANE Kazuyuki on May 28, 2018. At the UN Third STI Forum co-chaired by HOSHINO Toshiya (Ambassador, Deputy Permanent Representative of Japan to the United Nations), which was held in New York in the same month, Professor KISHI Teruo, the Science and Technology Advisor to the Minister for Foreign Affairs, noted that STI can contribute to the achievement of SDGs and that solving challenges using STI and forming a better future society are a good approach for all developed, emerging, and developing countries. Furthermore, Professor Kishi also pointed out that STI roadmaps developed by "knowledge structuring" through the analysis of correlations among SDGs and policies, can effectively ensure that all people receive the benefits of STI. He also added that an STI roadmap creates new business

1 White House Arctic Science Ministerial
2 Arctic challenge for Sustaitability

opportunities by allowing various stakeholders to work systemically rather than individually or bilaterally, which can lead us to proceed to a new scientific frontier. His remarks were accepted by other members with great interest.

In the Integrated Innovation Strategy approved by the Cabinet in June 2018, the promotion of STI for SDGs is listed as one of the priorities. Under the framework of the STI for SDGs Task Force established under the Integrated Innovation Strategy Promotion Council, the Cabinet Office is currently working with other relevant ministries and agencies to develop the STI for SDGs Roadmap to clarify the path to the achievement of SDGs for Japan. The Cabinet Office also holds the Conference for the Development of the STI for SDGs Platform with the participation of the representatives of industry, the government, academia, and international organizations in order to discuss the development of a platform to promote the matching of needs and ST seeds in Japan.

B. United Nations Educational, Scientific and Cultural Organization (UNESCO)

Japan has been participating and actively cooperating in various science and technology projects and activities of 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) Organisation 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, experiences, 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 Nuclear Energy Agency (NEA), and the International Energy Agency (IEA).

In the CSTP, information and views concerning science and technology policies have been exchanged and the role of science, technology and innovation (STI) in economic growth, enhancements of research systems, and the roles of government and the private sector in R&D and international collaborations in R&D have been studied. The CSTP has four subgroups: the OECD 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).

A. Global Science Forum (GSF)

The GSF discusses ways to facilitate international cooperation for solving global issues. In 2018 the forum compiled the final report of a project to examine scientific recommendations in urgent situations and also the effective management of competitive funds.

B. Working Party on Innovation and Technology Policy (TIP)

The TIP studies how STI can contribute to economic growth through policies. In 2018, it discussed the impact of digitization and open innovation, and knowledge transfer between industry, academia and the government.

C. Working Party on Biotechnology, Nanotechnology and Converging Technologies (BNCT)

BNCT makes policy proposals for effective use of biotechnologies to contribute to sustainable economic growth and the prosperity of human kind, and has been advancing projects on the ripple effects of nanotechnology, internationalization of research and research infrastructure, etc.

D. 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 expenditure, science and technology human resources and the like, NESTI has been discussing and examining the development of survey methodologies and indicators, and frameworks for international comparisons of indicators. In 2018, NESTI issued the Oslo Manual 2018 (4th edition), which provides guidelines for collecting, reporting, and using data related to innovation. The updated edition describes the new definition and scope of the term "innovation."

(3) 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 EU, the European Atomic Energy Community, the U.S.A., Georgia, Norway, Kyrgyzstan, Armenia, Kazakhstan, the Republic of Korea, and Tajikistan. The agreement came into effect in 2017.

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 Strategic International Activities Related to Science Technology Innovation

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.

Since FY2008, MEXT has been implementing Science and Technology Research Partnership for Sustainable Development (SATREPS) and promoting international joint research with Asian and developing countries in other regions by combining excellent science/technologies and the ODA of Japan. The research will contribute to solving global issues in the fields of environment, energy, bioresources, natural disaster prevention and mitigation, and infectious diseases control. Since FY2009, the ministry has been implementing the Strategic International Collaborative Research Program (SICORP) to promote diverse international collaborative research according to the potential of the partner country/region, the field and the cooperation phase in equal partnership based on agreement among ministries and agencies toward creation of innovations through strategic international cooperation. Furthermore, MEXT has been implementing the Japan-Asia Youth Exchange Program in Science (Sakura Science Plan) since FY2014. This program aims to contribute to the development of science and technology in Japan and Asia and other regions by arousing interest in Japan's leading-edge science and technology among young people in these regions and developing excellent foreign human resources desired by Japanese universities, research institutions, and companies (See Chapter 4, Section 1, 2 (2) A (B)).

