Part II describes the measures taken to promote science, technology and innovation creation in FY 2020 in accordance with the 5th Science and Technology Basic Plan (January 22, 2016 Cabinet Decision).

Chapter 1 Development of Science, Technology and Innovation

Section 1 The Science, Technology, and Innovation Basic Plan

Science, technology and innovation policy in Japan is promoted comprehensively and in a planned manner according to the Science, Technology and Innovation Basic Plan (hereinafter referred to as the Basic Plan). The government renews and implements the 5-year Basic Plan pursuant to the Basic Act on Science, Technology, and Innovation (Act No. 130, 1995).

The government has developed the 1st (FY1996 to FY2000), the 2nd (FY2001-FY2005), the 3rd (FY2006-FY2010), the 4th (FY2011-FY2015) and the 5th (FY2016-FY2020) Basic Plans and promoted science and technology policy according to the plans. (The 1st to 5th plans were called the Science and Technology Basic Plan.)

The 6th Science, Technology and Innovation Basic Plan (for the period from FY2021 to FY2025) ("the 6th Basic Plan") that started in FY2021 is the first plan after the Basic Act on Science and Technology was renamed the "Basic Act on Science, Technology, and Innovation" with its full-scale revision in June 2020. Study for formulation of the 6th Basic Plan was conducted by the Expert Panel on Basic Policy for two years. The panel was set up when the Prime Minister solicited advice from the Council for Science, Technology and Innovation (CSTI) regarding the 6th Basic Plan by issuing the Consultation Request #21, Regarding the Basic Plan in April 2019. On March 26, 2021, the 6th Basic Plan was decided by the Cabinet.

As major changes in society during the period of the 5th basic plan, the 6th Basic Plan listed: reorganization of the world order caused by intensified competition between nations with focus on state-of-the-art technologies (AI, quantum, etc.); surfacing of the technology leak issue and strengthening of countermeasures; the manifestation of climate change and other global problems, and; exposure of the limitations of the information society (Society 4.0). The new plan pointed out that these changes are accelerated by the expansion of COVID-19. Next, it examined the past science, technology and innovation policies and described Japan's failure to make full use of the information communication technologies on which Society 5.0 is premised; the lowering of international position of Japan's papers; the severe environment surrounding young researchers, and; the inclusion of promotion of "humanities and social sciences" and "innovation creation" by the revision of the Basic Act on Science and Technology.

In this context, the 6th Basic Plan put the Society 5.0 presented by the 5th Basic Plan into a concrete shape, and expressed it as a "society that is sustainable and resilient against threats and unpredictable and uncertain situations, that ensures the safety and security of the people, and that enables each and every one

of them to realize well-being." The plan presented the following specific initiatives for its realization.

① Change to a sustainable and resilient society that ensures the safety and security of the people

The government aims for a society where each and every member can realize well-being by redesigning our society to solve global challenges first in the world and ensuring the safety and security of all inhabitants.

For this purpose, the government will change our society to one where cyberspace (virtual space) and physical space (real space) generate a dynamic virtuous cycle so that anyone can use data and AI anytime, anywhere and securely. Then, Japan will lead the carbon neutrality of the world and build a more resilient society by reducing risks, including natural disasters and COVID-19.

In addition, Japan will construct new industrial infrastructure to turn out startups and facilitate value creation through cooperation of diverse entities, while at the same time deploying Smart City (cities/areas pioneering Society 5.0) all over Japan and in the world.

In order to support these initiatives and address new social challenges, the government will use the convergence of knowledge to promote R&D and social implementation including the next SIP and Moonshot Research and Development programs to address social challenges and develop S&T diplomacy to support social changes.

② Strengthening Research Capacity to Open Up New Frontiers of Knowledge and Generate the Source of Value Creation

Diverse research activities based on the intrinsic motivation of the researchers and accumulation of in-depth "knowledge" in the natural sciences and the humanities and social sciences will not only have intellectual/cultural value but also will lead to innovations contributing to new technologies and solution of social challenges. The first measure for strengthening the research capacity that cultivates such knowledge is reinforcing the support for doctoral course students and young researchers. Next, while promoting basic/academic research including humanities and social sciences and convergence of knowledge, the government will bolster promotion of challenging research where dedicated researchers create ingenious results through knowledge exchange with diverse entities.

This will be followed by construction of new research systems including open science and data-driven research.

Universities are nodes of knowledge and the biggest and state-of-the-art foundations of knowledge. University reform will be advanced to diversify universities by extending their respective strengths and boost diverse self-expression of individuals. In order to promote further growth of research universities ranked high in the world, in particular, the government will advance measures including establishment of a 10-trillion yen university fund.

③ Education and human resource development to realize the well-being of each and every person and

tackling of challenges

In order to redesign society and create values in Society 5.0, the government aims to realize education/human resource development systems that will foster an increase in the number of people who have the ability and the will to pursue individual happiness and tackle challenges through trial and error. Specifically, learning based on curiosity is supported and the power to search is strengthened through promotion of STEAM education at the stages of primary and secondary education, promotion of DX in education including initiatives based on the GIGA School Vision, participation/utilization of external human resources and other resources in learning, for example. The government will also develop an environment that encourages continued learning by providing diverse curriculums at universities, etc., fostering environment/culture that promotes recurrent education and other measures.

In order to promote these science, technology and innovation policies, the government secured about 30 trillion yen for total government investment in R&D during the 6th Basic Plan, and set a goal of about 120 trillion yen for total public and private R&D investments.

Furthermore, to ensure steady implementation of the initiatives presented in the 6th Basic Plan, the government will strengthen the functions to use convergence of knowledge, develop policies toward the future, strengthen policy-making functions and ensure their effectiveness by using the evidence system (e-CSTI), implement policy evaluation linked to annual integrated strategy and the basic plan, and ensure effectiveness of the headquarter functions.

Section 2 Council for Science, Technology and Innovation

CSTI in the Cabinet Office is positioned as a council that advances key policies toward vigorously promoting Japan's science, technology and innovation policies under the leadership of the Prime Minister. CSTI consists of the Prime Minister as the chairperson, related Cabinet members, expert members and others, all of whom have the mission of overseeing the nation's science, technology and innovation efforts and offering comprehensive and fundamental policy plans and general coordination (Table 2-1-1).

