A Living Concept “Society 5.0” And the Role of Universities

Yuko Harayama
Executive Member
Council for Science, Technology and Innovation
Cabinet Office

About CSTI (1)

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

1. Council on Fiscal and Economic Policy
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

Council for Science, Technology and Innovation (CSTI)

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)
・Response

・Consultation

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

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)
・GMO
・Agriculture and Fisheries

Other ministries

・・・

About CSTI (2)

Chairperson

Shinzo ABE
Prime Minister

Cabinet Members

Yoshihide SUGA
Chief Cabinet Secretary

Taro ASO
Minister of Finance

Masaji MATSUYAMA
Minister of State for Science and Technology Policy

Yoshimasa HAYASHI
Minister of Education, Culture, Sports, Science and Technology

Seiko NODA
Minister for Internal Affairs and Communications

Hiroshige SEKO
Minister of Economy, Trade and Industry

※ *Relevant ministers are appointed ad-hoc members when needed to attend plenary session meetings of CSTI*

Executive Members

Dr. Kazuo KYUMA
Former Executive Adviser, Mitsubishi Electric Corp.
(Full-time Position)

Dr. Yuko HARAYAMA
Former Professor, Tohoku University
(Full-time Position)

Dr. Takahiro UEYAMA
Former Vice President; Professor, National Graduate Institute for Policy Studies
(Full-time Position)

Mr. Takeshi UCHIYAMADA
Chairman of the board, Toyota Motor Corp.

Head of an Affiliated Organization

Dr. Kazuhito HASHIMOTO
President, National Institute for Materials Science

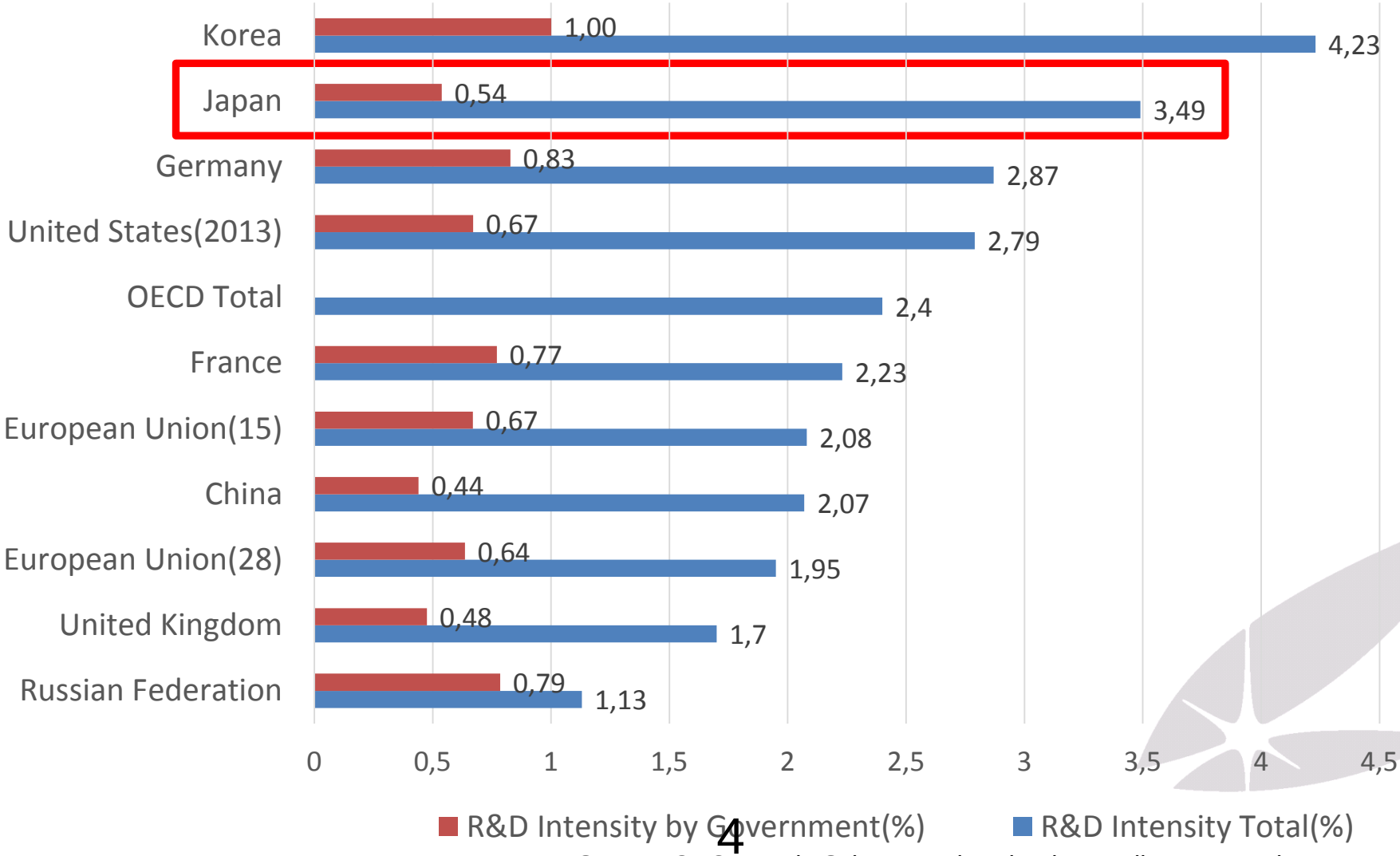
Dr. Motoko KOTANI
Professor, Tohoku University

