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.

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, seven specified national university corporations have been designated as of FY2019.

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, 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)).

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 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 1, 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 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"

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

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. In May 2019 RIKEN made application for authorization of the investment to a corporation supporting utilization of research results based on the amended Act. After examination and authorization by MEXT, RIKEN Innovation Co., Ltd. was established in September. 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) G20 Osaka Summit

G20 Osaka was held in June 2019. In their Declaration the leaders shared the visions of "Data Free Flow with Trust" (free flow of data under a reliable rule" and Society 5.0 that is a human centered future society promoted by Japan. The leaders welcomed the human-centered approach to AI as well as "G20 AI Principles" that was agreed upon at the meeting of the G20 Trade Ministers and Digital Economy Ministers at Tsukuba. The principles include "inclusive growth, sustainable development and well-being," "human-centered values and fairness," "transparency and explainability," "robustness, security and safety" and "accountability." They also agreed to encourage networking and experience-sharing among cities for the development of smart cities and endorse the Guiding Principles for the Development of STI[1] for SDGs Roadmaps.

(2) 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

1 Science, Technology and Innovation

solve global issues using S&T. 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.

(3) Asia-Pacific Economic Cooperation (APEC)

Meetings of the APEC Policy Partnership on Science, Technology and Innovation (PPSTI) are held to promote scientific and technological innovation in the APEC region through joint projects and workshops. The 13th and 14th meetings were held in May and August 2019 in Chile to plan PPSTI activities.

(4) 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. At the 9th ASEAN-Japan Cooperation Committee on Science and Technology (AJCCST-9) in October 2018, 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. The launch of the initiative was welcomed also in the Chairman's Statement of the subsequent 21st Japan-ASEAN Summit held in Singapore in November. Based on the above and the discussions at the 10th ASEAN-Japan Cooperation Committee on Science and Technology (AJCCST-10) held in Bali, Indonesia in June 2019, "The 1st Japan-ASEAN Multi-Stakeholder Strategic Consultancy Forum" was co-hosted by MEXT and the Ministry of Higher Education, Science, Research and Innovation (MHESI) of Thailand in Bangkok, Thailand, in October. The forum that was held under the theme of "sustainable energy, featuring mainly bioenergy" gathered about 135 participants from ministries, agencies, research communities and private enterprises of Japan and ASEAN countries.

(5) Other

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

Since 1993, Japan has been hosting the annual APRSAF, the largest forum of space cooperation in the Asia-Pacific region. This forum has provided a great opportunity to exchange information about space activities and utilization in the region as well as for promoting multilateral cooperation. The 26th APRSAF meeting was held in Nagoya in November 2019. The meeting was attended by about 470 participants, including the representatives of 31 countries and regions as well as the representatives of nine international organizations. Under the theme "Advancing Diverse Links Toward a New Space Era" the participants discussed policy issues that are the focus of increasing interest in the Asia-Pacific region, which include efforts toward space exploration and stable use of space (e.g. space debris management) and affirmed the importance of collaboration in the region. In addition, a discussion was held between

1 The Group of Senior Officials

representatives of the young generation including teens and heads of space agencies. At the closing, the "Nagoya Vision" was adopted which had set four goals addressing the direction of activities over the next 10 years while looking ahead to the next quarter century.

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 26th meeting of the GBIF Governing Board was held in Leiden, Netherlands in October 2019, with the participation of member countries and others. The purpose was approval of the budget for 2020 and of the Implementation Plan.

C. 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 245 countries, international organizations and entities. participate in GEO as of February 2020.

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 2019, the GEO Ministerial Summit was held in Australia. At this meeting, the members adopted the "Canberra Declaration" that reaffirms the importance of sustained Earth observations and data sharing and welcomes utilization of Earth observation for economic growth in addition to climate change, disaster risk reduction and sustainable development.

D. 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 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 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 on the initiative of Prime Minister ABE Shinzo with the aim of gathering the world's leading experts from industry, academia, and government to discuss climate change countermeasures through innovation. The 6th annual meeting was held in 2019 under the theme "Innovation and Green Finance" for bending world's CO2 emission curve down. Lectures and panel discussions were held at three plenary sessions and 12 sectional meetings attended by more than 1,000 participants from about 70 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 on the initiative of Prime Minister ABE Shinzo with the aim of creating discontinuous innovation toward sharp reduction of CO2 emissions. The first meeting held in Tokyo in October 2019 gathered about 300 participants including representatives of research institutions of G20 countries. They discussed the present state and outlook of R&D on clean energy technologies with focus on hydrogen and CCUS.