CSTI has established six expert panels that deliberate on technical aspects of key issues (Expert Panel on Basic Policy[1], Expert panel on STI policy promotion, Expert Panel on Key Issues, Expert Panel on Bioethics, Expert Panel on Evaluation and Expert Panel on the World Level Research Universities).

[1] Abolished with the conclusion of the survey for the Science, Technology and Innovation Basic Plan

■ Table 2-1-1/List of CSTI members ■

Cabinet members	SUGA Yoshihide	Prime Minister
	KATO Katsunobu	Chief Cabinet Secretary
	INOUE Shinji	Minister of State for Science and Technology Policy
	TAKEDA Ryota	Minister of Internal Affairs and Communications
	ASO Taro	Minister of Finance
	HAGIUDA Koichi	Minister of Education, Culture, Sports, Science and Technology
	KAJIYAMA Hiroshi	Minister of Economy, Trade and Industry
Experts	UEYAMA Takahiro (full-time)	Former Professor and Vice-President, The National Graduate Institute for Policy Studies (GRIPS)
	KAJIWARA Yumiko (part-time)	Corporate Executive Officer, Fujitsu Limited
	KOTANI Motoko (part-time)	Executive Director/Executive Vice President, Tohoku University Principal Investigator, Advanced Institute for Materials Research (AIMR); Prof., Graduate School of Science, Tohoku University
	SATO Yasuhiro (part-time)	Chairman, Member of the Board of Directors, Mizuho Financial Group Vice Chair, Keidanren
	SHINOHARA Hiromichi (part-time)	Chairman of the Board, NIPPON TELEGRAPH AND TELEPHONE CORPORATION; Vice Chair, KEIDANREN and the Chair of the Committee on Digital Economy, KEIDANREN
	HASHIMOTO Kazuhito (part-time)	President, National Institute for Materials Science (NIMS)
	FUJII Teruo (part-time)	President of the University of Tokyo
	KAJITA Takaaki (part-time)	President of the Science Council of Japan (The head of affiliated institutions)

Source: Cabinet Office

❶ Major Endeavors of CSTI in FY2020

CSTI has been discussing policy, budgets and systems. Such discussions address the following: 1) the establishment of the Integrated Innovation Strategy 2020 (approved on June 17, 2020 by Cabinet Decision), and 2) the operation of the Cross-ministerial Strategic Innovation Promotion Program (SIP) and Public/Private R&D Investment Strategic Expansion PrograM (PRISM).

In FY2020, the Council for Science, Technology and Innovation (CSTI) held on March 16, 2021 decided a draft report in response to the Consultation Request #21, Regarding the Science and Technology Basic Plan issued by the Prime Minister.

❷ Strategic Prioritization in the Science and Technology-related Budget

CSTI allocates the science and technology-related budget to important fields and measures, oversees all science, technology and innovation measures, and leads the activities of relevant ministries and agencies.

It does the above in order for the Basic Plan and the Integrated Innovation Strategy to be implemented.

(1) The policy for the allocation of budgets and other resources related to science and technology

According to the basic plan showing the medium- to long-term policy direction and based on the changes in the situation of the year, CSTI under the Integrated Innovation Strategy suggested areas of policy focus for the year, and proposed that allocations of governmental science and technology-related budgets be focused on important areas and programs and that policy be subjected to PDCA cycles.

(2) Promotion of the Strategic Innovation Promotion Program (SIP)

Through inter-ministerial and inter-disciplinary management where CSTI functions as the control tower, the SIP encompasses everything from basic research to the practical application and commercialization of research results under industry-academia-government collaborations. According to the CSTI policies, the Cabinet Office budget for Creating and Promoting Science, Technology and Innovation (FY2020: 55.5 billion yen) was intensively allocated to the implementation of the SIP. Health and medicine were promoted under the Headquarters for Healthcare Policy.

In the second period of SIP funded by the FY2017 supplementary budget, the productivity revolution that is the intention of the budget as well as the following 12 tasks are promoted, adhering to the concept of the first period SIP toward realization of Society 5.0. As FY2020 is the 3rd year of the second period of SIP, interim evaluation was made for each task alongside with interim evaluation of the SIP system.

A follow-up survey[1] of the first period of SIP was conducted after its completion. In this process, matters to be tackled during the program period toward social implementation will be identified to reflect on the operation of the system and tasks of the current second period of SIP.

In this process, based on the suggestions (e.g., utilization of matching funds from private companies, etc., introduction of stage gate evaluation and implementation of a follow-up survey) in the system evaluation carried out in the FY2018 that was the last year of the first period of SIP, the Guidelines on the Strategic Innovation Promotion Program were revised and the SIP system was reviewed.

<<Reference>>

Outline of Research and Development Plan for SIP (2nd period)

https://www8.cao.go.jp/cstp/gaiyo/sip/kenkyugaiyou02.pdf

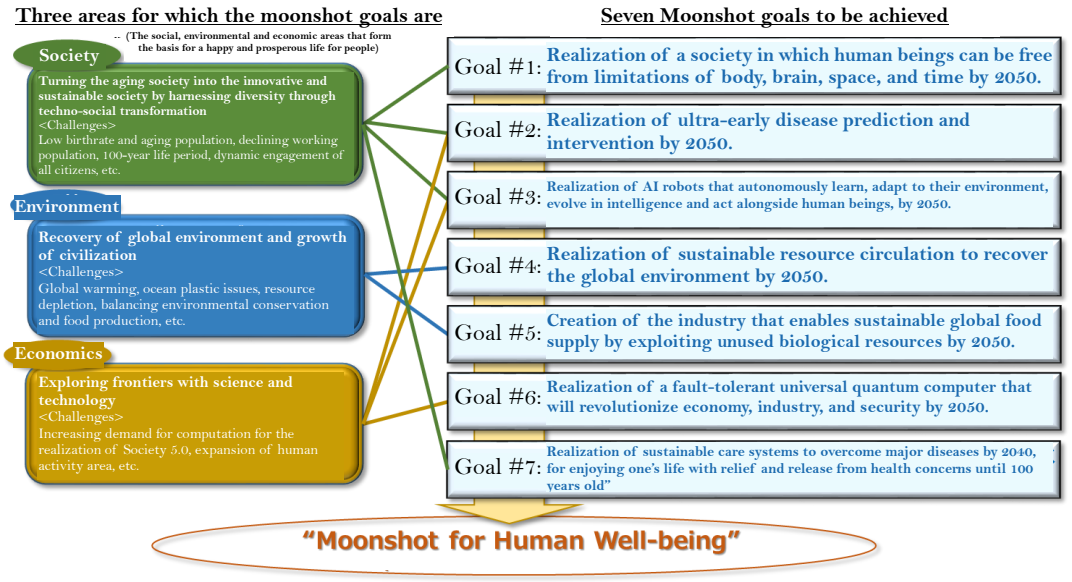
[1] The 20th Governing Board (https://www8.cao.go.jp/cstp/gaiyo/sip/200305/siryo2-2.pdf) and the 50th Governing Board (https://www8.cao.go.jp/cstp/gaiyo/sip/210225/siryo1.pdf)