Mr. Masakazu TOKURA
Representative Director, & President Sumitomo Chemical Co., Ltd.

Dr. Takashi ONISHI
President, Science Council of Japan

R&D Intensity

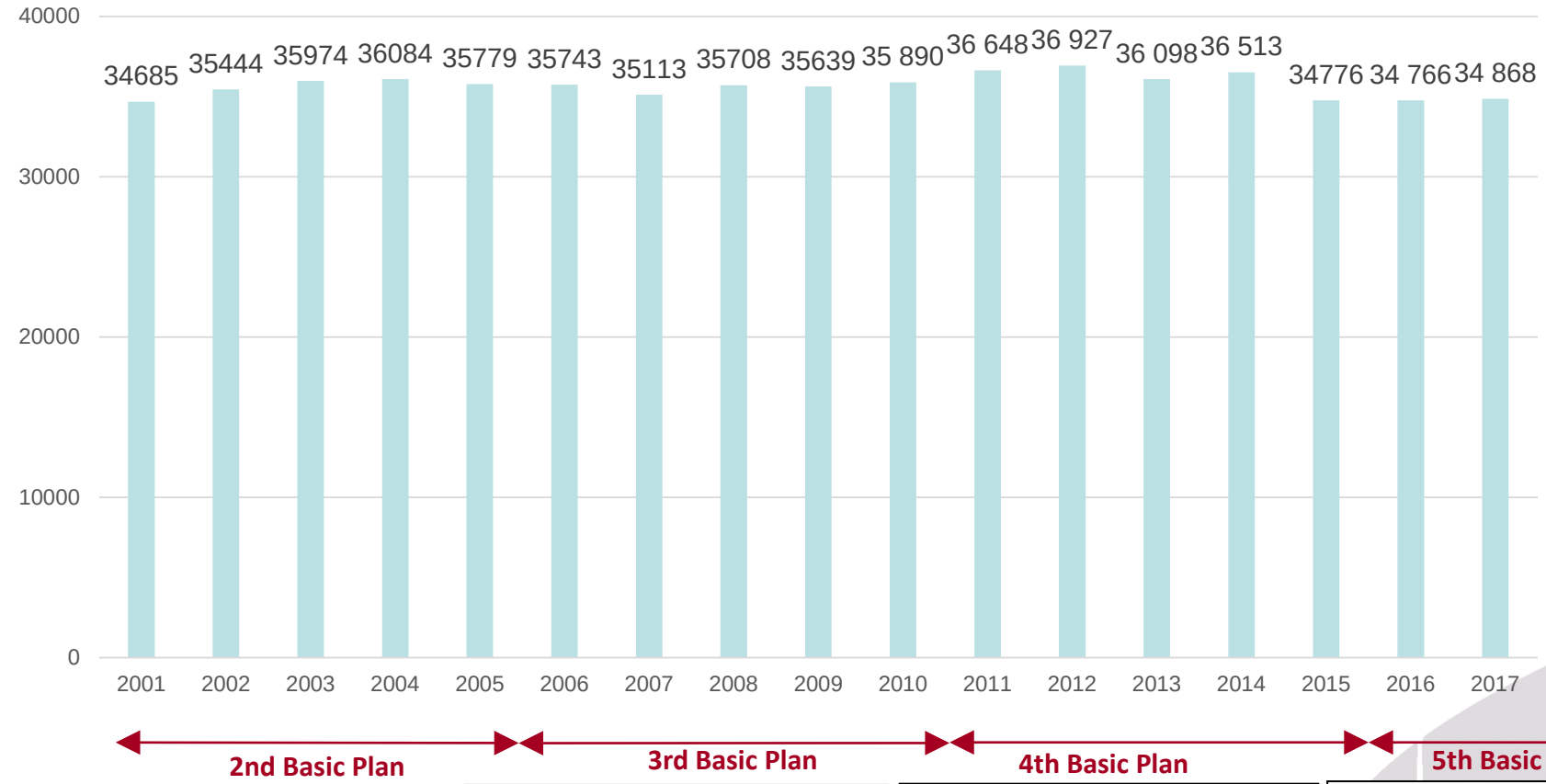
R&D intensity (R&D expenditure as a percentage of GDP)



