TRENDS

Society 5.0: Aiming for a New Human-centered Society
Japan's Science and Technology Policies for Addressing Global Social Challenges

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We are now in a new era, one in which innovation driven by enabling technologies such as IoT, AI, and robotics are bringing significant changes to the economy and society. In anticipation of global trends, the 5th Science and Technology Basic Plan, adopted by the Japanese Cabinet in January 2016, presented Society 5.0 as a core concept. It was identified as a strategic part of the "Basic Policy on Economic and Fiscal Management and Reform 2016," which is a basic policy for economic fiscal management and reform, and furthermore as one of the growth strategies for the "Council on Investments for the Future," which was established in September 2016 as a headquarters for innovation strategy to enhance Japan's growth potential. Why is the Japanese government promoting Society 5.0 now, and what is the government's vision of the society on which Japan's future nation will be built? We asked Yuko Harayama, Executive Member of the Council for Science, Technology and Innovation, about the pioneering "super smart society" aimed for by Society 5.0.

Interviewer
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Joined Hitachi, Ltd. in 1987, and worked on the research and development of reliability technology for social infrastructure. Appointed General Manager of the Mechanical Engineering Center, Hitachi Research Laboratory in 2014, and took her current position in 2015. She has a Doctor of Engineering, and is a member of the Japanese Society of Mechanical Engineering and the Science Council of Japan.

Creating Innovation that Helps Solve Social Challenges

Fukuyama: As Deputy Director of the Directorate for Science, Technology and Industry in the Organisation for Economic Co-operation and Development (OECD), you have been in close contact with global trends. When formulating the 5th Science and Technology Basic Plan, what aspects of these global trends have attracted your attention in the era of major change we're experiencing today?

Harayama: I would say the dramatic changes that are fundamentally transforming society and the innovation that is bringing them about. The OECD played a leading role in triggering this, and in 2010, an "Innovation Strategy" was formulated and positioned as the core of our growth strategy.

Yuko Harayama received a Ph.D. in Education from the University of Geneva in 1996 and a Ph.D. in Economics from the same institution in 1997, where she also taught as an Assistant Professor in the Department of Political Economy. She was a Fellow at the Research Institute of Economy, Trade & Industry (RIETI) in Japan, and in 2002 became a Professor in the Management of Science and Technology Department, Graduate School of Engineering, Tohoku University. From 2006, she spent two years as an Executive Member on the Council for Science and Technology Policy (CSTP) in the Japanese Cabinet Office, and from 2010 to 2012 served as Deputy Director of the OECD Directorate for Science, Technology and Industry. She was appointed in March 2013 as an Executive Member on the Council for Science, Technology and Innovation (CSTI) of the Japanese Cabinet Office, and continues to serve there today. She is Professor Emeritus at Tohoku University, and in 2011 was inducted into the French National Order of the Legion of Honour.

This is not limited to developed countries such as Japan. In emerging countries, too, movements are accelerating, relying on the complementarity between science and technology (S&T) and innovation to fuel economic growth. Even in developing countries, efforts toward bottom-up advancement of frugal innovation and inclusive innovation leading to economic growth are becoming a trend. Furthermore, in September 2015 the United Nations adopted the 2030 Agenda for Sustainable Development, with Sustainable Development Goals (SDGs) as its core. In the SDGs as well, there are high expectations that innovation will play a central role in addressing challenges.

Under these circumstances, new technologies and services are also created one after another through new combinations and/or integration into a system of existing technologies, and the world has been undergoing substantial transformation with innovation as a driving force. Yet, while this has greatly enhanced lifestyle convenience, it has also increased social complexity, and some negative aspects of our new digital society are becoming apparent. Looking at the current situation in Japan, reduced labor productivity is an urgent issue to address, and considering that the declining labor force will become more severe in the future, thoroughly strengthening industrial competitiveness is becoming an urgent task as well.