(3) Promotion of the Public/Private R&D Investment Strategic Expansion PrograM (PRISM)

PRISM is a program established in FY2018 in order to steer measures of individual ministries/agencies to areas[1] where they are likely to induce private investments and where efficiency improvement of the government spending is expected through utilization of R&D results. According to the various strategies decided by the CSTI, budget has been allocated with focus on initiatives to establish a data coordination platform for infrastructure, drug discovery, agricultural and other fields. In FY2020, additional budget was allocated to the quantum AI and quantum life technology fields based on the Quantum Technology Innovation Strategy formulated in January 2020. Projects of individual ministries and agencies will be accelerated to expand private and public R&D investments based on the various strategies decided by the CSTI.

(4) Promotion of the Moonshot Research and Development Program

Under the Moonshot Research and Development Program, the government sets ambitious goals that fascinate people (Moonshot Goals) to address important social challenges including the super-aging society and global warming, and promote aggressive R&D. CSTI decided Moonshot Goals 1 to 6 in January 2020 (the 48th CSTI plenary session). In addition, the Headquarters for Healthcare Policy decided Moonshot Goal 7 in July 2020 (the 30th headquarter meeting). Based on the approach of human-centered society presented at the Visionary Council on the Moonshot Research and Development Program, the program ultimately aims for well-being of each and every person.



[1] AI, construction/infrastructure maintenance and disaster prevention /mitigation and bio technologies was added in FY2019. Quantum technology was added in FY2020.

In FY2020, 47 R&D projects in total were launched toward the seven goals as described below. An industry-academia-government strategy promotion council was set up and held for strategic promotion of R&D, acceleration of practical application of R&D results and effective cooperation/coordination among relevant ministries and research promotion corporations.

Because the social economy is expected to greatly change due to the impact of the COVID-19 pandemic, there is a need to rethink Japan's future vision and how the aggressive R&D projects toward the vision should be. Under this program, goals are to be added according to changes in the social environment. In order to respond to the changes in the economic society caused by the spread of COVID-19 and other factors, teams to study new goals were publicly solicited with focus on young people, and 21 teams were adopted (made public on January 19, 2021). The adopted study team will conduct research for six months and CSTI will decide new goals based on the results in autumn of 2021.

A. Goal #1: Realization of a society in which human beings can be free from limitations of body, brain, space, and time by 2050.

Moonshot goal 1 aims for establishment of the foundation of cybernetic avatars by combining remotely controlled vicarious robots and avatars showing 3D images, and Cyborg technology aims to substitute or extend human physical abilities and ICT technologies so that anyone can take part in social activities free from limitations of place and ability. Toward this goal, three R&D projects were launched.

■ Table 2-1-2 Projects of Moonshot Goal 1 ■

Project Name
Realization of a Human-Avatar Symbiotic Society where Everyone can Experience a Diverse Range of Human Activities
Freedom from Bodily Limitations by Expanding Physical and Perceptional Capabilities
Development of Cybernetic Avatars to Create Shared-Experience with Harmonious Physical and Social Characteristics

B. Goal #2: Realization of ultra-early disease prediction and intervention by 2050.

The key to extension of healthy life expectancy is a society that enables ultra-early disease prediction and intervention detecting ultra-early state or disease precursors, and prevents outbreaks by breaking away from conventional ideas of treatment after outbreaks. In order to realize ultra-early disease prediction and intervention, the government promotes various R&D including observation, manipulation, measurement, analysis and database compilation to comprehensively elucidate inter-organ networks by integrating these R&D fields. Toward this goal, five R&D projects were launched.

■ Table 2-1-3 Projects of Moonshot Goal 2 ■

Project Name
Comprehensive Mathematical Understanding of the Complex Control System between Organs and Challenge for Ultra-Early Precision Medicine
Challenge toward the Control of Intractable Cancer through Understanding of Molecular, Cellular, and Interorgan Networks
Challenge for Eradication of Diabetes and Comorbidities through Understanding and Manipulating Homeostatic Systems
Towards Overcoming Disorders Linked to Dementia based on a Comprehensive Understanding of Organ Connectivity
Understanding and Control of Virus-Human Interaction Networks

C. Goal #3: Realization of AI robots that autonomously learn, adapt to their environment, evolve in intelligence and act alongside human beings, by 2050.

As society is aging with a declining birthrate, it is important to use robots in all situations including dangerous or short-staffed sites, opening of human frontiers and life support. The key is the development of robots who learn and act by themselves through coevolution of AI and robots. The government promotes R&D toward AI robots that combine the physicality of robots and self-developing learning of AI. Toward this goal, four R&D projects started.

