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

Effective, flexible implementation of the policies and measures stipulated in 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.

❶ 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 corporation designated by the minister set high-level goals toward the world's best education and research activities. Under this system, nine specified national university corporations have been designated as of FY2020.

While promoting donations through a sequence of tax reforms, the ministry made land loans possible in FY2017. In FY2020, the system was amended to promote diversification of financing sources through relaxing of requirements for long-term debts and bond issues.

In addition, MEXT has promoted the fundamental reform of graduate school education through the

Doctoral Program for World-leading Innovative & Smart Education, etc. 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)).

For industry-academia collaboration activities, MEXT promoted full-scale organization-to-organization collaboration among companies, universities and national R&D agencies. At the same time, 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 (see Chapter 4, Section 1, 2(3)).

In March 2020 MEXT formulated "Governance Code for National Universities" so that national universities can further enhance their education, research and social contribution functions while governing their management. In addition, MEXT is implementing a "Leading Initiative for Excellent Young Researchers" to support researchers and research institutions so that promising young researchers can obtain a stable and independent research environment in industry, academia and government research institutions and devote themselves to voluntary and self-directed research (see Chapter 4, Section 1, 1(1)).

The Cabinet Office established the PEAKS[1] university support forum for universities, industry and the government in May 2019. The forum is specifically discussing management challenges of universities and solutions, disseminating good examples leading to innovation creation, studying deregulation and fostering university management.

In order to encourage national universities to diversify the funds necessary for innovation, the Cabinet Office launched the "program to reinforce the environment for innovation by national universities" to distribute funds as incentives corresponding to the obtained external funds.

Section 2 Reforming the National R&D Agency System and Enhancing Its 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.

❶ Reform of the R&D Agency System

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

[1] Leaders' Forum on Promoting the Evolution of Academia for Knowledge Society

national R&D agencies (as of March 31, 2021), 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) passed in May 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.

In addition, the R&D Capacity Strengthening Act was amended in 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 the scope of the businesses subject to their investment, and enabled them to acquire and hold shares of agency-initiated ventures. In June 2020, the act was amended further to expand the scope of R&D corporations that are allowed to invest in businesses using their research outcomes and to specify joint research, etc. and other related things. These amendments are expected to create an enriched cycle of knowledge, human resources, and funds surrounding National 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).

❶ 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, in Japan (Tsukuba City, Ibaraki) in 2016, and in Italy in 2017. 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 May 2020, the ministers' meeting was held online hosted by the United States, mainly to discuss response to COVID-19. The meeting released G7 Science and Technology Ministers'

Declaration on COVID-19, which includes enhancement of research cooperation in the priority fields concerning the infection and promotion of disclosure of research results/data to the public.

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, held sessions on social and economic impacts of the COVID-19 crisis and climate change at the International Forum for Sustainable Asia and the Pacific (ISAP) in November 2020. As of 2020, 17 research organizations from seven 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 15th meetings were held in Malaysia in February and the 16th meetings were held online in August 2020 to discuss PPSTI activity plans and other matters.

(3) Association of Southeast Asian Nations (ASEAN)

As the cooperation framework for Japan and the ASEAN Committee on Science, Technology and Innovation (COSTI), the ASEAN-Japan Cooperation Committee on Science and Technology (AJCCST) has been held every year. MEXT is taking a leadership role in Japan's contribution to AJCCST. Under the Japan-ASEAN STI for SDGs Bridging Initiative agreed at AJCCST-9 in 2018, the ministry continues the cooperation to strengthen social implementation of ASEAN-Japan joint research results.

(4) Other

A. Asia-Pacific Regional Space Agency Forum (APRSAF)

Since 1993, Japan has been hosting the annual APRSAF that has provided a great opportunity to exchange information about space activities and utilization in the region and also to promote multilateral cooperation. The first meeting was attended by 60 participants from 13 countries. It had developed into the largest forum of space cooperation in the Asia-Pacific region in 2019 when the 26th APRSAF meeting was held with attendance by about 470 representatives of 31 countries and regions as well as the representatives of nine international organizations. In 2020, in response to the spread of COVID-19 infection, Japan held an online event gathering 620 participants from 31 countries and regions. The participants discussed methods to promote participation by industries including non-space industries as

[1] The meeting of the Group of Senior Officials

well as initiatives for sustainable space activities and space technologies to contribute to solution of social challenges.