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, 1(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. Then Minister of Education, Culture, Sports, Science and Technology SHIBAYAMA Masahiko, attended the second round held in Berlin in October 2018. Japan co-hosted the third round with Iceland and proposed and received approval to hold this meeting in Japan in 2020. This will be the first ASM meeting held in Asia and will be held in Tokyo.

Second Arctic Science Ministerial (the fifth person from the right in the front row is then 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 eighth annual GRC meeting was held in Sao Paulo in May 2019, co-hosted by the São Paulo Research Foundation (FAPESP[2]), German Research Foundation (DFG[3]) and the National Scientific and Technical Research Council of Argentina (CONICET[4]). Over 49 agency heads from around 45 countries

1 White House Arctic Science Ministerial
2 English: São Paulo Research Foundation (Portuguese: Fundação de Amparo à Pesquisa do Estado de São Paulo)
3 English: German Research Foundation (German: Deutsche Forschungsgemeinschaft)
4 English: National Scientific and Technical Research Council of Argentina (Spanish: Consejo Nacional de Investigaciones Científicas y Técnicas)

discussed research support issues and the roles of Research Councils. They also approved an outcome document titled the "2019 GRC Statement of Principles: Addressing Expectations of Societal and Economic Impact."

2 Utilization of international organizations

(1) United Nations system (UN system)

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

The Advisory Board for the Promotion of Science and Technology Diplomacy (chaired by then Science and Technology Advisor to the Minister for then Foreign Affairs KISHI Teruo) formulated a recommendation titled "Recommendation for the Future: STI as a Bridging Force to Provide Solutions for Global Issues" in May 2017. The recommendation covers promotion of collaboration between different sectors including private enterprises and civil society, concrete initiatives of science and technology diplomacy toward achievement of SDGs, which include human resource development in the science and technology fields. In May 2018 the board submitted the Recommendation on the Science, Technology and Innovation to Achieve the SDGs and its Guiding Tool, the STI Roadmap. Based on these recommendations, the G20 Osaka Summit held in June 2019 confirmed the importance of STI and the fact that effective involvement of various stakeholders including the governments, academia, research institutions, civil society, private sector and international organizations is essential for utilization of potential of STI. "Guiding Principles for the Development of Science, Technology, and Innovation for SDGs Roadmaps (STI for SDGs)" created by G20 Development Working Group was approved as an annex to the G20 Osaka Leaders' Declaration.

In parallel with these efforts, the UN Interagency Task Team on STI for SDGs (UN-IATT) started activities called the "Global Pilot Program" to promote studies for formulation of roadmaps by individual countries. Five countries: Ethiopia, Ghana, Kenya, India and Serbia were chosen as the first pilot countries. In order to support these five countries in cooperation with the EU and international organizations, Japan commenced studies toward support for formulation and implementation of roadmaps by Kenya and India, in particular.

Furthermore, Japan has been conducting studies for establishment of" STI for SDGs Platform" to match needs of developing countries with ST seeds of Japan. On the sidelines of the Tokyo International Conference on African Development (TICAD7) in August 2019, the "SDGs Solution Hub" was released. This is a website to introduce Japan's excellent science and technologies, which can contribute to achievement of SDGs by developing countries in Africa and other places, as well as their utilization examples.

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[1], the Intergovernmental Hydrological Program (IHP), the Man and the Biosphere (MAB) Programme, UNESCO Global Geoparks, the International Bioethics Committee (IBC) and the Intergovernmental

1 Intergovernmental Oceanographic Commission

Bioethics Committee (IGBC), international rules are formulated and projects are implemented towards solving global challenges. Japan also promotes 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 capacity development on science and technology in the Asia-Pacific region etc.

(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 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), 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 2019, a workshop and an experts' meeting of one of its projects on "Addressing Societal Challenges using Transdisciplinary Research" were held in Tokyo.

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, 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.

