Realizing Society 5.0: Science and Technology Policy in Japan

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What is “Society 5.0”? 

Realize the advanced fusion of cyberspace and physical space, To balance economic advancement with the resolution of social problems, Bring about a human-centered society

New society “Society 5.0”
Advanced Fusion of Cyberspace and Physical Space

All types of data will be gathered from sensors installed throughout physical space via IoT. This Big Data will be analyzed by AI, and the results will then be fed back in physical space.

Current information society (4.0)

- **Cyberspace**
  - Cloud
  - Person access, and retrieve and analyze the information.
  - A person searches by navigation system
  - A person analyze information
  - Robots produce under control of human

Physical space

- Person access, and retrieve and analyze the information.

Society 5.0

- **Cyberspace**
  - **Big Data**
  - **Analysis**
  - **AI**
  - **Artificial Intelligence**

- Sensor info.
  - environmental information, equipment operating status, or people-related information, etc.
- High-value-added information, proposals, or equipment operating instructions, etc.

- Automatic-driving
- AI propose a person
- Automatic producing by robots in factory

Physical space

[source: CAO]
Administrative Structures for STI Policy in Japan

CSTI/Cabinet Office/Ministries

**Cabinet Office**

Roles:
- Support the Cabinet in **formulating important policies** and in **overall coordination** of Ministries
- Make total **planning and coordination from a higher standpoint of view** than other Ministries

**Councils on key policy fields**
2. **Council for Science, Technology and Innovation**
3. Advisory Council for National Strategic Special Zones
4. Central Disaster Management Council
5. Council for Gender Equality

**Chair:** Prime Minister  
**Member:** 7 cabinet members (including PM & Minister for S&T Policy) and **8 executive members**  
**Secretariat:** STI Bureau, CAO

<Main Functions>
1. Investigate and discuss **basic S&T Innovation policies**  
2. Investigate and discuss S&T **budgets** and the allocation of **human resources**
3. Assess Japan’s **key R&D**
4. Investigate and discuss **Framework conditions** for the promotion of innovation

- Basic policies on S&T (Budget Allocation, Basic Strategy etc.)  
- Consultation  
- Response

**Ministries (14 ministries)**
In conformity with the basic policy indicated by CSTI, each ministry promotes S&T according to the division of duties

**MEXT**  
(Ministry of Education, S&T)  
- University policy  
- Basic research  
- General promotion of S&T

**MIC**  
(Ministry of Internal Affairs and Communication)  
- ICT policy, etc.

**METI**  
(Ministry of Economy, Trade and Industry)  
- Industrial policy  
- Energy, Nuclear power

**MHLW**  
(Ministry of Health, Labor and Welfare)  
- Clinical study

**MAFF**  
(Ministry of Agriculture, Forestry and Fisheries)  
- Agriculture and Fisheries, etc.

(Source: CSTI)
Japanese population began to decline in 2010, it may have less than 100 million by 2050. Population aging rate of Japan is expected to rise, and it is estimated that it will reach about 40% in 2060.

(Source: H25 Information and communication white paper, ~2010 the census, 2015~ National Institute of Population and Social Security Research)

(Source: CSTI)
“Society 5.0” to balance economic advancement with the resolution of social problems

Economic advancement
- The demand for energy is increasing
- The demand for foodstuffs is increasing
- Lifespan is becoming longer, and the aging society is advancing
- International competition is becoming increasingly severe
- Concentration of wealth and regional inequality are growing

Resolution of social problems
- Reduction of GHG emissions
- Increased production and reduced loss of foodstuffs
- Mitigation of costs associated with the aging society
- Promotion of sustainable industrialization
- Redistribution of wealth, and correction of regional inequality

Incorporating new technologies such as IoT, robotics, AI, and big data in all industries and social activities, provide goods and services that granularly address manifold latent needs without disparity

To balance economic advancement with the resolution of social problems

(Source: CSTI)
Towards the realization of “Society 5.0”

11 Systems: Main Components of “Society 5.0”

To build “Society 5.0,” the CSTI identified 11 systems that will serve as main components.
At the 5th "Public-Private Dialogue towards Investment for the Future" held on April 12, 2016, Prime Minister Abe made the following remarks.

- The Government will develop a roadmap of research/development goals and industrialization concerning artificial intelligence during the ongoing fiscal year.