■ Table 2-1-4 Projects of Moonshot Goal 3 ■

Project Name
Smart Robot that is Close to One Person for a Lifetime
Innovation in Construction of Infrastructure with Cooperative AI and Multi-Robots Adapting to Various Environments
Co-evolution of Human and AI-Robots to Expand Science Frontiers
Adaptable AI-enabled Robots to Create a Vibrant Society

D. Goal #4: Realization of sustainable resource circulation to recover the global environment by 2050.

For regeneration of the global environment, the government aims to solve the issues of global warming (Cool Earth) and environmental pollution (Clean Earth) by realizing sustainable resource circulation. Toward this goal, 13 R&D projects are launched for "Development of Technologies to Recover Greenhouse Gases ("GHGs") and Convert Them into Valuable Materials" "Development of Technologies to Recover Nitrogen Compounds and Convert Them into Harmless or Useful Materials" and "Development of Marine Biodegradable Plastics Which Can Control the Timing and Speed of Their Degradability."

■ Table 2-1-5 Projects of Moonshot Goal 4 ■

(1) Development of technologies to recover greenhouse gases ("GHGs") and convert them into valuable materials

Project Name
Development of a bioprocess that uses electrical energy to fix atmospheric CO_2
Development of highly efficient direct air capture (DAC) and carbon recycling technologies
Integrated Electrochemical Systems for Scalable CO_2 Conversion to Chemical Feedstocks
C^4S* 6 Research and Development Project * C^4S：Calcium Carbonate Circulation System for Construction
Research and development toward saving energy for direct air capture with available cold energy
Development of Combined Carbon Capture and Conversion (quad-C) Systems for the Utilization of Atmospheric CO_2
Development of Global CO_2 Recycling Technology towards "Beyond-Zero" Emission
Mitigation of greenhouse gas emissions from agricultural lands by optimizing nitrogen and carbon cycles

(2) Development of technologies to recover nitrogen compounds and convert them into harmless or useful materials

Project Name
Innovative circular technologies for harmful nitrogen compounds
Development of recovery and removal techniques of dilute reactive nitrogen to realize nitrogen circulating society

(3) Development of marine biodegradable plastics which can control the timing and speed of their degradability

Project Name
Development of Multi-lock Biopolymers Degradable in the Ocean from Non-food Biomasses
Research and development of marine biodegradable plastics with degradation initiation switch function
Development of photo- switching ocean-degradable plastics with edibility

E. Goal #5: Creation of the industry that enables sustainable global food supply by exploiting unused biological resources by 2050.

It is projected that food demand will increase with the increase of the world population, but the natural circulation function of the earth might fail if we continue in the current manner. In order to satisfy both food production increase and global environmental conservation, the program aims to build a reasonable global-scale food supply system without waste by improving productivity while at the same time solving the issues of environmental burden and food loss. Toward this goal, ten R&D projects were launched for development of "Food Production Systems Achieving Both Food Supply Expansion and Global Environment Conservation" and "Food Consumption Systems Realizing Zero Food-loss and Waste."

■ Table 2-1-6 Projects of Moonshot Goal 5 ■

(1) Food Production Systems Achieving Both Food Supply Expansion and Global Environment Conservation

Project Name
Achieving zero food risks by improving crop robustness using cyber-physical systems
Building a platform for sustainable farming by environmental control based on the microbe atlas of the soil
Bio-economical food production system using circular cell culture of algae and animal cells
Using the destructive wood-decomposition ability of termites to turn unused wood into feed and food
Realization of zero pest damage agriculture by making full use of advanced physical methods and unused biological functions
Realization of a new livestock production system to reduce methane by 80% through complete control of the bovine rumen microbiome

(2) Food Consumption Systems Realizing Zero Food-loss and Waste

Project Name
Insect-Based Sustainable Food Production Systems toward Global Food Security and Human Space Exploration Project
Development of innovative food solutions for simultaneous food loss reduction and QoL improvement
Development of a method for identifying food loss and waste on a global scale
Creation of Next-Generation Food Supply Industrial Chains for a Natural Capitalism Society

F. Goal #6: Realization of a fault-tolerant universal quantum computer that will revolutionize economy, industry, and security by 2050.

The key to high-speed solution of diverse, complex and large-scale real problems by using quantum computers is realization of fault-tolerant universal quantum computers that execute exact computation while correcting quantum errors. For this purpose, the program promotes R&D on hardware, software, network and related matters. Toward this goal, seven R&D projects were launched.

■ Table 2-1-7 Projects of Moonshot Goal 6 ■

Project Name
Research and Development of Theory and Software for Fault-tolerant Quantum Computers
Development of Quantum Interfaces for Building Quantum Computer Networks
Fault-tolerant Quantum Computing with Photonically Interconnected Ion Traps
Development of Large-scale Fault-tolerant Universal Optical Quantum Computers
Research and Development of Large-Scale Silicon Quantum Computer[1]
Quantum Cyberspace with Networked Quantum Computer
Development of Integration Technologies for Superconducting Quantum Circuits

G. Goal #7: Realization of sustainable care systems to overcome major diseases by 2040, for enjoying one's life with relief and release from health concerns until 100 years old"

[1] Noisy Intermediate-Scale Quantum

The program aims for: a society where diseases are prevented naturally in daily life; a medical network to enable access to necessary medical care everywhere in the world, and; an inclusive society eliminating the health divide. Toward this goal, five R&D projects were launched.

■ Table 2-1-8 Projects of Moonshot Goal 7 ■

Project Name
Mitochondrial Medicine
Development of method for complex tissue regeneration via tissue embryonization
Realization of innovative medical systems that extend healthy lifespan to 100 years old by eliminating tissue inflammation-inducing cells
Quantum technology and neuromodulation medicine for new therapeutic strategies to suppress microinflammations
Development of new-generation medical care systems through customizing sleep and hibernation

❸ R&D Evaluation of Projects of National Importance

For comprehensive and plan-based promotion of the nation's science and technology policy, CSTI implements evaluation of R&D projects of national importance including large-scale R&D[1] implemented by individual ministries based on Article 26 paragraph (1)(iii) of the Act for Establishment of the Cabinet Office (Act No. 89 of 1999).

In the last fiscal year of the period for a medium- to long-term plan of a national research and development agency, CSTI offers opinions on estimation evaluations and drafts of the next medium- to long-term objectives from the perspective of linking with the Basic Plan and other national strategies based on Article 5 of the Act on Special Measures concerning the Promotion of Research and Development by Designated National Research and Development Agencies (Act No.43 of 2016).