Source: OECD, Main Science and Technology Indicators Database, June 2017

S&T Budget of the Central Government

(100M\)



2nd Basic Plan

2nd Plan（FY2001-2005）
Investment under the basic plan
Approx.24 trillion yen
Actual budget: 21.1 trillion yen

3rd Basic Plan

3rd Plan（FY2006-2010）
Investment under the basic plan
Approx.25 trillion yen
Actual budget: 21.7 trillion yen

4th Basic Plan

4th Plan（FY2011-2015）
Investment under the basic plan
Approx.25 trillion yen
Actual budget: 22.9 trillion yen

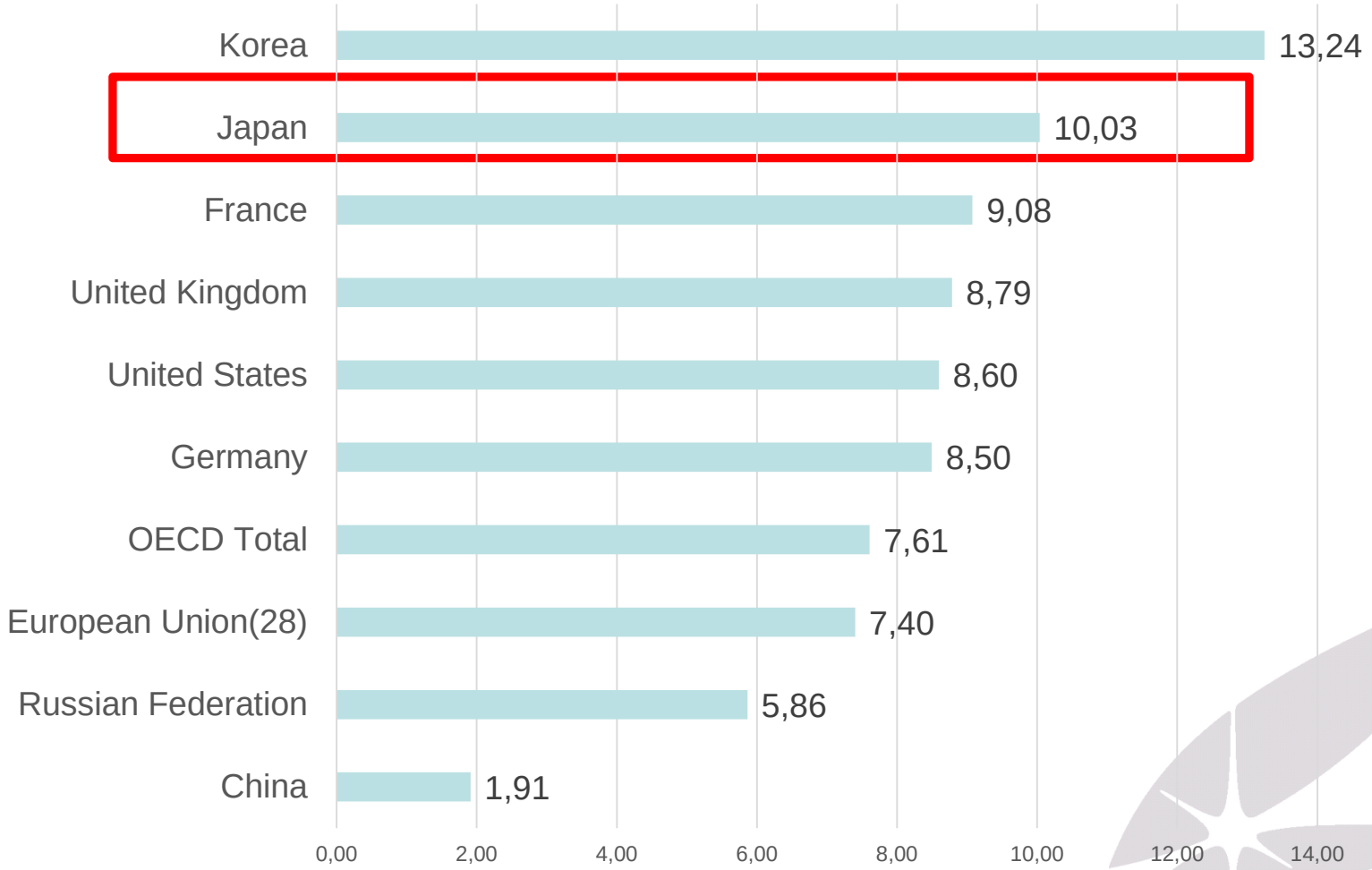
5th Basic Plan

5th Plan（FY2016-2020）
Investment under the basic plan
Approx.26trillion yen
Actual budget: 8.3 trillion yen

Source: Bureau of Science, Technology and Innovation, Cabinet Office (2017)