- To this end, the government will establish “Strategic Council for AI Technology,” which will integrate wisdom from across industry, government and academia beyond the sectoral boundary.”
Road map of R&D goals and industrialization concerning AI

**Health Care and Welfare**
- AI assistance system for Doctors
- Care homes with sensors
- Health monitoring with AI
- Preventive medical care using sensors
- AI assists all surgeries
- Nursing care robots, controlled by health care services under human control
- Spreading home medical examination
- Versatile robots provides services in daily life.
- Wearable robots to supplement and alternate our body functions
- Provision of handy highly advanced medical treatment under doctor control
- Health and longevity society with daily preventive care through sensor control
- A society with creative products and services beyond preconceived ideas
- Eco-system society as an outcome of integration of businesses

**Production and Services**
- Integration of manufacturing, service and distribution
- Cross field services and products
- New service and products with AI support
- Smart factory
- Integration of cyber space and physical space created by high value added to mobility
- Development of related industries, such as auto updating systems for vehicle

**Mobility in Space**
- Achieving full automation system saves travel time and space
- Realizing cyber space environment close to real physical environment
- Achieving full automation system saves travel time and space
- Integration of cyber space and physical space created by high value added to mobility
- Development of related industries, such as auto updating systems for vehicle

(Source: MEXT)
Priorities

1. Making “Society 5.0” a reality

2. Implementing the “Public & Private Investment Expansion Initiatives for STI (PRISM)”
   I. Reform in budget-making process
   II. Systemic reform for expanding investment for R&D
   III. Evidence-based actions for public & private investment

3. Achieving the government R&D investment target in promoting “Society 5.0”

(Source: CSTI)
Towards the realization of “Society 5.0”
R&D Investment Target Fields

《Priority Target（2018）》
1. Cyber space platform technologies（AI／IoT／Big Data）
2. Physical space platform technologies（Sensor／Actuator／Device／Robotics／Photonics・Quantum）
3. Construction and infrastructure maintenance technologies／Natural disaster prevention and reduction technologies

《Next Target（2019－）》
Database construction and utilization technologies（System of Systems）
ICT platform technologies（Cybersecurity／Network／Processing）
Energy storage and saving technologies
Automated driving technologies／Three-dimensional map information utilization technologies
Manufacturing technologies
Food production and distribution technologies
Life care and support technologies
Medical and drug design technologies
Bio-industry technologies
Materials development technologies

(Source: CSTI)
Common policy issues to realize Society 5.0

- Establishing Intersystem Data platform
  - Need to ensuring security and forgery protection, and avoid misuse of data
  - Need processing technologies to protect privacy

- IPR and standardization strategy

- Regulation to ensure safety and personal data security in the era of big data and promote innovation

- Human resource development
  - Need to address huge gap between needs and supply in AI, cybersecurity, data science areas

- Development of platform technologies (computing, network, cybersecurity, sensing..)
  - Need to develop cybersecurity technologies to match Society 5.0
Towards the realization of “Society 5.0”

SIP
(Cross-Ministerial Strategic Innovation Promotion Program)

Program Directors for SIP -

Automated Driving System
Seigo Kuzumaki
Toyota Motor Corp.

Cyber-Security for Critical Infrastructures
Atsuhiro Goto
Institute of Information Security

Enhancement of Societal Resiliency against Natural Disasters
Muneo Hori
University of Tokyo

Infrastructure Maintenance, Renovation, and Management
Yozo Fujino
Yokohama National Univ.

Next-Generation Power Electronics
Tatsuo Oomori
Mitsubishi Electric Corp.

Structural Materials for Innovation (SM*I)
Teruo Kishi
Univ. of Tokyo, NIMS

Energy Carriers
Shigeru Muraki
Tokyo Gas Co., Ltd.

Next-Generation Technology for Ocean Resources Exploration
Tetsuro Urabe
Univ. of Tokyo, JMEC

Innovative Combustion Technology
Masanori Sugiyama
Toyota Motor Corp.

Innovative Design/Manufacturing Technologies
Naoya Sasaki
Hitachi Ltd.

Tech. for Creating Next-Generation Agriculture, Forestry and Fisheries
Noboru Noguchi
Hokkaido Univ.

(Source: CSTI)
Ensuring Cyber Security for Critical Infrastructure

Social implementation (critical infrastructure)

Program Director
Atsuhiro Goto
Institute of Information Security
Dean and Professor
Graduate School of Information Security

Trusted Operational Platform for Cybersecurity (TOP)
- Provides all the stages from technology, deployment, operation procedures, to staff for cyber security as a set
- Provides a framework capable of being an outlet for excellent security technology and know-how inside and outside Japan

The Plan (planned from January 2016–2019)

- Authenticity determination technology
- Core technologies
- Behavior monitoring/analysis/defense technologies
- Encryption implementation technologies for IoT
- Social Implementation Technologies
  - Forms of checking compatibility
  - Information sharing
  - Evaluation verification
  - HR development

(URL: http://journal.jp.fujitsu.com/en/2017/06/15/02/)
Exit Strategies: Cyber-Security for Critical Infrastructures

Ensure social implementation of research and development outcomes

Advance research and development for adopting critical infrastructure for the 2020 Tokyo Olympic and Paralympic Games. Structure a research and development program that results in the shortest path from research and development to social implementation.

Develop measures to advance the spread of cybersecurity

Develop strong cybersecurity functions to incorporate into critical infrastructure across Japan. Encourage the creation of standards, specifications, safety evaluation methods and other certifications tailored to each sector. Promote the use of development outcomes. Contribute to global business by exporting technologies, products, and evaluation and verification services utilizing the results of this research and development.

