[Tentative translation]

Integrated Innovation Strategy 2023

June 9, 2023
Cabinet decision

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Chapter I: Overview (Science, Technology and Innovation to Support Important National Infrastructure and Transform Social Issues into Engines of Growth)

1. Basic Concept

Integrated Innovation Strategy 2023 (hereinafter referred to as "Integrated Strategy 2023") is the third annual strategy, positioned as an action plan, of the Sixth Science, Technology and Innovation Basic Plan (hereinafter referred to as the "Sixth STI Basic Plan") approved by the Cabinet on March 26, 2021. The Sixth STI Basic Plan sets out the medium- to long-term direction of our country's science, technology and innovation policies toward the realization of Society 5.0[1], which is the vision of society, by 2025, with a view to 2030. It consists of major and medium-term goals, as well as a series of programs aimed at achieving those goals. In order to evaluate progress, indicators linked to each goal are listed.

As an annual strategy for the one-year period of the Sixth STI Basic Plan, the Integrated Strategy 2023 calls for powerful promotion of effective measures aimed at achieving goals, for review and deepening of measures based on the status of progress thus far, and flexibly responding to changes in circumstances in Japan and overseas. To this end, the Government will continue to constantly improve the quality of science, technology and innovation policies, with a view to further enhancing the role of the Integrated Strategy as an annual strategy, establishing an effective and efficient policy promotion model, and considering the next STI Basic Plan.

(1) Domestic and overseas conditions surrounding science, technology and innovation

Science, technology and innovation are driving forces that transform climate change and other social issues into engines of growth and achieve sustainable economic growth. At the same time, science, technology and innovation are the national lifeline for Japan from the perspective of ensuring the safety and security of Japanese citizens against threats such as infectious diseases and natural disasters. In particular, the prolonged Russia’s aggression against Ukraine has increased the severity of the environment surrounding areas such as energy, food, and cyberspace, thereby further increasing the importance of supply chains and social infrastructure resilience. Furthermore, combined with the movement to build new international collaborations as countries steer toward the post-COVID-19, these trends have influenced a wide range of areas both domestically and internationally. Among increasing uncertainty in regard to the future outlook, expectations for science, technology and innovation are progressing into a new phase. At the same time, advanced technologies such as advanced generative AI, quantum technology and fusion energy[2] are showing signs of rapid development that are not an extension of the past. Against this background, there is an intensification of the fierce inter-state competition for advanced technology,

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[1]Society 5.0 is a vision of society that Japan should aspire to, and is proposed in the Fifth STI Basic Plan and other documents as “a human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space.”
The Sixth STI Basic Plan make concrete “a society that ensures the safety and security of the people by being sustainable and resilient in the face of threats and uncertain situations, and where each individual can realize diverse happiness (well-being).”

[2] In recent years, the term “fusion” is being used outside of Japan to refer to “nuclear fusion”, which has completely different characteristics from nuclear fission. Considering how the Integrated National Strategy will also be disseminated outside Japan, the term “fusion energy” is used in the Strategy.

especially between the U.S. and China. Moreover, investment in science, technology and innovation in major countries is moving toward further expansion. Additionally, the inter-state competition has expanded to include the acquisition and development of human capital, the source of knowledge and value creation.

In October 2022, the U.S. formulated its National Security Strategy, which expresses the importance of strengthening investment in advanced technology development and people within the security framework. Specifically, in accordance with the CHIPS and Science Act of 2022, which was enacted in August 2022, the U.S. government has committed to increasing investment by over $280 billion to promote fundamental 21st century technologies such as semiconductors, next-generation computing, quantum technology, AI, biotechnology, next-generation communications, and clean energy. The Act also positions investment in people as the highest-impact public investment, and declares that the U.S. will continue to be the world's largest provider of STEM talent through incentives for attracting STEM talent and strengthened commitment to STEM education and training. The EU updated the EU Industrial Strategy in May 2021. Based on the lessons learned from events such as the international supply chain disruptions that emerged as a result of the COVID-19 pandemic, the updated EU Industrial Strategy presents a basic recognition of the need to respond to dependence outside the EU, which is a strategic concern, and sets out to ensure "Open Strategic Autonomy" as the concept of a new EU. Based on this concept, the European Chips Act, for which political agreement was reached in April 2023, aims to achieve over 43 billion euros in public and private investment by 2030, and to increase the EU's share of global semiconductor production to 20%. In the U.K., the Advanced Research and Invention Agency (ARIA) was launched in January 2023 as a DARPA-type high-risk research funding agency to fundamentally strengthen efforts in advanced research, and has begun strengthening incentives to attract world-class human resources. Furthermore, as China aims to increase R&D expenditures by more than 7% per year under its "14th Five-Year Plan", it is reported that China has achieved a 14.2% increase in R&D expenditures in 2021 and a preliminary 10.4% increase in 2022, reaching 3 trillion RMB for the first time ever.

In the AI field, ChatGPT, an interactive generative AI (an interactive tool using natural language generative AI technology) developed by the OpenAI Inc., the company in the U.S. is said to have gained over 100 million users in the fastest time ever. The world is witnessing a premonition of large-scale social change due to advanced generative AI, and the movement toward its utilization is also spreading. In the energy field, National Laboratory in the U.S. have succeeded in development themes such as using laser fusion technology to generate more output energy than input energy for the first time ever. We are now seeing signs that the development of emerging technologies driven by the fierce inter-state competition will have a significant social impact.

On the other hand, Japan's capacity for research and innovation continues to be on a relative decline. Taking research capacity as an example, in recent years, Japan's ranking in terms of the number of high-profile research papers has fallen out of the top 10, and number of doctorates per population has remained stagnant for a long period of time, although it should not be judged one-sidedly only by indicators that are easy to grasp quantitatively. Against this background, it has been pointed out that these trends have led to a rapid decline in Japan's presence in the international research community. In terms of innovation, Japan's ranking in reports on global competitiveness has long been stagnant.

In order to overcome this critical situation and to strongly advance science, technology and innovation

policies, Japan set a target of approximately 30 trillion yen for the government as a whole and 120 trillion yen for the public and private sectors combined for R&D investment over the five years from FY2021 in the Sixth STI Basic Plan, which greatly exceeds the target of the 5th Basic Plan. It also aims to realize Society 5.0, which is a "society that is sustainable and resilient in the face of threats and uncertain situations, ensures the safety and security of the people, and enables each and every person to realize diverse well-being."

The budget for science and technology during the period of the Sixth STI Basic Plan (including the initial budget for FY2023) totals approximately 21.9 trillion and is progressing steadily. However, in the midst of the fierce inter-state competition, it is necessary to work on further expansion of R&D investment. In addition, conditions are being met to utilize new projects and systems that did not exist at the time of the formulation of the Sixth STI Basic Plan, such as the 10-trillion-yen University Endowment Fund, support for research universities with a regional core and distinctive characteristics, the Key and Advanced Technology R&D through Cross Community Collaboration Program, and dramatic expansion of the SBIR system. Additionally, through the Cross-ministerial Strategic Innovation Promotion Program (hereinafter referred to as SIP), progress is being made in applying the results of large-scale projects to the resolution of social issues and social implementation. As countries move toward the post-COVID-19 world and begin to construct new collaborations, we will use the aforementioned results as a driving force to continue acting with foresight to invest in basic research, the development of human resources and social implementation. We must tackle key national issues through science, technology and innovation by attracting private investment and public-private partnership and cooperation.

(2) Government agenda and expectations for the role of science, technology and innovation

The "Grand Design and Action Plan for a New Form of Capitalism" is a plan for realizing a new form of capitalism. The basic concept of the Plan is to achieve new market creation and economic growth by solving social issues through public and private sectors. To achieve these goals, the Plan calls for large-scale accumulation of human capital, development of advanced technology, and establishment of startup businesses. For this purpose, the Plan specifies "investment in people", "investment in science, technology and innovation", "investment in startups", and investment in other areas as pillars that are priority investment fields for increasing growth and distribution. It also calls for the use of government investment as a catalyst for fundamentally strengthening public and private investment. Furthermore, the Plan calls for supporting advanced science and technology fields through measures such as strengthening research capabilities by supporting Universities for International Research Excellence through University Endowment Fund and supporting research universities with a regional core and distinctive characteristics; advanced science and technology fields such as quantum technology, AI, and biotechnology, and for providing thorough support for startups based on "Startup Development Five-year Plan". Additionally, as a prerequisite for the realization of new capitalism, the Plan states the need to strengthen economic security, including energy and food, and positions diplomacy, defense, and ensuring the safety and security of Japanese citizen's lives as important pillars of policy.

In December 2022, Japan formulated a new National Security Strategy which positions technological capabilities as one of the main elements of comprehensive national power for Japan's national security. The

creation of science, technology and innovation is a source of Japan's own economic and social development. At the same time, against the background of accelerating progress in advanced science and technology and increasing difficulty in distinguishing technology by its application, the appropriate use of technological capabilities plays a crucial role in improving Japan's national security environment.

This philosophy and agenda for the realization of the New Form of Capitalism cannot be achieved without sustainable economic growth and the resolution of social issues. It is in line with the vision for Society 5.0, a people-centered society that balances these goals. At the same time, the principle of "a virtuous cycle of 'social transformation through Convergence Knowledge (So-Go-Chi)' and 'investment in knowledge and people'" presented in the Sixth STI Basic Plan embodies the virtuous cycle of growth and distribution in science, technology and innovation policies. The essence of the vision of society portrayed by Society 5.0 are the social transformation and future portents ushered in by the evolution of advanced science and technology, including advanced generative AI, quantum technology, and fusion energy. Furthermore, given the conditions in Japan and overseas (including the circumstances surrounding security) expectations are increasing dramatically for the importance of satisfying the safety, security, and well-being of Japanese citizens and the role of science, technology and innovation. In this sense, the society that Japan aims for will not waver from Society 5.0; rather our country must realize the ideal society with a greater sense of speed and urgency. Today, science, technology and innovation are closely intertwined with all areas of the economy and society. In this era, strengthening the contribution of science, technology and innovation is an urgent issue for further growth of such areas.

(3) Responses to changing circumstances and future direction of initiatives

As the international environment surrounding Japan becomes increasingly severe and advanced technologies show remarkable progress, it has become even more important to expand Japan's presence and contribution in the international community by strategically addressing key national issues with science, technology and innovation as key elements. To achieve this goal, it is essential to cooperate and collaborate with like-minded countries and partner countries that share Japan's values. On the basis of such international cooperation and collaboration, while ascertaining technological trends from a holistic perspective, it will become increasingly important to strategically promote advanced science and technology while identifying areas in which Japan has an advantage and is indispensable, and to develop technology that will support the future of Japan. As the competition between countries intensifies, it is essential to strengthen the acquisition and development of high-level human resources that will be the driving force behind such efforts, to form international brain circulation to achieve this acquisition and development, to create an environment that attracts diverse human resources who will take on the challenge of innovation, and to stimulate investment for supporting these efforts.

In light of the recent unpredictable changes in circumstances that have shaken the assurance of safety and security, the rapid progress of advanced technology, and the growing importance of responding to key national issues, it is necessary to mobilize the wisdom of Japan and form new collaborations across fields and organizations that can respond flexibly to social issues and various changes in circumstances. At that same time, Japan must maintain solid momentum from our past achievements, including the launch of new funding since the formulation of the Sixth STI Basic Plan.

In the Integrated Strategy 2023, while considering these changes in surrounding circumstances and the progress of past efforts, we will further strengthen our efforts and make them more concrete by focusing on the “three cornerstones” of our policy, which will be discussed in the next section. The concrete achievement of such policies is the embodiment of a strategic process toward the realization of Society 5.0 as set forth in the Sixth STI Basic Plan. By sharing information on this process, we will respond to key national issues by combining forces in industry, academia, and government, without being bound by organizational or disciplinary boundaries, while at the same time improving our foresight.

2. Three Cornerstones of Science, Technology and Innovation Policies

Given the recent situation in Japan and overseas as well as the progress of past efforts, from the perspective of important measures that should be taken immediately, we can broadly classify science, technology and innovation policies into the three cornerstones.

The first cornerstone is the "strategic promotion of advanced science and technology." Based on national policies for important fields and functions for think-tank, the government strategically promote R&D with a mind to ensuring the advantages and ultimately indispensability of Japan's technologies, develop technologies supporting the future society of Japan, and facilitate social implementation of them.

By strengthening the strategy for key technologies including the quantum field, formulating a new fusion energy innovation strategy, strengthening our response to generative AI, and launching and strengthening a think tank that conduct research and analysis on key advanced critical technologies, the government refine a strategic promotion process for goals such as achieving solutions to social issues and strengthening economic security with advanced science and technology at the core of our efforts. By promoting large-scale projects such as the Moonshot R&D Program (hereinafter referred to as "MS"), the SIP, and the Key and Advanced Technology R&D through Cross Community Collaboration Program (K Program), we will accelerate efforts for social implementation while linking social needs and technology seeds with enhanced collaboration across fields.