B. 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 27th meeting of the GBIF Governing Board was held online in October 2020, with the participation of member countries and others. The budget for 2020 and the Implementation Plan were approved by the meeting.

C. Group on Earth Observations (GEO)

The 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 247 countries, international organizations and entities participate in the GEO as of March 2021.

The 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.

The 13th Asia-Oceania Group on Earth Observations (AOGEO) symposium was held in March 2021. Earth observation can contribute to finding solutions of social challenges under the COVID-19 pandemic and in the era after the pandemic.

D. Intergovernmental Panel on Climate Change (IPCC)

The 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 is currently in its sixth round of assessments. The IPCC has released the Special Report on Global Warming of 1.5 °C (October 2018), the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (May 2019,) the Special Report on Climate Change and Land (August 2019,) and the Special Report on the Ocean and Cryosphere in a Changing Climate (September 2019). Currently

the IPCC is in the drafting phase of the Sixth Assessment Report (AR6) scheduled for release in the period from 2021 to 2022.

E. Innovation for Cool Earth Forum (ICEF)

ICEF is an international conference launched in 2014 with the aim of gathering the world's leading experts from industry, academia, and government to discuss climate change countermeasures through innovation. The 7th annual meeting was held online in October 2020 under the theme "Beyond zero emissions society in light of COVID-19; with a focus on gender equality." Lectures and panel discussions were held at three plenary sessions and 10 sectional meetings attended by more than 1,300 participants from about 80 countries and regions.

F. Research and Development 20 for Clean Energy Technologies (RD20)

RD20 is an international conference gathering leaders of research institutions of G20 countries with the aim of creating discontinuous innovation toward sharp reduction of CO_2 emissions. At the second meeting held online in October 2020, representatives of research institutions of G20 countries discussed the present state and outlook of R&D on clean energy technology.

G. Argo Program

The Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and the Japan Meteorological Agency (JMA) in coordination with MEXT and other interested organizations 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, 1(1)).

H. Arctic Science Ministerial (ASM)

The third Arctic Science Ministerial (ASM3) was scheduled to be cohosted by Japan and Iceland in November 2020, but it was postponed in the light of the spread of COVID-19 infection. The meeting was held in Tokyo from May 8 (Sat) to 9 (Sun), 2021. It was the first ASM meeting held in Asia. The ASM is a ministerial meeting aimed at promoting research and observations in the Arctic and responding to major social issues. The theme of the third meeting was "Knowledge for a Sustainable Arctic."

I. Global Research Council (GRC)

The GRC is an international conference comprised of the heads of Research Councils from various countries. In 2020, GRC adopted the "Statement of Principles on Mission-oriented Research" and "Statement of Principles on Public Engagement."

Third Arctic Science Ministerial

❷ Utilization of international organizations

(1) United Nations system (UN system)

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

In 2019 the UN Interagency Task Team on STI for SDGs (UN-IATT) started the "Global Pilot Program" to promote studies for formulation of STI for SDGs roadmaps by individual countries. Under the program, Ethiopia, Ghana, Kenya, India and Serbia were chosen as the pilot countries. Japan as a partner country commenced support for Kenya and India, in particular, through the World Bank in 2020.

In addition, Japan in collaboration with the United Nations Development Programme (UNDP) started the "Japan SDGs Innovation Challenge for UNDP Accelerator Labs" for Japanese enterprises, etc. to consider commercialization to respond to actual needs.

Japan has been conducting studies for establishment of "STI for SDGs Platform ("the Platform")" to match the needs of developing countries with ST seeds of Japan. In this process, Japan implemented empirical projects where stakeholders in the actual locations and Japan exchange opinions on social challenges in Kenya from the stage of understanding of challenges to examination of solutions, and studied requirements for the platform.

