Part II describes the measures taken to promote science and technology in FY 2015 in accordance with the 4th Science and Technology Basic Plan (August 19, 2011 Cabinet Decision), (Science and Technology Basic Plan; hereinafter: the Basic Plan).

Chapter 1 Development of Science and Technology

Section 1 The Science and Technology Basic Plan

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

The 4th Basic Plan presents five major goals that Japan aims at attaining through the Science and Technology Policy. In addition, to realize the sustainable growth and development of Japanese society for years to come, it sets the following as the primary pillars: 1) realizing reconstruction and revival from the Great East Japan Earthquake, 2) promoting "green innovation" and 3) promoting "life innovation." The Basic Plan also identifies "key issues that Japan is facing" and states that efforts should be shifted from focusing on specific fields to focusing on these key issues. "Basic research and human resources development" is another integral part of the efforts for addressing the priority issues; thus, the Basic Plan emphasizes the need for 1) the drastic enhancement of basic research from a long-range perspective, 2) the fostering of young researchers who will play active roles in science and technology research and 3) the development of an international-standard research environment and infrastructure. With the recognition that it is important that science, technology and innovation policies be developed and advanced in the social context, the Basic Plan underlines the importance of the following: public participation in the policymaking processes, the dissemination of information on science and technology, and reforms in the systems for promoting R&D.

FY 2015 was the last year of the 4th Basic Plan. Towards formulating the 5th Basic Plan, which was to start in FY 2016, the Prime Minister solicited advice from the Council for Science, Technology and Innovation (CSTI) by issuing the Consultation Request #5, Regarding the Science and Technology Basic Plan. The Council established the Expert Panel on Basic Policy and conducted studies and examinations for one year. In December 2015, the Council responded to the Consultation #5. On January 22, 2018, a Cabinet Decision was made to implement the 5th Basic Plan.

The 5th Basic Plan presents a recognition of the current situation of Japan and the world: This is a "period of great change" when the socioeconomic structure changes day by day due to the development of ICT and other technologies. The importance of promoting science, technology and innovation (STI) has been growing due to increases in the number of domestic and international issues, and in the complexity of those issues.

The basic plans of the previous 20 years have had achievements and issues. The achievements include steady improvements in the R&D environment, and notable award-winning R&D such as iPS cell technologies and blue LEDs. Issues include the weakening of "basic strengths" in science and technology and the stagnation of government investment in science and technology.

Against such a background and under a basic policy of focusing on Japan's ability to forecast the future (foresight and strategical strength) and Japan's ability to flexibly adopt to any changes (diversification and

flexibility), the Plan envisions what Japan should achieve: 1) sustainable development and the autonomous development of regional society, 2) safety and security for the country and its people, as well as a high quality of life, 3) a focus on global issues and contributions to global development, and 4) the continuous creation of intellectual assets. To realize these visions, the 5th Basic Plan sets the following 4 pillars:

i) Acting to create new value for the development of future industry and social transformation

Society 5.0 is to be strongly promoted to make a large change and to lead the era of revolution through a series of undertakings that realize a "super smart society" in which new values and services are created one after another ahead of the world and through the strengthening of R&D that achieves independent innovation.

ii) Addressing economic and social challenges

To take appropriate pre-emptive action addressing the various issues that have emerged domestically and globally, the national government will select important policy issues and promote STI towards addressing national and global issues before they become problems.

iii) Reinforcing the "fundamentals" for science, technology, and innovation

Basic capabilities in STI will be dramatically strengthened to address possible future changes flexibly and adequately, through the fostering of young human resources, the promotion of their active role-taking, and the reform and strengthening of universities.

iv) Building a systemic virtuous cycle of human resource, knowledge, and funding for innovation

Making the most of domestic and international human resources, knowledge and funds, we will foster and take advantage of "new value." To this end, we will develop an innovation creation system by circulating human resources, knowledge and funds beyond any barriers by fostering strong, deep collaboration among private businesses, universities and public research institutions and by strengthening venture business establishments.

To promote the aforementioned items i) to iv), strategic international development combined with science and technology diplomacy is indispensable for Japan. The 5th Basic Plan is positioned as a plan that will be collaboratively implemented by a wide range of actors (governments, academia, businesses and Japanese nationals) and that will lead to Japan becoming "the world's most innovation-friendly country."

The governmental R&D investment target was achieved only for the 1st Basic Plan. R&D investment by the government has stagnated during the past decade. The 5th Basic Plan sets a target of at least 4% for R&D investment as a share of GDP and a target of 1% for governmental R&D investment as a share of GDP. The latter is thought to be achievable with the Plan to Advance Economic and Fiscal Revitalization included in the Basic Policy on Economic and Fiscal Management and Reform 2015 approved by the Cabinet in June 2015. Assuming that the nominal GDP growth rate during the 5th Plan averages 3.3%, the investment in governmental R&D during that plan will total 26 trillion yen.

■ Figure 2-1-1 / Outline of the 5th Science and Technology Basic Plan (FY 2016 - FY 2020)

Outline of the 5th Science and Technology Basic Plan

■ The Science and Technology Basic Plan is a comprehensive plan prepared by the Japanese government in accordance with the Science and Technology Basic Law in order to promote science and technology in Japan over a five-year term, based on a 10-year forward outlook.
■ The 5th Basic Plan (FY2016 to FY2020), the first plan formulated by the Council for Science, Technology and Innovation (CSTI), is focused on enhancing "science, technology and innovation (STI) measures."
■ Executing this Basic Plan will require a wide spectrum of parties—including the government, academia, industry, and citizens—to work together and lead to transform Japan into "the most innovation friendly country in the world."

Chapter 1: Basic Concepts

(1) Recognition of the Current Situation

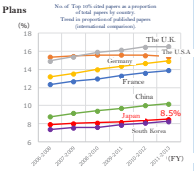
■ Advances in ICT, etc. have ushered in an "era of drastic change" in which the social and economic structures of the nation are significantly changing on a daily basis.
・Appearance of markets and businesses that do not fit within existing frameworks
・Shift from the tangible to the intangible and a diversification of values
・Change in knowledge and value creation processes (emphasis on open - innovation and a trend to open - science), etc.
Increasing scale and complexity of domestic and global-scale challenges (such as energy restrictions, the declining national birthrate and aging population, regional impoverishment, natural disasters, changes in security environment, and deepening global-scale challenges, etc.)

⇒ In light of this, it is necessary to pursue STI (while considering the multi - faceted nature of S&T, appropriately utilize the fruits).

(2) Achievements and Challenges in 20 Years of Science and Technology Basic Plans

■ Steady development of Japan's R&D environment and enhancement of its international competitiveness, such as by increasing the numbers of researchers and published papers. Advent of new science and technology that changes people's lives and the economy, such as LEDs and iPS cells. The fact that the nation has produced the second highest number of Nobel Prize winners (in the natural sciences) this century proves that Japan's science and technology has a strong international standing.

■ In recent years, however, Japan's "fundamental strength" has declined, as demonstrated by a drop in the quality and quantity of papers by international standards, delays in establishing international research networks, and the difficulty of young researchers to demonstrate their abilities. Industry–academia partnerships have also failed to develop fully. These problems can be attributed to delays in reforming the administration and human resource systems of universities and the existence of "barriers" between organizations.



Created based on "Science and Technology Benchmarking2015" National Institute of Science and Technology Policy

■ Growth in government R&D investment has stalled. Japan's international standing is on the declining trend.

(3) Target National Profile

■ A description of the kind of country the Basic Plan envisions

① Sustainable growth and self-sustaining regional development
② Ensure the safety and security for our nation and its citizens along with a high-quality, prosperous way of life
③ Respond to global challenges and contribute to global development
④ Sustainable creation of intellectual property

(4) Basic Principles

■ Focus on the ability to look ahead with vision and strategically take action (foresight and strategy), enhance the ability to respond appropriately to any kind of change (diversity and flexibility).
■ With the participation of all fields of humanities, social sciences, and natural sciences, build a framework that enables all kinds of individuals to compete and cooperate within an internationally open innovation system and to fully demonstrate their abilities.

① Four pillars of the Fifth Science and Technology Basic Plan

i) Acting to create new value for the development of future industry and social transformation.
ii) Addressing economic and social challenges
iii) Reinforcing the "fundamentals" of STI
iv) Establishing a systemic virtuous cycle of human resources, knowledge, and capital for innovation

※ In pursuing i to iv, an approach that integrates S&T diplomacy and aims at strategic international implementation is essential.

② Important issues in the promotion of the S&T Basic Plan

i) Deepening the relationship between STI and society
ii) Enhancing capacity to promote STI promote STI

・Based on the 5th Basic Plan as general guidelines over a five-year term, a "comprehensive strategy" will be formulated each fiscal year, and measures will be undertaken flexibly.
・Performance indicators and numerical targets will be set to assess the progress and outcomes of the plan. (Targets will be set to monitor the achievements of the country as a whole. Care is necessary to avoid that achievement of these numerical targets has become its own goals in each workplace such as university, R&D institutions, etc.)

Chapter 2: Acting to Create New Value for the Development of Future Industry and Social Transformation

To enable Japan to instigate major change and to remain a world leader in this "era of drastic change," we will reinforce R&D that generates discontinuous innovation and will boost efforts to devise mechanisms for realizing the world's first "super smart society" that creates new value and services in rapid succession.

(1) Fostering R&D and Human Resources that Boldly Challenge the Future

■ It is important to try and overcome high hurdles resolutely, without fear of failure, and to engage in generating innovation beyond reach of others. In addition to encouraging efforts to tackle R&D initiatives focused on novel ideas and on economic and social impact, we will provide individuals and teams who have highly creative ideas and the energy to implement them, with opportunities to trial their ideas (such as by promoting measures suited to the promotion of daring R&D challenges in the R&D projects of relevant government ministries, and by further developing and expanding ImPACT etc.).