In addition to these fields, we will support R&D investment in important fields such as social digitalization, green innovation, semiconductors, biotechnology, materials, health and medical care, space, oceans, and Beyond 5G (6G) from a midium-to-long-term perspective. The public and private sectors will cooperate in responding to key national issues, thereby making a fully-fledged comeback in Japanese technology. We will also strengthen our contribution to multi-use advanced technology in the context of the National Security Strategy.

The second cornerstone is "enhancement of knowledge bases (research capabilities) and human resource development." We will achieve synergistic strengthening of the knowledge base and fostering of human resources, and will continuously create new "knowledge" as a source of science, technology and innovation, and value creation.

Through initiatives to develop internationally outstanding research universities via the University Endowment Fund and efforts to improve research capability through enhanced support for regional core universities and universities with specific niches, we will promote basic research and academic research to produce diverse and preeminent knowledge, and will build a foundation for broad and multilayered knowledge throughout Japan.

Furthermore, without being bound by rigid humanities and science frameworks or boundaries between disciplines, we will strengthen the development of PhDs and other diverse human resources who lead creative research and expand career paths for their activities. At the same time, we will promote recurrent education that meets the changing social needs of the times and encourages students to continue learning. By collaborating with top overseas universities and producing a diverse range of globally active human resources through the realization of the Global Startup Campus Initiative described below, the intellectual assets generated by universities and other institutions will be returned to society.

Furthermore, taking the opportunity of hosting the G7 Summit in Japan, we will expand our presence

and contributions in the international community by strengthening cooperation with countries that share common values and partner countries, forming international brain circulation, and strengthening our response to global academic journal issues.

The third cornerstone is "creation of innovation ecosystem." In this area, we will bring startups to the forefront as bearers of innovation, and will return the benefits of science, technology and innovation to the Japanese people, society, and communities.

Under the "Startup Development Five-year Plan", the government will provide thorough support for startups, including deep tech startups, a field in which Japan can be a global leader. We will also promote the Global Startup Campus Initiative and other initiatives such as hub cities. By doing so, the government will create a startup ecosystem in which cities, regions, universities, and startups will work closely together to stimulate the economy and create a succession of growing startups, including deep tech startups that take on the challenge of resolving social issues. We will expand the creation and development of good regional examples in conjunction with the Vision for a Digital Garden City Nation. In addition to initiatives for the development of the venture capital (VC) market, the government will utilize all policy tools, such as R&D Promotion Tax System, the SBIR system, and the promotion of public procurement of research results, to invigorate a growth-oriented funding cycle and to expand R&D funding both for the public and private sectors.

We will also strengthen fundamental efforts to respond to unpredictable changes in circumstances, rapid advances in emerging technologies, and key national issues. Following the formulation of the Sixth STI Basic Plan, beginning with the establishment of the 10-trillion-yen University Endowment Fund, we have strengthened support for research universities with a regional core and distinctive characteristics, and have dramatically expanded the Key and Advanced Technology R&D through Cross Community Collaboration Program, as well as the SBIR system. In order to effectively utilize these initiatives as a powerful driving force, we will build new alliances to enhance the research infrastructure and human resources centered on public research institutions and funding agencies that support the three cornerstones of science, technology and innovation policies. This will enable us to dynamically gather Japan's wisdom for responding to key national issues.

In light of the fact that approximately two years have passed since the formulation of the Sixth STI Basic Plan, the following section examines notable trends during the year and identifies priority measures in line with these three cornerstones. In addition, Chapter 2 provides an analysis of the implementation status and current status of the measures organized in accordance with the table of contents of the Sixth STI Basic Plan, future plans, and lists specific annual measures. Integrating these measures, the government will set priorities centered on the three cornerstones and comprehensively advance the Sixth STI Basic Plan, while strongly promoting science, technology and innovation policies toward the realization of Society 5.0.

(1) Strategic promotion of advanced science and technology

① Promoting national strategies for key technologies and responding to key national issues (Strengthening national strategies for key technologies)

Quantum technology

Based on the "Quantum Technology and Innovation Strategy" formulated in January 2020, we

established the "Quantum Technology Innovation Hubs (QIH)" and the "Quantum STrategic industry Alliance for Revolution (Q-STAR)" to promote the creation of industry and innovation. When considering changes (for example, intensifying international competition in the quantum industry) in the environment surrounding quantum technology since the strategy-making, we established, the "Vision of Quantum Future Society" in April 2022. This defines a vision of a future society and three goals to be achieved through quantum technology (production value of 50 trillion yen, 10 million users in Japan, and creation of quantum unicorn ventures by 2030). In April 2023, in order to realize the vision and goals set forth in the Vision of Quantum Future Society, we formulated the "Strategy of Quantum Future Industry Development," which outlines the main issues to be addressed in the practical application and industrialization of quantum technology, and provides basic response policies and action plans.

Based on this strategy, we will promote support for the creation of use cases for quantum technology using the SIP, etc., develop an environment for the use of quantum technology, and provide support for start-ups/venture companies and new business creation, and form an ecosystem, etc. While promoting the integration of quantum technology and fundamental technology (AI technology, conventional computation infrastructure, etc.), we will demonstrate use cases by collaborating with biotechnology, materials, and other important fields. We will continue to enhance MS and other R&D projects in order to ensure Japan's advantage in advanced technology infrastructure that will be the source of industrialization and commercialization. Furthermore, as an innovation infrastructure to support these efforts, we will strengthen the functions of the Quantum Technology Innovation Hubs which handle creation of use cases, R&D of hardware and software, support for R&D aimed at strengthening the supply chain for devices, components, and materials, expansion of comprehensive global support for industry such as international standards, organization and provision of a state-of-the-art quantum-classical hybrid computing infrastructure, and R&D and industrial support for a quantum technology infrastructure.

AI

The Japanese government has clarified basic strategies and principles for AI, such as "AI Strategy 2022" and "Social Principles of Human-Centric AI." However, given the changes in technologies such as generative AI [3]and international discussions, the government established a new "AI Strategy Council" of experts with a wide range of knowledge. The Council held intensive discussions on various issues with the "AI Strategy Team" and other organizations composed of relevant ministries and agencies. On May 26, 2023, the Council released "TENTATIVE SUMMARY OF AI ISSUES," which is a compilation of issues to be addressed due to the advent of generative AI, while maintaining the basic strategies and principles that have already been established.

The use of AI could bring significant benefits. These benefits could be even greater due to advances in AI technology such as generative AI. AI is one of the key tools to realize Society 5.0.

On the other hand, the emergence of generative AI has raised concerns about risks related to AI, such as not knowing what data the AI is processing or how that data is being processed, whether the AI is giving wrong answers, whether confidential information will be leaked by interacting with the AI, and whether the

[3]Refers to diffusion models that generate images and large language models (LLMs) that handle natural language. There is a system for classifying generative models as opposed to existing discriminative models. This term focuses on the generative aspect of the models.

AI can be misused for crimes. Other security risks have also been pointed out. Moreover, since the scale of computing resources and data has a significant impact on the performance of generative AI, there is concern in regard to the possibility of large-scale AI becoming increasingly dominant due to competition for scale. There is also concern for the risk of supply disruptions due to the high dependence of AI-related products and services on foreign countries.

Therefore, based on the discussion points at the AI Strategy Council, we will promote international discussions on AI and responses to various risks. We will also optimize the use of AI and strengthen AI development capabilities as we aim for innovation, creation of new industries, and realization of Society 5.0.

International Discussions and Responses to Risk

- At the G7 Hiroshima Summit in May 2023, the G7 leaders affirmed the need for AI governance in line with G7 values. In particular, as for generative AI, the G7 leaders tasked relevant ministers to discuss it and report back to the G7 leaders by the end of this year as the "Hiroshima AI Process." As Japan is in a responsible position in the international community, Japan will continue to lead international discussions.
- There is a need for "guardrails" against generative AI. Specifically, the risks and direction of response must be organized according to each AI developer, service provider, and user. Also, concerns and risks related to generative AI must be addressed appropriately.
- The first step is to encourage AI developers and service providers to comply with existing laws, regulations, and guidelines. It is also necessary to use new technologies to deal with problems caused by new technologies. For example, we should consider the development and dissemination of new technologies such as AI for use in controlling inappropriate results generated by AI.
- With regard to various risks related to AI (for example, leakage of confidential information, inappropriate use of personal information, risks related to privacy, risks of destabilization and disruption of society due to disinformation, risks of sophisticated cyber attacks, and risks of copyright infringement), we will consider necessary measures based on trends in international discussion, while also taking into account schedules set in frameworks such as the "Hiroshima AI Process."
- In regard to the use of generative AI in education, while its use has the potential to improve the effect of education and reduce the workload of teachers, there are concerns that the use of generative AI for homework and essays may undermine appropriate evaluation and reduce the creativity of students and children. Accordingly, we seek to formulate guidelines before the summer.

Optimal use of AI

- Generative AI has the potential to accelerate digitalization, improve the overall productivity of Japan, and contribute to the resolution of various social issues. In order to accelerate the use of AI, we will build a data linkage infrastructure, develop human resources, and construct an appropriate business environment.
- Although the use of generative AI poses risks such as leakage of confidential information, there is potential for government agencies to reform work styles and improve services to citizens by

streamlining various administrative tasks and procedures. Trial measures using publicly available information are being performed in an effort to improve the efficiency of administrative operations and the quality of administrative services through the use of generative AI. We will also conduct workshops, ideathon, and proofs of concepts

- We aim to enhance education on AI skills and literacy so that a wide range of generations can enjoy the benefits of generative AI.

Strengthening of AI development Capabilities

- As the world is on the brink of being revolutionized by generative AI, it is important to promptly foster fundamental R&D capabilities in Japan related to generative AI.
- For that purpose, while fully utilizing the vitality of the private sector, we will promote the development and expansion of computing resources and data, which can be called infrastructure for the development of generative AI.
- The enormous amount of electricity consumed by AI is an issue. Accordingly, we will consider measures to effectively utilize renewable energy and other forms of power, including the use of regional data centers. At the same time, we aim to promote the development of energy-saving semiconductors and other products for early social implementation.
- Furthermore, since a large amount of high-quality data is necessary for the development of generative AI, we will establish a mechanism to make data held by public organizations accessible to institutions such as Japanese companies and universities for development purposes, while paying attention to copyrights and other issues.
- During these initiatives, we will consider the speed of technological innovation, respect market principles to the maximum extent possible, and accelerate the efforts of players in a prompt, flexible, and intensive manner. Additionally, based on the possibility that new technological innovations will be created through the release of technology, we will develop an environment that provides openly available basic technology, as well as computing resources and data. We will also create an environment for research and human resource development where top personnel from around the world can gather and work hard together, and will promote the reinforcement of basic development capabilities of industry-academia-government collaboration by also utilizing the framework of the AI Japan R&D Network.
- Many startups have been established in this field throughout the world. In Japan, we will strongly promote startup policies and encourage appropriate acceleration and investment.

Strengthening the Government's Review System

- In order to address various issues related to AI, the AI Strategy Council, which is composed of experts, and the AI Strategy Team, which consists of relevant ministries and agencies, will fulfill a leading role in formulating and promoting policies in cooperation with each ministry and agency. Through the framework, we will respond quickly and flexibly to unexpected situations.

Fusion Energy Innovation

Fusion energy is expected to be the next generation of clean energy. In recent years, governments in major countries have taken the lead in promoting initiatives and expanding investment in venture businesses related to fusion energy. Japan has been participating in projects such as ITER. While utilizing the technologies gleaned from such projects, we must accelerate efforts for industrialization. In order to consider new measures for themes such as industrialization of fusion energy, acceleration of R&D, and establishment of a promotion system, we established the Fusion Strategy Expert Council under the Integrated Innovation Strategy Promotion Council. We then formulated the Fusion Energy Innovation Strategy in April 2023. Based on this Strategy, we will steadily cultivate the fusion industry and develop fusion technology through measures such as establishing the Fusion Industry Council (provisional name) as a forum for industry-academia-government exchange, strengthening R&D in private companies (including startups) and universities, enhancing support for creative emerging technologies, and establishing an environment for fusion energy development by achieving international standardization of related technologies through discussions of safety regulations with like-minded countries.

Biotechnology

The biotechnology sector is an important technological field for realizing a sustainable social economy. In light of the growing international attention, Japan formulated "Bio Strategy" in 2019. The aim of the Strategy is to promote policies for realizing a bioeconomy, which is a social economy with biotechnology at its core. In particular, in FY2022, the Japanese government embarked on a course of bold and focused investment in biomanufacturing, which uses genetic technology to produce useful substances from microorganisms and animal/plant cells. We are also promoting strategic efforts for linking this investment to the creation of new bio-industries. Quantum technology is beginning to show signs of practical use as a new fundamental technology. Therefore, we will promote the application of quantum technology in R&D in the field of biotechnology, and work to create new interdisciplinary fields combining quantum technology and biotechnology. Specifically, we will promote the following initiatives.