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 Intergovernmental Oceanographic Commission (IOC), the Intergovernmental Hydrological Program (IHP), the Man and the Biosphere (MAB) Programme, 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 challenges. Japan is implementing support programs including the science human resource program in the Asia-Pacific region and the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) through contribution to UNESCO/Japanese-Funds-in-Trust, etc. Japan also promotes UNESCO activities by sending experts to contribute to discussions of committees/commissions.

C. The United Nations Decade of Ocean Science for Sustainable Development (2021-2030)

The United Nations Decade of Ocean Science for Sustainable Development (2021-2030) is an international framework for concentrated initiatives for the ten years from 2021 to 2030 in order to attain the United Nations Sustainable Development goals including SDG14 through promotion of ocean science. It was proclaimed by the 72nd United Nations General Assembly (UNGA) in December 2017. IOC-UNESCO formulated its Implementation Plan and submitted it to the 75th UNGA in 2020. The 75th UNGA took note of the plan with appreciation through its Resolution on Oceans and Laws of the Sea (December 2020). The United Nations Decade of Ocean Science for Sustainable Development (2021-2030) was launched in January 2021.

As societal outcomes to be achieved through the initiatives over the 10 years, the plan presents: (1) A clean ocean, (2) A healthy and resilient ocean, (3) A productive ocean, (4) A predictable ocean, (5) A safe ocean, (6) An accessible ocean, (7) An inspiring and engaging ocean. To this end, 10 challenges will be addressed, which include reduction in marine pollution, preservation of the marine ecosystem, improvement of marine literacy and change in human behavior. With the aim of contributing to these societal outcomes, Japan is promoting industry-academia-government-civilian collaboration which involves relevant government offices and agencies and is advancing various initiatives at regional, national and international levels.

(2) Organisation for Economic Co-operation 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 on Digital Economy Policy (CDEP), the Committee on Industry, Innovation and Entrepreneurship (CIIE), the Nuclear Energy Agency (NEA), and the International Energy Agency (IEA), etc.

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 2020, as

outcomes of the project, the following reports were released: "Optimization of the operation and use of national research infrastructure," "Addressing social challenges by using transdisciplinary research" and "Building digital workforce capacity and skills for data-intensive science."

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

The TIP studies how STI can contribute to economic growth through policies. In 2019, it discussed co-creation in industry-academia-government collaboration with citizen participation, and innovation policy for continued and inclusive growth, for example.

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, directs and coordinates OECD statistical work and contributes to the development of indicators and quantitative analyses, which are helpful for the promotion of STI policies. Specifically, with regard to science, technology and innovation indicators related to R&D expenditures, science and technology human resources and other factors, NESTI has been discussing and examining the development of survey methodologies and indicators as well as frameworks for international comparisons of indicators.

(3) International Science and Technology Center (ISTC)

The ISTC is an international organization established 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. Today ISTC supports research activities of scientists in a broad area beyond Russia and the CIS with contribution from Japan, the United States, EU, ROK and Norway.

❸ 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.

❹ 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 the 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 to solve issues common to the nations in the Asia-Pacific region. In February 2021, the 24th intergovernmental meeting was held, and the 5th Strategic Plan was adopted toward further development of its activities. The ninth annual LoCARNet (Low Carbon Asia Research Network) meeting was held online in March 2021 with the aim of sharing the latest research outcomes and knowledge toward low-carbon growth of Asia.

❺ Cooperation with Other Countries

(1) Cooperation with the United States and European countries

Japan has been advancing science and technology cooperation with the United States and European countries in advanced research areas such as life sciences, nanotechnology, materials science, environmental sciences, nuclear energy 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.

Based on the Agreement between the Government of Japan and the Government of the United States of America on Cooperation in Research and Development in Science and Technology signed in June 1988, the two countries have set up the U.S.-Japan Joint High-Level Committee Meeting on Science and

Technology Cooperation (minster level) and the Joint Working-Level Committee Meeting on Science and Technology Cooperation.