❹ Major Deliberations at Expert Panels

(1) Expert Panel on Evaluation

For implementation of better policies and measures, it is important to look back over the past, learn various lessons and knowledge from the past and use the lessons and knowledge for examination and promotion of the next policies and measures. In this sense, with the aim of making the best of the results of the evaluation of research and development for the improvement of science, technology and innovation policies and measures, the "Working Group for Enhancement of R&D Evaluation" was set up (from October 2019 to July 2020) under the Expert Panel on Evaluation. The WG conducted research and examination and compiled the method of "integrated evaluation of measures" (implementation of follow-up of the Basic Plan, etc.) that should be conducted by CSTI in order to pursue the 6th Basic Plan.

In order to encourage individual ministries to establish effective follow-up evaluation/surveys for correct

[1] R&D projects with 30 billion yen or more national expenses in total, which the Expert Panel on Evaluation found to require evaluation in light of their importance for the science and technology policy.

understanding of the "long-term impact" including secondary results and ripple effects after a certain period following the completion of the R&D, CSTI compiled "Successful Examples" by gathering successful initiatives of follow-up evaluation/surveys that individual ministries had devised.

(2) Expert Panel on Bioethics

In order to deepen discussions on research that uses genome editing technology for human fertilized embryo, the Expert Panel on Bioethics set up a task force for review, etc. of "the Basic Idea on Handling of the Status of Human Embryo" and compiled a report on the review, etc. of "the Basic Idea on the Status of Human Embryo – use of genome editing technologies on human fertilized embryo" in June 2019. The report recommended continuing study on basic research using genome editing technologies on human embryos created for research purposes and the study is underway through hearing of experts and relevant parties and discussions by panel members.

(3) Expert Panel on Basic Policy

Toward the formulation of the 6th Basic Plan, the panel compiled a review of the 5th Basic Plan in June 2020. Based on the review, the panel advanced studies and compiled a draft report in February 2021.

Section 3 Integrated Innovation Strategy

Japanese Government has been formulating "Integrated Innovation Strategy" for cross-departmental and integrated promotion of related measures toward realization of Society 5.0. This strategy has been reviewing related measures after analyzing the situation surrounding science and technology innovations in Japan and abroad during the year, and identifying the needs for strengthening and new tasks to tackle.

The "Integrated Innovation Strategy 2020" that was decided last year suggested the importance of the idea of Society 5.0 in the light of the impact of the COVID-19 pandemic and changes in the environment of innovation in Japan and abroad. Under the idea of Society 5.0, the following initiatives will be promoted:

① Response to the Difficult Situation We are Facing Due to the Novel Coronavirus Disease and Building of a Sustainable and Resilient Social and Economic Structure

② Creation of Innovation that Overcomes Domestic and Overseas Issues and Leads to Growth (development of startup ecosystem cities, realization and international deployment of smart cities, etc.

③ Strengthening Research Capacity, the Source of STI (Support for the Challenges of Young Researchers; Establishment of a University Fund of Globally Comparable Scale and; Further Promotion of Humanities and Social Sciences, etc.)

④ Major Fields that Should Be Advanced Strategically (AI, bio, quantum and material and other fundamental technologies; S&T for safety and security against infectious diseases and natural disasters; applied field of environment and energy)

Regarding AI among the fields that should be tackled strategically, "the AI Strategy 2019" Follow-up was compiled (decided by the Meeting to Promote Comprehensive Innovation Strategy on June 26, 2020), which confirmed the progress of the AI Strategy 2019 and presented the initiatives to address new challenges revealed in the process of implementing the strategy as well as the COVID-19 pandemic.

Expansion of bioeconomy is important for solution of social challenges including control of COVID-19 and realization of 2050 carbon neutrality as well as the economic development of the nation. To this end, the Meeting to Promote Comprehensive Innovation Strategy decided the "Bio-Strategy 2020 (basic measures)" on June 26, 2020 and "Bio-Strategy 2020 (final market area policy version)" on January 19, 2021. Toward building a 92-trillion yen market by 2030 under the overall goal to realize the world's state-of-the-art bioeconomy society by 2030, necessary measures are promoted based on back casting.

Material is a field where Japan has its strength and an important field directly leading to the realization of carbon neutrality and a circular economy. In order to enhance material innovation power, the government conducts study for the development of a comprehensive policy package covering R&D, industry-academy-government cooperation and human resource development, and made a report on "Strategies for Enhancing Material Innovation Power – Interim Summary of Issues" at the Meeting to Promote Comprehensive Innovation Strategy on January 22, 2021.

Section 4 Administrative Structure and Budget for Science, Technology and Innovation Policies

❶ Administrative Structure for Science, Technology and Innovation Policies

On the basis of these recommendations and guidelines, relevant administrative agencies are supervising the following: 1) research conducted at national experiment and research institutions, at national R&D agencies and at universities, 2) the promotion of research under various research programs, and 3) improvements in the environment for R&D activities.

MEXT is responsible for the coordination that is necessary for the development of specific R&D programs in diverse fields as well as for science and technology-related of various administrative agencies. MEXT also has initiatives in comprehensively promoting the implementation of R&D programs in important state-of-the-art science and technology fields and the advancement of creative basic research. The Council for Science and Technology (CST), under the jurisdiction of MEXT, is engaged in studies and deliberations regarding important matters related to the comprehensive promotion of S&T, in response to consultation with the Minister of MEXT, and provides its opinions to the Minister.

Table 2-1-9 shows major decisions and reports from CST.