- With regard to bio-manufacturing, we will continue to promote R&D and human resource development. In tandem, we will promote initiatives to accelerate the expansion of market areas through the cultivation of business operators, the conversion of existing industries to biotechnology, and the creation of new industries. We will study institutional measures to create initial demand for bio-derived products and reduce product costs. Then, we will compile policies for the large-scale production and social implementation of bio-derived products by the end of FY2023.
- The biotechnology field has relatively high potential for breakthroughs through the fusion of different fields due to how it applies results from other basic science fields such as mathematics, physics, and

chemistry. In order to develop Japan's biotechnology into a world-leading field, it is important to aim for a leap forward in the field of biotechnology through the application of quantum technology, which is an advanced technology originating in the field of physics. The application of quantum technology in the field of biotechnology is still in the early stages of R&D worldwide. At this point, active efforts to integrate the different fields of biotechnology and quantum technology will be effective in building an international technological advantage. We will present a concrete vision for the use of quantum technology in the biotechnology field, promote the creation of concrete usage examples and the accumulation of know-how, and accelerate collaboration among researchers in the biotechnology and quantum fields.

Materials (Materials Science)

Materials are fields of key basic technologies that are a strength of Japan's industry and academia as well as key elements of the growth strategy for the New Form of Capitalism: "science, technology and innovation," "the Vision for a Digital Garden City Nation," "net-zero greenhouse gas emissions" and "economic security." Given the growing global awareness of ESG and SDGs, and the intensifying competition in the materials industry due to the entry of manufacturers from emerging economies, R&D must become more efficient, faster, and more sophisticated using data and AI based on Japan's strengths. To this end, based on the "Materials Innovation Strategy" that was formulated in 2021, the following initiatives will be strongly pursued based on priority themes:

- In order to promote data-driven research in the field of materials, we will promote strategic materials R&D through the establishment and the utilization of the Materials DX Platform, which consists of further development of shared facilities and equipment capable of high-quality data accumulation, structuring and AI analysis functions.
- By networking a wide variety of material data and evaluation/analysis bases, we will construction a platform that can be used as a foundation for creating the applications necessary for building innovative businesses.
- With regard to manufacturing processes, which are the source of competitiveness in the materials field, the government will work on the developing and upgrading the basic technologies such as those for acquiring data on highly reliable fine ceramics, functional chemicals, etc., as well as the establishment and utilization of process databases.
- In order to strengthen collaboration with important fields such as quantum technology, which is expected to have a large impact in a wide range of areas, we will contribute to the development of quantum technology through the accumulation and utilization of quantum material data, and will promote initiatives such as use case demonstrations utilizing quantum computers in the materials field.

(Strengthen strategic response in important fields)[4]

Health and medical care

Based on the "Healthcare Policy" and the "Plan for Promotion of Medical Research and Development," the following initiatives will be pursued:

- Aim to dramatically curb the onset and progression of dementia by developing treatments, etc., which leverage our advantages in the development of Japan-originated and world-first treatments for Alzheimer's disease, biomarkers, etc. To achieve these goals, we will establish a new national project on brain science. This project will invigorate the development of new diagnostic and therapeutic methods, etc., through industry-academia-government collaboration, by strengthening the system of interactive clinical and basic research, etc., as well as international networks. By focusing on unknown mechanisms and pathological mechanisms, etc., we will promote the discovery of drug targets for dementia, including diseases other than Alzheimer's. We will establish a hub to serve as a base for these efforts, and will promote the construction of innovative measurement and imaging techniques, as well as mathematical scientific research methods that integrate multi-dimensional and multi-level data.
- By promoting next-generation drug discovery such as genomic drug discovery, we will promptly deliver innovative drugs for intractable and rare cancers, intractable diseases, cranial nerve diseases, autoimmune diseases, etc. For this purpose, we will strategically collect multiomics information and clinical information in genome data bases and biobanks. Furthermore, we will introduce and utilize the latest analysis methods (AI, etc.) in order to dramatically accelerate the drug discovery process. By developing technologies related to new modalities and optimizing those technologies according to diseases, we will create next-generation drug discovery, including high-functional biotechnology and middle molecular technology. When advancing these activities, we will establish a system to promote the development of new joint research by integrating biobank-led industry-academia resources, and promote the utilization of shared infrastructure for biopharmaceutical drug discovery research and electronic medical record data for drug discovery.
- In preparation for the next contingency of infectious diseases, the Japanese government will strengthen the system for the development of domestically developed vaccines, and will consider measures such as purchasing and stockpiling vaccines to prepare for emergencies. We will support R&D of therapeutic agents for emerging and re-emerging infectious diseases, and consider the construction of a clinical trial and clinical research network for infectious diseases. We will strengthen the global surveillance system for emerging and re-emerging infectious diseases by reinforcing the network of research centers in Asia, Africa, and other areas at risk of infectious disease endemics.
- For medical startups, we will implement a package that includes new entrepreneur training, funding for burgeoning research ideas, and other types of support for early-phase startups at universities and other locations. We will strengthen accompanying support through business contests, acceleration programs, and public support offices which leverage the opportunities presented by Expo 2025 Osaka, Kansai. In order to accelerate the entry of start-ups and the practical application of Software as a

[4]The environmental and energy fields are described in the latter part of this section (Promoting social change and disruptive innovation to overcome global challenges). The fields of safety and security are described in the latter part (Building a resilient, safe and secure society) and Chapter 1, 2 (1) (2).

Medical Device (SaMD) which has a high market potential, we will consider the enrollment in insurance reimbursement through two-step pharmaceutical approval, while also enhancing development of innovative seeds. We will bring this to a conclusion by the end of FY2023. In light of the increasing demands to accelerate the consultation and review process for SaMD, PMDA will strengthen its consultation and review system.

- We will conduct further innovative R&D in the fields of regenerative medicine, cell medicine, and gene therapy; for example, fusing different fields to conduct original therapeutic technology research and develop basic manufacturing technology. In order to overcome the challenges for industrialization, PMDA will start on-site consultations and provide support for proving efficacy, expanding coverage, and improving production processes for products and technologies that are already in clinical trials and on the market. We will disseminate information both domestically and internationally at Expo 2025 Osaka, Kansai.
- In order to steadily advance the "Action Plan for Whole Genome Analysis 2022" (formulated in September 2022) and deliver high-quality medical care, we aim to develop new treatment methods by constructing a high-quality information infrastructure equipped with whole genome data obtained from patients with cancer and intractable diseases, and by encouraging private companies, academia, and other parties to utilize the obtained data. We will promote the prompt introduction of analysis results, etc., into routine medical care and the realization of new personalized medicine. We will also promote studies for the establishment of a project implementation organization responsible for the operation of such initiatives.

Space

We will steadily promote the following initiatives.

- We will strengthen JAXA's strategic and flexible funding function, considering the fact that space agencies in Europe and the U.S. have funding functions for universities and private companies that conduct research seeds, as well as for technology development by private companies that are trying to commercialize their products.
- In order to realize what is known as a "G-Spatial Society," we will use a system of seven satellites to steadily upgrade the Quasi-Zenith Satellite System (QZSS), which enables more precise positioning without relying on the GPS of other countries. We will also begin the study and development of a system of 11 satellites while reducing costs, etc.
- We will participate in the Artemis Program, which aims for sustainable manned exploration of the 'lunar surface, and develop a pressurized crew rover, etc. The goal is to realize the Japanese astronaut's landing on the moon as the first non-American astronaut in the late 2020s.
- After investigating the cause of the launch failure of the H3 launch vehicle and Epsilon launch vehicle, we will work to strengthen the international competitiveness of mainstay launch vehicles while ensuring their reliability so that domestic and international satellite launches can be performed.
- To contribute to disaster prevention and mitigation, we will configure a constellation of numerous small synthetic aperture radar (SAR) satellites by 2025 under the cooperation of the public and private sectors. These efforts will include the promotion of demonstration projects and the development/verification of

next-generation technologies.

- We will steadily advance the development of next-generation geostationary meteorological satellites.
- In anticipation of the Beyond 5G Era, we will promote the development and demonstration of next-generation communication technologies such as non-terrestrial networks (NTN), space optical communications, and satellite quantum cryptography communications, for their social implemention.
- We will further promote the sophistication and use of space weather forecasting.
- We will develop and demonstrate next-generation technologies, such as space optical communication networks and satellite quantum cryptographic communications, for their social implementation.
- We will develop near-real-time information gathering capabilities by utilizing assets such as satellite constellations.
- In order to stimulate the private sector's demand for low Earth orbit satellites for the 2030s and beyond, we will secure and improve the environment for low Earth orbit utilization, including through the utilizationof the International Space Station (ISS) and its equipment.
- In light of the drastic changes in the international environment surrounding space transportation, the public and private sectors will work together to advance the R&D as well as the maintainance of engines and other equipment necessary for future space transportation systems toward 2040.
- We will continue to make progress with the launch of the Global Observing SATellite for Greenhouse gases and Water cycle (GOSAT-GW) in FY2024.
- By FY2025, we will conduct a demonstration of technology for transmitting energy from satellites to the ground by using space solar power energy.
- In order to achieve new space transportation businesses and space port development as soon as possible, we will study the legal systems and safety standards necessary for the utilization of foreign space transportation technology, demonstration and commercialization of manned suborbital flights, and the utilization of airports as space ports, and will promote the development of related systems.
- We continue to develop satellites so that we could early achieve improvement of the information gathering capabilities which is the aim of the fleet consisted of ten Information-Gathering Satellites.
- To achieve the world's first large-scale debris removal, we will accelerate the development of a demonstration satellite for large-scale debris removal technology, aiming for a launch in FY2026.
- To establish a Space Domain Awareness (SDA) system for ensuring safe and stable use of outer space, we will manufacture SDA satellites, aiming for their launch by FY2026.
- To collect the world's first samples from the Martian Sphere, we will proceed with the Martian Moons eXploration (MMX) mission, including a planned launch of the MMX spacecraft in FY2024. This initiative will be based on the "Exchanges of Notes between the Government of Japan and the Government of United States of America for the Martian Moons eXploration (MMX) Mission," which was signed in April 2023.

Ocean

Based on the "Basic Plan on Ocean Policy,"[5] the following initiatives will be strongly pursued:

- As an initiative toward comprehensive maritime security, we will promote initiatives that contribute to economic security, enhancing Maritime Domain Awareness (MDA), and disaster prevention and mitigation of natural disasters occurring in the maritime domain. Efforts to contribute to economic security include promoting the development of domestic marine resources such as rare earth muds, methane hydrate, and seafloor hydrothermal deposits, and fostering advanced key technologies such as autonomous underwater vehicles (AUV), communications satellite systems for ships (satellite VDES), advanced sensing technology, and high-precision navigation technology. In particular, with regard to the development of domestically produced marine resources, as part of the "R&D Plan on Innovative Technologies for Exploration of Deep Sea Resources" in the second phase of the SIP, we have promoted the development of rare earth mud recovery technology as an initiative to develop and demonstrate marine resource investigation technology. We have also successfully established technology for operating ten AUVs through technical demonstrations and simulations of platoon control using four different types of AUVs in the deep sea area, and promoted the further advanced functionality of AUVs. Third phase of the SIP is "Establishment of a Marine Security Platform," which will be implemented from FY2023. In this phase, we will develop rare-earth production technology and marine robotics survey technology, including R&D on AUV coordinated fleet control technology and wide-area monitoring systems. We will also develop marine environmental impact assessment technology and conduct basic survey research on marine basalt CCS. Furthermore, with regard to AUVs, we will develop new technologies such as deep-sea AUVs and sea-air unmanned vehicles, and formulate strategies for social implementation through collaboration between the public and private sectors. Efforts to strengthen the capacity of MDA include the development of data for the selection of suitable sites for offshore wind power generation and the enhancement of new functions such as a commercially available API for the marine information sharing system "MSIL"[6]. These efforts will make it possible to share and utilize ocean data in the public and private sectors. As part of efforts to contribute to disaster prevention and mitigation of natural disasters that occur in the sea area, we will enhance and strengthen the observation network of the sea area and the seafloor, including the observation of crustal deformation of the seafloor to elucidate slow slip events and the status of locking between the tectonic plates.
- To build a sustainable ocean, we will promote initiatives that contribute to the realization of net zero greenhouse gas emissions and the conservation, restoration, and maintenance of the marine environment. Efforts to contribute to net zero greenhouse gas emissions include the development of technologies related to ocean-derived energy such as offshore wind power, the formation of carbon neutral ports (CNP), the development of zero-emission ships, and the development and demonstration of technologies related to carbon dioxide capture and storage (CCS). Efforts to contribute to the conservation, restoration, and maintenance of the marine environment include conducting survey research on marine plastic litter, conducting global observations (including the Arctic and Antarctic)

[5] The fourth Basic Plan on Ocean Policy was approved by the Cabinet on April 28, 2023.

[6] MDA Situational Indication Linkages

which are necessary for advanced climate change prediction, creating convergence through citizen-participatory research in the marine field, building "Digital Twin of the ocean," and promoting research that contributes to understanding marine ecosystems. In particular, with regard to the implementation of global observations including the Arctic and Antarctic regions, we will construct an Arctic research vessel, conduct operation and study as an international research platform, and steadily conduct observations and research in the Antarctic region.