With the EU, then MEXT Minister HAYASHI Yoshimasa and then 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 the agreement, the Japan Agency for Medical Research and Development (AMED) and the European Research Council (ERC) expanded research exchange by signing an Implementing Arrangement on implementation of research exchange in November 2020. Earlier in May 2020, the Cabinet Office and the European Commission signed a document expressing their opinions on further development of Japan-EU science, technology and innovation cooperation, which was welcomed by the heads on both sides. MIC, the National Institute of Information and Communications Technology (NICT) and the European Commission held the seventh EU-Japan symposium on international joint research in December 2018. Based on the result of the symposium, MIC and the EU started the 5th Japan-EU joint open call of research in the field of eHealth in November 2019 and adopted one project in October 2020. Studies for the next joint calls have been made on a continuing basis. In November 2020 Japan and the Finland held a Joint Committee on Scientific and Technological Cooperation, where attendants discussed further promotion of S&T cooperation between the two countries.

(2) Cooperation with China and the Republic of Korea

Based on the memorandum that was signed when Prime Minister ABE Shinzo visited China in October 2018, the 1st Japan-China Innovation Cooperation Dialogue was held in Beijing in April 2019. The Strategic International Collaborative Research Program (SICORP) (environment and energy) in China set up its base in the Shanghai Jiao Tong University in 2020.

In terms of the trilateral collaboration of Japan, China, and the Republic of Korea, the A3 Foresight Program conducted joint public invitation and adopted two proposals. The Japan-China- ROK science and technology policy seminar was held online for the first time in cooperation among the National Institute of Science and Technology Policy (NISTEP), MEXT and government-affiliated science and technology policy research institutes of China and the ROK.

(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. Institutions of East Asia Summit member countries participate in the program that covers seven fields: materials (nanotechnology), agriculture (food), alternative energy, health research (infectious diseases and cancer), disaster risk reduction and management, environment (climate change and marine science) and advanced interdisciplinary research towards innovation. The health research field has been supported by the Japan Agency for Medical Research and Development (AMED) since April 2015. In FY2020, urgent public invitation was made for joint research projects on COVID-19 infection.

As for Collaboration Hubs for International Research Program (CHIRP) in the SICORP, 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, aiming to promote Japan's identifiable and sustainable contribution, while also building research networks and fostering young researchers. In November 2020, JST held the 10th Japan-India Joint Science Technology Committee Meeting as a teleconference. The attendants were appreciative that the cooperation in the S&T field has been promoted continuously.

(4) Cooperation with Russia

Japan and Russia hold meetings of the Joint Committee on Science and Technology Cooperation based on the Agreement between the Government of Japan and the Government of the Russian Federation on Scientific and Technical Cooperation signed in September 2000.

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, the plan is being put into concrete shape by the two countries. In September 2017, MEXT and the Ministry of Education and Science of the Russian Federation signed the "Memorandum of Cooperation on the Japan-Russia Science and Technology Joint Project" in Vladivostok, Russia. Based on this memorandum, both countries have been implementing joint research on priority cooperation areas: "Rational nature management including Arctic research" and "Energy efficiency" and "Nuclear science".

(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. MEXT convened the "Africa-Japan Ministerial Dialogue Meeting on STI for SDGs" as an official side event of the 7th Tokyo International

Conference on African Development (TICAD7[1]) in 2019. Based on the discussions at the meeting, AJ-CORE which is a program of joint research by Japan and more than two African countries with the leadership of Japan and South Africa started research invitation in December 2019 and adopted four projects in February 2021.

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 Integrated Innovation Strategy- depending on the status of priority policy implementation. In addition, the CSTI has been strengthening its leadership functions.

❶ Following up the Basic Plan

In order to promote STI policies based on objective grounds, the 6th Basic Plan stipulates that progress and achievements of the plan shall be assessed by setting goals, key indicators and reference indicators. Assessment will be made continuously by the Expert Panel on Evaluation of the Council for Science, Technology and Innovation (CSTI). The results will be used for development of annual strategies and the next basic plan, and review of the 6th Basic Plan as needed.