■ Table 2-1-9/Major decisions and reports from Council for Science and Technology (FY2020) ■

Date of issue	Major Reports
May 15, 2020	[Bioethics and Biosafety Commission]
	About amendment of "Guidelines on Handling of Specified Embryo" etc.
July 28, 2020	[Committee on Information Science and Technology Working Group on Next-generation Science Information Network/Data Infrastructure Development]
	Policy on Development of the Next-generation Science Information Network and Data Infrastructure (Conclusion of Deliberation)
September 30, 2020	[Subdivision on Science and Committee on Information Science and Technology (Joint Proposal)]
	Proposal on measures to promote scientific research and information science and technology towards post COVID-19 age (Proposal)
December 3, 2020	[Committee on Human Resources]
	"Issuance of guidelines for employment and training of postdoctoral researchers." (Summary)
December 14, 2020	[Bioethics and Biosafety Commission]
	On the formulation of "Ethical Guidelines for Medical and Biological Research involving Human Subjects"
	Concerning revision of "about revision to define authorized host-vector system based on the provisions of Ministerial Ordinance providing containment measures to be taken in Type-2 use of living modified organisms for R&D"
December 22, 2020	[Subdivision on Resources Research]
	Standard Tables of Food Composition in Japan (Eighth Revised Edition)
December 23, 2020	[Subdivision on Science Research Environment Infrastructure Group]
	Results of external assessment of inter-university research institutes
January 21, 2021	[Subdivision on Grants-in-Aid for Research]
	Improvement and enhancement of KAKENHI toward the 6th STI Basic Plan
January 22, 2021	[Subdivision on Science Special Committee on Humanities and Social Sciences]
	Co-creation of scientific knowledge around humanities and social sciences (Summary of Deliberation)
January 28, 2021	[Bioethics and Biosafety Commission]
	Concerning revision of "the Ethical Guidelines for Research using Gene-altering Technologies on Human Fertilized Embryos" and "the Ethical Guidelines for Research of Assisted Reproductive Medicine that Creates Human Fertilized Embryos"
February 4, 2021	[Subdivision on R&D Planning and Evaluation Quantum S&T Committee Quantum Beam Use Promotion Subcommittee]
	Appropriate State of Quantum Beam Facilities Overviewing the Entire Nation (Summary)
February 5, 2021	[Subdivision on Professional Engineers]
	Study Report of the 10th meeting of the Subdivision on Professional Engineers based on the "Summary of Issues of the Reform of the Professional Engineer System"
February 12, 2021	[Committee on Information Science and Technology Subcommittee on Journal issues]
	Response to Issues on Scholarly Communication in Japan (Conclusion of Deliberation)

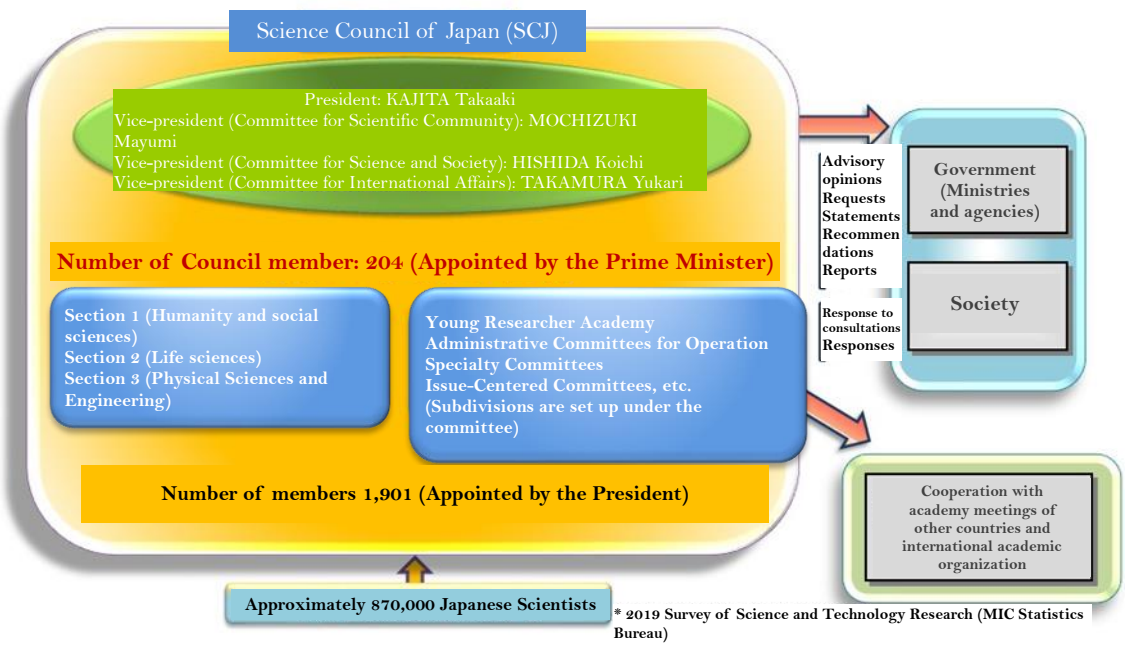
Source: MEXT

The Science Council of Japan (SCJ), an organization that represents Japan's scientific community and has 210 Council members (fixed number) and about 2,000 members, is under the supervision of the prime minister. SCJ's duties are to carry out deliberations of important issues regarding science and work for their realization, while coordinating scientific research to improve their efficiency (Figure 2-1-10).

SCJ has worked on its improvement based on the "Future prospects of the Science Council of Japan"

(decided by the expert meeting to think about new prospects of the SCJ in March 2015). Now SCJ extracts issues through self-inspection of its current state and is examining the origin of the academies so that it can fulfill a better role. (Toward Better Fulfillment of the Role of the Science Council of Japan (Interim Report), the Executive Board of Science Council of Japan, December 16, 2020).

■ Figure 2-1-10/Organizational structure of the Science Council of Japan (SCJ) ■



Note: As of October 1, 2020
Source: Cabinet Office

In terms of recommendations to the government and society, the SCJ announced 64 recommendations, 15 reports and 1 response in fiscal 2020 (there were no advisory opinions, requests, statements or response to consultation) (Table 2-1-11). In addition, the following Statements of the Executive Board of Science Council of Japan were made public: "Consideration of Measures against COVID-19." SCJ set up various committees and conducts deliberations for future publication of recommendations, etc.

The SCJ is also working to strengthen and utilize networks in the scientists' community including cooperative academic societies (2,078 societies as of the end of fiscal 2020) while at the same time promoting cooperation and communication with parties outside of the community through various symposiums, press conferences and other opportunities.

In addition, the SCJ represents Japan in 44 international academic societies including the International Science Council (ISC) and promotes international academic exchange program. In FY2020, SCJ jointly hosted an international conference with the verbal agreement by the Cabinet and released the G-Science Academies' Joint Statements on four subjects including the COVID-19 pandemic in April and May 2020, which were compiled jointly with academies, etc. of the G7 member countries.