(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 Kazakhstan. In December, the Agreement on the Continuation of the ISTC was signed by representatives of Japan, the U.S.A., the EU, the European Atomic Energy Community, Norway, the Republic of Korea, Kazakhstan, Armenia, Kyrgyzstan, Georgia, 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 41st Steering Committee meeting in Kobe in July 2019. The eighth annual LoCARNet (Low Carbon Asia Research Network) meeting was held in Beijing in November 2019 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 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. In May 2019, the U.S.-Japan Joint High-Level Committee Meeting on Science and Technology Cooperation was held in Washington. From Japan, then Minister of State for Science and Technology Policy HIRAI Takuya and then MEXT Minister SHIBAYAMA Masahiko attended the meeting as co-chair and confirmed the intention to strengthen Japan-U.S. cooperation in AI, the Moonshot Program, quantum technology and other fields. During their visit to the United States, Minister Hirai and Minister Shibayama made a visit to the Executive Secretary of the National Space Council Scott Pace. Minister Shibayama also paid a visit to National Aeronautics and Space Administration (NASA) Administrator James Bridenstine and exchanged opinions on Japan-U.S. space 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, research exchange with the European Research Council (ERC) has been implemented according to the Implementing Arrangement (IA) signed by the Japan Science and Technology Agency (JST) and the European Commission. In the field of quantum technology, the Japan-EU workshop was held in Europe in September 2018 and the Japan-U.S.-Europe joint workshop was held in Japan in December 2019. Joint research support is also provided in the field of Arctic science. MIC, the National Institute of Information and Communications Technology (NIST) 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 public invitation of research in the field of eHealth in November 2019 as the 5th invitation of the program. Studies for the subsequent invitations have been made on a continuing basis. In December 2019 Japan and the EU held a Japan-EU Joint Committee on Scientific and Technological Cooperation, where parties concerned discussed further promotion of Japan-EU cooperation.

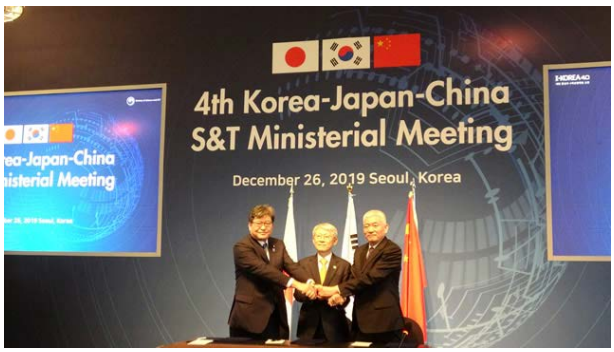
Japan also convened the Joint Committee on Science and Technology Cooperation with: Netherlands in July 2019, Serbia in January 2020.

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 May 2019 then Minister of State for Science and Technology Policy HIRAI

Takuya had talks with EC Vice President for Digital Single Market Andrus Ansip and EC Commissioner for Research, Science and Innovation Carlos Moedas. The Minister and Vice President Ansip discussed AI ethics and social principles. The minister and Commissioner Moedas agreed to open discussions on the system for Moonshot-type R&D and collaboration with EU's Horizon Europe. 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

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. There have been various Japan-China exchange events in the field of science and technology, which include the "Japan-China University Fair and Forum in China 2019" held by JST and the Ministry of Science and Technology of the People's Republic of China in Chengdu in May and "the 12th China-Japan Science and Technology Policy Seminar" held jointly by MEXT, the Chinese Academy of Sciences and JST in Kochi in September. Furthermore, Japan started to support the scheme of the SICORP Collaboration Hubs for International Research Program (Environmental and Energy fields) in China from March 2019.



4th Korea-Japan-China S&T ministerial Meeting
Source: MEXT

In terms of the trilateral collaboration of Japan, China, and the Republic of Korea, the 4th Korea-Japan-China S&T Ministerial Meeting was held in Seoul, ROK, for the first time in 7 years. MEXT Minister HAGIUDA Koichi and others attended the meeting from Japan. The participants of the meeting affirmed the importance to promote cooperation among research institutes of the three countries. The current cooperation includes: the meetings of heads of Japanese, Chinese and Korean academic organizations and the A3 Foresight Program held among JSPS and the academic organizations of China and ROK, and; the Japan-China- ROK science and technology policy seminar held among the National Institute of Science and Technology Policy (NISTEP), MEXT and government-affiliated science and technology policy research institutes of China and ROK. The Ministers agreed to hold the 5th Korea-Japan-China S&T Ministerial Meeting and the 3rd young scientist workshop in Japan in 2021 and so on.