In light of these circumstances, when formulating the 5th Science and Technology Basic Plan, we believed it was important not only to advocate for S&T development and growth in Japan, but also to equip our plan with the flexibility to respond to a world that is changing daily at tremendous speed. In this age of uncertainty, we cannot predict what the world will be like five years from now. So, as a prerequisite for innovation, we decided to indicate the direction for our society to be pursued involving both industry and academia.

Today, movements toward incorporating new elements into existing technologies and knowledge, thereby designing and creating previously unknown business services are gaining visibility. As the rise of Uber* shows, traditional producer–consumer dichotomies are also collapsing. As in the past, innovation functions as a driving force for economic activity, but its mechanisms are diversifying with a momentum that is overturning existing industrial structures as well. Behind all this is "digitized information." In the future, innovative information-based technologies such as the Internet of Things (IoT), artificial intelligence (AI), and robotics are expected to generate new added value. We created the concept of Society 5.0 under these circumstances, and by doing so, we intend to propose a new guiding principle for innovation from Japan to the world.

Always a Core of People, Not Technology

Fukuyama: Society 5.0 aims at a "super smart society." Is digitalization at its center?

Harayama: Digitalization is a means, but we humans must remain central actors. Traditionally, innovation driven by technology has been responsible for social development, but in the future, we will reverse our way of thinking, focusing on how to build a society that makes us happy and provides a sense of worth. That is why we focus on the word "society" as the foundation for human life.

*Uber is a trademark of Uber Technologies, Inc.

So, just what is Society 5.0? Taking a long view of history, I think we can define Society 1.0 as groups of people hunting and gathering in harmonious coexistence with nature, Society 2.0 as forming groups based on agricultural cultivation, increasing organization and nation-building, Society 3.0 is a society that promotes industrialization through the Industrial Revolution, making mass production possible, and Society 4.0 as an information society that realizes increasing added value by connecting intangible assets as information networks. Society 5.0 is an information society built upon Society 4.0, aiming for a prosperous human-centered society (see Figure 1).
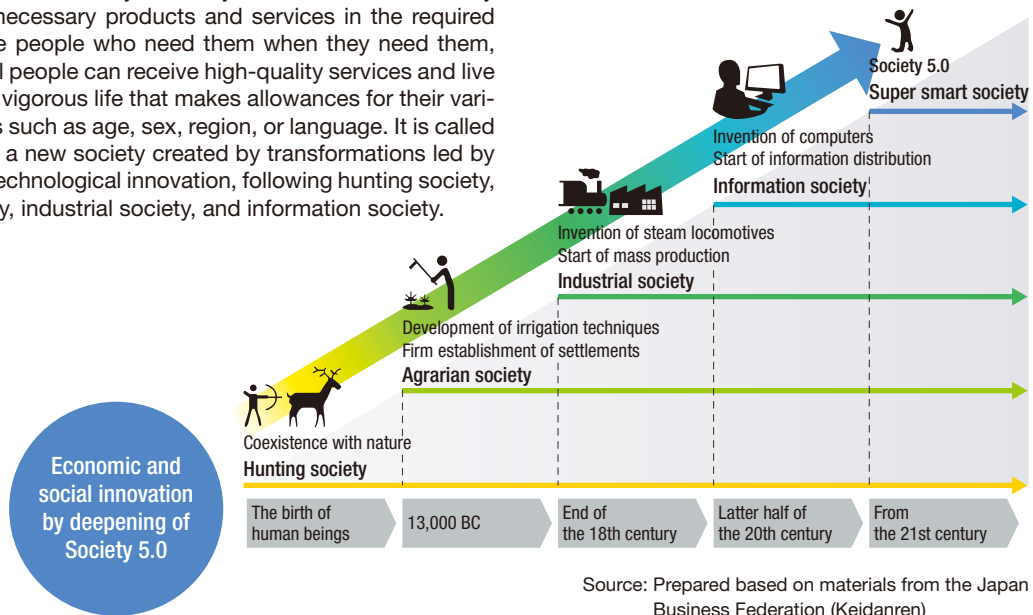
The outline of the 5th Science and Technology Basic Plan describes Society 5.0 as "an initiative merging the physical space (real world) and cyberspace by leveraging ICT to its fullest, where we are proposing an ideal form of our future society: a 'super smart society'" and "a series of initiatives geared toward realizing this," but this is just a starting point in the Basic Plan, which goes on to state that this is "now being further deepened and intensively promoted as 'Society 5.0.'" We consider this as a concept to be developed alongside citizens.