(2) Realizing "Society 5.0" ("Super Smart Society")

■ Around the world, initiatives that use networks and the Internet of Things (IoT), centered on manufacturing fields, are now coming out. In Japan, the use of such networking will not be limited to manufacturing. Instead, it will be extended to various other fields in order to promote economic growth, the formation of a healthy and long-living society, and social transformation. In addition, it will help the fruits of science and technology to penetrate into all kinds of fields and spheres, and thereby lead to enhanced business capability and higher quality services.
■ We will share our vision of the future, which is characterized by the sophisticated integration of cyberspace with physical space ("the real world") and work to enhance it, while further pursuing a series of measures aimed at its realization, under the concept of "Society 5.0".*

* The history of humankind reveals that the evolution of human society has been fueled by technological advances, with key steps along the way as a hunter-gatherer society, agrarian society, industrial society, and, today, an information society. "Society 5.0" is next, and we'll achieve it by mobilizing the full power of STI.

■ It is necessary to aim at "systemization" of services and businesses, system advancement, and coordination between multiple systems. Therefore, we will promote the measures needed to develop a common platform for this goal (called "Society 5.0 Service Platform"), through collaboration between industry, academia, and government and the relevant government ministries.

What is Society5.0?
It is a society that can be expected to facilitate human prosperity. Such a society is capable of providing the necessary goods and services to the people who need them at the required time and in just the right amount; a society that is able to respond precisely to a wide variety of social needs; a society in which all kinds of people can easily obtain high-quality services, overcome differences of age, gender, region, and language, and live vigorous and comfortable lives.

(3) Enhancing Competitiveness and Consolidating Fundamental Technologies in Society 5.0

■ Enhance IP and international standardization strategies, fundamental technologies, and human resources, in order to maintain and increase competitiveness.
■ Create new businesses through the promotion of system package exports and turn the fact that Japan is an advanced economy facing many serious challenges into a strength.
■ Focus on the fundamental technologies needed for the service platform (such as cybersecurity, IoT system development, "big data" analysis, AI, and devices etc.) and strive to enhance technologies that represent core strengths for new value creation (such as robots, sensors, biotechnology, materials and nanotechnology, and Light/quantum technology etc.), by setting ambitious targets from a medium-term perspective.

Chapter 3: Addressing Economic and Social Challenges

To preemptively address emerging national and global challenges, Japan is identifying important policy issues and pursuing STI in attempts to find solutions.

■ For each of the 13 important policy issues, we are systematically pursuing measures from R&D to use in society.

<Sustainable growth and self-sustaining regional development>
・Ensuring stable energy and improving energy efficiency
・Ensuring stable resources and cyclical use;
・Securing a stable food supply
・Establishment of a society in which people enjoy long and healthy lives with world-leading medical technology
・Building infrastructure for sustainable cities and regions;
・Extending service life for efficient, effective infrastructure
・Improving competitiveness in manufacturing and value creation
<Ensure safety and security for our nation and its citizens and a high-quality, prosperous way of life>
・Addressing natural disasters
・Ensuring food safety, living environments, and occupational health
・Ensuring Cybersecurity
・Addressing national security issues
<Addressing global challenges and contributing to global development>
・Addressing global climate change; ・Responding to biodiversity loss

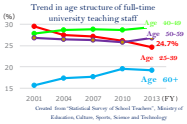
■ In association with responses to a variety of problems, we will continuously enhance the series of science and technology initiatives that support the appropriate development, utilization, and management of "the oceans" and "space" which are strategically important frontiers for Japan, from a long-term respective.

Chapter 4: Reinforcing the "Fundamentals" for STI

To flexibly and appropriately respond to the various changes that may occur in the years ahead, we will work at thoroughly consolidating fundamental strengths while focusing on fostering young human resources and improving their career prospects in STI, and on reforming and enhancing the functions of universities.

(1) Developing High - quality Human Resources

■ Clearly defining career paths for young researchers and establishing an environment that enables them to actively demonstrate their abilities and motivation according to the stage of their career (such as by increasing the number of tenure posts for young researchers through the adoption of annual salary schemes and the conversion to fixed-term employment for senior staff at universities, promote introduction of the tenure track system as a general rule; and increasing the number of young full-time teaching staff at universities by 10%, etc.).



Created from "Statistical Survey of School Teachers", Ministry of Education, Culture, Sports, Science and Technology

■ Foster and secure a diverse human resources who engage in STI, and establish career paths for them; reforms of graduate school education through collaboration with universities, industry, and other sectors; and develop human resources that will engage in STI in the next generation.
■ Improve women's career prospects in STI by bringing up and appointing women leaders; increase the number of women researchers as a proportion of new hires (to 30% overall in the natural sciences); and expand the number of women for the next generation.
■ Develop international research networks by enhancing support for Japanese researchers going overseas and increasing the level of acceptance and retention of foreigners in Japan; promote greater mobility of personnel across disciplines, organizations, and sectors.

(2) Promoting Excellence in Knowledge Creation

■ Reforms and enhancements aimed at promoting academic and basic research as a source of innovation (This includes the reform and enhancement of Grants-in-Aid for Scientific Research (KAKENHI) in accordance with the public mandate; reform and enhancement of strategic and imperative fundamental research; improvement of interdisciplinary research; pursuit of international joint research; and the formation of research centers that meet the highest international standards etc.)
■ Strategic enhancement of common fundamental technologies to support R&D activities, facilities, equipment, and information infrastructure; and the development of a system for implementing open science (such as by expanding the utilization of findings from publicly funded research etc.).
■ Increase the number of published papers through such efforts, and increase the number of Top 10% papers as a proportion of total papers (to 10%).

(3) Strengthening Funding Reform

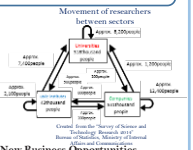
■ Reform and definite measure of fundamental expenses in order to enable more efficient and effective management of universities
■ Reform of public funding (such as by making competitive funds easier to use, examining the inclusion of overhead expenses into all research funding, and promoting the shared use of research equipment etc.).
■ Integrate national university reform with research funding reform (including new allocation and assessment of operating expense grants etc.)

Chapter 5: Establishing a Systemic Virtuous Cycle of Human Resources, Knowledge and Capital for Innovation

To create new value and rapidly pursue its use in society, using domestic and overseas human resources, knowledge, and capital, we will establish a system that rotates personnel, knowledge, and capital across all kinds of barriers to generate innovation by promoting full-scale collaboration between companies, universities, and public research institutes, and by encouraging entrepreneurship and boosting the creation of startup companies.

(1) Enhancing Mechanisms for Promoting Open - innovation

■ Enhance promotion systems in companies, universities, and public research institutes (such as by engaging in full-scale collaboration with input of human resources, knowledge, and capital from industry, management system reform of universities; and enhancing the "bridging" function of National R&D Institutes).
■ Accelerate the mobility of human resources and create "spaces for co creation" to concentrate personnel, knowledge, and capital.
■ Through these initiatives, increase the number of researchers transferring between sectors by 20% and the amount of collaborative research funds received from industry by universities and National R&D institutes by 50%.



Created from the "Survey of Science and Technology Research 2014" Bureau of Statistics, Ministry of Internal Affairs and Communications

(2) Enhancing the Creation of SMEs and Startup Companies to Tackle New Business Opportunities

■ Provide appropriate support at each phase, from nurturing entrepreneurs, starting up companies, commercialization, and business growth (such as by promoting the creation of academic startups, guaranteeing initial demand for new products and services etc.), increase IPOs and M&As.

(3) Strategic Use of International Intellectual Property and Standardization

■ Promote utilization of IP scattered across small and medium-sized companies and universities (increase proportion of domestic patent applications by small and medium-sized companies to 15%, increase the number of license agreements on university patents by 50%), promote international standardization and enhance support systems for this purpose.

(4) Reviewing and Improving the Regulatory Environment for Innovation

■ Review systems in accordance to new products and services, improve IP systems in response to tremendous development in ICT.

(5) Developing Innovation Systems that Contribute to "Regional Revitalization"

■ Drive self-regulating and sustainable innovation systems through regional leadership (such as promote revitalization of regional companies etc.).

(6) Cultivating Opportunities for Generating Innovation in Anticipation of Global Needs

■ Establish mechanisms to promote anticipation of global needs and inclusive innovation*
* Socially inclusive and sustainable innovation. In science and technology cooperation with newly emerging and developing countries, aim to shift from the aid - style cooperation of the past.

Chapter 6: Deepening the Relationship between STI and Society

In pursuing STI, we will work to communicate and cooperate with a variety of stakeholders in society.

■ Promote "co-creation" with a variety of stakeholders. Issue scientific advises for policy formation and address ethical, legal, and social issues. In addition, take measures to ensure research integrity.

Chapter 7: Enhancing the Capacity to Promote STI

Reform and enhance the functions of universities and National R&D Institutes that are the main agents of STI; enhance the system for promoting STI policy; and ensure R&D investment.

■ Radically reform and enhance the function of universities based on a recognition of their "contribution to society through education and research", and reform and enhance the function of National R&D Institutes, as a driving force of the innovation system.
■ To increase the effectiveness of STI policy, by aiming for a unified implementation of international STI activities and science and technology diplomacy, and by promoting policy based on objective evidences. Also, enhance the "control tower" function of CSTI (such as by constantly improving policy quality through the use of performance indicators, promote SIP etc.).
■ To implement the Basic Plan, ensure that combined public and private sector R&D investment is at least 4% of GDP, and that government R&D investment is at least 1% of GDP, maintaining compatibility with "The Plan to Advance Economic and Fiscal Revitalization." If GDP growth averages 3.3% per year over the term of the Basic Plan, total government R&D investment would be approximately 26 trillion yen.