(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: 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.

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 with a focus on direct communication, while also building research networks and fostering young researchers.

(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 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, 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. From 2018 to 2019, the Cabinet Office and the Ministry of Foreign Affairs (diplomatic missions abroad) implemented the SIP Caravan in Argentina, Brazil and other countries by taking an opportunity of an overseas business trip of the Science and Technology Advisor to the Minister for Foreign Affairs. In September 2019, Japan held the 16th meeting of the Joint Committee on Science and Technology Cooperation with Australia, where parties concerned discussed further promotion of Japan-Australia cooperation.

Human resource development and exchanges, as well as collaborative research, are promoted for the future with emerging countries. In August 2019, MEXT, with cooperation of JSPS, AMED and JICA

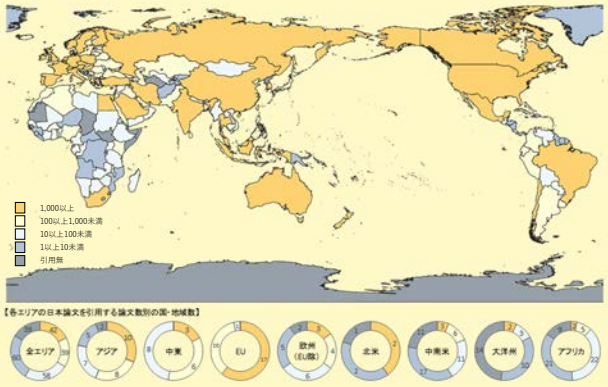
convened the "Africa-Japan Ministerial Dialogue Meeting on Science, Technology and Innovation for Sustainable Development Goals (STI for SDGs)" as an official side event of the 7th Tokyo International Conference on African Development. Opinions on promotion of science and technology cooperation and other topics were exchanged with the representative of the African Union and ministers of 17 African countries. In December MEXT opened an invitation for proposals for research under AJ-CORE[1] which is a program of joint research by Japan and more than two African countries with the leadership of Japan and South Africa.

1 Africa-Japan Collaborative Research

Column 2-14 Overview of the International development of Japan's research activities plotted on a world map

As countries in the world are promoting strategic international activities on science, technology and innovation, how is the current state of international contribution and cooperation of Japan's research activities? Here is an overview of citations from and international co-authorship of about 110,000 Japanese papers(*1) published in 2014, which are plotted on a world map.

(1) Contribution of Japanese papers on countries/regions in the world (citations)



Geographical distribution of papers citing Japanese papers (number of citations) (excluding Japan)
Source: NISTEP

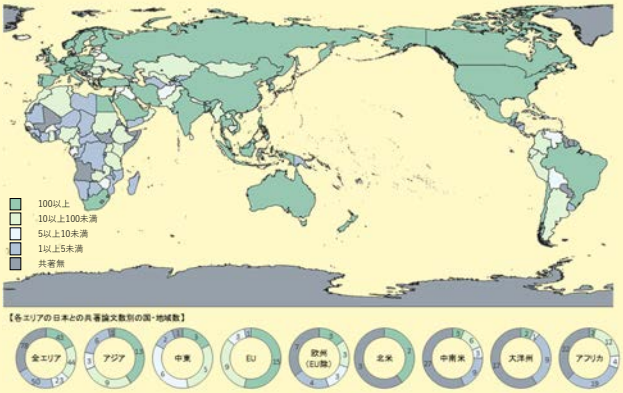
Approximately 60,000 of 110,000 Japanese papers published in 2014 were cited in other countries/regions in three years from 2014 to 2016. Namely, approximately 54% of them contributed to papers created in the world.

By country/region, Japanese papers were cited from 199 countries/regions (83.6% of 238 countries/regions) papers in three years after publishing. The top three countries in the number of citing Japanese papers are China, the United States and Germany in this order. Many of the countries/regions with a large number (more than 1,000) of citing Japanese papers are in the EU, North America and Asia. Japanese papers make more contribution to papers created in these areas.