MEXT—which plays a central role in promoting scientific and technological innovation—will monitor the changing situation comprehensively not only based on the indicator values but also by using qualitative information toward effective policy making and improvement according to the situation.

❷ 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.

Based on the Guideline on the Method of Evaluation for Government R&D in MEXT (decided by the MEXT Minister on June 20, 2002) that was revised to ensure consistency with the revised National Guidelines, MEXT evaluates the R&D projects. And toward full-scale R&D program evaluation, MEXT

[1] Tokyo International Conference on African Development

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, both of which were revised following the amendment of the National Guidelines, METI is tackling effective evaluation that constitutes a part of the PDCA cycle in order to help efficient and effective operation of R&D projects.

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. Revised on March 12, 2019.), 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.

❸ 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 is also promoting practice of EBPM in each stage of policies, measures and businesses.

In order to promote EBPM, the Cabinet Office is constructing an evidence system (e-CSTI), which consists of: (1) visualization of the S&T budgets; (2) visualization of the research capacity; (3) visualization of the status of acquisition of external funds; (4) visualization of industry needs related to human resource development, and (5) visualization of the visions that academia should pursue in the communities. The Cabinet Office shares its analysis and other functions with related organizations. In FY2020, universities and other research institutes started to use e-CSTI and a site was launched to disclose its publicly available part.

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 conducts R&D management including disclosure of information of public invitation for competitive funding and reception of applications by using the Cross-ministerial R&D Management System (e-Rad). CSTI uses the data collected by e-Rad to promote scientific and technological innovation policies based on scientific evidence. e-Rad is also used for construction of e-CSTI.

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). Especially in FY2020, NISTEP promptly conducted survey of the impact of COVID-19 infection on science and technology in Japan[1] and provided information that helped policy making for improvement of the conditions of the research sites.

Column 2-17 Toward Analysis of Factors of Stagnant Research Capacity - Challenges for Academic Paper Production in Japanese Universities.

Over the past 10 years, academic paper production was stagnant in Japan, while the number of academic papers produced in major countries of the world is increasing. It is suggested that Japan's status has deteriorated as a result. With the aim of clarifying the factors of stagnant academic production, MEXT NISTEP organized long-term macro data of the number of papers, number of researchers and R&D expenses of Japanese Universities since 1980s and also analyzed the data covering the period when the number of papers were increasing in Japan.

The figure is a result of estimation of changes in the number of papers (covering all universities in science, engineering and agricultural fields) with an integer count (in the case of multiple authorship involving multiple countries, one count is given to each country). Bars represent the estimated value of contribution of each factor to the change in the number of papers; yellow lines show the estimated values of the change in the number of papers; red lines show the actual values of the change in the number of papers, and grey bands represent 95% confidence interval of the estimation results.

Analysis by dividing the period into (1)" from the latter half of 1980s to 1990s" when the number of papers increased, and (2)" from the mid-2000s to the early 2010s" when the number decreased and (3) "the 2010s" when the number remain stagnant shows the following tendency:

① From the latter half of the 1980s to the 1990s: the average increase rate of the number of papers of all universities was about 6%. Major factors of the increase are the increase in the number of teachers when their research hours were considered in calculation, the number of doctoral students and material expenses

② From the mid-2000s to the early 2010s: the average increase rate of the number of papers of all universities was about -0.6%. The major factor of the decrease is the decrease in the number of teachers when their research hours were considered in calculation. Because the number of teachers remained mostly level when their research hours were not considered in calculation, the decrease in the number of teachers when their research hours were considered in calculation can be explained by the decrease in the ratio of research hours,