Source: MEXT

Section 2 Council for Science, Technology and Innovation Policy

CSTI in the Cabinet Office is positioned as a council that advances key policies toward vigorously promoting Japan's science and technology policies under the leadership of the Prime Minister. The Council 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 and technology efforts and offering comprehensive and fundamental policy plans and general coordination (Table 2-1-2).

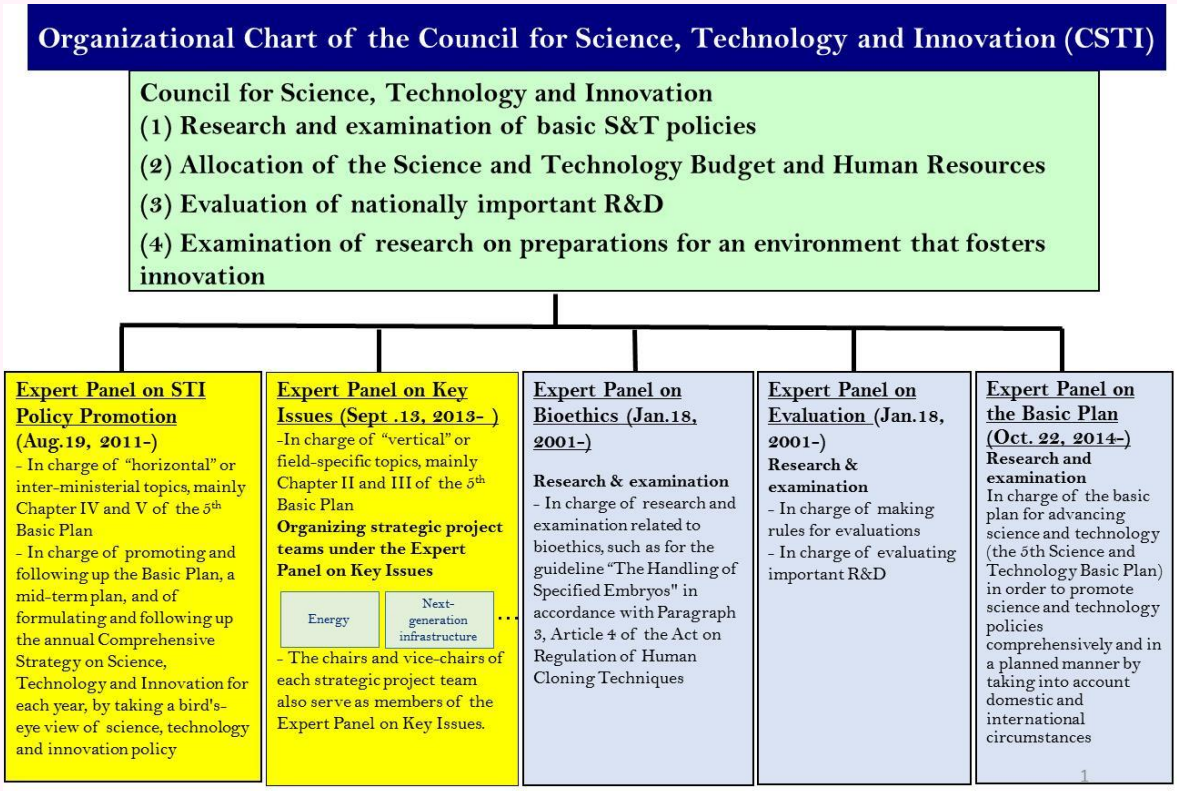
As of March 2016, CSTI has established the Expert Panel on Science, Technology and Innovation Policy Promotion and four other expert panels that deliberate on technical aspects of key issues (Figure 2-1-3).

■ Table 2-1-2 / List of CSTI members

Cabinet members	Shinzo Abe	Prime Minister
	Yoshihide Suga	Chief Cabinet Secretary
	Aiko Shimajiri	Minister of State for Science and Technology Policy
	Sanae Takaichi	Minister of Internal Affairs and Communications
	Taro Aso	Minister of Finance
	Hiroshi Hase	Minister of Education, Culture, Sports, Science and Technology
	Motoo Hayashi	Minister of Economy, Trade and Industry
Experts	Yuko Harayama (full-time)	Former Professor, Graduate School of Engineering, Tohoku University
	Kazuo Kyuma (full-time)	Former Senior Corporate Adviser, Mitsubishi Electric Corp.
	Takahiro Ueyama (part-time)	Professor and Vice-President, The National Graduate Institute for Policy Studies (GRIPS)
	Takeshi Uchiyamada (part-time)	Chairman of the Board, Toyota Motor Corp.
	Motoko Kotani (part-time)	Director, Advanced Institute for Materials Research (AIMR); Prof., Graduate School of Science, Tohoku University
	Masakazu Tokura (part-time)	Representative Director & President, Sumitomo Chemical Co., Ltd.
	Kazuhito Hashimoto (part-time)	President, National Institute for Materials Science (NIMS) and Professor, Policy Alternatives Research Institute of the University of Tokyo
	Takashi Onishi	President of the Science Council of Japan (The head of affiliated institutions)

Source: Cabinet Office

■ Figure 2-1-3 / Organizational chart of CSTI



Source: Cabinet Office

1 Major Endeavors of CSTI in FY2014

CSTI has been discussing policy, budgets and systems. Such discussions address the following: 1) the establishment of the 5th Basic Plan and the Comprehensive Strategy on Science, Technology and Innovation 2015, 2) contributions to the compilation of the "Japan Revitalization Strategy" revised in 2015 (approved on June 30, 2015 by Cabinet Decision), 3) the strategic development of science and technology budgets by the entire government through the STI Budget Strategy Committee and priority measures of the Comprehensive Strategy on Science, Technology and Innovation 2015, and 4) the operation of the Cross-ministerial Strategic Innovation Promotion Program (SIP) and the Impulsing Paradigm Change through Disruptive Technologies Program (ImPACT).

2 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 Comprehensive Strategy on Science, Technology and Innovation to be implemented. Towards the formulation of the science and technology budget for 2016, the Science, Technology and Innovation Budget Strategy Committee, whose chairperson is the Minister of State for Science, Technology and Innovation Policy and whose members are the directors of relevant ministries, was convened to decide policy areas on which to prioritize budget allocations, in accordance with the Comprehensive Strategy on Science, Technology and Innovation.

(1) The policy for the allocation of budgets and other resources related to science and technology in FY2016

Under the Comprehensive Strategy on Science, Technology and Innovation, CSTI suggested areas of policy focus and measures of focus for each policy area, 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) Meetings of the Science, Technology and Innovation Budget Strategy Committee

The Council held three meetings of the Science, Technology and Innovation Budget Strategy Committee that were chaired by the Minister of State for Science, Technology and Innovation Policy and whose members include the directors of relevant ministries and agencies concerned. These meetings aimed at close coordination among relevant ministries and agencies prior to the formulation of the FY2016 science and technology budget, towards ensuring the implementation of the Comprehensive Strategy on Science, Technology and Innovation. Based on the discussions at the meetings, CSTI determined the priority measures and led the entire government in formulating the science and technology budget from the planning stage of budget requests by each ministry and agency.

(3) Determination of measures for the Action Plans for Science and Technology Priority Measures FY 2016 (approval and supplementary recommendation on September 18, 2015)

CSTI established 11 systems under the basic policy, and each ministry proposed related programs. Under the basic policy, desirable socioeconomic systems are built by using value chains that combine the "new values" realized by the application of R&D to important measures for resolving socioeconomic issues described in the Comprehensive Strategies on Science, Technology and Innovation 2015. Regarding the measures proposed by each ministry and agency, CSTI guided policy by conducting interviews and examinations with experts and Diet members. 158 action plan programs were selected as priority programs in order to provide advice for collaborations, the elimination of project duplication and coordination among projects for relevant ministries and agencies.

(4) The creation of the Strategic Innovation Promotion Program (SIP)

CSTI founded the SIP in FY 2014 to manage and promote R&D interdisciplinarily and inter-ministerially. The SIP encompasses everything from basic research to the practical application and commercialization of research results under industry-academia-government collaborations. The 10 program directors (PDs) play central roles on relevant program. With the addition of one program in November 2015, the SIP has come to work on 11 programs that are socially important for Japanese or that have the potential to contribute to economic reform in Japan. According to the CSTI policies, the Cabinet Office budget for the Creating and Promoting Science, Technology and Innovation (FY 2016: 50 billion yen) is intensively allocated to the implementation of the SIP. Health and medicine are promoted under the Headquarters for Healthcare and Medical Strategy Promotion founded pursuant to the Act to Promote Healthcare and Medical Strategy (Act No. 48, May 30, 2014).

(5) Priority polices for the Comprehensive Strategy on Science, Technology and Innovation 2015 (approval and supplementary recommendation on September 18, 2016)

The Comprehensive Strategy on Science, Technology and Innovation 2015 sets 5 priority policy fields, and for each of these it sets "prioritized undertakings." Relevant ministries proposed to CSTI the programs that should be included as "prioritized undertakings." After interviewing ministry officials on proposals and conducting coordination among the proposals, CSTI decided the "priority programs."