- To promote marine science and technology, we will develop basic technologies such as unmanned vehicles (AUVs, ROVs, etc.), establish and operate research platforms such as oceanographic research vessels, manned research vessels, test water tanks, and supercomputers, and work to cultivate human resources related to marine science and technology.

Food, Agriculture, Forestry and Fisheries

Japan's agriculture industry faces not only a low food self-sufficiency rate, but also various problems such as dependence on foreign countries for most of the raw materials in chemical fertilizers, which are materials for food production, and the rapid decline and aging of the agricultural workforce. It is clear that these problems cannot be solved by a combination of existing measures alone. Instead, efforts toward agricultural and food innovation are needed. Therefore, based on the "Strategy for Sustainable Food Systems, MIDORI" formulated in May 2021, we aim to establish a food system that balances productivity improvement and sustainability in the food, agriculture, forestry, and fisheries industries. To strengthen food security, we will promote the establishment of a smart production system that accounts for the shortage of domestic agricultural labor force, and will develop technologies that contribute to a shift away from overseas dependency on chemical fertilizers, etc. We will also study measures for agricultural and food innovation from various angles; for example, promoting the use and integration of advanced science and technology (including AI and quantum technology) in the field of agriculture. We will materialize results during FY2023.

(Creating new value through the fusion of cyberspace and physical space)

To realize the Society 5.0, Digital Twin implementations by utilizing advanced technologies including AI, and diverse and massive amounts of data, are fundamental elements to form a digital society. The Digital Agency was established in September 2021 as the government's command post for the formation of a digital society. Under the "Priority Policy Program for the Realizing Digital Society[6]," the Digital Agency and other related ministries and agencies facilitate the development of environment for utilization of data, working together to develop the Base Registry, digitalize quasi-public fields such as education, healthcare, and disaster prevention, and secure trust as a foundation for reliable data flow. In addition, from the viewpoint of promoting the formation of a digital society, efforts are being made to wipe out analog regulations by June 2024. The Ministry of Economy, Trade and Industry (METI) is developing the Cyber/Physical Security Framework (CPSF) in April 2019 to ensure cyber security associated with the creation of new value through the convergence of cyber and physical space. As for the Digital Twin, in

[6] Cabinet decision of June 7, 2022

addition to the development of related technologies, the construction of such a Digital Twin is underway in each field.

Meanwhile, the performance of AI products and services based on the foundation model is rapidly improving and becoming popular among the general public, and is truly becoming a social infrastructure. In AI products and services based on the foundation model, the scale of data is increasingly influencing their performance to a greater degree than ever before, and the lack of data on Japan may lead to poor AI performance as it relates to Japan, affecting the lives of the Japanese people and the competitiveness of the industry. As for the Digital Twin, there is much room for expansion of efforts in areas such as disaster prevention, in the fields where its use is expected.

Therefore, we will strengthen our efforts to further increase data and to build Digital Twin, and continue to work together with the government and related agencies, centered on the Digital Agency, to build a digital society.

Further enrichment of data and promotion of international data flow

Based on the "Priority Policy Program for the Realizing Digital Society," continue to develop the Base Registry, facilitate digitization in the quasi-public sector, and secure trust as a foundation for reliable data flow, as well as further promote Data Free Flow with Trust (DFFT) under the international framework agreed at the G7 Digital and Technology Ministerial Meeting. In addition, to further increase training data related to Japan, we will promote the provision of public data held by government agencies and the development of rules, etc. for this purpose, as well as the development and provision of data in Japanese**.**

Building Digital Twin

Promote efforts in collaboration with related ministries and agencies in fields where building Digital Twin is expected to be utilized, such as building Digital Twin for disaster prevention to optimize damage prediction and response to large-scale natural disasters, and the construction of Digital Twin to realize advanced infrastructure maintenance, etc.

Development and next-generation social infrastructure suitable for using Data and AI

Revise the "Strategy for Semiconductors and the Digital Industry" for semiconductors, a strategic fundamental technology that supports the digital society, to accelerate efforts to secure the semiconductor industry base, etc., and to form a core center of academia for the sustainable production of R&D personnel who will support the semiconductor industry. Based on the "Infrastructure Development Plan for a Digital Garden City Nation" (formulated in March 2022, revised in April 2023), the city will promote the development of 5G, optical fiber, and other technologies that support data distribution and the use of advanced AI, as well as the upgrading of information and telecommunications infrastructure, while also aiming to realize ultra-low power consumption and expanded communication coverage using Japan-originated technologies. At the same time, we will promote R&D of Beyond 5G (6G). In addition, the "Digital Lifeline Development Plan" will be formulated by the end of FY2023 to promote the development of the infrastructure that supports social implementation of digital technology, including hardware, software, and rules.

(Promoting social change and disruptive innovation to overcome global issues)

With an increasing number of countries and regions declaring net zero greenhouse gas emissions and the global competition for long-term, large-scale investment in green transformation (GX) intensifying, Russia's aggression against Ukraine has reaffirmed Japan's energy security challenges, and in May 2022, Prime Minister Kishida issued a directive to materialize a new policy initiative to realize over 150 trillion yen in investments for 10 years. In response to this, and based on discussions at the GX Implementation Council, etc the GX Implementation Council, etc., the "Basic Policy for the Realization of GX - Roadmap for the Next 10 Years" (hereinafter referred to as the "Basic Policy for the Realization of GX")[7] was approved by the Cabinet in February 2023, following public comment and other procedures, in order to achieve the three goals of decarbonization, stable energy supply, and economic growth simultaneously through the GX by making maximum use of decarbonization technology fields where Japan has strengths. Based on this basic policy, the "Act on Promoting Transition to the Decarbonized Growth Economic Structure (GX Promotion Act)" was enacted on May 12, 2023, which includes legislative measures necessary for the early materialization and implementation of the pro-growth carbon pricing concept.

Regarding biodiversity conservation, the "National Biodiversity Strategy and Action Plan of Japan 2023-2030" was approved by the Cabinet in March 2023, based on the "Kunming-Montreal Global Biodiversity Framework," a new global biodiversity framework adopted at COP15 of the Convention on Biological Diversity.

In light of this situation, we will promote measures to address climate change issues, harnessing diverse energy sources, and achieve new sustainable growth by simultaneously achieving " net zero greenhouse gas emissions," " nature positive," and "circular economy."

Addressing climate change issues

We will steadily realize and implement the measures included in the "Basic Policy for the Realization of GX" The Green Innovation Fund, which provides continuous support for innovative technologies from R&D to social implementation, will work to add initiatives to existing projects and formulate new projects by utilizing the expanded portion of the FY2022 supplementary budget and the FY2023 initial budget. In addition, through Green technologies of eXcelllence Project (GteX), which was established to conduct integrated R&D at universities and other institutions in important technological fields where Japanese academia has strengths, we will promote basic R&D at universities and other institutions for innovative GX technology creation and human resource development to support future technology, while collaborating with industry with a view to social implementation, and also collaborating with overseas partners.

Promotion of global cooperation in the development of green energy technologies is also important. Through continuous coordination with the international community, the functions of related research centers will be strengthened, and the exchange of human resources and knowledge in Japan and overseas will continue to be promoted. Under Japan-U.S. Climate Partnership on Ambition, Decarbonization, and Clean Energy and the Japan-EU Green Alliance, cooperation in the development of technologies for energy

[7]Based on the follow-up to the "Green Growth Strategy through Achieving Carbon Neutrality in 2050" (released by the Growth Strategy Council on December 25, 2020) and the "Progressive Environment Innovation Strategy" (Decision of Integrated Innovation Strategy Promotion Council made on January 21, 2020), the Cabinet decided on February 10, 2023.

transition and innovation for green growth would also be promoted.

Accordingly, we will continue to promote measures related to technological development to achieve both productivity improvement and sustainability in the food, agriculture, forestry, and fisheries industries, as defined in the Strategy for Sustainable Food Systems, MIDORI and "(Law No. 37/2022) concerning the Promotion of Environmental Burden Reduction Activities for the Establishment of Environmentally Harmonised Food Systems (hereinafter referred to as "The MIDORI Act.")."

In addition, in order to promote addressing climate change issues, we will promote the advancement of an infrastructure for combining and integrating climate projection data with various types of data such as land use, etc., such as the "Data Integration and Analysis System (DIAS)."

Harnessing diverse energy sources

The aforementioned the "Basic Policy for the Realization of GX" summarizes Japan's international commitments regarding climate change countermeasures and its efforts to strengthen its industrial competitiveness and achieve economic growth. GX will implement a major transformation of energy, all industries, and ultimately the economy and society. In order to realize more than 150 trillion yen of GX-related investment for 10 years, the government will take measures such as bold support for initial investment using GX Economy Transition Bonds, incentives for initial GX investment through carbon pricing, and the use of new financial instruments under the "pro-growth carbon pricing concept."

Based on the "Basic Policy for the Realization of GX" and the "Strategic Energy Plan," etc., we will also work on energy-related innovation and technological development. Specifically, to harness diverse energy sources, the government will promote the necessary R&D, demonstration, and international cooperation on energy efficiency improvement, renewable energy, nuclear power and fusion energy. With regard to energy efficiency improvement, in order to further develop potential energy efficiency improvement, the government will develop, commercialize, and demonstrate innovative energy efficiency improvement technologies across various fields, as well as demonstrate ZEH[8] / ZEB[9] and the improvement of transportation efficiency throughout the supply chain. Regarding renewable energy, we will promote the maximum adoption by utilizing the Green Innovation Fund for the development of next-generation solar cells and the development of key technologies related to floating offshore wind farms, among other initiatives. Regarding nuclear power as an option for decarbonization at the practical stage, based on the "Basic Policy for the Realization of GX" as well as the "Basic Policy for Nuclear Energy" [10], and taking

[8] ZEH (Net Zero Energy House): Energy-efficient housing that achieves a reduction of 20% or more in energy consumption and further reduces energy consumption through the introduction of renewable energy, the following definitions are used based on the amount of reduction: (1) Zero Energy House (ZEH): Achieves a reduction of 100% or more in energy consumption, (2) Nearly Zero Energy House: Achieves a reduction of 75% or more but less than 100% in energy consumption, (3) ZEH Oriented: Refers to housing that aims for energy reduction without the introduction of renewable energy.

[9] ZEB (Net Zero Energy Building): Buildings that have further reduced energy consumption by introducing renewable energy sources, etc., in addition to energy savings of 50% or more. Depending on the amount of reduction, it is defined as (1) "ZEB" (reduction of 100% or more), (2) Nearly ZEB (reduction of 75% or more but less than 100%), or (3) ZEB Ready (without introducing renewable energy), and also as one that saves 30-40% or more of energy and is expected to have energy-saving effects, (4) ZEB Oriented is defined as a building of 10,000 m^2 or more that is expected to achieve energy savings of 30-40% or more and that introduces technologies that are not currently evaluated in the energy conservation calculation program based on the Building Energy Efficiency Act.

[10] Revised by the Atomic Energy Commission on February 20, 2023. In the same month, the Cabinet decided that the government would respect it.

into account the domestic and international circumstances surrounding nuclear power, including net zero greenhouse gas emissions, in addition to further improving safety, we will steadily promote R&D and human resource development, including the development of next-generation innovative reactors that incorporate new safety mechanisms, from the viewpoint of promoting innovation to meet diverse requirements such as coexistence with renewable energy, hydrogen production, and heat utilization.

Realization of new sustainable growth through simultaneous achievement of "net zero greenhouse gas emissions," "nature positive," and "circular economy"

To achieve "net zero greenhouse gas emissions," "nature positive," and "circular economy" at the same time, we aim to form high-quality environmental capital as a stock through integrated efforts, and to create the Circular and Ecological Economy. By doing so, we aim to achieve sustainable new growth and ensure a high quality of life for years to come.

The effects of climate change have already reached a remarkable level, with the number of heat illness deaths frequently reaching over 1,000 per year in recent years. As an effort to protect human life and health, the health of the Earth is integral to human health, and the promotion of decarbonization is an issue that cannot wait. As part of adaptation measures, we will promote measures against heat illness more than ever before, and as concrete decarbonization efforts, we will promote structural transformation of industry and society and creation of areal demand through creation of Decarbonization Leading Areas that also contribute to solving regional issues, nationwide implementation of priority measures as a foundation for decarbonization, further promotion of ZEH and ZEB, energy-saving renovations, national movement proposing "New and Prosperous Lifestyles," and other measures.

Regarding nature positive, based on the “National Biodiversity Strategy and Action Plan of Japan 2023-2030,” which was formulated in March 2023, an integrated response to biodiversity loss and the climate crisis will be promoted. In order to achieve the “30by30 target” agreed at COP15 Convention on Biological Diversity[11], the following measures should be promoted: expansion and quality improvement of protected areas, promotion of private sector initiatives for Other Effective area-based Conservation Measures (OECMs), Ecosystem-based Disaster Risk Reduction (Eco-DRR) and other Nature-based Solutions (NbS), creation of a favorable environment, etc. In addition, the transition to a nature-positive economy that uses natural capital in a sustainable manner will be promoted.