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 23rd annual intergovernmental meeting in Thailand in July 2018. The seventh annual LoCARNet (Low Carbon Asia Research Network) meeting was held in Indonesia in November 2018 with the aim of sharing the latest research outcomes and knowledge toward low-carbon growth of Asia.

5 Cooperation with Other Countries

(1) Cooperation with the United States and European countries

Japan has been 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 Joint High-Level Committee Meeting in 2015 and the Joint Working-Level Committee Meeting in 2016. The committees were set up based on the Agreement between the Government of Japan and the Government of the United States on Cooperation in Research and Development in Science and Technology. In 2018, the Director of the National Science Foundation, France A. Córdova, exchanged opinions with MEXT Minister HAYASHI Yoshimasa during Minister Hayashi's visit to the United States and with MEXT Minister SHIBAYAMA Masahiko during the STI Forum.

With the EU, MEXT Minister HAYASHI Yoshimasa and European Commissioner (for Research, Science and Innovation) Carlos Moedas agreed to expand exchange of young researchers and enhance bilateral cooperation in the fields of quantum technology and arctic science during the talk held in January 2018. Based on this agreement, Japan and the EU held a workshop on quantum technology in September, and

signed the IA[1] on research exchange between the Japan Science and Technology Agency (JST) and ERC[2] in October. Japan and EU are also supporting joint research projects in the arctic science field. In addition, the Ministry of Internal Affairs and Communications (MIC) and the European Commission (EC) opened the fourth Call for Proposals and launched research projects on smart cities and 5G-related technologies in July 2018. MIC and EC intend to continue to discuss the topics for the next Call for Proposals. In December 2018, MIC, the National Institute of Information and Communications Technology (NICT), and EC held the seventh Japan-EU Symposium on ICT Research and Innovation, where they agreed to further strengthen bilateral cooperation in the ICT field. Japan also convened the Joint Committee on Science and Technology Cooperation with: Norway in June 2018, Sweden in August 2018, Canada in January 2019, Germany in February 2019. In addition, when the Science and Technology Adviser to the Minister for Foreign Affairs visited the France in February 2019, 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 2017, the 7th EU–US–Japan Trilateral Conference on Critical Materials was held in the United States by major rare metal consumer countries. Policy makers and experts of the three economies participated in a workshop for cultivating a shared understanding of the global situation related to rare metals including rare-earth minerals, and also for discussing the development of rare-earth alternative materials and rare-earth recycling technologies.

(2) Cooperation with China and the Republic of Korea

Celebrating the 40th anniversary of the conclusion of the Treaty of Peace and Friendship between Japan and China, MEXT Minister Yoshimasa Hayashi visited China in May 2018. In August, the Chinese Minister of Science and Technology, Wang Zhigang, visited Japan in order to attend the 16th meeting of the Japan-China Committee of Science and Technology (vice-ministerial-level). For the first time, both ministers attended and greeted the committee and they signed a memorandum of understanding concerning the establishment of the Japan-China International Joint Research and Innovation Center (Chinese name: Joint Scientific Research Platform). Based on this memorandum, the scheme of the SICORP Collaboration Hubs for International Research Program (Environmental and Energy fields) was adopted in March 2019. In September, MEXT and the Chinese Academy of Sciences hosted the 11th Sino-Japan Seminar on Science and Technology Policy in Chengdu. In May, JST and the Chinese State Administration of Foreign Experts Affairs (SAFEA) held the Japan-China University Fair and Forum in China 2018 in Guangzhou. In addition, during Prime Minister Shinzo Abe's visit to China in October, a memorandum of understanding on the establishment of the Japan-China Innovation Cooperation Dialogue was signed between the ministers of Japan and China.