In Part I of the Comprehensive Strategy on Science, Technology and Innovation 2015, priority programs were set for three policy fields, towards launching the 5th Science and Technology Basic Plan. Those policy fields are "endeavors to create future industry and to transform society in the period of great change" (5 priority programs), "the promotion of STI that contributes to regional revitalization" (9 priority programs) and "the promotion of STI that makes the most of the opportunity of the 2020 Tokyo Olympic and Paralympic games" (one priority program). The creation of an environment that fosters innovation chains is one of 5 policy fields for which 38 programs have been identified as priority programs and for which performance indexes have been set for understanding and analyzing how the situation of Japan has been changing. These indicators will be used for follow-up activities.

(6) Promotion of the Impulsing Paradigm Change through Disruptive Technologies (ImPACT) Program

The ImPACT Program for high-risk, high-impact, innovative R&D is being promoted to create STI that will bring significant changes to industry and society if it is realized. In additions to the 12 program managers (PM) who have been given major authority and responsibility for planning, promoting and managing R&D, CSTI selected 4 new program managers from publicly invited applicants in September 2014. The PMs started their work of implementing R&D programs, including providing workshops and assigning projects to R&D institutes and soliciting applications from R&D institutes.

(7) Towards the formulation of the science and technology budget (approval and supplementary recommendation on December 18, 2015)

When formulating the budget, CSTI collated the key issues and notes into a report: *Toward the Formulation of the Science and Technology Budget for FY 2016*. This was done to acquire a Science and Technology budget that adequately reflects priorities, based on the Comprehensive Strategy on Science and Technology Innovation, and CSTI presented the report to the Prime Minister and other ministers.

3 R&D Evaluation of Projects of National Importance

(1) Evaluation of Large-Scale R&D Projects (approved and notified on December 18, 2015)

Large new R&D development projects started in FY 2016[1], including the Advanced Integrated Intelligence Platform Project (AIP). This comprehensive project covers AI, big data, the IoT and cybersecurity. CSTI assessed the AIP project and provided advice to the Minister of MEXT, who is in charge of that project. CSTI reevaluated the Subsidies for an Integrated Coal Gasification Fuel Cell Combined Cycle Demonstration Project, whose preliminary evaluation was done in FY 2011, based on the

1 R&D projects for which national funds totaling over 30 billion yen were allocated

decision to reevaluate the project before its second phase. CSTI made an interim evaluation and reported it to the Minister of Economy, Trade and Industry, who supervises the project.

(2) Evaluation of Large-Scale R&D Projects (approved and reported on December 18, 2015)

CSTI conducted an ex-post evaluation on the completed promotion of basic research to generate innovation (MAFF), the development of practical technologies for implementing new agricultural, forestry, and fishery policies (MAFF), Field Test Project on New Photovoltaic Power Generation Technology (METI) and Research & Development for the 3rd-Term Comprehensive 10-year Cancer Control Strategy (MEXT and MHLW), all of which had been subject to preliminary evaluation by CSTI, and CSTI sent the evaluation results to the minister of each ministry.

4 Major Deliberations at Expert Panels

(1) Undertakings towards the formulation of the 5th Science and Technology Basic Plan

Towards formulating the 5th Basic Plan, in October 2014, the Prime Minister made the Consultation Request #5, Regarding the Science and Technology Basic Plan, to CSTI. On the same day, CSTI established the Expert Panel on Basic Policy to research and examine the Basic Plan according to domestic and international circumstances, so that science and technology programs could be developed in a comprehensive, planned manner. The panel has already started researching and examining the 5th Basic Plan.

The Expert Panel on Basic Policy held its first meeting in December 2014. The panel issued the interim report at the 9th meeting in May 2015. The panel continued study and discussions until the Science and Technology Basic Plan (Recommendation) was completed at the 15th meeting in December 2015.

MEXT established the Comprehensive Policy Special Committee under the Council for Science and Technology (CST) in June 2014 to assist in the examination of the 5th Basic Plan by CSTI, and study and examination started. In January 2015, the committee published an interim report. The report pointed out the importance of strengthening the foundation for innovation, such as by the systemic reform of human resource management and by the creation of a new innovation system that corresponds to academic research, basic research and open innovation. The committee continued to deepen the discussions and compiled a final report in September 2015. The discussions by the committee were reported to CSTI (Figure 2-1-4).

■Figure 2-1-4 / Outline of the final report by the Comprehensive Policy Special Committee

Japan's STI Policies looking beyond the Mid-to Long Term

– Toward Post the 4th Science and Technology Basic Plan – (Final report) Overview

Chapter 1: Basic Concept

1. Influences on STI policy due to socio-economic conditions and changes

Socio-economics has been greatly changing. This also has a great influence on STI policies.

- ✓ Due to population decline, it will become more difficult to increase human resource volume. **System reforms on human resources that place importance on improving the quality of human resources** will be necessary going into the future.
- ✓ **In order to react quickly and flexibly with alacrity to new diverse issues in the future, the creation of new systems that enable sustainable open innovation** ※1 will be indispensible.
- ✓ Cyber space has quickly expanded and **"the advanced cyber society"** ※2 **has arrived**. The arrival of this new society continues to have a great effect on society and the shape of science. Further, due to changes in the state of geopolitics and in the security environment, involving Japan, there is a rising importance for **obtaining, maintaining, and accumulating technologies that government should be responsible**. A response to these changes must be made.
- ✓ Sincere initiatives are necessary for **regaining trust from society** in regard to S&T and researchers, etc. since having a drop in reputation due to the Great East Japan Earthquake and dishonest research practices, etc.

※1 Methods that make proactive use of outside knowledge and technology in innovation.
※2 A society where the fast expansion of cyberspace does not merely act as a supplement and substitution for actual society, but rather where a variety of activities that exceed the realm of actual society are autonomously carried out in cyberspace and, through a unification/fusion with actual spaces, come to exert a large influence over actual society.

2. Trends in foreign STI policies

In overseas countries, STI policy is positioned as an important measure in propelling the country's development, and initiatives are strengthened by planning for the expansion of expenditure, etc.

USA: The "Strategy for American Innovation" established a target of 3% of GDP for R&D expenditures (private and government R&D expenditures combined). U.S. policies in recent years have been consistent in placing importance on continuous investment in basic research to help the U.S. remain competitive and in promoting the development of advanced manufacturing technologies.

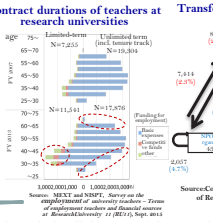
Europe: EU has established a target of 3% of GDP for total R&D expenditure. In Germany, in addition to achieving this in FY2012, an importance has been placed on the promotion of innovation via initiatives such as "Industrie 4.0" and "The New High-Tech Strategy." In the UK, despite budgetary austerities, funding to scientific research has been maintained.

Asia: China is substantially increasing its total R&D expenditure and is focusing on key business areas, such as manufacturing, that are being advanced in the "Made in China 2025" initiative. In the 3rd Science and Technology Basic Plan, South Korea aims to increase government R&D investment by 40% from the 2nd Science and Technology Basic Plan.

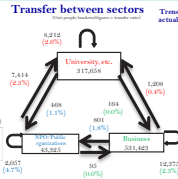
3. Achievements and issues from the 1st Science and Technology Basic Plan

- Due to the initiatives of 20 years from the 1st Plan, **the substantive scope of researchers and patents, etc. and the high international competitiveness of basic research and research infrastructure have been Japan's great strengths on the world stage**. Further strengthening and effective efforts are needed at this.
- On the other hand, Japanese STI faces a vast number of issues. For example, the following are cited:
  - ✓**The career prospects** for young researchers **are not clear and employment is unstable.** Also, due to the **"a generation gap in mobility," etc. human resources are not able to perform at their full potential at the right posts**. Because of this, **students are hesitant in proceeding to doctoral courses.**
  - ✓**The diversity of basic research in Japan is in declining**. Also, in regard to written theses, there is **a downward trend in international rankings for both quality and volume.**
  - ✓**Systems appropriate for realizing innovation are insufficiently well established**, for example with fewer businesses involved in innovation realization than other countries. One of the reasons are **almost no mobility of human resources across the sectors** of industry, academia, and government.
  - ✓Since the 2nd Basic Plan, **government of R&D expenditure goals have not been met**. A **decline in basic funds** for universities and R&D agencies has been one cause of many issues such as the decline in stable positions of researchers.

Contract durations of teachers at research universities

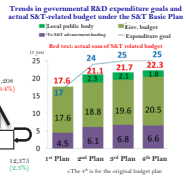


Transfer between sectors



Source:Compiled by MEXT based on MIC's "Survey of Research and Development"

Trends in governmental R&D expenditure goals and actual S&T-related budget under the S&T Basic Plan



- **In order to resolve various issues and realize sustainable development in the world, the promotion of STI will be of continuing importance.**
- **The maximization of investment returns from the last 20 years will determine the success or failure of future STI policy, and the 5th Science and Technology Basic Plan will play an extremely important role for Japan.**

Chapter 2: Principles for the next STI policy

1. Target picture of Japan → "Building nation based on STI"

A nation that realizes sustainable development for Japan and the world, with high level STI skills that, through its innovation activities, finds solutions to problems inside and outside of its borders

STI Create intellectual and cultural value based in new knowledge derived from scientific discoveries and invention, etc., and, through the development of knowledge, bring about reforms that lead to the creation of financial, social, and public value.

As concrete examples of the target picture of Japan being "A nation that realizes sustainable development for Japan and the world," the following 3 ideals will shape that direction.

Ideal 1: Live together with Earth and contribute to the advancement of mankind
Ideal 2: Ensure the safety of the country and its people, and realize a comfortable and happy life
Ideal 3: Preserve world-ranking top-class economic strength and presence

2. Change the shape of STI and raise the importance of the innovation creation basis

If the following changes are made to the shape of STI, **the importance of innovation creation basis increases.**

- ✓ Change from an old "linear" model that propels basic, application, and developing research in a straight line to a research model that moves forward in a "spiral" and interactive manner
- ✓ Switch from a so-called "self-sufficiency" model to one that values "open innovation"
- ✓ Increase the importance placed on integration and cooperation between the all fields of the humanities, the social sciences, and the natural sciences

3. The government's role in STI – important initiatives for the future

Aiming at the realization of the target picture of Japan, government initiatives will place importance on the following 2 points.