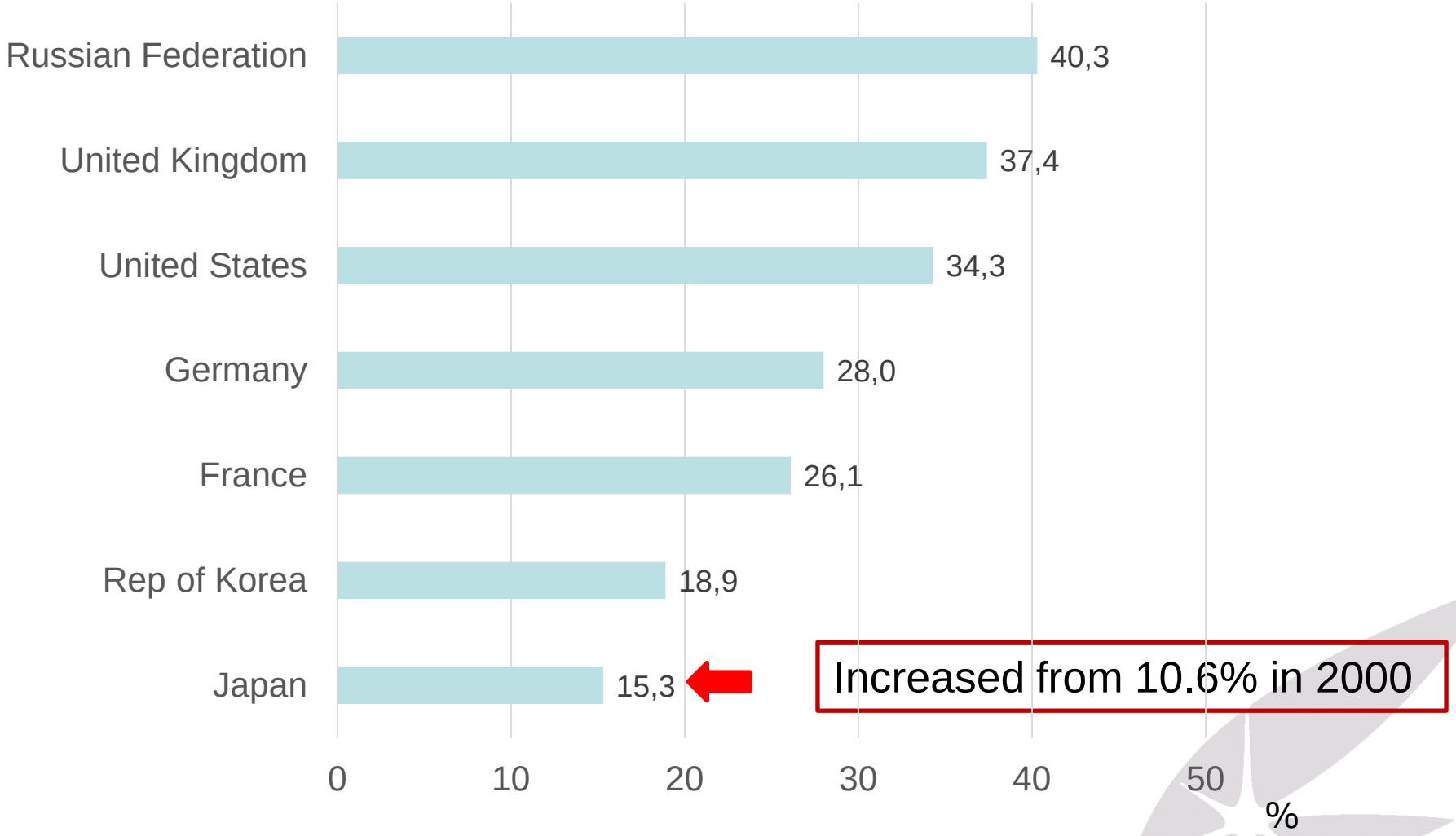
Number of Researchers

Researchers Total, Per 1000 employed, 2014, 2015



Source: OECD Main Science and Technology Indicators, June 2017

Percentage of the Female Researchers

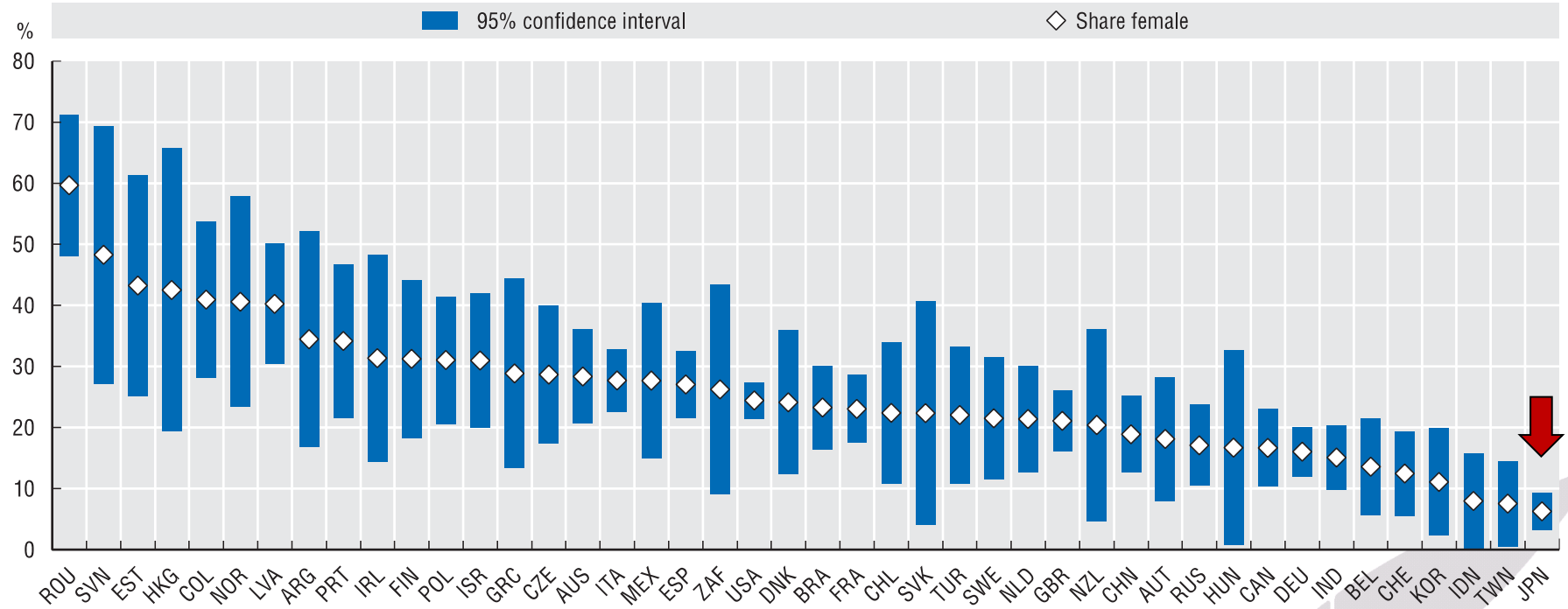


OECD “Main Science and Technology Indicators”(2013, 2014,2015)