What I would rather focus on is realizing a super smart society—a society where the various needs of society are finely differentiated and met by providing the necessary products and services in the required amounts to the people who need them when they need them, and in which all the people can receive high-quality services and live a comfortable, vigorous life." Contributing to the welfare of people will of course require a variety of approaches, and Society 5.0 is that kind of broad concept.

Actually, the process of "nurturing as a concept" has a point in common with the generation of the concept of the "National Innovation System (NIS)," which everyone today recognizes as a key concept of innovation. NIS tries to capture institutional mechanisms that generate innovation as a system of interactions by actors such as companies, universities, and governments, but it did not

Figure 1 | The "Super Smart Society" Aimed for by Society 5.0

A super smart society is characterized as follows: a society where the various needs of society are finely differentiated and met by providing the necessary products and services in the required amounts to the people who need them when they need them, and in which all people can receive high-quality services and live a comfortable, vigorous life that makes allowances for their various differences such as age, sex, region, or language. It is called this to indicate a new society created by transformations led by scientific and technological innovation, following hunting society, agrarian society, industrial society, and information society.

Society 5.0
Super smart society

Invention of computers
Start of information distribution
Information society

Invention of steam locomotives
Start of mass production
Industrial society

Development of irrigation techniques
Firm establishment of settlements
Agrarian society

Coexistence with nature
Hunting society

Economic and social innovation by deepening of Society 5.0

| The birth of human beings | 13,000 BC | End of the 18th century | Latter half of the 20th century | From the 21st century |

Source: Prepared based on materials from the Japan Business Federation (Keidanren)

take such a concrete form from the beginning. It appeared as an issue in OECD science and technology policy in the 1990s, and it was conceptualized over time through back-and-forth discourses between innovation and policy. In particular, they took in the parts that cannot be grasped from linear models of innovation by bringing a systemic viewpoint, and they deepened their ideas while constructing an overall picture of innovation processes consisting of actor interactions.

In the same way, we would like to deepen Society 5.0 by focusing on human beings, providing breadth as a shared concept. We would also like to involve a wide variety of actors that in the past have only participated in non-visible ways. We want participation not only by experts, but the society as a whole, especially women and young people who are looked to for future activity in Japan. I think that it is important to build a social foundation that allows for game changers, one where these participants can continue to take on challenges, even if they fail at first. In other words, in the 5th Science and Technology Basic Plan, we have created space for accommodating various bottom-up ideas, demonstrating a world with room for dreams.

Fukuyama: It seems that while the legal system has opened some doors, the situation in Japan remains one where it is hard to imagine equal opportunity for all. Do you believe that will change through inclusion of a larger variety of actors and through digitalization?

Harayama: I do. I think the most needed reform is human empowerment. In other words, each constituency of a nation or organization would be equipped with the ability necessary for development and change and be able to explore fully this ability. It is important to increase the number of people working under their own initiative and acting as game changers. In Japanese society through today,

I think that these people are constrained by existing norms and practices and, in some respects, find it difficult to demonstrate their own strength. From now on, we need to create places where people with a willingness to change society can fully work toward doing so by their own initiative. I think that such efforts are vital to realizing Society 5.0.