■ Table 2-1-11/Major proposals by the Science Council of Japan (SCJ) (FY2020)■

Matters related to this white paper	Recommendations	Date of issue	Gist
Development of science and technology policy	Toward a Social System that Promotes Citizen Science (Recommendation)	September 14, 2020	In the light of the current state and challenges of citizen science promotion in Japan, SCJ proposed (1) public relations toward expansion of citizen science for promoting knowledge production activities; (2) improvement of the basis to maintain research ethics of citizen science; (3) establishing a base for social cooperation to promote citizen science, and (4) establishment of a research funding system to support activities of citizen scientist.
	Toward Gender Equality in Society and Science – Challenges toward 2030 – (Recommendation)	September 29, 2020	SCJ proposed: "mainstreaming of gender perspective (Gender Mainstreaming)" in every law and policy; women's participation in decision-making and overcoming "unconscious bias"; elimination of discrimination based on sexual orientation and gender identity (SOGI); gender equality for men and boys; eradication of "violence based on sex/gender"; appropriate evaluation and equal distribution of care works between women and men; positive attention to "gender" factors that have been made invisible, and; mainstreaming of the gender perspective in every field of science.
Response to economic and social challenges	Need for Research on the Ecological/Health Effects of Aquatic Environment Pollution Caused by Microplastics and Plastic Governance (Recommendation)	April 7, 2020	(1) SCJ proposed: (1) Promotion of research and study on microplastics in the ocean and collection of scientific knowledge contributing to the evaluation of environmental and health risks, (2) efforts by the government, industry and citizens to reduce total plastic emissions, and (3) control of use of primary microplastics and collection of marine plastics that are the source of secondary microplastics.
	Acceleration of innovations for long-term drastic reduction of GHG emissions (Recommendation)	May 12, 2020	Based on the formation, the "Long-Term Strategy under the Paris Agreement as Growth Strategy," etc., SCJ proposed (1) Establishment of stable energy and climate change policies; (2) improvement of the predictability of energy-infrastructure investments to realize low-carbonization and decarbonization; (3) improvement of the share of electricity in final energy and acceleration of low-carbonization and decarbonization of power sources (4) inducement of innovations with focus on basic research, and; (5) examination of cost effectiveness from a long-term perspective
	Establishment of a Permanent Organization to Prevent and Control Infectious Diseases (Recommendation)	July 3, 2020	In order to promptly take infection control measures in possible future emergencies, SCJ proposed (1) The Cabinet Office should establish the Infectious Disease Prevention and Control Committee (a tentative name) as a permanent organization, and; (2) A permanent organization should be established in the prefecture.
	Social Challenges of Automated Driving – Society Design with New Mobility – (Recommendation)	August 4, 2020	Because we need to solve not only technical issues but also social issues at the social implementation phase of automated driving, SCJ proposed: study of the role of automated driving/mobility as part of grand design of future society; social implementation based on a human-

			centered design concept with consideration of values and ethics of humanities and social sciences, and other matters.
	Role of Science for Dementia – Toward "Coexistence" and "Prevention" – (Recommendation)	September 11, 2020	Considering the desirable approach of science to dementia and how science should fulfill its role, SCJ proposed: (1) development of a society where people "live with" dementia; (2) establishment of a new discipline that supports people with dementia; (3) development and expansion of industry to support people with dementia; (4) establishment of a scientific basis, and; (5) sustainable medical treatment system.
	Building a sustainable global society by strengthening disaster resilience: Developing an "Online Synthesis System (OSS)" and fostering "Facilitators" to realize consilience (Recommendation)	September 18, 2020	To address two challenges of enhancement of disaster resilience and sustainable development, SCJ proposed the need for "conversion of knowledge" by collaboration of the people in the disaster prevention/mitigation field with scientist communities, and training of facilitators who will play roles necessary for the achievement.
Reinforcing the "fundamentals" for science, technology, and innovation	Toward Deepening and Promotion of Open Science (Recommendation)	June 3, 2020	For promotion of open science that can change research methods themselves, after reviewing the current status of data-driven science in each research field, SCJ proposed (1) making rules for the age where data play a central role; (2) construction and spread of data platforms, and; (3) need for permanent retention of primary samples/materials.
	Strengthening of ICT Infrastructure and Promotion of Digital Transformation for Infection Control and Social Change (Recommendation)	September 15, 2020	In order to strengthen ICT infrastructure and digital transformation for infection control and social change, SCJ proposed (1) digital transformation of medical systems; (2) digital transformation of social life, and; (3) cyber security and privacy protection.
	Reconstitution of the Scholarly Information Environment to Maintain Global Competitiveness in the Age of Electronic Information Dissemination (Recommendation)	September 28, 2020	With the basic policy of budget concentration and organizational reconstruction for creation of top runners in the global digital scholarly publishing sector, SCJ proposed reorganization of distributed organizations, budgets, etc. and reconstitution of new systems and organizations for journal subscriptions and publishing suitable to the forthcoming revolutionary digital scholarly publishing era.
Reformation and function enhancement of universities	Disciplinary Reference Points for Curriculum Design and Quality Assurance of University Education - Education Studies (Report)	August 18, 2020	At the request of MEXT, SCJ issued its Response "Quality Assurance Framework for University Education" in July 2010. Later, SCJ developed disciplinary reference points in line with the framework of the Response. The reference points for 32 fields have been released up to now. In this report, the reference points for education studies were compiled and released.
	Toward Internationally Acceptable Quality Assurance of Education and Research in Business Schools of Japan (Recommendation)	September 29, 2020	Because review of the graduate school system, its certification/evaluation system and corporate practice and strengthening of graduate school education will be an important basis for quality assurance of business school education in Japan and ensuring of international acceptability of diplomas, SCJ proposed (1) review of the graduate school system; (2) review of the certification and evaluation system; (2) shift to business society where high skilled management personnel can work successfully, and;(4) strengthening of business school education.