(1) Strengthening the innovation creation basis

- In order to respond with alacrity to diverse issues, strengthen innovation creation basis as the basis for STI potential.

(Reform human resource systems, strengthen and reforms in academic and-basic research as the basis for innovation, and strengthen and reform research infrastructure, create new innovation systems, etc.)

(2) Leading society through STI

- Develop the diverse knowledge and value that comes out of innovation creation basis, resolve various domestic and foreign issues, and drive societal reforms.(Resolve policy issues, realize the desired "the advanced cyber society," develop "National Critical Technologies," S&T diplomacy, and regain trust from society, etc.)

4. Basic stances on the promotion of STI policy

The 6 basic stances that, in particular, concerned parties should be strongly aware of the promotion of STI policy.

(1) Invigoration of academic research that explores the frontiers of knowledge.
(2) Promotion of initiatives in global society.
(3) The basic roles of universities, public R&D agencies, and industries.
(4) Basic consideration of distribution of budget.
(5) Unified promotion via cooperation between related policies.
(6) Cooperation and joint-understanding with all stakeholders.

Chapter 3 Enforcement of Innovation Creation base

1. Reforms in human resource system

(1) Reforming the carrier system for young persons

- ✓ Introducing a **tenure system** for young teaching staff in universities **in principle, providing more posts for young employees through annual salary system for senior staff and contractual employment**, and clarifying carrier path through **excellent researcher system (provisional)**
- ✓**Diversifying carrier path** through increased matching opportunities such as medium- to long-term internship
- ✓Developing an environment for full support of doctoral students and encouraging young researchers to be independent

(2) Fostering STI human resources

- ✓ Fostering and increasing next-generation human resources for **graduate school reforms** including doctoral education in collaboration with the industry, and **uniform reforms in high-school and university education and university entrance selection**, and increasing engineers

(3) Diversifying human resources

- ✓**Promoting female leaders**, developing an environment to accept and support foreign students

(4) Promoting movement of human resources across organizations, sectors and borders

- ✓ Introducing **new salary and employment systems** such as annual salary and cross appointment, and **support of young Japanese in foreign countries**

2. Reinforcement of innovation sources

(1) Promoting scientific and basic research as innovation sources

- ✓ **National investment in scientific and basic research** excluded from market principle
- ✓ **Reform and reinforcement of Grants-in-Aid to respond to social demand**, and effective and efficient promotion of strategic creation programs including the shared use and joint research system reform and reinforcement and setting of evidence based strategic goals, and formulation of world-leading research center

(2) Strategic reinforcement of common base technology, facilities and equipment and information infrastructure to support R&D activities

- ✓ Promotion of R&D for nanotechnology, photon and quantum, telecommunication, mathematical science, development of research facilities and equipment available for industry, academic and government as common platforms, development of facilities and equipment at universities, and reinforcement of information infrastructure

3. Establishment of an innovation system for sustainable open innovation

(1) Reforms in industry-academia-government collaboration

- ✓ **Regional creation** through STI or the **establishment of a new innovation system enabling prompt R&D and application to society**, including a **"collaboration platform"** for producing outstanding collaborative achievements by promoting mobility of personnel, things, money and information (e.g. **cross-sectoral human movement**, **visualization** of research outcomes and needs) and synergetic effects of knowledge, viewpoints, and ways in industry, academia and government.

(2) Promotion of STI in companies and reinforced support for business deployment

- ✓Support of capable university ventures, reinforcement of SMEs, and tax incentive for companies conducting R&D

(3) Fostering human resources supporting innovation (innovation human resources)

- ✓**Increases in innovation human resources** such as program managers, research administrators and technical assistance

Chapter 4 Leading society with STI

1. STI through issue settings

(1) Response to socially critical issues

- ✓ Effectively addressing the policy issues defined in the Comprehensive Strategy on STI, in order to formulate "strategies for world leadership by Japan," foster awareness in Japan of the nation's advantages and disadvantages and make use of them. Using the Tokyo Olympics and Paralympics as a worldwide platform to showcase Japan's STI, which will help solve policy issues after the Olympics and Paralympics

(2) Innovations for realizing a super smart society

- ✓ Identifying a new pressing issue that has become increasingly important in light of the rapid advancement of "cyber society"
- ✓ Promoting R&D for the creation of new services that utilize cyberspace, sensor technologies, AI and big data; responding to the effects of cybersecurity issues on our society and to cyberspace activities; innovating techniques for enhancing STI, including data science and open science techniques; and developing and recruiting human resources

(3) Government-initiated core technologies (national strategy core technology)

- ✓ Acquiring, retaining and developing technologies affecting **the nation's existence (national strategy core technologies)** for **ensuring security and safety of the country and people** or **driving national growth,** while taking into account changes in national security situations, including geopolitical information, to ensure self-organization and autonomy of Japan

[Potential technological examples]
Observation and forecast of natural disaster, HPC, space exploration, next-generation aircraft, marine resource survey, data driven type material design, dynamic biological systems, artificial intelligent, robotics, cyber security, advanced laser, etc.

2. Strategic international promotion of STI

- ✓ Promoting global strategies on the basis of various policies for cooperation with different countries; developing international strategies for enhancing science and technology; and developing international diplomatic ST strategies
- ✓Building **international cooperation innovation centers** in Japan and the world, and promoting large R&D projects in international cooperation

3. Reinforcement of relations between STI and society

(1) Recovery of social trust

- ✓ Taking measures against research misconduct , and promoting risk communication

(2) S&T progressed with society

- ✓ Emphasizing " co-creative STI " that helps solve social issues by connecting social needs to research and policy formation through various activities, including communication and collaboration among diverse stakeholders
- ✓ Improving platforms that diverse stakeholders can use to respond to each other; increasing social involvement by scientists and engineers; and increasing involvement in STI by stakeholders in society

Chapter 5 Optimization of STI creation function

1. Reinforcement of university function

- ✓ Towards the functional improvement of universities based on the future visions of various universities, defining three prioritized support areas within the framework of government subsidies for national university corporations
- ✓ Creating "specific-research universities (tentative)" and "prominent graduate schools (tentative)"
- ✓ Enhancing efforts for the functional strengthening of IR at universities
- ✓ Increasing financial aid to private educational institutions

2. Functonal enhancement of national R&D institutes as innovation hubs

- ✓**Enhancing the "innovation hub" function to drive the new innovation hub** in light of **national R&D institutes**
- ✓Promoting the establishment of a **unique researcher evaluation system at each corporation**, leadership of human resource system reform, reinforcement of creating and utilizing intellectual properties, and **formulation of a center to integrate industrial, academic and government personnel, things, money and information**, through edium- to long-term target setting, evaluation of corporations, budget procedures and projects

3. Reforms in fund allocation

- ✓National funds comprise a dual **support for basic research funds and competitive funds, in principle**, and reforms include both funds.
- ✓ Ensuring that funding for competitive funds covers direct costs plus an additional 30% for indirect costs.
- ✓ Sharing, in principle, relatively large, versatile equipment and devices purchased with competitive research funds
- ✓ Making reforms that address the need to foster young human resources (i.e., making salaries for research leaders be payable from direct costs , and emphasizing the need to foster young researchers in screening and evaluation processes)

Chapter 6 Enhancement of the promotion system of STI policies

1. Enhancement of policy planning and promotion function

- ✓Integrating policy areas relating to the CSTIP and exercising control tower function.
- ✓Promoting science for policies, and investigating scientific advising mechanism

2. PDCA cycle in STI policies

- ✓Continuous improvement of R&D evaluation systems
- ✓Introducing R&D program evaluation for routine use, fostering human resources and ensuring carrier path

3. Increases in national R&D investment

- ✓National R&D investment goals were not achieved after the 2nd Basic Plan.
- ✓**1% of national R&D funds to GDP is fundamentally ensured, and the total investment amount clearly indicated in the 5th Basic Plan.**

Source: Cabinet Office

The Ministry of Internal Affairs and Communications (MIC) was to consult the Telecommunications Council for advice on the direction for a new telecommunications technology strategy for the 5 years from December 2014. The interim recommendation was compiled in July 2015 by the Strategy Committee of the Telecommunications Council. The interim recommendation proposes priority R&D fields and issues, and methods for promoting them, in order to reform the social system and foster "new value" It fosters such value by adapting world-leading ICT to society. The interim recommendation identified priority R&D issues. To focus discussion on issues of advanced technology, such as next-generation artificial intelligence that combines big data analysis, brain science and automatic control/autonomous driving systems, the Strategy Committee established the AI & Brain Science Working Group and the Advanced Technology Working Group in December 2015. These working groups started examinations on detailed methods of promoting projects, on methods of educating research personnel, and on a standardized road map.

Under METI, the R&D and Evaluation Subcommittee of the Committee on Industrial Science and Technology Policy and Environment under the Industrial Structure Council compiled an interim report for the 5th Basic Plan in June 2014. That report emphasized the importance of the following: developing a scheme for creating outstanding technology seeds, establishing a gap-bridging system that nurtures innovative technology seeds to commercialization, proposing roles for each body in an innovation system and collaboration among bodies, and pursuing the development and mobility of human resources who lead innovation. In March 2015, the R&D and Evaluation Subcommittee discussed issues related to the 5th Basic Plan.