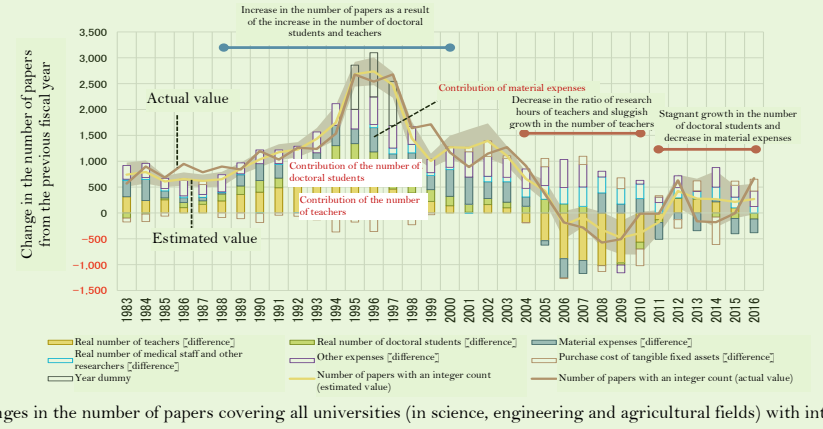
③ The 2010s: the average increase rate of the number of papers of all universities was about 0.4%. The change is small during this period. Decrease in the material expenses and the number of doctoral students and other factors contributed to the stagnant production since 2011.

As shown above, the stagnant academic paper production in Japan since the mid-2000 is attributable to multiple factors including: 1) decrease in the number of teachers when their research hours were considered in calculation as a result of decrease in the ratio of research hours of teachers (from the mid-2000s to around the 2010s) ; 2) decrease in the number of doctoral students (since around 2010), and; 3) decrease in expenses directly related to implementation of research, which include material expenses (since around 2010s).

"Research Capacity Improvement Reforms 2019" of MEXT and "Comprehensive Package to Strengthen Research Capacity and Support Young Researchers" of CSTI also recognize the research hours and number of doctoral students as the challenges to be tackled in order to strengthen Japan's research capacity. It is considered that steady carrying out of measures provided in the initiatives above will be effective for re-acceleration of Japan's research capacity.

[1] https://www.nistep.go.jp/coronavirus

Attention should be paid to the fact that this is a macro analysis lumping all universities together. In actuality, a certain increase in a certain input may not necessarily lead to similar increase in the number of papers of every university. Individual factors' contribution to the overall change may not be the same. For this reason, it is necessary to consider the size and role of the university rather than applying the same measures to all university.



Estimated changes in the number of papers covering all universities (in science, engineering and agricultural fields) with integer counting
Provided by MEXT NISTEP

Note 1: Because the number of papers extremely increased from 1995 to 1996 compared with other periods, year dummies are included to control its impact.
Note 2: The number of papers, the number of researchers and R&D expenses were analyzed with a 2-year time lag.
Source: "Analyses on the production of scientific publications in Japanese universities using long-term input and output data" MEXT NISTEP 2020, DISCUSSION PAPER No.180