Source: Cabinet Office

❷ Science and Technology Budgets

The science and technology-related portion of Japan's initial budget for FY2020 is 4.3787 trillion yen, of which 3.5693 trillion yen is allocated for the general account budget and 809.4 billion yen is allocated for the special account budget. The science and technology-related portion of Japan's supplementary budget in FY2020 was 4.3256 trillion yen, of which 4.2423 trillion yen was allocated for the general account budget, and 76.4 billion yen was allocated for the special account budget (As of March 2021). From the science and technology-related portion of Japan's supplementary budget in FY2020, the "Green Innovation Fund Program" (2 trillion yen) and "10-trillion yen university fund" are used for large-scale and long-term S&T projects. the S&T expenditure of these funds during the 6th phase period will be ascertained. Changes in the science and technology budget (initial budget) are shown in Table 2-1-12, and science and technology budgets are broken down by ministry in Table 2-1-13.

■ Table 2-1-12/Changes in science and technology budgets ■

(Unit: 100 million yen)

Item \ FY		FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
	Science and technology promotion expenditures (A)	12,857	12,930	13,045	13,175	13,597	13,639
	As a % of the previous FY	96.2	-	100.9	101.0	103.2	100.3
	Other research-related budget (B)	16,610	15,225	15,339	17,340	20,584	22,054
	As a % of the previous FY	97.1	-	100.7	113.0	118.7	107.4
Science and technology budget included in the general account budget (C) = (A) + (B)		29,467	28,155	28,384	30,515	34,182	35,693
As a % of the previous FY		96.7	-	100.8	107.5	112.0	104.5
Science and technology budget included in the special account budget (D)		5,309	7,514	7,497	7,908	8,237	8,094
As a % of the previous FY		87.9	-	99.8	105.5	104.2	98.3
Science and technology budget (E) = (C) + (D)		34,776	35,669	35,881	38,423	42,419	43,787
As a % of the previous FY		95.2	-	100.6	107.1	110.4	103.3
General account budget of Japan (F)		963,420	967,218	974,547	977,128	1,014,571	1,026,580
As a % of the previous FY		100.5	100.4	100.8	100.3	103.8	101.2
General expenditure budget of Japan (G)		573,555	578,286	583,591	588,958	619,639	634,972
As a % of the previous FY		101.6	100.8	100.9	100.9	105.2	102.5

Note: 1) Initial budget amounts are shown.
2) Because figures of FY2016 and after are calculated using a new calculation method based on a unified standard, simple comparison with data in FY2015 is not possible.
3) Because of rounding, the cumulative amounts in some columns may not equal the totals.
Source: Adapted by MEXT based on data provided by the Cabinet Office and MOF

■ Table 2-1-13/Science and technology budgets of each ministry/office/agency ■

(Unit: 100 million yen)

Item / Ministry/ Office/ Agency	FY2019 (Initial budget)				FY2019 (Initial budget)				FY2020 (Initial budget)				FY2020 (Initial budget)			
	General account	Science and technology promotion expenditures	Special account	Total	General account	Science and technology promotion expenditures	Special account	Total	General account	Science and technology promotion expenditures	Special account	Total	General account	Science and technology promotion expenditures	Special account	Total
National Diet	12	11	-	12	-	-	-	-	12	11	-	12	-	-	-	-
Cabinet Secretariat	625	-	-	625	2	-	-	2	653	-	-	653	224	-	-	224
Reconstruction Agency	-	-	312	312	-	-	-	-	-	-	248	248	-	-	-	-
Cabinet Office	1,203	833	-	1,203	250	130	-	250	1,249	872	-	1,249	688	554	-	688
National Police Agency (NPA)	24	21	-	24	-	-	-	-	23	22	-	23	-1	-1	-	-1
Consumer Affairs Agency	31	-	-	31	11	-	-	11	31	-	-	31	11	-	-	11
MIC	1,082	489	-	1,082	141	109	-	141	1,830	541	-	1,830	772	717	-	772
Ministry of Justice (MOJ)	12	-	-	12	-	-	-	-	12	-	-	12	-	-	-	-
Ministry of Foreign Affairs (MOFA)	169	-	-	169	36	-	-	36	132	-	-	132	89	-	-	89
Ministry of Finance (MOF)	10	10	-	10	5	5	-	5	10	10	-	10	-	-	-	-
Ministry of Education, Culture, Sports and Science (MEXT)	20,783	8,954	1,093	21,876	4,011	3,587	-	4,011	20,135	8,863	1,089	21,224	10,380	9,434	-	10,380
Ministry of Health, Labour and Welfare (MHLW)	2,171	639	162	2,333	57	5	-	57	2,474	656	169	2,643	3,799	805	62	3,861
Ministry of Agriculture, Forestry and Fisheries (MAFF)	2,000	945	-	2,000	350	129	-	350	2,048	957	-	2,048	296	74	-	296
Ministry of Economy, Trade and Industry (METI)	1,560	1,131	5,226	6,786	4,645	1,465	176	4,821	1,787	1,133	5,102	6,889	25,847	21,416	219	26,066
Ministry of Land, Infrastructure, Transport and Tourism (MLIT)	2,816	281	127	2,943	88	40	-	88	3,598	283	82	3,681	357	180	2	359
Ministry of the Environment (MOE)	395	282	1,318	1,712	64	61	9	73	417	291	1,404	1,821	29	11	481	510
Ministry of Defense (MOD)	1,290	-	-	1,290	-	-	-	-	1,280	-	-	1,280	-	-	-	-
Total	34,182	13,597	8,237	42,419	9,659	5,531	185	9,844	35,693	13,639	8,094	43,787	42,493	33,189	764	43,256

Note: 1) Supplementary budget amounts are calculated in a manner not based on a unified standard as in the case of the initial budget, but instead based on the judgment of the responsible ministries.

2) Because of rounding, the cumulative amounts in some columns may not equal the totals.

3) From the science and technology-related portion of Japan's supplementary budget in FY2020, the "Green Innovation Fund Program" (2 trillion yen) and "10-trillion yen university fund" are used for large-scale and long-term S&T projects. the S&T expenditure of these funds during the 6th phase period will be ascertained.

Source: Adopted by MEXT based on data from the Cabinet Office