(2) Cooperation in paper writing with other countries/regions (international co-authorship)

About 28,000 (25%) Japanese papers in 2014 were written jointly with researchers of other countries/regions.

In 2014, co-authorship of Japanese papers was conducted by researchers of 160 countries/regions, or 67.2% of all countries/regions (238). The top three countries regarding the number of paper co-authorships with Japanese researchers are the United States, China and Germany in this order. Many of the countries/regions with a large number (more than 100) of paper co-authorship with Japanese researchers are in the EU, Asia and North America. Japanese researchers are writing a large number of papers jointly with researchers in these areas.



Geographical distribution of paper co-authorship with Japanese researchers
Source: NISTEP

Visualization on a world map enables overview of the level of the international relationship with Japan in research activities for each country/region. Contribution of elucidation of the relationship with various countries/regions might lead to a new direction of strategic international activities. The column can show only one example, but we hope that the data can be used for strategic international development of science, technology and innovation policies in the future.

*1 Papers with more than one author belonging to a Japanese institution. We used Scopus of Elsevier for this analysis.
Source: NISTEP RESEARCH MATERIAL No.285: "Analysis on the international expansion of research activities in Japan focusing on citation and co-authorship of papers"

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.

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.

The CSTI set up an expert committee for examination of the basic plan on April 18, 2019. For study toward the 6th Basic Plan, the committee has been reviewing the status of achievement of the target values, key indicators, etc. set by the 5th Basic Plan.

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.

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 eight preliminary evaluations, seven interim evaluations, and six 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.

In order to promote "policy making based on evidence" CSTI is constructing an evidence system that can be used for investigation of the structure and cause of a mountain of issues. The evidence system has five analysis functions: (1) visualization of science and technology budgets; (2) analysis of research capability; (3) analysis of external funds acquisition by universities, etc.; (4) analysis of human resource development by universities, etc. and ;(5) grand design of universities, etc. in the communities. The system enables information sharing not only by government offices but also universities and other research institutions. The system became available in the government within FY2019. CSTI is working on construction toward start of use by universities and other research institutions.

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 discloses information of public invitation for competitive funding and conducts R&D management including reception by using the Cross-ministerial R&D Management System (e-Rad[1]). 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

Column 2-15 Trends of Sports Science Research Papers

This column shows the result of an analysis of papers related to sports science and introduces characteristics of sports science study and changes in the number of papers by country/region.

Figure 1 shows the changes in the number of papers and journals on sports science for the period from 1981 to 2017. Sports science has grown into a study area with nearly 10,000 papers annually in recent years.

Figure 2 shows the percentage of the related subject categories of sports science research papers for the period from 2013 to 2017. The subject category with the highest percentage is orthopedics followed by physiology, surgical medicine and rehabilitation. The papers are related to a broad range of subject categories including three psychology categories, hospitality/leisure/sports/tourism, engineering/biomedicine, public health/environmental hygiene/occupational health, pedagogy/educational research and geriatrics/gerontology.

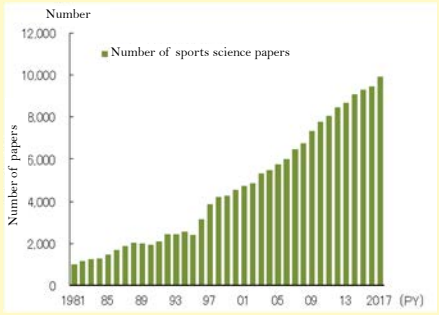


Figure 1 Changes in the number of sports science research papers
Source: NISTEP
Research Material no.283, Japanese Science and Technology Indicators 2019, Fig. 4-1-14

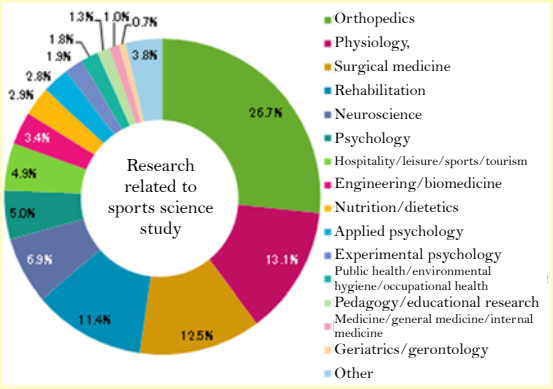


Figure 2 Research related to sports science study
Source: NISTEP
Research Material no.283, Japanese Science and Technology Indicators 2019, Fig. 4-1-15

The Basic Act on Sport provides:" Sport are athletic competitions and other physical activities performed by individuals or groups for the purpose of sound development of mind and body, retention and promotion of health and physical strength, acquisition of mental satisfaction and cultivation of the spirit of self-sufficiency or other mentalities."