In terms of the trilateral collaboration of Japan, China, and Republic of Korea, three Ministerial Meetings on Science and Technology Cooperation have been held since 2007. Also, JSPS holds meetings of heads of Japanese, Chinese and Korean academic organizations and the A3 Foresight Program every year. In addition, Japan-China-ROK science and technology policy seminars are held annually among government-affiliated science and technology policy research institutes. From Japan, the National Institute

1 Implementing Arrangement
2 European Research Council

of Science and Technology Policy (NISTEP), MEXT, participates in this seminar.

(3) Cooperation with ASEAN countries and India

In Asia, Japan can make use of its science and technology for the solution of problems in many fields including environment, energy, food, water, natural disaster prevention, and infectious diseases. It is necessary to play an active role in solving Asia's common issues and build relationships of mutual trust and benefits in the region.

In June 2012, MEXT in cooperation with JST launched the *e-ASIA Joint Research Program* for multilateral joint research. The program aims to strengthen R&D capabilities and solve common issues facing Asian countries by accelerating research exchange in science and technology. Institutions of East Asia Summit member countries participate in the program that covers seven fields: material (nanotechnology), agriculture (food), alternative energy, health research (infectious diseases and cancer), disaster prevention, environment (climate change and marine science) and advanced technology fusion toward innovation. The health research field has been supported by the Japan Agency for Medical Research and Development since April 2015.

As for the SICORP Collaboration Hubs for International Research Program, support started in ASEAN (environment/energy, bioresources, biodiversity and disaster prevention fields) in September 2015 and in India (ICT field) in October 2016. With an eye to creating innovation, improving Japan's science and technology capabilities, and strengthening the foundation of research cooperation with partner countries and regions, JST has promoted continuous joint research and cooperation programs with a focus on direct communication, while also building research networks and fostering young researchers. In addition, Japan and Singapore held the first Joint Committee Meeting on Cooperation in Science and Technology in April 2018 based on the economic partnership agreement.

(4) Advanced S&T cooperation with Russia

Japan and Russia hold meetings of the Joint Committee on Science and Technology Cooperation based on the Japan-Russia Science and Technology Cooperation Agreement signed in September 2000. At the 13th meeting held in Tokyo in April 2018, the participants shared science and technology policies of Japan and Russia, discussed the current situation and prospects of inter-university exchanges between the two countries, and reported efforts in the fields of Arctic science, agriculture, IT/digital, etc.

At the Japan-Russia summit held in Sochi, Russia in May 2016, Prime Minister ABE Shinzo presented a cooperation plan describing eight objectives to President Vladimir Putin. Currently, in relation to one of these objectives, "advanced technology cooperation that brings together the wisdom of Japan and Russia," various cooperative efforts are made in fields such as ICT and postal services, and agriculture. In September 2017, MEXT and the Ministry of Education and Science of Russia signed the Memorandum of Cooperation on the Japan-Russia Science and Technology Joint Project in Vladivostok, Russia. Based on this memorandum, both countries opened a call for proposals for research on "rational nature management, including Arctic research" and "energy efficiency" in January 2019.

(5) Cooperation with other countries

Japan has promoted science and technology cooperation with other countries as well, including

information exchange, researcher exchange, and joint research. From 2017 to 2018, the Cabinet Office and the Ministry of Foreign Affairs (diplomatic missions abroad) implemented the SIP Caravan in Indonesia, Thailand, the Philippines, Malaysia, Qatar and other countries by taking an opportunity of an overseas business trip of the Science and Technology Advisor to the Minister for Foreign Affairs.

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 5th, medium-to-long-term Science and Technology Basic Plan, the CSTI has been annually revising the Comprehensive Strategy on Science, Technology and Innovation depending on the status of priority policy implementation. In addition, the CSTI has been strengthening its leadership functions.

1 Following up the Basic Plan

In order to promote STI policies based on objective grounds, the 5th Basic Plan stipulates that progress and achievements of the plan shall be assessed by setting target values and key indicators and combining quantitative and qualitative data.