In addition, to address the dual crises of climate change and biodiversity loss, it is essential to transition to a circular economy by limiting biodiversity loss due to carbon emissions and new resource extraction throughout the entire life cycle. In September 2022, the Ministry of the Environment (MOE) formulated the “Circular Economy Roadmap" that outlines the direction of the circular economy that should be pursued toward net zero greenhouse gas emissions by 2050 and the direction of measures for 2030 for each sector, including materials and products. In March 2023, the Ministry of Economy, Trade and Industry (METI) formulated the "Strategy for a Growth-Oriented, Resource-Autonomous Circular Economy" as a comprehensive policy package from the perspective of promoting innovation in technology and rules to both build a more autonomous and robust domestic resource circulation system and capture new overseas

[11] It refers to the goal of effectively conserving at least 30% of the land and sea as healthy ecosystems by 2030.

markets related to the system. Based on this Roadmap and the Strategy, we are promoting the recycling of plastics, metal resources, and renewable energy-related products (solar panels, storage batteries, etc.), as well as the demonstration of the production of bioplastics and sustainable aviation fuel (SAF), in order to achieve an integrated arterial and venous resource circulation in which arterial industries such as manufacturing and venous industries such as waste management work in tandem.

(Building a resilient, safe and secure society)

Response to natural disasters

Challenges we face include the risk of a huge earthquake (Nankai Trough earthquake and tsunami, Tokyo inland earthquake, etc.), frequent and severe wind and flood damage due to the impact of climate change, a growing labor shortage in Japan and the weakening of disaster prevention capacity. These challenges must be addressed by improving observation and prediction capabilities, efficiently sharing and transmitting information, and implementing quick and effective responses through DX. In “Enhancement of National Resilience against Natural Disasters ” in the 2nd period of SIP by FY2022, satellite observation and prediction of stationary linear mesoscale convective systems and super typhoons have been pursued, as are information-sharing with local governments (linking to the Shared Information Platform for Disaster Management, SIP4D) and decision support (CPS4D , IDR4M , disaster prevention chatbot development, etc.). The automatic detection technique for detecting stationary linear mesoscale convective systems that developed in this assignment has been implemented in Information related to localized heavy rainfalls brought by stationary linear mesoscale convective systems which the Japan Meteorological Agency launched in June 2021. Also, the SIP4D information sharing platform is being linked to prefectural disaster information systems, and IDR4M and disaster prevention chatbots are being introduced to prefectures and other entities. For example, disaster prevention chatbots have been introduced in 76 municipalities by the end of FY2022. One of the key points of initiatives to building greater national resilience is addressing the impact of climate change and " Dealing with Imminent Crises," one of the strategic goals of the AI Strategy 2022, which is to promote zero strandings, prompt and appropriate rescue and relief supplies, and disaster-resistant local governments, businesses and communities

In the 3rd period of SIP, "Development of a Resilient Smart Network System against Natural Disasters," which will be implemented from FY2023, we will work on the development of digital twin and information provision infrastructure that will enable effective disaster response through the development of diverse sensing data including small SAR satellites for faster and more detailed collection of disaster information, data integration infrastructure, disaster prevention IoT, and disaster prediction simulation technology for risk prediction in anticipation of severe disasters, including the effects of climate change. In these efforts, we will also consider collaboration with other SIP issues such as "Smart Infrastructure Management System.”

In addition, Japan will harness its disaster prevention know-how as an advanced country in disaster risk reduction to standardize the concept of resilience in order to improve the country's ability to recover quickly, by establishing International Organization for Standardization (ISO) standards.

Furthermore, the medium- to long-term and difficult challenges faced by Fukushima, which was hit by the nuclear disaster caused by the Great East Japan Earthquake, are common to Japan and the world. The

Fukushima Institute for Research, Education and Innovation (F-REI), which was established in April 2023, aims to raise Japan's industrial competitiveness and realize a new sustainable regional society model by solving these issues through science, technology and innovation. In addition, in order to make the Fukushima Hamadori region a leading location for the creation of start-ups, we will continue to improve the demonstration environment, including the expansion of demonstration sites, and strengthen our efforts to attract start-ups to the region.

Strengthening the resilience of the infrastructure sector

In response to issues such as the deterioration of urban and rural areas due to accelerating infrastructure aging and a lack of financial resources and labor shortages, as well as the risk of massive earthquakes, and to promote the development of a resilient national land through efficient infrastructure maintenance, etc., advanced technologies are being applied to public works. At the same time, the digital transformation and 3D rendering of infrastructure data is being implemented for managers and rules and platforms for their utilization are being developed. In response to issues such as the deterioration of urban and rural areas due to accelerating infrastructure aging and labor shortages, as well as the risk of massive earthquakes, and to realize efficient infrastructure management to build greater national resilience, advanced technologies are being applied to public works. At the same time, the digital transformation and 3D rendering of infrastructure data is being implemented for managers and rules and platforms for their utilization are being developed.

- In the area of innovative construction, in the Public/Private R&D Investment Strategic Expansion Program (PRISM), infrastructure maintenance and management technologies, and innovative disaster prevention and mitigation technologies, efforts have been made to create a database of the results of periodic inspections of infrastructure such as bridges every five years, develop inspection and update technologies, develop ICT construction technologies and build the MLIT Data Platform. In the future, based on field trials of advanced technologies, we will proceed in a phased manner to publish a compilation of trial technologies, establish guidelines for trials on a nationwide basis, and revise various standards. In addition, from FY2023, we will work on the transformation of business processes through innovative technologies, while utilizing the successor program, "programs for Bridging the gap between R&d and the IDeal society (society 5.0) and Generating Economic and social value (hereinafter referred to as “BRIDGE”) ."
- As part of the technological development in infrastructure maintenance management, the company is promoting infrastructure facility maintenance management initiatives that utilize AI-based analysis of images acquired by drones, satellites, and other means to realize sustainable infrastructure maintenance by reducing labor while maintaining and improving the level of inspections. In FY2023, a field demonstration will be conducted for on-site implementation of versatile drones.
- In addition, in the development of the MLIT Data Platform, it will be linked with data on land, economic activities and natural phenomena held by the national government, local governments and the private sector. In addition to promoting further data linkage,
  work to create use cases and improve usability and search functions to expand the utilization of data.

In " Smart Infrastructure Management System" in the 3rd period of SIP to be implemented from 2023,

amid the aging of Japan's vast array of infrastructure structures and buildings, we will engage in technological development and R&D to achieve efficient infrastructure management by establishing a system to promote sustainable, attractive, and strong national, urban, and regional development through integrated mana s gement from design to construction, inspection, and repair, using digital technology. In particular, we will focus on "building Digital Twin," which is at the core of Society 5.0, as the core of our development efforts, and also promote the construction of innovative construction production processes, advanced infrastructure maintenance cycles, strategic use of human resources of local governments, etc., and the development of technologies for creating attractive national landscapes, cities, and regions through smart infrastructure. In addition, we will promote technological development for the creation of attractive national land, cities, and regions through smart infrastructure.

(Enhancement of analysis functions by utilizing the Evidence data platform constructed by Council for Science, Technology and Innovation (e-CSTI))

Since the launch of e-CSTI in March 2020, we have been collecting and analyzing data for objective Evidence-based Policy Making (EBPM) and corporate management (EBMgt), and promoting the analytical functions shared among relevant ministries and agencies, national universities, and National R&D Agencies. In order to promote effective and efficient R&D, it is important to conduct analysis on important scientific and technological areas based on objective data on the past allocation of funds, domestic and international research trends, and Japan's strengths and weaknesses. To this end, we will develop tools that enable a multifaceted and comprehensive understanding of R&D trends in Japan, utilizing the latest domestic and foreign papers, patents, and open corporate information. Furthermore, a trial analysis utilizing the developed tool will be conducted and the analysis tool will be evaluated with the participation of experts. Tools to analyze the relationship between research inputs and outputs, such as budgets, by various researcher attributes, such as gender and field of study, will be developed and shared with relevant ministries and agencies. In addition, the EBPM/EBMgt will be strongly promoted by mapping the Sixth STI Basic Plan to science and technology-related budgets, visualizing trends in related indicators, and conducting surveys and analyses of the status of shared research facilities and equipment and technical staff at national universities and other institutions.

② Contributing to advanced science and technology to ensure safety and security

(Promotion of initiatives related to safety and security, including the promotion of advanced science and technology to strengthen economic security (promotion of the K Program, preparations for think-tank functions))

In recent years, science, technology and innovation have become central to the international competition, and from the viewpoint of building a safe and secure society, there are extremely high expectations for advanced technologies to ensure security in such as cyberspace, where attacks are becoming more diverse and sophisticated and also risks are growing due to recent changes in the global situation, to address new biological threats, cope with threats to safety and security in space and oceans, and to respond to crosscutting risks, threats, and crises in these fields.

In order to ensure the safety and security of the nation and its people against these various threats, the utilization of advanced technologies is extremely important, and various efforts are being made in Japan

and overseas. In addition, the appropriate use of technological capabilities plays an important role in improving Japan's security environment, and it is necessary to actively utilize the advanced technological capabilities of the public and private sectors that Japan has developed over the years in the security field, without being bound by the conventional thinking. In light of the equivocal nature of science and technology, and with a view to strengthening science and technology endeavors as the foundation for comprehensive security, Japan has made various efforts for "knowledge" and "fostering" technologies to respond to threats, "harnessing" those technologies by applying them in the real world, and "protecting" those technologies by preventing leakage. The government will continue to take necessary measures on major urgent issues.

With regard to "knowledge," the government has been proceeding preparatory work for the establishment of a think tank that will conduct research and analysis on key advanced critical technologies related to safety and security from FY2023 onward, in anticipation of being entrusted surveys and research based on the Economic Security Promotion Act[12].Also the government will continue preliminary research and analysis activities in order to succeed the results of the pilot projects in FY2021 and FY2022 and to hand them over to a think tank.

With regard to "fostering" and "harnessing" technologies, the government will steadily implement the “Key and Advanced Technology R&D through Cross Community Collaboration Program” (K Program) which provides strong support for the practical application of key advanced critical technologies by utilizing the results of a think tank, aimed at a broad use of technologies in civilian and public section, given a multi-usability of technologies. In particular, the government examine the technologies from the perspective of maximizing the use of the budget provided in the second supplemental budget for FY2022, formulate the next R&D vision, and indicate technologies that should be newly targeted for the support. The government will proceed the call for research proposals, adoption and others in turn, in collaboration with related ministries and agencies, promote R&D steadily, including the implementation of public/private sector support through a council for a designated fund, and aim to realize continuous and strong support by the program.

With regard to "protecting" such technologies, we will strive to autonomously ensure soundness and fairness of research (research integrity) at universities and research institutes in response to the new risks associated with globalized and open research. In addition, the Government will pursue appropriate measures against technology leakage, such as strengthening systems for investment screening, screening for the acceptance of foreign students and foreign researchers, and management of sensitive technology information at universities, research institutes and companies, and establishing requirements for security export controls in government R&D projects.

Under the Economic Security Promotion Act, the government will steadily implement policies on technical cooperation between the public and private sectors, the non-disclosure of selected patent applications, and the supply chain resilience, and will strengthen the systems for the promotion of economic security and the systems necessary for collection and analysis of information by the relevant ministries and agencies.

[12] Act on the Promotion of Ensuring National Security through Integrated Implementation of Economic Measures (Act No. 43 of 2022)

(Active use of advanced science and technology in the security field based on the National Security Strategy of Japan)

Based on the National Security Strategy of Japan, in order to widely and actively utilize the advanced technological capabilities of Japan's public and private sectors for security purposes in a wide range of security targets and fields, Japan will strengthen the system to improve technological capabilities of the public and private sectors that can be used for security purposes, to utilize, in a whole-of-government manner, funds and information related to R&D.Under this structure and framework, we will match R&D needs from the views of the Ministry of Defense with the appropriate technological seeds possessed by the relevant civilian ministries and agencies, and strengthen efforts to link them to defense innovation while identifying advanced technologies with various possibilities for utilization.

③ Strengthening R&D and social implementation to accelerate solutions to social issues
(Integrated operation of SIP Phase 3 and BRIDGE)

SIP is a program that utilizes the headquarters function of the CSTI to engage in cross-ministerial R&D. In the follow-up evaluation of the 11 issues of SIP Phase 1 FY2022, progress toward social implementation was seen in each proposal, including energy carriers and automated driving systems. In SIP Phase 2, those involved in the 12 issues, including automated driving, photonics and quantum technology, disaster prevention/mitigation, and AI hospitals, will continue to work toward social implementation in cooperation with relevant ministries and industrial sectors even after the completion of the SIP period. In the third phase of theSIP which will begin in FY2023, we will utilize the results of the second phase and launch programs for 14 issues, including issues from new perspectives such as inclusive communities and ways of working and learning, in addition to disaster prevention networks and maritime security, which we aim to further develop, in cooperation with efforts by related ministries and agencies, for social implementation. The program will be launched in collaboration with the efforts of relevant ministries and agencies. For social implementation, the concept of maturity level (XRL) from the five perspectives of not only technological development but also business, systems, social acceptability, and human resources will be introduced, reflecting improvements made from Phases 1 and 2, while also taking into account the perspective of utilizing Convergence Knowledge (So-Go-Chi), and the changes in social conditions and progress in R&D will be taken into account to ensure that the program is operated in an agile manner. Operationalize the program. Update the mechanism for social implementation of XRL, etc., based on the operational status of the program, and develop it into projects of relevant ministries and agencies and private-sector initiatives. Furthermore, BRIDGE, a revised version of PRISM, will be launched in FY2023. Utilizing the command post function of CSTI, BRIDGE will set priority issues for innovation of each ministry and agency's policies, and accelerate each ministry's efforts in policy transformation, such as DX-ization, and start-up business creation. The priority issues will be determined annually by the CSTI Governing Board based on policy needs such as the Integrated Innovation Strategy.