National Science Foundation“Science and Engineering Indicators 2016”（2013）
Statistics Bureau, Japan, 2017

Female Scientific Authors

Female scientific authors in selected fields, by country, 2011

As a percentage of corresponding authors, estimated shares



Note: This is an experimental indicator, based on a stratified random sample of scientific authors.

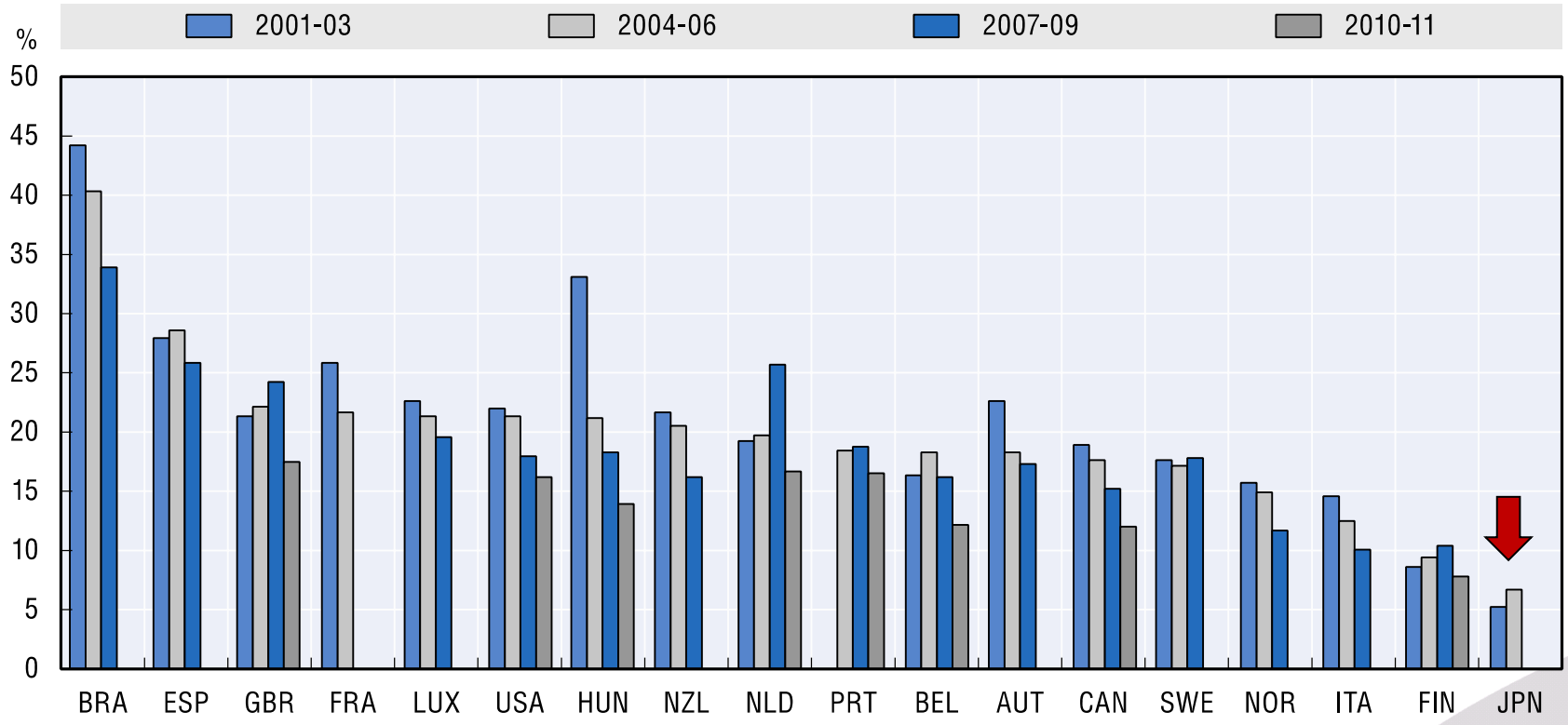
Source: OECD, based on preliminary analysis of the OECD Pilot Survey of Scientific Authors, July 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273335