❹ Strengthening the Leadership Functions of the CSTI

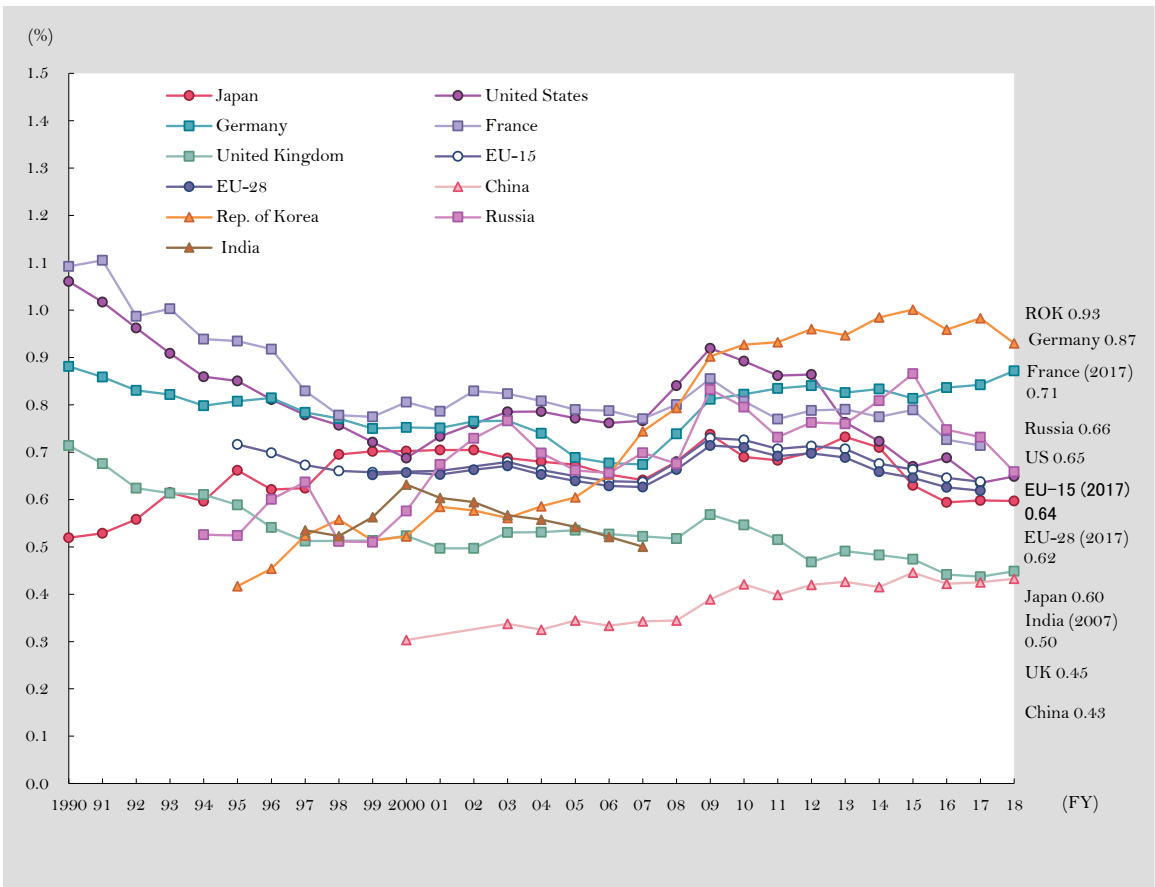
Toward further fulfillment of its headquarter function, the CSTI is powerfully advancing the "Cross-ministerial Strategic Innovation Promotion Program (SIP)" and "Public/Private R&D Investment Strategic Expansion Program: PRISM." Based on the Act for Partial Amendment of the Science and Technology Basic Act (Act No.63 of 2020,) and in order to enhance the headquarter function, a science and technology innovation promotion office was established at the Cabinet Office for cross-ministerial coordination of science and technology innovation policies.

Section 5 Ensuring R&D Investment for the Future

Science, technology and innovation are essential for meeting the global agenda including pandemics and climate change and also for enhancing international competitiveness. Other countries are planning large investments in STI with a view to the era after the COVID-19 pandemic. In order to prevail in a firce competition among nations, Japan needs to spur investments in bold R&D, which will include promotion of new types of investment such as ESG investment and impact investment.

With the aim of greatly expanding public and private investments while using diverse funds, the 6th Basic Plan set the goal of about 30 trillion yen for total government R&D investments and the goal of about 120 trillion yen for total public and private R&D investments.