After the CSTI formulated the 5th Basic Plan, it has collected data of target values, key indicators, etc.

MEXT—which plays a central role in promoting scientific and technological innovation—monitors the progress of the 5th 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. 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.

In April 2017, MEXT revised the Guideline on the Method of Evaluation for Government R&D by MEXT (approved by the MEXT Minister on June 20, 2002) 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.

The Ministry of Economy, Trade and Industry (METI) evaluates R&D projects before, during and after their implementation. Based on the METI Guidelines for Technology Evaluation, and the Standard Evaluation Items and Criteria Based on the METI Guidelines for Technology Evaluation which were revised following the amendment of the National Guidelines, METI took specific measures to create an environment for promoting the efficient and effective implementation of evaluations. To date, it has conducted three preliminary evaluations, ten interim evaluations, and four post-hoc evaluations.

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). In accordance with the Guidelines for Incorporated Administrative Agency Evaluation (Decision of the Minister of Internal Affairs and Communications of September 2, 2014), national R&D agencies are evaluated by the competent ministers based on the recommendations of the Council for Research and Development. The main objective of this evaluation is to maximize R&D outcomes.

3 Promoting Policies Supported by Objective Evidence

In order to make effective use of limited resources to increase public trust in administration, the government is promoting Evidence-based Policymaking (EBPM) based on the final report of the Statistics Reform Promotion Council (decision of the Statistics Reform Promotion Council in May 2017). The government has been developing the EBPM promotion system by holding the EBPM Promotion Committee as a cross-ministerial function in August 2017 and by creating the office of Deputy Director-General for EBPM promotion in ministries in FY2018. It is also promoting practice of EBPM in each stage of policies, measures and businesses.

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 Integrated Innovation Strategy, 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 using the Cross-ministerial R&D Management System (e-Rad[1]). The CSTI uses the data collected by e-Rad to formulate objective policies to promote scientific and technological innovation.

NISTEP 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).

1 Electronic - Research and Development

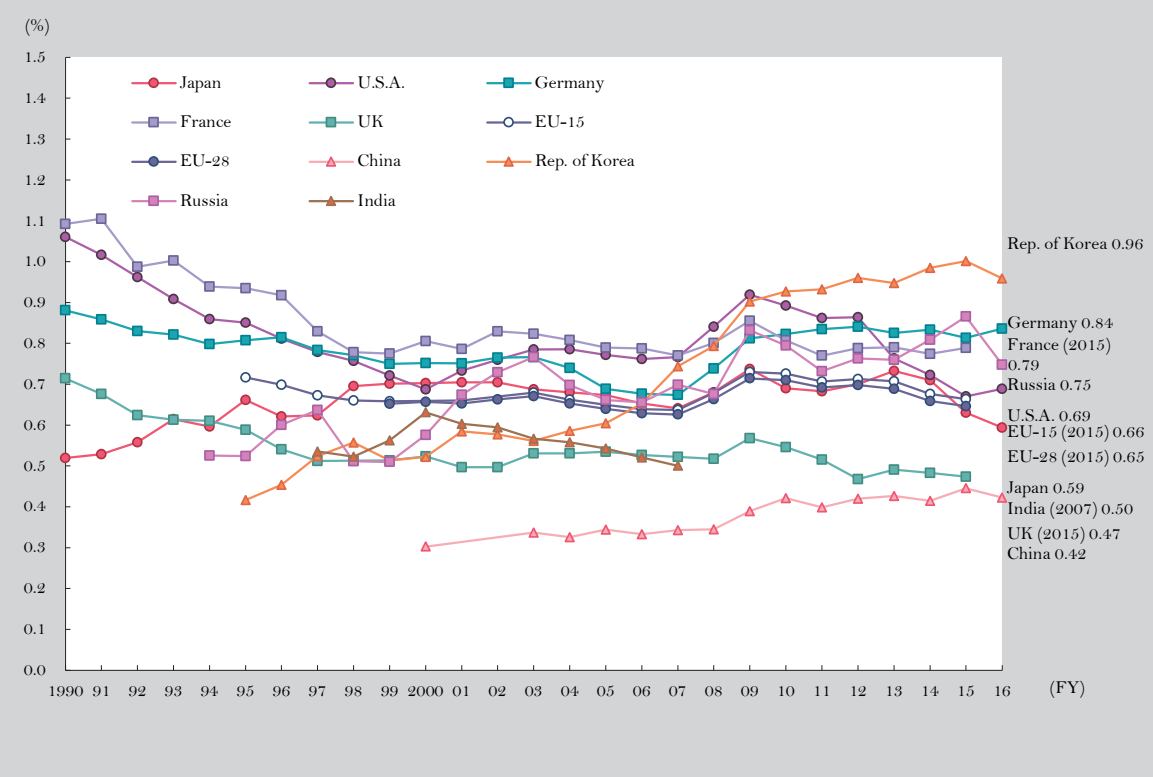
4 Strengthening the Leadership Functions of the CSTI