Sports include not only events of the Olympic and Paralympic Games but also a broad range of outdoor activities and sports/recreation activities. The trends of sports science research papers include diverse subject categories reflecting the diverse aspects of social life surrounding sports.

4 Strengthening the Leadership Functions of the CSTI

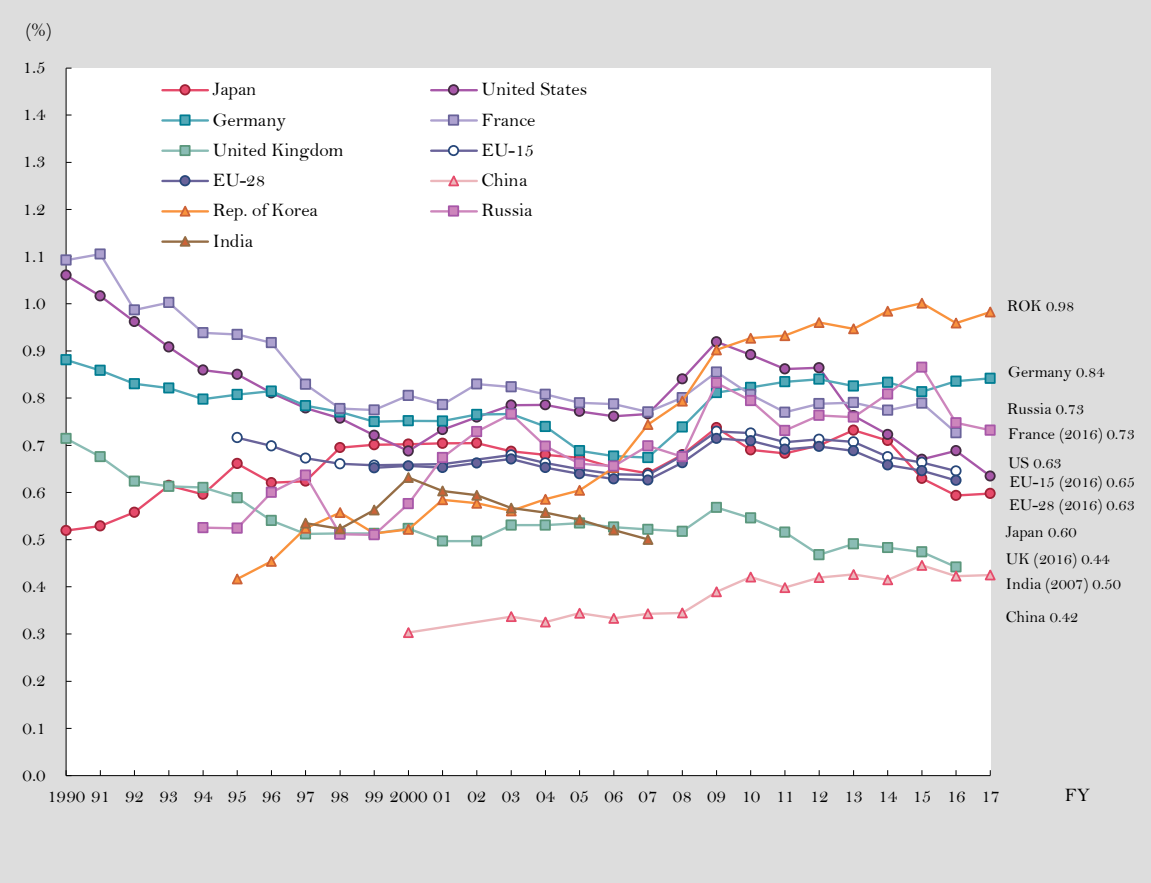
Toward further fulfillment of its headquarter function, the CSTI is powerfully advancing the "Cross-ministerial Strategic Innovation Promotion Program (SIP)" and "Public/Private R&D Investment Strategic Expansion Program: PRISM." In order to enhance its headquarter function, a bill to take measures including establishment of a science and technology innovation promotion office for cross-ministerial coordination of science and technology innovation[1] was submitted to the Diet.