(Promotion of The Moonshot R&D Program)

As for MS, we will steadily promote the newly initiated R&D on weather and mental goals. In FY2023, following the environment and agriculture-related goals in FY2022, we will conduct stage gates of

cybernetic avatars, AI robots, quantum, and health and medical goals based on the external evaluation in the third year and review the direction of the projects. To achieve the goals, we will continue to enhance the R&D for up to 10 years from the start of the research, while narrowing down promising issues, securing human resources, strengthening international collaboration, etc. In addition, we will enhance cross- sectoral support (ELSI (ethical, legal and social issues), mathematical science, etc.) in order to promote R&D more effectively by utilizing the Convergence Knowledge (So-Go-Chi) and strengthen international collaboration with Europe, the U.S., and other countries, as well as outreach domestically and internationally and publicity activities for research findings, and collaboration with industry, which will play a role in social implementation to achieve the goals.

(Strengthening international standardization)

Global awareness is rising on the importance of international standards strategies as a factor in the success of companies and industries. Global companies and governments in their industrial policies are jostling to take the initiative in setting international standards. As these efforts in other countries progress, it is necessary to promote efforts to raise the awareness of industry, academia, and government regarding the strategic formation and utilization of international standards in Japan and to improve their capabilities, accordingly, in order to promote and strengthen social implementation of science, technology and innovation. In order to ensure more robust social implementation and international competitiveness in government R&D programs in important fields such as science, technology and innovation policies, a clear presentation of social implementation strategies, international competition strategies, and international standardization strategies, and a system of project management and follow-up, etc. that requires commitment from corporate management to efforts to achieve these strategies, will be developed horizontally based on the status of efforts in the R&D projects targeted for FY2022. Furthermore, from the perspective of economic security, a comprehensive standards strategy for Japan as a whole will be compiled by the end of FY2023. By strengthening the functionality of industry-academia-government collaboration to accelerate standards development, international standardization efforts in government R&D, and support functions for standardization and certification, efforts to strategically utilize standards in Japan will be further strengthened and promoted, and an ecosystem will be formed for autonomous development.

(Enhanced utilization of Convergence Knowledge (So-Go-Chi))

One of the key points of the Sixth STI Basic Plan is the use of Convergence Knowledge (So-Go-Chi) is the creation of "knowledge vitality" in which diverse "knowledge" gathers to create new value. The utilization of convergence knowledge, including not only natural science but also humanities and social science, will play an important role in solving social issues through science, technology and innovation, and in social reforms such as the realization of Society 5.0. In order to promote the utilization of convergence knowledge, the basic concept of Convergence Knowledge (So-Go-Chi) and measures to strategically promote its utilization were published as an "interim report" in March 2022. Based on this, from FY2022, we have started a Convergence Knowledge (So-Go-Chi) caravan through webinars, workshops, etc., and information dissemination on the Convergence Knowledge (So-Go-Chi) portal site to disseminate information about convergence knowledge, collect examples of utilization, and gather

information to improve and strengthen promotion measures.

In the future, we will utilize the information on examples of utilization of convergence knowledge collected to date to promote the use of convergence knowledge in measures that aim to solve social issues and promote social change, such as the third phase of the SIP, which will begin in FY2023. Regarding indicators related to Convergence Knowledge (So-Go-Chi), based on the results of the preliminary study conducted in FY2022, we will start an ongoing "awareness (level of understanding) survey" etc. in FY2023, and will also study the ideal form of more specific indicators.

(2) Enhancement of knowledge base (research capabilities) and human resource development

① Reinforcement of research infrastructure and university reforms through a 10-trillion-yen (University Endowment Fund and promotion of research universities with a regional core and distinctive characteristics

Realization of world-class research universities through the University Endowment Fund)

In promoting the expansion of functions in Japanese universities, universities have a sense of urgency to improve their research capabilities through international friendly competition and they must not only to attract world-class researchers, but also foster independent young researchers who will lead the next generation, allocate resources boldly to enable them to play an active role, reduce the burden on researchers to ensure sufficient time for research, and value the intellectual resources possessed by the university. In addition, from the viewpoint of enabling flexible up-front investment in conjunction with these efforts, it is also necessary to continuously secure and utilize financial resources for the creation of a university's own fund, and to promptly realize a research university that can promote these efforts in an integrated manner.

For this purpose, universities that are expected to develop internationally outstanding research and utilize research results that will bring about changes in the economy and society to a considerable extent will be recognized as Universities for International Research Excellence, and necessary procedures such as the selection of Universities for International Research Excellence will be continued with the aim of subsidizing the system enhancement plans prepared by these universities from FY2024 onward with the investment income of the 10-trillion-yen University Endowment Fund. Through subsidies from the investment income of the University Endowment Fund, we will enhance the research environment at the Universities for International Research Excellence, promote the acquisition of excellent human resources, and create a virtuous cycle of intellectual value creation, as well as realize world-class research universities by having the Universities for International Research Excellence lead Japan's academic research network.

Promotion of research universities with a regional core and distinctive characteristics

In order to drastically improve Japan's research capabilities, it is important not only to realize world-class research universities, but also for diverse, highly motivated universities to fully demonstrate their strengths and characteristics, contribute to the development of local economies and societies and to the resolution of issues at home and abroad, and also to promote the international expansion of their distinctive research in diverse ways. In February 2022, the "Package for Comprehensive Promotion of Research Universities with a Regional Core and Distinctive Characteristics" was formulated as a dual effort with the 10-trillion-yen University Endowment Fund, and in February 2023, the package was revised to achieve

"quantitative expansion" to further increase support and "qualitative expansion" to clarify the image of universities to be pursued and strengthen coordination among projects of each ministry and agency.

Based on the approach of this package, efforts will be made to work in a coordinated manner, combining both soft and hard approaches. This includes the “Promotion of regional core and/or distinctive research universities," with the fund newly created in the second supplementary budget for FY2022, smoothly implement the "Interdisciplinary Field Development Hub Formation Program," etc., steadily establish industry-academia-government collaboration centers through the "Program on Open Innovation Platforms for Industry-academia Co-creation (COI-NEXT)," and systematically and continuously promote the formation of international research hubs with world-class research standards through the "World Premier International Research Center Initiative (WPI)." Through these both soft and hard approaches, we will encourage ambitious universities to develop diverse research capabilities and human resource development by fully demonstrating their own strengths and characteristics through strategic management development. This will encourage the university to become a driving force for the growth of Japan and local communities, solving local and global issues and driving social change through collaboration with society by comprehensively utilizing all knowledge, including the humanities and social sciences.

② Enhance the development and education of creative and diverse human resources and promote their activities

(Promotion of doctoral graduates' active roles in society)

In response to the major challenge of improving the environment for younger researchers in particular, such as the falling rate of advancement to a doctoral program (18.7%: 1981 → 16.7%: 2000 → 9.9%: 2022), unstable employment for young researchers, and the decrease in the number of research hours they have available, efforts have been made to improve conditions based on the “Package for Comprehensive Promotion of Research Universities with a Regional Core and Distinctive Characteristics" and the Sixth STI Basic Plan. To improve the unstable employment of young researchers, we will work on the diversification of career paths for doctoral graduates.

We will continue to implement the long-term paid internship program which began in FY2021, so that young researchers can create a vision of a career path to not only in academia but also in a wide range of fields and industries. At the same time, we will work to increase the number of interactions between young researchers and companies, including startups, while also utilizing the ongoing matching system for finding excellent young researchers by companies and universities. In order to further utilize doctoral degee holders in the national public service, we will continue to conduct surveys on them, such as the number of their recruitment status in each ministry, and promote further efforts, referring to the current utilization of them in each ministry, the utilization of doctoral graduates in the national public service in other countries, and so on.

(Support for doctoral students)

Since uncertainty about financial prospects and career paths after entering a doctoral program is considered to be a major cause of the decline in the percentage of students advancing from master's programs to doctoral programs, the Sixth STI Basic Plan aims to increase the number of students who

receive an amount equivalent to living expenses to three times the previous level and to support approximately 9,000 students (more than double the previous level overall) through the Next Generation Researchers Challenging Research Program, the University Fellowship Establishment Project, and other programs. Steadily promote these financial and career path supports.

(Promotion of careers for women in research)

From the viewpoint of improving the diversity of research and research environment, it is necessary to accelerate the activities of female researchers by eliminating the gender gap, etc. However, while there is an increasing proportion of women in full-time university faculty from year to year, the current status is still below 30% (26.7% in FY2022), and the percentage of female professors (university president, vice president, professor) among faculty has been increasing year by year but still does not reach 20% (18.7% in FY2022).

To this end, we will continue to support efforts by universities and other organizations to realize diversity in the research environment, such as the development of an environment that enables researchers to balance life events such as childbirth and child rearing with their research, and the promotion of female researchers' activities. Based on the Sixth STI Basic Plan and the “Fifth Basic Plan for Gender Equality” the government will continue to steadily enact initiatives to further promote the careers of female researchers, including those in leadership positions, efforts are being made in consideration of the period of life events in the age limit for public research funding support programs for young researchers, as well as strengthen initiatives to encourage female junior high school and high school students to choose careers in science and engineering, and promotion of gender equality in the competitive research funding system and the development of a research environment where both male and female researchers can continue to work together.

(Improving the research environment for young researchers)

In order to improve Japan's research capabilities, it is vital to secure excellent researchers, especially younger ones, and create an environment in which they devote themselves to their research. This requires stable employment as researchers. In reality, however, the ratio of faculty members under 40 years old in the total number of full-time university faculty members has decreased to approximately 20% (from 29.5% (FY2001) to 22.1% (FY 2019)), and the percentage of national university faculty members under 40 years old with tenure has also increased to nearly 70% (from 38.7% (FY 2007) → 68.8% (FY 2022)).

Therefore, there is an urgent need to improve the research environment for researchers, beginning with In terms of budgetary support for national universities, continue efforts to evaluate the status of implementation of personnel and payroll management reforms, including the formulation of mid- to long-term personnel plans and the use of external funds for personnel expenses, and reflect the results in the allocation of national university grants. In addition, the program of Fusion Oriented REsearch for disruptive Science and Technology (FOREST), which provides integrated support, securing stable research funding and an environment in which researchers can devote themselves to research for up to 10 years, targets diverse researchers gaining independence to continue to take on free, challenging and fusion-oriented concepts without fear of risk. while accelerating research through horizontal development of examples of

research environment improvement and stable support for doctoral students, etc., who support research as RAs, will promote regularization of the projects and, together with research funding projects such as Grants-in-Aid for Scientific Research (hereinafter referred to as “KAKENHI”) for Scientific Research, support researchers according to their careers so that they will be able to make a leap forward in the future.

(Realization of a research environment in which you can devote yourself to research (securing time for research))

A decrease in the ratio of research time to total work time has been noted for researchers affiliated with Japanese universities. This is a problem that could lead to a decline in the attractiveness of researchers as a profession as well as a decline in research capacity. In order to ensure that researchers have sufficient time to devote to research, the "Guidelines for Improving the Quality and Quantity of Research Time" were formulated, which include sharing research facilities and equipment, promoting the management and utilization of research data, and promoting the use of research management personnel and support staff such as URAs and PMs. By linking these guidelines to the "Package for Comprehensive Promotion of Research Universities with a Regional Core and Distinctive Characteristics" and the program of Fusion Oriented REsearch for disruptive Science and Technology and by promoting package-related projects to strengthen specific efforts to secure research time at universities, we will encourage universities to change their efforts and behavior and revitalize efforts to secure research time in Japan as a whole. Also, in light of the indication of researchers' fatigue due to application and evaluation of competitive research funds and research projects, we will promote studies on the appropriate measures for facilitating application and evaluation of them. In addition to providing priority support to young researchers, we will also promote KAKENHI, which will radically improve research quality through the flexible use of research funds according to research progress, for an extensive range of researchers.

(Promotion of measures based on the Policy Package for Education and Capacity Building for Society 5.0)

We have established the Education and Capacity Building Working Group under CSTI with the participation of members of the Central Council for Education and the Industrial Structure Council. The working group formulated "the Policy Package for Education and Capacity Building for Society 5.0" in June 2022. The package consists of the following three policies: (1) diversification of "time" and "space" in learning that emphasizes children's distinctive characteristics; (2) establishment of an ecosystem that supports inquiry-based and STEAM education throughout society; and (3) overcoming the division between humanities and sciences and closing the gender gap in science and mathematics education. In this package, a roadmap of measures to be taken by the relevant ministries and agencies for the next five years is set forth, and measures are being promoted based on this roadmap. In promoting measures, we will engage in practice and demonstration not only from the perspective of education, but also from the perspective of innovation. The results of practice and demonstration will be fed back to the policy as needed, and will be discussed professionally at CSTI and other institutions to follow up on the progress of this roadmap while deepening the measures in an agile manner.