The CSTI has vigorously promoted the Strategic Innovation Promotion Program (SIP) and the Impulsing Paradigm Change through Disruptive Technologies Program (ImPACT), while also securing budget for the 2nd phase of SIP in the FY2017 supplementary budget and starting the project ahead of the schedule. The CSTI and the Council on Economic and Fiscal Policy jointly held a meeting of the Committee for the Activation of STI and Economy and Society in December 2016. Based on the final report on the "Public and Private Investment Expansion Initiative for Science and Technology Innovation" compiled by the committee, the CSTI is working to implement the three actions specified in the initiative: reforming budgeting processes, reforming systems to encourage greater R&D investment, and effective increase of public and private R&D investment based on evidence. For reforming budgeting process, CSTI decided the fields where ministries' measures to stimulate private R&D investment will have big effects toward establishment of the Public/Private R&D Investment Strategic Expansion PrograM (PRISM) in FY2018. For reforming systems to encourage greater R&D investment, the CSTI studied specific measures that will assist universities and national R&D agencies to acquire funds from various sources and smoothly distribute human resources, information and funds. For effective increase of public and private R&D investment based on evidence, the CSTI started to build the "Evidence System" for systematic collection and analysis of information from inputs through outputs and outcomes concerning STI policies.

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.

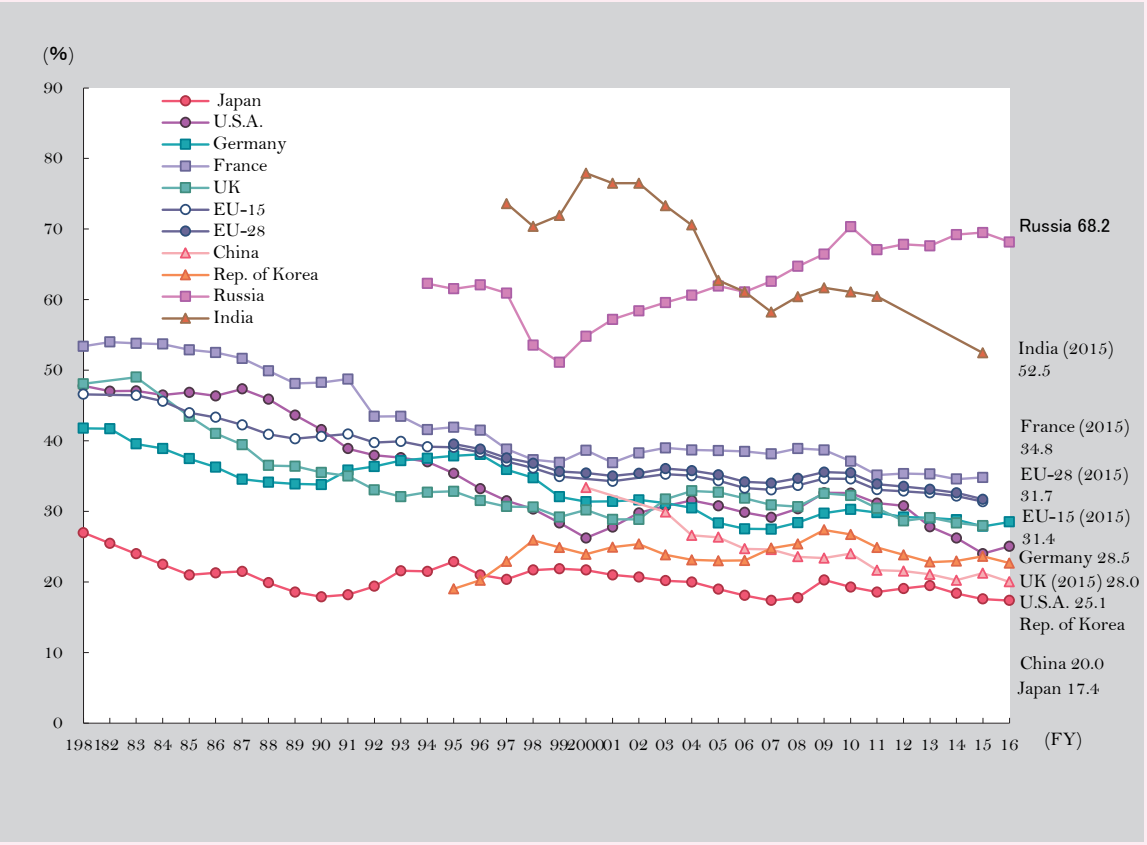
Figure 2-7-1/Trends in the percentage of Government-financed R&D Costs to Gross Domestic Product



