

Toward Realizing Society 5.0

<Creation of innovation, and humanities and social sciences>

The advancement of ICT, including the invention of the internet and the dissemination of smartphones, has brought about great changes to economy and society, making it possible to access information and goods instantly and have various communications. Generating new values through creative activities such as scientific discoveries and inventions, disseminating these values, and thereby creating great changes to economy and society is defined as "creation of innovation"¹ in the Basic Act on Science, Technology, and Innovation. In recent years, it has been recognized anew that the source of a country's competitive power is its power to create innovation. Meanwhile, opening up new frontiers of knowledge that nobody has ever set foot on, based on researchers' intellectual curiosity—as was done by forerunners in history who advocated the sun-centered theory, discovered the law of universal gravitation, and proposed the general theory of relativity—is an undertaking of great importance, irrespective of whether its outcome will directly lead to practical application.

The rapid development in science and technology such as ICT, AI, and genome-editing technology is having a great impact on human beings and society, and the relationship of human beings and society with science, technology and innovation (STI) has now become close and inseparable. Therefore, it is necessary to draw up a vision for a desirable future of human beings and society in an STI policy and carry out the policy according to that vision. In this context, the fusion of "knowledge in the humanities and social sciences" in which human beings and society are the subject of research, and "knowledge in the natural sciences" (the "Convergence of Knowledge") is required.

Against this background, in June 2020, the Basic Act on Science and Technology, which provides for the basic framework for Japan's science and technology policy, underwent a substantial amendment for the first time since its enactment. Through this amendment, "creation of innovation" was set as one of the pillars of the Act, and the humanities and social sciences (referred to as the "humanities" in the Act), which had not been covered by the Act, were included in the scope subject to the Act. The Act was renamed the "Basic Act on Science, Technology and Innovation," and accordingly, the name of this White Paper was also changed to the "White Paper on Science, Technology and Innovation" from the 2021 edition.

<Circumstances surrounding Japan and the world>

From around December 2019, COVID-19 spread throughout the world instantly. In March 2020, the World Health Organization (WHO) declared that it can be characterized as a pandemic, and the situation

¹ More precisely, the Basic Act on Science, Technology, and Innovation defines "creation of innovation" as follows: "to generate new value through scientific discovery or invention, development of new products or services, or other creative activities, and through the dissemination thereof, create great change in the economic society."

in the international community changed drastically due to restrictions on cross-border travel, for example. The COVID-19 pandemic also brought about domestic changes, promoting a shift to an ICT-based lifestyle such as telework, online education, and remote medical care.

In Japan, it is necessary to deal with issues such as a declining birthrate, an aging population, and depopulation. We also need to respond to issues that concern all humanity, i.e., global warming and protection of the marine ecosystem.

In order to confront these social issues by taking advantage of STI, Japan has advocated a concept of "Society 5.0." With the fight over STI intensifying among major countries, efforts are being made to apply the outcomes of basic research to security issues, including response to the spread of infectious diseases and the occurrence of large-scale natural disasters. Japan is required to play a leading role in creating a new world order and rules.

<What is Society 5.0?>

Society 5.0 is a concept proposed in the 5th Science and Technology Basic Plan (adopted by the Cabinet Decision in January 2016) as a future society for which Japan should aim. It is a new society following the hunter-gatherer society (1.0), agricultural society (2.0), industrial society (3.0), and information society (4.0), which is defined as a "human-centered society in which economic development and the resolution of social issues are compatible with each other through a highly integrated system of cyberspace and physical space."

Industrial society (Society 3.0) was formed as a result of inventions of the steam engine, etc., and information society (Society 4.0) was formed through the ICT development. In this manner, we aim to form a new society by means of the "fusion of cyberspace and physical space." Along with the transition to a new society, there will be changes to the social structure including lifestyles and industrial structures.

In Society 5.0, diverse big data is accumulated in cyberspace on supercomputers using ICT. In this cyberspace, advanced analysis is conducted and predictions and decisions are made on various elements of society through vast data processing and simulations using AI, and the analysis results are reflected in physical space. Through this cycle between cyberspace and physical space, we aim to change our society into a better "human-centered society."