(Drastic enhancement of inquiry, STEAM, and entrepreneurship education)

In order to strengthen inquiry-based, STEAM, and entrepreneurship education at the elementary and secondary education levels and in line with the "Policy Package on Education and Human Resource Development for the Realization of Society 5.0," we will continue to promote the use of Colleges of technology (KOSEN) as centers for STEAM education for elementary and junior high school students, the provision of opportunities to experience high-level inquiry at universities and other institutions, reform of high school general courses, and regional development of STEAM education utilizing science museums and "places for dialogue and collaboration" nationwide. In addition, from FY2023, the project will promote the development of initiatives under the cooperation of the public and private sectors to encourage study abroad from the high school stage by society as a whole. It will provide support for the assignment of coordinators to promote cooperation between SSH-designated schools and schools and universities within the region and the dissemination of results, conduct public awareness and training for understanding students with special talents. It will accumulate and disseminate practical examples through empirical research on support for such students and support for the reorganization of university and Colleges of technology (KOSEN) into growing fields. Furthermore, starting from the publicly solicited applications in FY2023, researchers who have won competitive research funds, etc. will be able to pay for outreach activities to children on the results of their research activities from their direct expenses, and efforts to provide incentives will be promoted. In addition, with the aim of launching operations in early FY2024, we will work to build a platform that connects schools and children with companies, universities, and research institutions that support inquiry, STEAM, and entrepreneurship education.

(Elimination of the gender gap in mathematics and science)

In order not only to improve research diversity and nurture potential bearers of knowledge that contribute to the improvement of research diversity, but also to realize the individual well-being in all its diversity, it is important to promote the career development of female researchers, encourage the independent career choice among young people, and eliminate the disengagement of girls from science. Therefore, in order to eliminate gender bias in science and mathematics learning and gender roles by parents, schools, and society, we will continue to implement initiatives to promote the advancement of female-junior high school and high school students into science and engineering fields, while taking into account the "Policy Package on Education and Human Resource Development for the Realization of Society 5.0."

In addition, from FY2023, the following activities will be implemented: information dissemination and events to foster a social movement in cooperation with industry; presentation of role models who are active in their studies in science, mathematics, etc.; large-scale surveys and factor analysis of factors that prevent women from choosing science; outreach conducted by researchers who have won competitive research funds, etc.

(Enhancement of recurrent education)

Countries with higher participation in work-related adult learning tend to have higher labor productivity

per hour. Recurrent education also has the potential to be a driving force for industrial structural change. In order to respond to changes in the socioeconomic structure by establishing a system in society as a whole that relearning and continuing to learn are rewarded, and to create an environment in which those who wish to do so can receive diverse, high-quality recurrent education, the visualization of academic history, required abilities and learning, and evaluation of relearning at companies should be promoted so that individual relearning is appropriately evaluated. Furthermore, in order to promote reskilling and investment in growth areas through public-private partnerships, and to deliver structural wage growth and strengthen growth potential, it was decided to expand the "Investment in Human Capital" Policy Package which amount to 1 trillion yen over 5 years in "Comprehensive Economic Measures to Overcome Rising Price and Realize Economic Revival (October 28, 2022, Cabinet Decision)," and to strongly promote skill development and labor mobility to growth areas simultaneously.

In light of this, the government will promote the enhancement of support for persons motivated to learn and the improvement of the environment by utilizing the new menu of human resource development support subsidies included in this package of measures. In addition, we will develop methods to support the development of highly specialized human resources in companies and to evaluate the educational effects of recurrent education and its impact on society.

③ Collaboration with like-minded countries and partner countries that share the common values (Strategic promotion of science and technology diplomacy)

While science and technology are positioned at the core of inter-state competition, international science and technology cooperation is also required to solve global agendas such as climate change and pandemics. In the G7, which shares the same values as our country, it is confirmed that we will work together for principles that support international cooperation based on trust, as open as possible, and as secure as necessary. Under these circumstances, the question arises as to how Japan should promote international collaboration in science and technology, keeping in mind the need to improve the self-relianceof its economic structure and to ensure the advantages and ultimately indispensability of its technologies. In light of the recent geopolitical changes, the challenge now is to strengthen the foundations that support the development of our strategic science and technology diplomacy for the country as a whole, driven by greater awareness of international cooperation and competition.

To this end, we are pursuing a strategic science and technology diplomacy consisting of strengthening the partnerships between the Science and Technology Advisor to the Minister for Foreign Affairs, the "Advisory Board for Promoting Science & Technology Diplomacy" and other relevant ministries, agencies, and organizations, strengthening the systems for collecting and disseminating information by person in charge of science and technology at diplomatic missions in major countries overseas, and building partnerships by harnessing these systems. Furthermore, we will utilize, disseminate, and deploy Japanese science, technology and innovation knowledge that contributes to solving social issues through financial contributions to international organizations, etc. We will also closely monitor trends in discussions at international organizations and strategically participate in discussions necessary for Japan.

In May 2023, Japan, as the Presidency of the G7, hosted the G7 Science and Technology Ministers' Meeting in Sendai and compiled the Ministers' Communiqué. Based on these results, we will continue our

efforts to contribute to adressing global issues through science and technology. In particular, Japan will actively contribute to the improvement of interoperability of research data infrastructures, research evaluation and providing incentives, open science initiatives for academic papers, etc., dissemination of best practice documents on research security and integrity, etc., and promotion of international brain circulation with the G7 and other partners.We will also work to promote international brain circulation with emerging and developing countries from a diplomatic perspective while also taking into account the perspective of cooperation in the Asian region, such as expanding cooperation with ASEAN and other countries of political importance. In order to promote autonomously ensuring the soundness and fairness of research (research integrity) in response to the new risks associated with globalized and open research in Japan, based on the government's policy (Integrated Innovation Strategy Promotion Council, April 2021), the government will strengthen cooperation between academia and the government to make it more effective, while harmonizing it internationally, investigate the status of efforts being made by researchers, universities, research institutions, and research funding agencies, and consider further necessary measures.

(Promotion of open access to scholarly publications and scientific data)

Publicly funded research outputs including research data and scholarly publications should be widely given back to the public, but their distribution is under the market dominance of the global academic publishers (academic platformers), then both subscription fees for academic journals and APC (Article Processing Charge) for academic articles are increasing. These soaring prices increase the cost burden on universities, researchers, and others involved in the fundamental aspects of academic research, such as journal subscriptions and publication of articles, and may have adverse effects such as undermining the autonomy of the research community. In order to enhance Japan's competitiveness, it is necessary to create an environment in which researchers can freely and widely publish and share their research outputs and the public can widely access their intellectual assets. To this end, we will promote efforts to ensure access to a variety of knowledge, including new forms such as preprints, in order to link publicly funded research outputs including research data and scholarly publications with the creation of new science, technology and innovation and with the solution of social issues.

In addition, based on the G7 Hiroshima Leaders' Communiqué and the G7 Science and Technology Ministers' Communiqué in May in 2023, we will formulate a national policy to promote immediate open access to publicly funded scholarly publications and scientific data underlying the publications for new applications starting FY2025 of the competitive research funds[13]. Specifically, the government will support enhancing the ability to negotiate for universities and research institutes with academic publishers, based on the national policy. In addition, we will enhance the research DX platforms[14] for managing and utilizing research outputs such as scholarly publications, research data, and preprints, and enhance the ability of researchers and the research community to disseminate their research outputs. Through these efforts, we will promote collaboration with countries, regions, and international organizations that share values with

[13] To be defined in the national policy, as covering competitive research funds in which scholarly publications are thier main outputs.

[14] The Research Data Infrastructure System (the NII Research Data Cloud) and other platforms for managing and utilizing research outputs, such as preprints and articles.

Japan, such as the G7, in order to promote open access to research outputs. We also aim to establish and transition to a new system for evaluation and providing incentives, while reviewing the excessive reliance on quantitative indicators in research evaluation and understanding and analyzing the current status and issues for promoting open science.[15]

(Promotion of management and utilization of publicly funded research data)

In the "Principle on Management and Utilization of Publicly Funded Research Data" (decided by the Integrated Innovation Strategy Promotion Council on April 27, 2021), the vision of promoting the management and utilization of research data based on open and closed strategies by making overview information (metadata) on publicly funded research data searchable on the research data infrastructure system (the NII Research Data Cloud), which is the core infrastructure. The system to grant metadata for all new applications for publicly solicited research funds is to be introduced by FY2023, and universities and other R&D institutions are to formulate data policies and include research data in institutional repositories. To achieve this, we will further accelerate advanced data management in MS, deploy the knowledge and use cases obtained, develop support systems at universities, and promote international collaboration such as the G7.

In addition, under the "Research Data Ecosystem Development Project to Promote the Use of AI, etc." launched in FY2022, we will continue to upgrade the nationwide research data infrastructure that links research data from various fields and institutions, and promote dissemination and public relations activities for the utilization of the research data infrastructure for research institutes and researchers.

(Development of infrastructure supporting research DX, sharing of research facilities and equipment, and promotion of data-driven research)

To promote AI and data-driven research for the realization of Research DX, the government promotes the upgrading of research digital infrastructure such as SINET (ultra-high-speed, high-capacity network infrastructure), computational resources, and storage. Regarding computational resources such as supercomputers, we will efficiently and steadily operate "Fugaku", while promoting their wide use in academia and industry, and deepen research on elemental technology researches related related to next-generation computing infrastructure for next-generation computing resources with a view to post-"Fugaku" through industry-academia collaboration. In addition to the above, the operation of "NanoTerasu" will be started, steady operation of existing specified large advanced research facilities and measures against aging will be implemented, and upgrading of facilities will be promoted in response to the progress of technological innovations, etc.

Also, by using these, efforts for strategic collection, sharing, and utilization of research data in the materials field will be accelerated, and similar efforts will be developed in other fields including life science,

[15] Refer to "Points of Evaluation for R&D in Anticipation of a New Era - Towards the Promotion of Better Research Activities" (August 25, 2021, Document 2 , Research Planning and Evaluation Subcommittee (77th meeting), Council for Science and Technology , Ministry of Education, Culture, Sports, Science and Technology, (https://www.mext.go.jp/content/20210823-mxt_chousei02-000017422_2.pdf), "Progress confirmation of the Science, Technology and Innovation Basic Plan (March 28, 2023)" Expert Panel on Evaluation,, Council for Science, Technology and Innovation, (https://www8.cao.go.jp/cstp/tyousakai/hyouka/kenkai.pdf), etc.

climate change, ocean, disaster prevention and mitigation, and other fields including humanities and social sciences. Regarding the sharing of research facilities and equipment, the "Guidelines for Shared Use of Research Facilities and Equipment" formulated in March 2022 will be followed up, and based on the "Study for policy consideration on research facilities and equipment," the status of research facilities and equipment renewal timing, requirements, and financial resources secured through shared use, etc. at national universities will be analyzed and the nature of government support will be considered.

(Acceleration of international talent mobility and circulation)

In order for Japan to produce outstanding research, it is necessary for Japan to be positioned in the international mobility of human resources. In order to strengthen the international research network necessary for this purpose, we will continuously promote the formation of hub for the attractive international talent mobility and circulation in a planned and continuous manner, such as “World Premier International Research Center Initiative (WPI)),” andthe international joint research through KAKENHI for international leading research. In order to promote a new top-down international brain circulation, we will promote the entry of Japanese researchers into the international top scientific circle by supporting international joint researes in strategic fields and domains set by the government, targeting developed countries such as Western countries that have high scientific and technological standards with a view to increasing opportunities for Japanese researchers to study and experience under top-level overseas researchers and foster the next-generation of excellent researchers.

(3) Creation of innovation ecosystem

① Thorough support for startups (promotion of Startup Development Five-year Plan)

(Developing a world-class startup ecosystem)

A world-class startup ecosystem is essential to unleash the potential of young people with outstanding skills and abilities produced at universities and other institutions and to continuously create innovations that lead to new industries and societal change. In particular, from the perspective of creating an innovation ecosystem, it is important to create startups and realize large-scale growth by having universities and other institutions as the source of innovation, utilizing new technologies (deep tech) born from high-quality basic research, and having highly creative people jump onto the path of entrepreneurship without hesitation. In November 2022, the government formulated "Startup Development Five-year Plan" to provide strong support for startups, with the goal of increasing investment in startups more than tenfold (to 10-trillion-yen) by FY 2027, five years later. In order to create an innovation ecosystem centered on universities and other institutions as a source of innovation and to create large-scale startups, particularly in the field of deep-tech, the government will work to utilize the enhanced SBIR system, realize the Global Startup Campus Initiative, strengthen support for commercialization and social implementation of startups in the deep tech field through the Deep Tech Startup Support Project, expand public procurement, broaden the entrepreneurial base, form a growth-oriented funding cycle, and further promote the enhancement of university IP governance.