However, it is difficult to create such an environment through government decree. It can be hard to remove oneself from a comfortable situation of business as usual, thereby reducing the occurrence of innovation. In an era of profound changes, we need to have pioneering courage — and the ability to disrupt stability when necessary. We are approaching an era of 100-year lifespans, so I consider it vital that young people accumulate experience and cultivate their skills so that they can accommodate drastic social change.
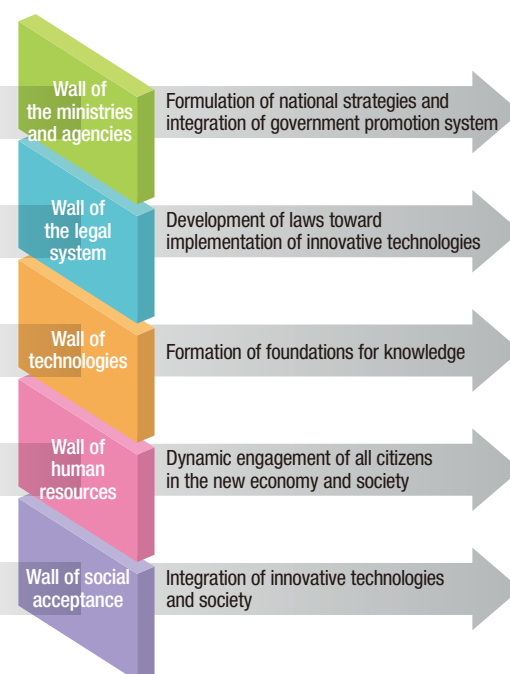
Of course, it is also essential that we revisit our current value system. The past work value that call for families to be supported by a single household member, is shifting to one in which each family member may choose to work in view of pursuing his/her own goal, accompanied by a sense of contributing to society. Therefore, there are various fields and options to conceive the work, and what is needed is a society that allows its constituents the possibility to choose how to work at different times and occasions in their life, which is exactly what Society 5.0 is.

Goals of Society 5.0 as an Innovation Ecosystem

Fukuyama: The 5th Science and Technology Basic Plan states that companies, universities, and others who are responsible for innovation systems should strengthen their cooperation, breaking down organizational walls and promoting open innovation (see Figure 2). As a specific initiative, full-fledged collaborative research between industry and academia will be promoted, involving the creation of innovation and ecosystems including ventures and the like. Please tell me about that concept.

Figure 2 | **Breaking through the "Five Walls"**

Realizing a new economy and society in which discontinuous and disruptive changes are expected to occur will require breaking through five walls.

| Wall of the ministries and agencies | Formulation of national strategies and integration of government promotion system |
Wall of the legal system	Development of laws toward implementation of innovative technologies
Wall of technologies	Formation of foundations for knowledge
Wall of human resources	Dynamic engagement of all citizens in the new economy and society
Wall of social acceptance	Integration of innovative technologies and society

Source: Prepared based on materials from the Japan Business Federation (Keidanren)

Harayama: Actually, when I was involved in formulating Innovation Strategy at the OECD, I made a proposal at a brainstorming meeting to move one step further from the National Innovation System into the "Ecosystem." Merely having different organizations such as companies and universities follow a research plan for producing results is no different from conventional collaborative research. Innovation arises in unexpected places, and I believe that coming across people in various fields promotes the noticing of new things, much like in a wide-open natural ecosystem. I believe that such soft forms of cooperation are the basis for an innovation ecosystem. So, going forward, what will be important is the extent to which we can build mutually inspiring relationships while maintaining a higher degree of freedom, without being limited to formal industry–academia collaboration. How to build so-called social capital that regards such relationships as an asset will be the key to igniting innovation.