(2) Expert Panel on Key Issues

The Expert Panel on Key Issues was established for the purpose of ensuring the promotion of solution-oriented policies under the 4th Basic Plan and for furthering the Action Plans specified by CSTI. This expert panel intends to use its expertise to investigate and examine the key issues that are listed in the 4th Basic Plan and the Comprehensive Science, Technology and Innovation Strategy as issues that need to be focused on at present or to be more thoroughly dealt with in future.

(3) Expert Panel on Evaluation

The Expert Panel on Evaluation conducted one ex-ante evaluation, one mid-term evaluation and three ex-post evaluations of large R&D development projects and collated the evaluation results.

(4) Expert Panel on Bioethics

The Expert Panel on Bioethics has been studying and examining emerging bioethical issues in response to recent advances in the life sciences and has published an interim report. These issues include research on the use of germ cells derived from ES cells and iPS cells to create human embryos.

Section 3 Comprehensive Strategy on Science, Technology and Innovation

Each year, CSTI leads in formulating the Comprehensive Strategy on Science, Technology and Innovation, because STI is positioned as an important pillar of the growth strategy. The Comprehensive Strategy on Science, Technology and Innovation 2015 was established in June 2015 in conjunction with the 5th Basic Plan that would be launched in FY 2016 (Figure 2-1-5).

Five fields were positioned as priority policy fields for the Comprehensive Strategy. They were selected considering the following: 1) FY 2016 is the first year of the 5th Basic Plan, 2) measures need to be launched a year before the start of the Basic Plan to secure the Plan's smooth start, 3) issues identified from the current domestic and international socioeconomic situations must be promptly and surely addressed, and 4) the policy objectives need to be surely achieved through the comprehension and analysis of previous priority measures that were specified in the former comprehensive strategies. The five fields are as follows:

1) Endeavors to create future industry and to transform society in the era of revolution
2) The promotion of science, technology and innovation that contribute to regional revitalization
3) The promotion of science, technology and innovation that make the most of the opportunity of the 2020 Tokyo Olympic and Paralympic games
4) The creation of an environment that fosters innovation chains
5) The implementation of important measures that address socioeconomic issues

For the implementation of programs in priority policy fields, key performance indicators (KPIs) have been set for a proper understanding and analysis of the situation, towards achieving the objectives. In addition, the Comprehensive Strategy indicates that in order for CSTI to be a control center, there is the need for cross-ministerial policy development and effective PDCA cycles for the 5th Basic Plan.

■ Figure 2-1-5 / Outline of the Comprehensive Strategy on Science, Technology and Innovation 2015

Cabinet Office

Comprehensive Strategy on Science, Technology and Innovation 2015 【Summary】

Comprehensive Strategy on Science, Technology and Innovation

- Specifying priority issues for each fiscal year according to mid- and long-term policies defined in the Science and Technology Basic Plan
- Decided by the Cabinet every year as part of the economic revival plan since the start of the second Abe administration
- Aiming at promoting science, technology and innovation effectively and efficiently by linking the S&T Basic Plan with the Comprehensive Strategy on Science, Technology and Innovation for generating synergy and securing mid- and long-term continuity of efforts

Future direction of science, technology and innovation policies

- The advent of the "Age of Revolutionary Change," when the process of socioeconomic value creation changes dramatically
  - Rapid progress of ICT that changes innovation creation models; intensifying global competition that results in growth in the importance of open innovation
  - A host of issues that need to be addressed by using science, technology and innovation (e.g. limited energy, food and other resources; dwindling population; economic distress in regional economies)
- In the Age of Revolutionary Change, which can also be called the Age of the Fourth Industrial Revolution, Japan will pave the way to the future, solve domestic and global issues and aim at sustainable development of the county
  - Taking actions preemptively to address pressing issues towards the start of the Fifth Science and Technology Basic Plan → Three policy issues to be addressed in starting the Fifth Science and Technology Basic Plan
  - Advancing reforms that need to be addressed in order to solve priority issues specified in the Comprehensive Strategy on Science, Technology and Innovation; further advancing necessary efforts → Two policy issues that need to be addressed toward the creation of S&T innovations
- On the basis of the Comprehensive Strategy on STI, fulfillment of the Council for Science, Technology and Innovation's function as a command center
  - Taking cross-ministerial, policy-led action swiftly and with foresight in proper chronological order; examining effective PDCA cycles under the Fifth Science and Technology Basic Plan
  - Studying how to promote R&D on basic technologies, including those that are significant for national strategies and for achieving a super smart society
  - Bolstering cooperation with other command centers; fulfilling its role as a command center for promoting institutional reforms; strengthening its capabilities as a head office

Three policy issues that are to be addressed in starting the Fifth Science and Technology Basic Plan

- Efforts towards the creation of future industries and the achievement of social change in the Age of Revolutionary Change

A major challenge lies in the need to strengthen Japan's international competitive edge in order to achieve sustainable development in the Age of Revolutionary Change. Thus, Japan will try new things aggressively, actively work on value creation, develop its strengths and aim to achieve a "super smart society" before the rest of the world. In such a society, systems are developed, integrated, and networked across sectors and regions.

【Priority issues】
- ○ Developing concepts of future society and industries in cooperation with a broad range of stakeholders
- ○ Investing in ambitious R&D; enhancing human resources (Studying the further development of the ImPACT; disseminating ImPACT to other ministries)
- ○ Utilizing Japan's strengths in order to implement projects for the systemization of services and businesses (e.g., the development of intelligent transport systems and new manufacturing systems as part of efforts to address socioeconomic problems); integrating these systems
- ○ Improving common basic technologies (e.g., the IoT, big data analysis, mathematical science, AI, cybersecurity, sensors, robotics, materials, nanotechnology) and human resources towards the realization of a super smart society

- Promoting S&T innovations that help "regional revitalization"

Regional strengths will be used to foster businesses and projects that can play a central role in innovations that lead to regional revitalization. At the same time, the aim is to build a structure under which cooperation among the industrial, academic, government and financial sectors results in the autonomous development of S&T innovations.

【Priority issues】
- ○ Creating new industries and businesses through innovations suited to regional characteristics (i.e., autonomous regional revitalization)
  - Assistance provided by public research institutes and AIST to national-level "translational R&D"
  - Generating opportunities for universities, technical colleges, research institutions, companies and local governments to collaborate on innovation creation
  - Promoting commercialization initiated by local small and mid-sized enterprises on the basis of intellectual property
- ○ Revitalizing regional economy and industry through support provided to regional core businesses
  - Providing consistent support in the process from research to commercialization to business viability
  - Improving the business environment for young or female entrepreneurs; promoting "businesses restarts in new or different business categories"
- ○ Promoting regional revitalization led by local universities and technical colleges through region-wide development and the utilization of human resources who are capable of creating innovations

- Enhancement of S&T innovations by taking advantage of the Tokyo 2020 Olympic and Paralympic Games

To help solve domestic issues, the 2020 Olympics and Paralympics will be used as a worldwide platform to showcase Japan's S&T innovations. This will help enhance global business activities of domestic industries and will trigger a positive economic growth cycle from 2020 onward. In the future, a master plan for specific implementation of the nine projects that should be carried out with the cooperation of the private sector towards the Olympics and Paralympics will be formulated and pursued.

【The nine projects】
1. Hospitality Innovation
2. Disease Information Innovation
3. New Accessibility Innovation
4. Mobility Innovation
5. Energy Innovation
6. Weather Forecast Innovation
7. Big Data & Sensing Innovation
8. Global Movie Experience Innovation
9. Flower Innovation


Mobility Innovation

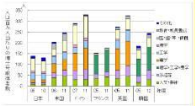

Global Movie Experience Innovation

Two policy issues that need to be addressed toward creation of S&T innovations

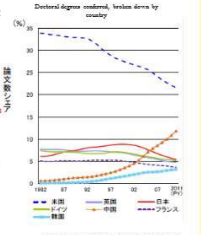
- Improvement of the environment for generating innovation chains

Various "obstacles" to policy promotion will be eliminated, in order to generate a chain of innovations and develop sustainable and expansive innovation systems. At the same time, it is important to enhance open innovation, take a global perspective and strategically utilize intellectual property.

1. Increases in opportunities for youth and females
   - Developing young human resources through industry-academia collaboration (e.g., industry-academia-government round-table conferences, and internships) and through reforms/improvements to postgraduate education
   - Using the annual salary system and the cross-appointment system to enhance the mobility and exchanges of researchers; securing career paths for young researchers by using the tenure track system and the excellent young researcher system
   - Promoting females to leading positions; enhancing female involvement by facilitating a balance between work and life issues



2. Integrated promotion of reforms at universities and in research funding systems
   - Functionally enhancing national universities by implementing reforms of government subsidies for national university corporations and by strengthening universities' management capabilities
   - Reforming research funding systems through the review of eligibility for competitive funding and the allocation of indirect costs, for the purpose of enhancing the research capabilities of universities
   - Promoting the autonomous management of national university corporations through the diversification of financial resources



Published papers, broken down by country

3. Enhancement of academic and basic research
   - Reforming and enhancing Grants-in-Aid for Scientific Research (reviewing the research fields, the methods and the screening system; promoting international networking)
   - Reforming and enhancing the shared use of facilities and collaborative research systems through effective cooperation among institutions of academic and basic research
   - Promoting the development of world-leading international research centers (e.g., the WPI) and international collaborative research that helps enhance basic studies in Japan
   - Promoting open science that opens up fresh avenues for the creation of new knowledge and leads to innovations