(Strengthening the SBIR system and the use of government procurement)

In April 2021, control of the SBIR system was transferred to the Cabinet Office under the provisions of the Law Concerning the Revitalization of Science, Technology and Innovation Creation (Law No. 63, 2008). The Cabinet Office was placed in charge of the new system to strengthen continuous support while selecting initiatives across ministries and agencies in a phased manner, with a focus on innovation creation. From FY2021 onward, specific operation rules have been established, and under the accompaniment and support of the program manager, R&D tasks based on policy and government procurement needs have been set, and proof of concept, R&D, etc. (Phase 1 and 2) have been steadily implemented. In addition, the project has been drastically expanded with the addition of Phase 3, which supports technology demonstrations, to the operation rules starting in FY2023. Based on the “Startup Development Five-year Plan”, we will utilize this project to strongly promote early social implementation of advanced technologies owned by startups.

It is also important to use government procurement to nurture startups. Government procurement procedures will be revisited with a view to facilitating the participation of startups, such as the qualifications to participate in bidding. The government will consider making it possible to enter into discretionary contracts with companies selected as J-Startupwith advanced new technologies in the same manner as the procurement method for R&D results under the SBIR system.

(Enhancement of university IP governance)

The "University IP Governance Guidelines"[16] were established in March 2023 to indicate how IP rights pertaining to joint research results should be attributed and the authority to implement them, and how startup stock acquisition rights should be utilized as compensation for licensing, which are considered necessary to maximize opportunities for social implementation of IP created by universities and to achieve a virtuous cycle of funding. This will be disseminated to target universities nationwide through collaboration with the Universities for International Research Excellence program, and the Project for Strengthening Regional Core and Distinctive Research Universities, and efforts will be made to improve university IP governance.

(Strengthening the human resources and other infrastructure necessary for entrepreneurship)

To provide incentives to entrepreneurs and employees to create startups that will drive growth, we will review the stock option system as necessary. At the same time, we will steadily promote the program to dispatch 1,000 employees for five years and expand initiatives to foster young human resources through mentors. And based on the "Policy Package on Education and Human Resource Development for the Realization of Society 5.0," at the elementary and high school levels, the government will drastically strengthen inquiry-based, STEAM and entrepreneurship education, and provide opportunities for all university students who wish to start their own businesses to receive high-quality entrepreneurship education.

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[16] University IP Governance Guidelines: (Developed and published in March 2023 as an annex to the "Guidelines for Strengthening Joint Research through Industry-Academia-Government Collaboration." In addition, the Universities for International Research Excellence program requires the establishment of systems, etc., based on the "Guidelines for Strengthening Joint Research through Industry-Academia-Government Collaboration" and other guidelines.

In addition, we will discover and nurture management personnel and support efforts to match them with the excellent technology seeds of universities and other organizations. At the same time, we will carry out initiatives such as promoting carve-outs by personnel with excellent technologies from business corporations, etc., in order to stimulate innovation and create start-ups in the deep-tech field by utilizing the technologies of business corporations, etc.

② Strengthening collaboration among cities, regions, universities, and startups, starting with the Global Startup Campus Initiative

(Promotion of the Global Startup Campus Initiative)

In order to seamlessly link the potential of new technologies (deep tech) born from high-quality basic research with businesses that could take the world by storm, the government has begun full-scale efforts toward the realization of the Global Startup Campus (GSUC) Initiative that combines research and incubation functions in the field of deep tech. Aiming to create a flagship center for this initiative in Tokyo[17], we will proceed with the concrete implementation of the concept, including coordination with top overseas universities such as the Massachusetts Institute of Technology (MIT) and consideration of facilities, while taking into account the opinions of experts and others. In addition, the government will promote integrated efforts to maximize the effects of the GSUC concept, such as conducting related international joint research prior to the establishment of the GSUC, and will activate R&D at domestic universities and promote reform through the realization of the GSUC concept. In establishing the flagship center, we aim to create a synergistic effect in cooperation with the startup policies of related municipalities, and to encourage integrated town development, which includes the living environment, to make cities more attractive to foreign human resources. In addition, with this flagship center at its core, the project will promote the formation of an ecosystem that will generate world-standard businesses throughout Japan by collaborating with the ecosystems in each region.

(Strengthening incubation functions of cities, universities, etc.)

In the startup ecosystem hub cities and projects incorporating similar perspectives in Japan, the issues include a shortage of growth capital, human resources, information, and options for global expansion support, especially in regions outside metropolitan cities. In order to accelerate the global expansion of startups, the government will enhance global acceleration programs and promote efforts to strengthen startup ecosystem functions through cooperation between local governments and universities. In addition, the commercialization of research results from universities and other institutions will be supported through gap funding programs, etc., to verify the feasibility of developing into international markets, mainly in hub cities. Furthermore, in order to attract outstanding entrepreneurs from around the world, private organizations such as venture capital funds, incubators, and accelerators that have been accredited by the government will be able to perform the verification procedures related to the issuance of a Startup Visa,, and their maximum period of stay will be extended.

[17] Assumed to be built on state-owned land located in Shibuya and Meguro wards (the former site of the National Institute for Defense Studies, etc. adjacent to Acquisition, Technology & Logistics Agency Naval Systems Research Center and the former site of Training Institute of the Public Security Intelligence Agency).

③ Formation of a growth-oriented capital cycle and expansion of R&D investment

(Growth-oriented funding cycle formation)

In order to fully utilize the potential of Japan's funding pool for its growth, with individuals such as angel investors, long-term investment funds such as pensions and insurance, and record-breaking internal reserves and cash and deposits of companies, it is necessary to push this funding pool into circulation in long-term investments in startups to create innovation in society. Successful entrepreneurs and others who have created social and economic value can in turn become angel investors themselves. To this end, we will promote the introduction of fair value assessment in VC funds, etc. and the sharing of auditing practices related to such assessment to encourage VC investment by institutional investors; strengthen the function of domestic risk capital by pump-priming it with public funds; strengthen the relationship between Japan and overseas VC funds; and continue to promote the use of the Open Innovation Taxation System and the angel taxation system, etc. through publicity and dissemination, etc., in order to strengthen the startup ecosystem.

In addition, the stock option system needs to be revised from the viewpoint of acquiring excellent human resources in Japan and overseas, and there needs to be an improvement of conditions such as the establishment of a market for the purpose of trading unlisted stocks as introduced in foreign countries and stronger funding at the pre-seed, seed, and early stages including R&D support for deep tech startups through cooperation with domestic and overseas VC. At the same time, we will consider support for business development from the perspective of backing social implementation of innovative technologies. In addition, the committee will also consider the development of an environment to revitalize trading of unlisted stocks, the addition of cryptographic assets and tokens as investment targets for limited partnerships (LPS), and the relaxation of requirements for overseas investment ratios.

(Expansion of R&D investment by revitalizing the flow of funds)

While investment in science, technology and innovation is growing significantly in other countries, Japan must secure a bold scale of government R&D investment and use this as a springboard to expand R&D investment by the public and private sectors if we are to win out in the fierce competition among countries. In the Prime Minister's Policy at the 211th session of the Diet in January 2023, the government announced that it would "support R&D investment in semiconductor, quantum, AI, and next-generation communication technologies, as well as in biotechnology, space, ocean, and strategic fields."

During the period of the Sixth STI Basic Plan, the government's budget for science and technology, including the initial budget for FY2023, totaled approximately 21.9 trillion yen, making steady progress toward achieving the investment targets of approximately 30 trillion yen for government R&D investment and 120 trillion yen for public and private R&D investment. However, in the midst of fierce international competition, the government is working to further expand R&D investment and lead the international R&D competition. At the same time, we will take necessary measures to induce private investment by mobilizing all policy tools, such as the R&D Promotion Tax System, the SBIR system, innovation in government projects, and public procurement of research findings.

In addition, from the viewpoint of encouraging the creation of intellectual property and strengthening

Japan's competitiveness as a location for innovation, we will continue to examine the appropriate measures, including taxation, to encourage R&D investment by the private sector for the creation of intellectual property.

④ Accelerating the Vision for a Digital Garden City Nation

Smart cities are positioned as a model regional vision in the “comprehensive strategy for the Vision for a Digital Garden City Nation” formulated in December 2022, together with initiatives such as super cities and digital garden health special zones. It is necessary to further encourage local regions to take independent initiatives and develop such initiatives by, for example, creating good examples of various initiatives that take advantage of local resources and presenting them to local regions. Currently, the smart city project is moving from the demonstration stage to the implementation stage. In addition to disseminating information via the smart city public-private partnership platform, the joint review committee selected projects in FY 2021 and promoted the integrated implementation of smart city projects with support from relevant ministries and agencies for local public-private implementation in cities.

The government will focus on setting out a roadmap for the broad usage of smart city services as a digital platform to leverage the digital capabilities of each and every region in Japan and address various issues, the further elaboration of measures and initiatives by the public and private sectors supporting the roadmap, consideration of issues for sustained action, the creation of support hubs, training, and other areas. In addition, based on the "Package for Comprehensive Promotion of Research Universities with a Regional Core and Distinctive Characteristics" revised in February 2023, we will promote industry-academia-government collaboration and open innovation with those universities at the core, and utilize smart cities, startup ecosystem hub cities, regional biocommunities, and other collectives to contribute to the realization of the Vision for a Digital Garden City Nation.

3. Initiatives supporting the three cornerstones of Science, Technology and Innovation Policies

In the Integrated Strategy 2023, while we work to further strengthen and integrate efforts centered on the "three cornerstones " of science, technology and innovation policies as specifically described in the previous section, we will also begin to strengthen fundamental efforts to ensure that the achievements to date will serve as a solid driving force to support the "three cornerstones," while responding flexibly to unpredictable changes in circumstances.

Given the rapid acceleration of advanced science and technology, the fierce competition between countries, and the severe international environment surrouding Japan, it is necessary to implement technologies in society at an early stage regarding key national issues that must be solved through science, technology and innovation by linking the technologies, facilities, and human resources of universities, companies, and public research institutions, while also utilizing large-scale government investment.

To this end, we will consider the establishment of a system to bring together resources such as excellent human resources from universities, companies, and other national research and development corporations, with national research and development agency as the core, as well as the measures needed to improve the research environment. In addition, encouraging flexible salary settings for the gathering of excellent researchers and management personnel (including PMs) at the relevant national research and development agency even in the midst of severe competition for human resources, and the effective and efficient promotion of related operations of fund allocation agencies will be discussed and materialized within FY2023.

Strengthening such fundamental efforts will only contribute to the strengthening of the innovation ecosystem, which is the third cornerstones to deliver the benefits of science, technology and innovation to society. In addition to the formation of an innovation ecosystem that brings startups to the forefront, we will continue to promote studies to strengthen new industry-academia-government collaboration and ecosystem formation, including the aforementioned efforts to bring together Japan's wisdom.

Also, in order to effectively and efficiently pursue science, technology and innovation policies to achieve Society 5.0, it is necessary to continue to identify and analyze the latest trends, including changes in domestic and international circumstances, and the appropriateness of initiatives, and to review and implement the policies in a flexible manner. To this end, we will steadily promote the use of analysis by Council for Science, Technology and Innovation (e-CSTI) and the monitoring and evaluation of progress by the Expert Panel on Evaluation.

Furthermore, as we are approaching the mid-year of the Sixth STI Basic Plan, preparations should be initiated for the review of the Sixth STI Basic Plan in the following fiscal years and beyond. As described above, the importance of realizing Society 5.0 and expectations for the role of science, technology and innovation for this purpose have increased dramatically due to the rapid progress of advanced science and technology and the increasingly severe international environment surrounding Japan, and we have indeed entered a new phase of development. In order to respond to such changes in preconditions and demands of the times, as well as to further deepen policies in line with the progress of initiatives, issues have emerged that need to be considered for medium- and long-term responses, with the next Basic Plan as a target for consideration. The government must identify and take on new challenges in science, technology and innovation policies, such as analyzing advanced science, technology and innovation trends in the midst of

rapid changes; identifying Japan's advantage and indispensability from a bird's-eye viewpoint that goes beyond analysis of trend in advanced science and technology and individual fields and technologies; linking national strategies in key fields with large-scale projects such as SIP and MS; and strengthening the acquisition and development of highly skilled human resources in the midst of intensifying inter-state competition and incorporating growth-oriented evaluation methods that take into account domestic and international trends, and then the government must further strengthen the innovation ecosystem.

We will promote the initiatives of the Integrated Strategy 2023 and advance the direction of science, technology and innovation policies of "a virtuous cycle of ‘social transformation through Convergence Knowledge (So-Go-Chi)’ and ‘investment in knowledge and people’" presented in the Sixth STI Basic Plan. Amidst an increasingly challenging international environment, we will bring together the collective wisdom of Japan's industry, academia, and government, take on the challenge of achieving key national issues through science, technology and innovation, and by expanding our presence and contribution to the international community, we will strongly advance our progress toward achieving Society 5.0.