Figure 3 | **Constructing a Platform for Society 5.0**

There is a need for "systemization" of services and projects, more advanced systems, and coordination between multiple systems, and we will promote efforts toward building a common platform (a super smart society service platform) in collaboration with industry, academia, government, and related ministries.
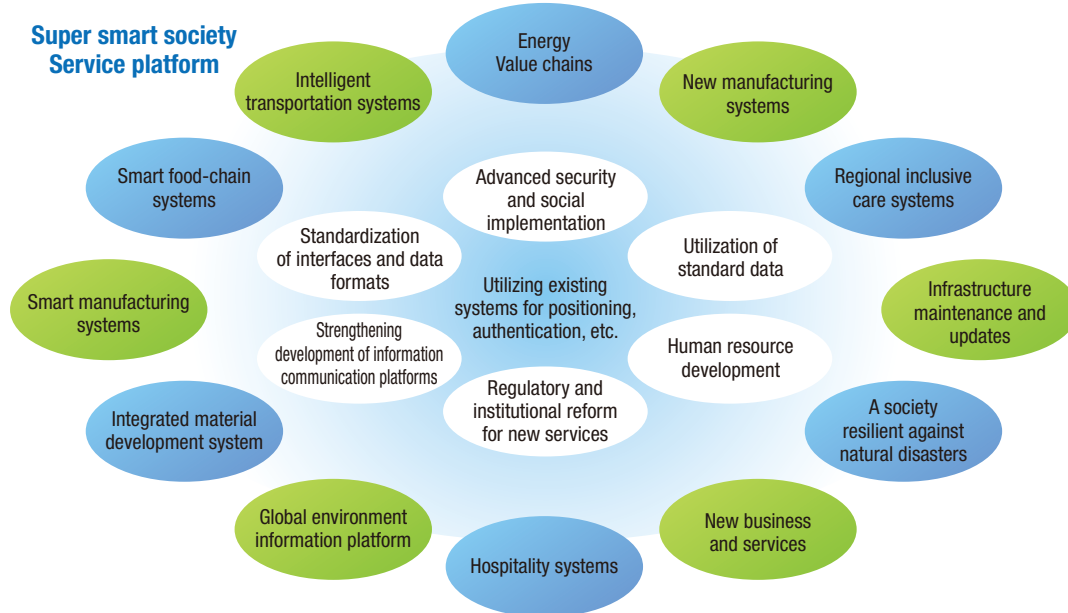
Fukuyama: Hitachi, too, is looking to transform ideas from industry–academia collaboration that matches traditional needs and seeds, and as part of our efforts to create and disseminate a vision for realizing Society 5.0 and to resolve issues based on that vision, we are working on open innovation with The University of Tokyo, Kyoto University, and Hokkaido University, but there is a need for further discussion before we can produce anything concrete.

Harayama: Planning, developing a roadmap and following it, checking off requirements as you go along, this approach is quite well grounded. Unfortunately, we cannot say for certain that this approach effectively applies to innovation. You can never be sure you will obtain results, but nothing ventured, nothing gained. Of course, ideas that are produced by the same organization tend to be homogeneous, so you cannot expect the spark of new ideas from these ideas. It is necessary to get involved outside of one's own walls. Further, efforts crossing organizational barriers are indispensable for standardization that will survive international competition. All you can do is try various approaches. In that sense, I am very

much looking forward to the results of Hitachi's open laboratory initiative.

We have passed through industrialization, and then through digitalization, providing an age of convenience and healthy lives. That is exactly why we should pause to reconsider our lifestyles and take action. Of course, there have been negative aspects accompanying scientific and technological advancement. There has been an undeniable increase in inequality. We have arrived at a time for engagement in social issues not just by a few selected specialists and politicians but by everyone, especially women, the young, and the elderly. Private enterprises have a social responsibility to demonstrate leadership through their human resources, funds, networks, and extensive technologies and expertise.

Precisely because this is an era in which everyone can enter the ring to change society, we must consider alongside a broad range of other people what kind of society we want to create, what is needed to do so, and how to develop the needed human resources. We hope that efforts to realize Society 5.0 will provide such opportunities (see Figure 3).

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