4. Funcational enhancement of R&D institutes
   - Improving operation and management, such as by increasing the flexibility of the procurement of goods and services necessary for R&D, the accounting of institute revenues and the carrying-over of budgets
   - Examining the criteria and ceiling of negotiated contract amounts, in order to ensure that situations at R&D institutes are balanced with those at national university corporations and that R&D institutes can procure goods and services swiftly and effectively
   - Promoting the use of R&D institutes as venues for co-creation where world-leading research infrastructure, including supercomputers, is developed and available for shared use
   - Strategically promoting "translational R&D" on the basis of advanced translational R&D by AIST, NEDO and other parties
   - Reinforcing strategic management systems for marketing, intellectual property and publicity; creating innovation hubs
   - Creating and operating a system for the Specified National Research and Development Agency (tentative)

5. Increases in opportunities for small, mid-sized and venture businesses to take on challenges
   - Using Silicon Valley and other places to foster young entrepreneurs; providing risk capital; utilizing angel tax credits, R&D tax credits and other tax credits
   - Improving environments for the practical application and commercialization of technologies by utilizing a stage-gate screening process
   - Promoting demand-side policies in the public sector by increasing the use of bidding systems that emphasize technological capabilities (e.g., systems utilizing comprehensive evaluations of bidders)
   - Enhancing open innovation through the work of a council that is under the Intellectual Property Strategy Headquarters and through the strengthening of the intellectual property strategy

- Significant efforts towards solving socioeconomic issues

Prior to "the creation of future industries and social changes," ideal socioeconomic systems will be planned, various R&D efforts including SIP will be combined for systematization and value chains will be created to generate competitive advantage in industry. Goals to be achieved by 2020 will be set in order to ensure the practical application of R&D results.

"The early recovery from, and reconstruction after, the Great East Japan Earthquake" will be aggressively promoted in view of the actual conditions of recovery and reconstruction.

I. Clean, economical energy systems
- i) Optimization of the energy value chain
  Forecasting and controlling energy supply and demand by utilizing ICT and technologies for storing hydrogen and other energy resources for the purpose of establishing networks for production, distribution and consumption on the basis of the anticipated diversification of the energy mix, energy supply structures and energy demand
- ii) Development of global environment information platforms
  Predicting the global environment and integrating relevant information in order to balance the substantial introduction of renewable energy with stable power supply

II. Leading the world in realizing a society of healthy longevity
Aiming at obtaining specific results by discovering excellent technological seeds in basic studies and growing them into practical applications (Promoting the following: drug discovery research; the development of medical equipment; the development of centers for innovative medical technologies for treatment; regenerative medicine; personalized genomic medicine; and research on cancer, mental and neurological disorders, emerging and re-emerging infectious diseases and intractable diseases)

III. Development of next-generation infrastructure before the rest of the world
- i) Efficient and effective maintenance and renewal of infrastructure
  Optimizing inspections, evaluations and responses for the purpose of managing assets by using limited human and financial resources
- ii) A society resilient to natural disasters
  Combining technologies for predicting, preventing, evacuating from and recovering from natural disasters, in order to achieve the shared use of real-time disaster information

IV. Development of new industries that capitalize on Japan's strengths and utilize the IoT and big data
- i) Intelligent transport systems
  Utilizing autonomous driving technologies that enable the real-time determination of vehicle and pedestrian locations towards realizing Advanced Rapid Transit (ART) and other means of mobility for regional communities
- ii) New manufacturing systems
  Building systems that surpass Industrie 4.0 and swiftly provide high value-added products and services by using robots and devices that foresee the needs of potential users by incorporating explicit knowledge of master technology and know-how
- iii) Materials integration systems
  Utilizing highly reliable data for determining what materials are needed according to the required performance and their manufacturing processes and highly reliable data for bringing these materials to market in a short span of time
- iv) Comprehensive regional systems of medical and nursing care
  Analysing and sharing information on disease prevention, medial care and nursing care in local communities for the purpose of helping the elderly to enjoy self-sufficiency and extended healthy longevity; creating a cross-sectoral cooperative support system; developing services that are not covered by nursing-care insurance
- v) "*Omotenashi*" hospitality systems
  Ensuring that visitors enjoy safety, security and convenience by realizing multilingual speech translation, the smooth flow of people through sensing data and efficient and intelligent security, all of which contributes to continuous increases in visitors to Japan and the vitalization of regional economies

V. Development of agriculture, forestry and fisheries into growth industries
- i) Smart food chain systems
  Systems that link information about the needs of consumers, food-service industries and distribution industries at home and abroad in order to make use of that information in breeding and production
- ii) Smart production systems
  Systems that utilize ICT and robot technology to ensure stable agricultural management by providing support to young farmers and aging farmers

Source: Cabinet Office

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

1 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 institutes 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 administrative work of various administrative agencies. MEXT also takes administrative leadership in comprehensively promoting the implementation of R&D programs in important advanced science and technology fields and the advancement of creative basic research.

Table 2-1-6 shows major reports from CST.

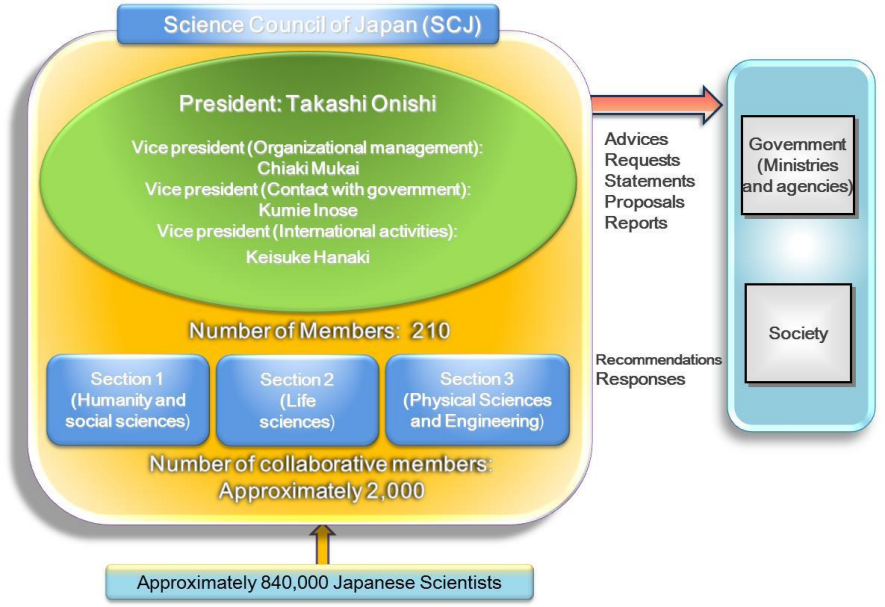
The Science Council of Japan (SCJ), an organization that represents Japan's scientific community and has 210 members and about 2,000 associate members, is under the supervision of the prime minister. The SCJ is responsible for the following: 1) deliberating on key issues and making recommendations to the government and the public, 2) fostering the networking of scientists, 3) collaborating with international academic institutions, and 4) promoting scientific literacy through education. (Figure 2-1-7 and Table 2-1-8).

Table 2-1-6 / Major reports from Council for Science and Technology (FY 2015)

Date of issue	Major Reports
	Subdivision on R&D Planning and Evaluation
June 16, 2015	Measures to promote Relationships between Society and Science, Technology and Innovation: Towards Co-creative Science, Technology and Innovation [The Committee for the Science and Technology for Safety and Security, and Social Linkage]
Aug. 25, 2015	10-Year Policy on Earth Observation Implementation Policy for Japan [Earth Observation Promotion Working Group]
	Subdivision on Resources Research
Nov. 27, 2015	Standard tables of food composition in Japan 2015 (Seventh Revised Edition) Amino Acids, Standard Tables of Food Composition in Japan 2015 (Seventh Revised Edition) Fatty Acids, Standard Tables of Food Composition in Japan (Seventh Revised Edition) Available Carbohydrates, Polyols and Organic Acids, Standard Tables of Food Composition in Japan (Seventh Revised Edition)
	Subdivision on Science
Sept. 11, 2014	Promoting Open Access to Academic Information in Japan (interim report) [Academic Information Committee]
Feb. 26, 2016	Promoting Open Access to Academic Information in Japan (interim report) [Academic Information Committee]
	Subdivision on Ocean Development
Aug. 27, 2015	Results of the preliminary R&D evaluation concerning marine science and technology (August 2015)
Aug. 27, 2015	Concept of Future Marine Biology Research [Marine Biology Committee]
	Advanced Research Infrastructure Working Group
Aug. 5, 2015	Measures to promote the shared use, maintenance and improvement of facilities and equipment that support R&D infrastructure
Nov. 25, 2015	The introduction of a new system for research facilities and equipment whose shared use allows the integrated management of a research organization
Nov. 25, 2015	Overview report on Technology for Advanced Measurement and Analysis [Committee for the Development of Systems and Technology for Advanced Measurement and Analysis]
	Subcommittee on Industrial Collaboration and Regional Support
July 3, 2015	Management of Risk in Cooperative Industry-University-Government Activities at Universities [Examination Committee for the Management of Risk in Cooperative Industrial-Academic Activities at Universities]
Aug. 5, 2015	On the Future Direction of Intellectual Property Management at Universities towards Innovation: Establishing a Future-oriented Research Management System for Universities [Committee on University Intellectual Property Management for Strengthening Competitiveness]
	Strategic Basic Research Working Group
June 8, 2015	Guideline for the formulation of strategic goals
	Committee on Human Resources
Aug. 3, 2015	Next-Generation Human Resource Development for Science, Technology and Innovation (summary of discussions thus far) [Next Generation Human Resource Development Working Group]
	Special Committee on Comprehensive STI Policy
Sept. 28, 2014	Medium- to Long-term STI Policy in Japan - Toward Post 4th S&T Basic Plan - (final report)