1 Bill to partially amend the Basic Act on Science and Technology (Cabinet Decision on March 10, 2020)

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.

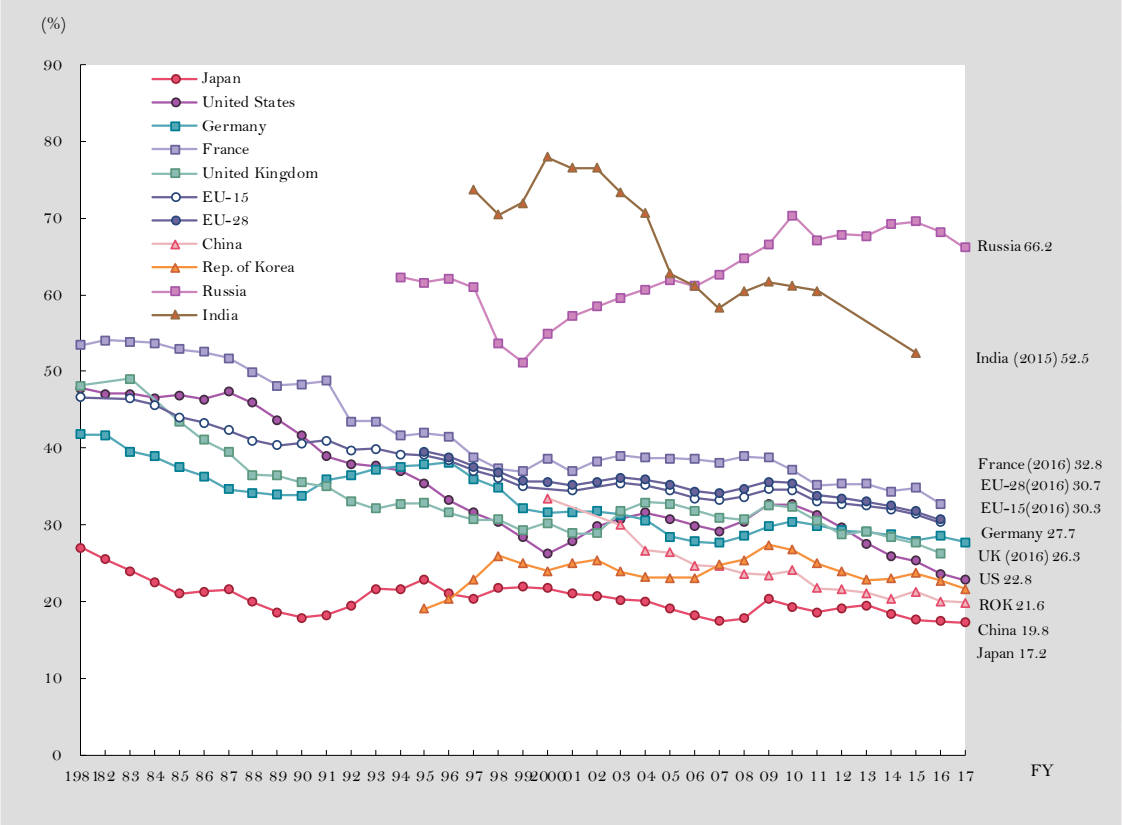
■Figure 2-7-1/Trends in the percentage of Government-financed R&D Costs to Gross Domestic Product



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 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 by other organizations.
5. The German values for FY1982, 1984, 1986, 1988, 1990, 1992, 1994, 1995, 1996, 1998, 2000 2002 and 2010 are estimated value.
6. France values for FY2016 are provisional.
7. The U.S.A. values for FY2016 and 2017 are provisional and those for 2017 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. 2019/10.
India: UNESCO Institute for Statistics S&T database
Other countries: OECD, Main Science and Technology Indicators, Vol. 2019/10.

■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, 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 U.S.A. values for 2016 are provisional and those for 2017 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. 2019/10

(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.)