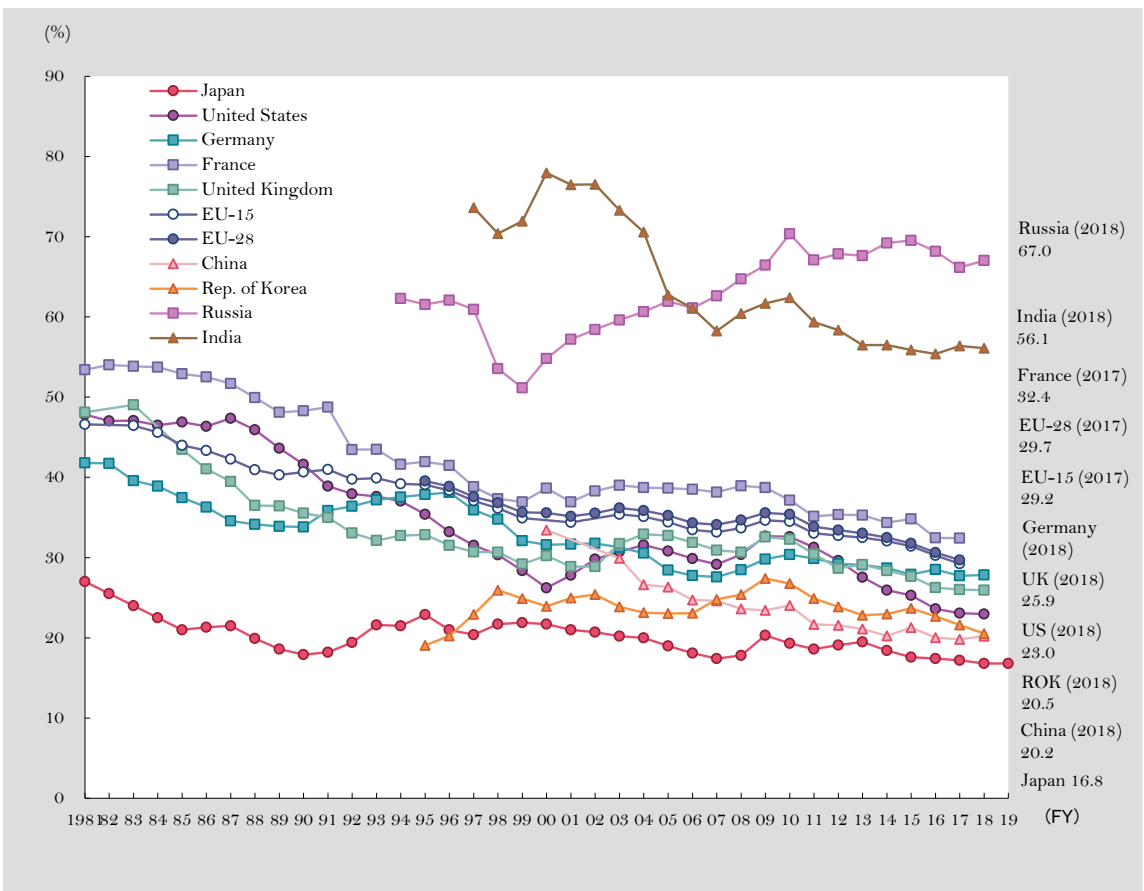
■ Figure 2-7-1/Trends in the percentage of Government-financed R&D Costs to Gross Domestic Product ■



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 sciences are included in this analysis, except for the Republic of Korea up to FY2006.
4. The UK values for FY1981 and 1983 are estimated value by the OECD. The UK values for FY1981, 1983, 2008-2010, 2012, 2014 and 2016 were estimated by other organizations.
5. The German values for FY1982, 1984, 1986, 1988, 1990, 1992, 1996 and 19998 are estimated value.
6. France values for FY2017 are provisional.
7. The U.S.A. values for FY2017 are provisional and those for 2018 are estimated.
8. The EU values are calculated from provisional values, data from Eurostat and OECD estimates.
9. 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
(Percentage of R&D expenditures financed by government) OECD, Main Science and Technology Indicators, Vol. 2020/11.
India: UNESCO Institute for Statistics S&T database
Other countries: OECD, Main Science and Technology Indicators, Vol. 2020/11.

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



Note: 1. Humanities and social sciences 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, 2014 and 2016 were estimated value by other organizations.
3. The German values for FY1982, 1984, 1986, 1988, 1990, 1992, 1994, 1995, 1996 and 1998 are estimated value.
4. The French values for FY2017 are provisional.
5. The U.S.A. values for 2017 are provisional and those for 2018 are provisional and estimated.
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. 2020/11

(Government R&D investment)

Government R&D investment in FY2019 was 5.7520 trillion yen. The breakdown was 5.2221 trillion yen (including the supplementary budget) from the central government and 529.9 billion yen from local governments. (As of February 2020; For details on R&D investment by the central government (See Chapter 1, Section 4, Paragraph 2.)