Note: 1. Estimated by MEXT from the value of government-financed R&D costs and gross domestic product.
2. Government-financed R&D costs are estimated by MEXT from R&D expenditures and percentage of R&D expenditures financed by government (excluding Japan).
3. Humanities and social science are included in this analysis, except for the Republic of Korea up to FY2006.
4. The German values for FY1982, 1984, 1986, 1988, 1990, 1992, 1994, 1995, 1996, 1998, 2000 2002 and 2010 are estimated value.
5. The UK values for FY1981 and 1983 are estimated value by the OECD. The UK values for FY2008, 2009, 2010, 2012, 2014 and 2015 were estimated by other organizations.The UK values for FY2015 and 2016 were provisional.
6. The U.S.A. values for FY2015 and 2016 are provisional.
7. The EU values are calculated from provisional values, data from Eurostat and OECD estimates.
8. The Indian values for FY2006 and 2007 are estimated.

Source: Japan (government-financed R&D costs) – Statistics Bureau, MIC, Report on the Survey of Research and Development.
(GDP) Cabinet Office, National Accounts (Final) and National Accounts (Estimates)
EU: (R&D expenditures, GDP) Eurostat database
EU: (Percentage of R&D expenditures financed by government) OECD, Main Science and Technology Indicators, Vol. 2018/7.
India: UNESCO Institute for Statistics S&T database
Other countries: OECD, Main Science and Technology Indicators, Vol. 2018/7

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



Note: 1. Humanities and social science are included in this analysis, except for the Republic of Korea up to FY2006.
2. The UK values for FY1981 and 1983 are estimated value by the OECD. The UK values for FY2008, 2009, 2010, 2012 and 2014 were estimated value by other organizations.
3. The German values for FY1982, 1984, 1986, 1988, 1990, 1992, 1994, 1995, 1996, 1998, 2000 2002 and 2010 are estimated value.
4. The U.S.A. values for FY2015 and 2016 are provisional.
5. The Rep. of Korea values for FY2008-11 are estimated value.
6. The EU values were estimated by the OECD.
7. The Indian values for FY2006 and 2007 are estimated value. 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. 2018/7

(Government R&D investment)

Government R&D investment in FY2018 was 4.7921 trillion yen. The breakdown was 4.28 trillion yen (including the supplementary budget) from the central government and 510.1 billion yen from local governments. (As of March 2019; For details on R&D investment by the central government (See Chapter 1, Section 4, Paragraph 2.)