For example, as part of the measures to control COVID-19, the supercomputer, "Fugaku," was used to perform simulations of the spread of droplets in cyberspace, and it was scientifically verified and presented to society that the use of facemasks, the use of partitions and the ventilation of rooms are effective in reducing the infection risk. This result is used when the national and local governments, companies and other entities consider infection control measures (see Chapter I, Section 1-1(2)).

<Society 5.0, the society for which Japan aims: 6th Science, Technology and Innovation Basic Plan>

In 1995, with the aim of becoming a nation that creates science and technology, Japan enacted the Basic Act on Science and Technology. As a reason for submitting a bill of this Act, it was explained as follows: the time when Japan was able to import technology from developed countries it aspired to be like came to an end, and in the future, Japan will independently venture into unexplored science and technology fields as one of the world's frontrunners. Based on such awareness of the issue, Japan has formulated a Science and Technology Basic Plan every five years under this Act.

- The 1st Basic Plan placed emphasis on expanding government investment in R&D and reforming of R&D systems in order to venture into unexplored science and technology fields.
- The 2nd and 3rd Basic Plans aimed at making priority investments in important research areas. During the period of the 2nd Basic Plan, national universities were incorporated in order to ensure independent management, which resulted in a decrease in basic funds for supporting universities but an increase in competitive research grants.
- The 4th Basic Plan shifted its focus to problem-solving science and technology.
- The 5th Basic Plan proposed Society 5.0 as the future society for which Japan aims.

Based on the amendment to the Basic Act on Science and Technology mentioned above, the 6th Science, Technology and Innovation Basic Plan (hereinafter referred to as the "6th Basic Plan") was launched in April 2021. The 6th Basic Plan states that its objective is to achieve Society 5.0, the society for which Japan aims.

It is a pressing issue for Japan to secure sustainability and resilience against not only COVID-19 but also devastating natural disasters for which climate change is one of the causes. In addition, people's values have been changing in recent years as they emphasize well-being and contribution to the nation and the world not limited to pursuing wealth. Against this background, Japan has declared that the society for which it aims as Society 5.0 is a "society that is sustainable and resilient against threats and unpredictable and uncertain situations, that ensures the safety and security of the people, and that enables each and every one of them to realize well-being," by way of digital transformation (DX) that will change people's lives in a better direction in all aspects through the penetration of ICT. This coincides with "SDGs"¹ adopted at the UN summit in

■ Figure: Sustainable Development Goals (SDGs) ■



Source: United Nations Information Center

¹ Sustainable Development Goals

2015 and also encompasses Japan's traditional values that emphasize "trust" and "sharing."

<What is necessary to realize Society 5.0>

The prerequisite for realizing Society 5.0 is to make the "fusion of cyberspace and physical space" possible, and to achieve this, it is necessary to promote R&D of basic technology such as supercomputers, AI, and quantum technology and also promote digitalization in society as a whole. At the same time, in order to "ensure the safety and security of the people," it is also necessary to promote R&D toward achieving a carbon-neutral or decarbonized society for enhancing the sustainability of the global environment, as well as R&D in technologies for disaster prevention and disaster mitigation (see Chapter 1).

Furthermore, in order to ensure that "each and every one of the people can realize well-being," in addition to the initiatives mentioned above, it is important to utilize the "Convergence of Knowledge" that is the fusion of knowledge in the humanities and social sciences and knowledge in the natural sciences (see Chapter 2). Diverse "knowledge" is required in the process of designing Society 5.0, and promoting the creation of new values in this new society, and it is vital to strengthen the basic research capacity that leads to creating such "knowledge" (see Chapter 3).

<Objective of this White Paper>

The objective of this White Paper is to explain, in an easy-to-understand manner, the future society for which Japan aims through the STI policy and the R&D initiatives for supporting this, with a focus on the "Convergence of Knowledge" that is the fusion of humanities and social sciences with natural sciences. We hope that this White Paper will be of some help for understanding the society for which Japan aims as Society 5.0.