Source: MEXT

■ Figure 2-1-7 / Organizational structure of the Science Council of Japan (SCJ)



Note: As of October 2, 2014
Source: Cabinet Office

■ Table 2-1-8 / Major recommendations by the Science Council of Japan (SCJ) (FY 2015)

Matters related to this white paper	Recommendations	Date of issue	Gist
Advancement of measures for solving key issues	*Recommendation on the Disposal of High-level Radioactive Waste (Recommendation)*	April 28, 2015	The report Disposal of High-level Radioactive Waste was drafted in September 2012 in response to a request by the Chairman of the Atomic Energy Commission. More detailed discussions were held to comprehensively consider both society and technology, and the recommendations were made regarding the following: (1) methods and durations of temporary storage; (2) the responsibility of businesses that generated the waste, and fairness among regions bearing the burden, (3) actions that address responsibility to future generations, (4) permanent disposal candidate sites, risk analyses for these, and (5) the organization of a system for forming consensus.
Increases in the affluence of people's lives	*Improving the Environment of Meijijingu Gaien [the outer park of Meiji Shrine] and Ensuring That Meijijingu Gaien Achieves Harmony with the New National Stadium (Recommendation)*	April 24, 2015	Instead of producing temporary assets, the huge investment in facilities for the Olympic and Paralympic Games, a globally notable event, should produce enduring, widely used assets that will be handed down to future generations. To this end, the following improvement plans, which are feasible and which contribute to the global environment, are recommended: (1) the creation of a real forest whose ground, unlike the planned artificial ground, fosters a natural water cycle and whose ecosystem resembles the current ecosystem of Meijijingu Shrine; (2) the restoration of surface flow on the

			Shibuya River in order to improve the thermal environment and landscape, to restore sound water circulation and to create a natural corridor; and (3) the establishment of a committee that formulates a vision for the restoration of water and greenery, and a vision for the future of Meijijingu Gaien.
	Emergency Recommendation to Establish a Prefectural Ordinance on Secondhand Smoking for Metropolitan Tokyo (Recommendation)	May 20, 2015	In Japan, many people, including workers at restaurants and bars, cannot avoid breathing in someone else's cigarette smoke. Legislation that prevents secondary smoking needs to be urgently enacted. Especially for a city that is hosting the Olympic and Paralympic games, it is international common sense to prohibit smoking in public buildings. Towards the 2020 Tokyo Olympic and Paralympic Games, the establishment of such legislation should be regarded as one of the most important matters. Accordingly, an urgent recommendation for legislation to prevent secondary smoking in public spaces through the enactment of an ordinance was made to the Tokyo Metropolitan Government.
The development of human resources capable of playing active roles in science and technology	The Promotion of Gender Equality in the Science Community (Recommendation)	Aug. 6, 2015	Matters for inclusion in the Fourth Basic Plan for Gender Equality are recommended, with the aim of including proposals based on analyses from a report titled "The promotion of gender equality in the science community," which was issued in September 2014.
Contributions to solutions to international issues	Recommendation for the Promotion of International Research on Disaster Prevention and Mitigation and the Reduction of Disaster Risk (Recommendation)	Feb. 26, 2016	Japan, where natural disasters frequently occur, has experience and expertise in disaster prevention and mitigation. To globally contribute to disaster prevention and mitigation through international cooperation, the discussions leading to the Sendai Framework for Disaster Risk Reduction, which was adopted at the 3rd World Conference on Disaster Risk Reduction held in Sendai, were summarized and recommendations were made on which issues should be addressed jointly by countries around the world and which actions should be taken by Japan.

As one contribution of the Science Council of Japan (SCJ) that addresses important issues of Japan, the Issue-centered Committee for Disposal of High-level Radioactive Waste of the SCJ made a recommendation in April 2015 toward forming a national consensus on the temporary storage of high-level radioactive waste. For discussion of the recommendation from various standpoints, the SCJ held an academic forum in October 2015.

The first meeting of the Issue-centered Committee for Deliberation on National Support to, and Research and Education by, National Universities towards Science Promotion was held in May 2015. The following were discussed: 1) how economic, industrial, social and educational research influences universities, especially national universities, 2) what roles national universities play in education and research, and 3) how national universities and support from the national government should be managed. In addition, in view of the effective and efficient use of research funds for science promotion, the first meeting of the Issue-centered Committee for Deliberation on Research Funding Systems to Promote Science Research was held in September 2015.

Japan, where natural disasters frequently occur, has experience and expertise in disaster prevention and mitigation. To globally contribute to disaster prevention and mitigation through international cooperation, the discussions leading to the Sendai Framework for Disaster Risk Reduction, which was adopted at the 3rd World Conference on Disaster Risk Reduction held in Sendai, were summarized and recommendations were made on which issues should be addressed jointly by countries around the world and which actions should be taken by Japan. Furthermore, aiming at preserving the global environment and achieving a sustainable global society, deliberations have been made by the Committee for Future Earth Promotion, in order to compile recommendations on implementation.

2 Science and Technology Budgets

The science and technology-related portion of Japan's initial budget for FY2015 is 3.4766 trillion yen, of which 2.9467 trillion yen is allocated for the general account budget and 503.9 billion yen is allocated for the special account budget. The funds for promoting science and technology, which represent the principal science and technology-related expenditures in the general account, are 1.2857 trillion yen. The science and technology-related portion of Japan's supplementary budget in FY 2015 was 158.8 billion yen, of which 103.0 billion yen was allocated for the general account budget (including 80.3 billion yen in funds for promoting science and technology), and 55.8 billion yen was allocated for the special account budget. Changes in the science and technology budget (initial budget) are shown in Table 2-1-9, and science and technology budgets are broken down by ministry in Table 2-1-10.

■ Table 2-1-9 / Changes in science and technology budgets

(Unit: 100 million yen)

Item \ FY	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Science and technology promotion expenditures (A)	13,334	13,352	13,135	13,007	13,372	12,857
As a % of the previous FY	96.8	100.1	98.4	99.0	102.8	96.2
Other research-related budget (B)	17,197	17,213	16,728	16,571	17,102	16,610
As a % of the previous FY	104.8	100.1	97.2	99.1	103.2	97.1
Science and technology budget included in the general account budget (C) = (A) + (B)	30,531	30,565	29,863	29,578	30,474	29,467
As a % of the previous FY	101.1	100.1	97.7	99.0	103.0	96.7
Science and technology budget included in the special account budget (D)	5,359	6,083	7,063	6,520	6,039	5,309
As a % of the previous FY	98.3	113.5	116.1	92.3	92.6	87.9
Science and technology budget (E) = (C) + (D)	35,890	36,648	36,927	36,098	36,513	34,776
As a % of the previous FY	100.7	102.1	100.8	97.8	101.1	95.2
General account budget of Japan (F)	922,992	924,116	903,339	926,115	958,823	963,420
As a % of the previous FY	104.2	100.1	97.8	102.5	103.5	100.5
General expenditure budget of Japan (G)	541,724	540,780	517,957	539,774	564,697	573,555
As a % of the previous FY	104.7	99.8	95.8	104.2	104.6	101.6

Note 1: Initial budget amounts are shown.
Note 2: 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 2-1-10 / Science and technology budgets of each ministry/office/agency

(Unit: 100 million yen)

Item / Ministry/Office/Agency	FY2014 (Initial budget)				FY2014 (Supplementary budget)				FY2015 (Initial budget)				FY2015 (Supplementary 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 assembly	11	11	-	11	-	-	-	-	11	11	-	11	-	-	-	-
Cabinet Secretariat	610	-	-	610	83	-	-	83	614	-	-	614	100	-	-	100
Reconstruction Agency	-	-	404	404	-	-	-	-	-	-	240	240	-	-	-	-
Cabinet Office	740	721	-	740	9	8	-	9	708	689	-	708	76	25	-	76
National Police Agency (NPA)	21	21	-	21	0	0	-	0	21	21	-	21	-	-	-	-
MIC	493	406	-	493	8	-	-	8	459	406	-	459	26	23	-	26
Ministry of Justice (MOJ)	68	-	-	68	3	-	-	3	59	-	-	59	0	-	-	0
Ministry of Foreign Affairs (MOFA)	103	-	-	103	1	-	-	1	108	-	-	108	2	-	-	2
Ministry of Finance (MOF)	13	10	-	13	-	-	-	-	13	10	-	13	-	-	-	-
Ministry of Education, Culture, Sports and Science (MEXT)	21,917	8,483	1,202	23,118	856	448	-	856	21,629	8,530	1,172	22,801	397	359	-	397
Ministry of Health, Labour and Welfare (MHLW)	1,599	1,255	28	1,627	32	5	-	32	1,027	751	28	1,055	10	2	-	10
Ministry of Agriculture, Forestry and Fisheries (MAFF)	978	928	-	978	85	26	-	85	970	922	-	970	100	100	-	100
Ministry of Economy, Trade and Industry (METI)	1,286	1,004	4,110	5,396	294	273	836	1,130	1,287	997	3,530	4,817	300	279	542	842
Ministry of Land, Infrastructure, Transport and Tourism (MLIT)	729	281	4	733	18	13	-	18	732	275	4	736	5	-	-	5
Ministry of the Environment (MOE)	319	253	263	582	16	16	16	32	314	246	335	649	15	15	16	31
Ministry of Defense (MOD)	1,587	-	28	1,615	-	-	-	-	1,517	-	-	1,517	-	-	-	-
Total	30,474	13,372	6,039	36,513	1,406	789	852	2,258	29,467	12,857	5,309	34,776	1,030	803	558	1,588

Because of rounding, the cumulative amounts in some columns may not equal the totals.
Source: Adopted by MEXT based on data from the Cabinet Office