(Source: http://www8.cao.go.jp/cstp/panhu/sip_english/41-42.pdf)
“Society 5.0” bring about a human-centered society

Benefit everyone regardless of age and gender

Everyday life is happy and fun

provide goods and services that granularly address manifold latent needs without disparity

advance fusion of cyberspace and physical space

Liberated from cumbersome work, effectively utilizing time

More convenient, safe and secure life

Society 5.0

Comfort

Comfort

Society 5.0

Vitality

High-quality Lives

to balance economic advancement with the resolution of social problems

[source: CAO]
Back up slides
Science and Technology Basic Law (1995)
Science and Technology Basic Plan is to be complied to promote science and technology in Japan over a five-year term, based on a 10 year forward outlook.

<table>
<thead>
<tr>
<th>S&amp;T Basic Plan</th>
<th>Major Achievements</th>
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| **1st Basic Plan (1996-00)** | ◆Introduction of R&D evaluation system(‘97)  
◆Actual support of 10,000 post-docs(‘99)  
◆Competitive funding doubled(‘00) |
| **2nd Basic Plan (2001-05)** | ◆Establishment of CSTP (‘01)  
◆Establishment of the independent administrative institutions (‘01)  
◆Intellectual Property Basic Act (‘03) |
| **3rd Basic Plan (2006-10)** | ◆Long-term Strategic Guidelines “Innovation 25” (‘07)  
◆Basic Act on Ocean Policy (‘07)  
◆Act on Enhancement of R&D Capacity and Efficient Promotion (‘08) |
| **4th Basic Plan (2011-2015)** | ◆Funding Program for World-Leading Innovative R&D on Science and Technology(FIRST)  
◆Cross-ministerial Strategic Innovation Promotion Program (SIP)  
◆Impulsing PARadigm Change through disruptive Technologies Program (ImPACT) |

(Source: CSTI)
CSTI mobilizes 11 SIP projects in realizing “Society 5.0.”

- CSTI appoints Program Directors (PDs) for each themes and allocates the budget.
- Established in 2014
- Annual budget \$50 billion/year (USD 500 million/year)

(Source: CSTI)
Exit Strategies: Cyber-Security for Critical Infrastructures

(SOURCE: http://www8.cao.go.jp/cstp/panhu/sip_english/41-42.pdf)
Some of the **ImPACT** projects are also expected to contribute to making “Society 5.0” a reality.

**<ImPACT>**

- Create disruptive innovations which revolutionize industries and society through high risk / high impact R&Ds.
- Giving great authority for planning, acting and managing the program to Program manager (PM)
- Established in 2013
- Budget: 55 billion yen/5 years (USD 550 million/5 years: multi year fund)

(Source: CSTI)
Towards the realization of “Society 5.0”

**ImPACT (2)**
*(Impulsing PAradigm Change through disruptive Technologies Program)*

**Ultra Big Data Platform for Reducing Social Risks**

Program Manager
Hiroshi Harada

(Source: CSTI)

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**Innovative Cybernic System for a ZERO Intensive Nursing-care Society**

Program Manager
Yoshiyuki Sankai

(Source: CSTI)
Strategic Council for AI Technology

Established in response to Prime Minister’s instruction

- Control Tower for the AI strategy in Japan
- Collaboration system of 3 Ministries
- Developing a roadmap of R&D goals and industrialization
- Integrating the wisdom from across Industry, government, and academia

Sharing R&D Targets and Product Strategy

Cabinet Office MAFF MHLW MLIT

Platform of Information and Communication
Excellent Scientific & Technological Platform
Technology implementation in the society

Early transformation of R&D outcomes into practice

Industries

AI technology research institutions around Japan

- JST AIP Network Lab
  - 64 existing issues
  - 3 new areas are recruiting new projects

- Japan Society for Promotion of Science (JSPS)
  - KAKENHI

- Cabinet Office
  - Cross-ministerial Strategic Innovation Promotion Program (SIP) 5 big categories

- NICT, Universal Communication Research Institute
- NICT, Advanced Speech Translation REsearch and Development promotion Center (ASTREC)
- RIKEN Center for Advanced Intelligence Project (AIP)
- AIST The Artificial Intelligencer Research Center (AIRC)
- National Institute of Informatics (NII)

(Source: MEXT)
A society realized with “Society 5.0”

Current society
Knowledge and information are not shared and cross-sector value is difficult to create.

IoT will connect all people and things, all sorts of knowledge and information will be shared, and totally new value will be born.

Society 5.0
AI will free humans from the burdensome work of analyzing huge amounts of information.

The possibilities open to humans will expand through the use of robots, automatic-driving cars, etc.

Current society
A variety of constraints exists with respect to social problems such as the aging society and regional depopulation making a sufficient response difficult.

Social issues will be overcome and humans will be liberated from various types of constraints.

Current society
With an overflow of information, the work of finding and analyzing the information desired is difficult and burdensome.

People do a large amount of work, their abilities had limitations, and the behavior of the physically challenged is constrained.

[source: CAO]