Start-ups

Start-up rates have declined across countries

Percentage of start-ups in all businesses



OECD *Innovation Imperative (2016)*

Background

- Historical framework
  - Science and Technology Basic Law (1995)

  ➡ Science and Technology Basic Plan (5 year-planning, since 1996)
- Changing policy environment
  - Mainstreaming of innovation

  ➡ From Council for S&T Policy to Council for STI
- Accelerated rate of changes
  - “In” and “Surrounding” STI, including geo-politics
- Challenges
  - Enhancing preparedness for the unforeseeable future
  - More proactive role for the government

Where we go?

- Policy coordination
  - Cross-ministry, within ministry, among funding agencies
- Stakeholders
  - Main actors: Universities, Public research institutes, Large companies
  - Need to engage: SMEs, Start-ups, Civil society (in particular societal trust), International partners
  - Cross-sectorial coordination
- Excellence in science
  - Mobility of researchers (national & international)
  - Career development of young researchers & female researchers
  - Cross-disciplinary approach
  - Infrastructures, with a particular eye on intangibles, including data infrastructure
- Institutional reforms
  - National research institutes, National universities, Funding systems

The 5th Science & Technology Basic Plan

1. Introduction: changing context and our goal
2. Preparing the next: Future industry and society
   - **Society 5.0**
3. Addressing socio-economic & global challenges
4. Investing in “fundamentals”: People and Excellence
5. Better functioning STI systems
6. STI and society
   - Everybody on board, including “citizen”
7. Leading effective STI Policy implementation

Annex: Indicators and numerical targets

http://www8.cao.go.jp/cstp/english/basic/5thbasicplan.pdf

Society 5.0

What's next?

5.0

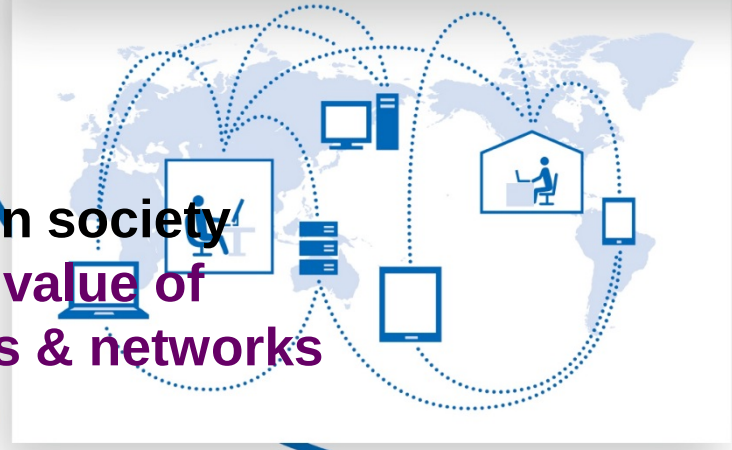
Hunting & gathering society
In symbiosis with Nature

1.0

2.0

Agrarian society
Beginning of human organization

Industrial society 3.0
Mastering of power & Mass production



Information society
Increased value of intangibles & networks

4.0

In Other Words ▪ ▪ ▪

- A society where the necessary goods and services are provided to the people who need them at the right time and in the right amounts, regardless of age, gender, location, language or other limitations, for a fulfilling and comfortable lifestyle where everyone can receive high-quality service
  - Coexistence of people and robots/AI
  - Made-to-order services
  - Elimination of service inequality
  - Increased opportunities for game changers

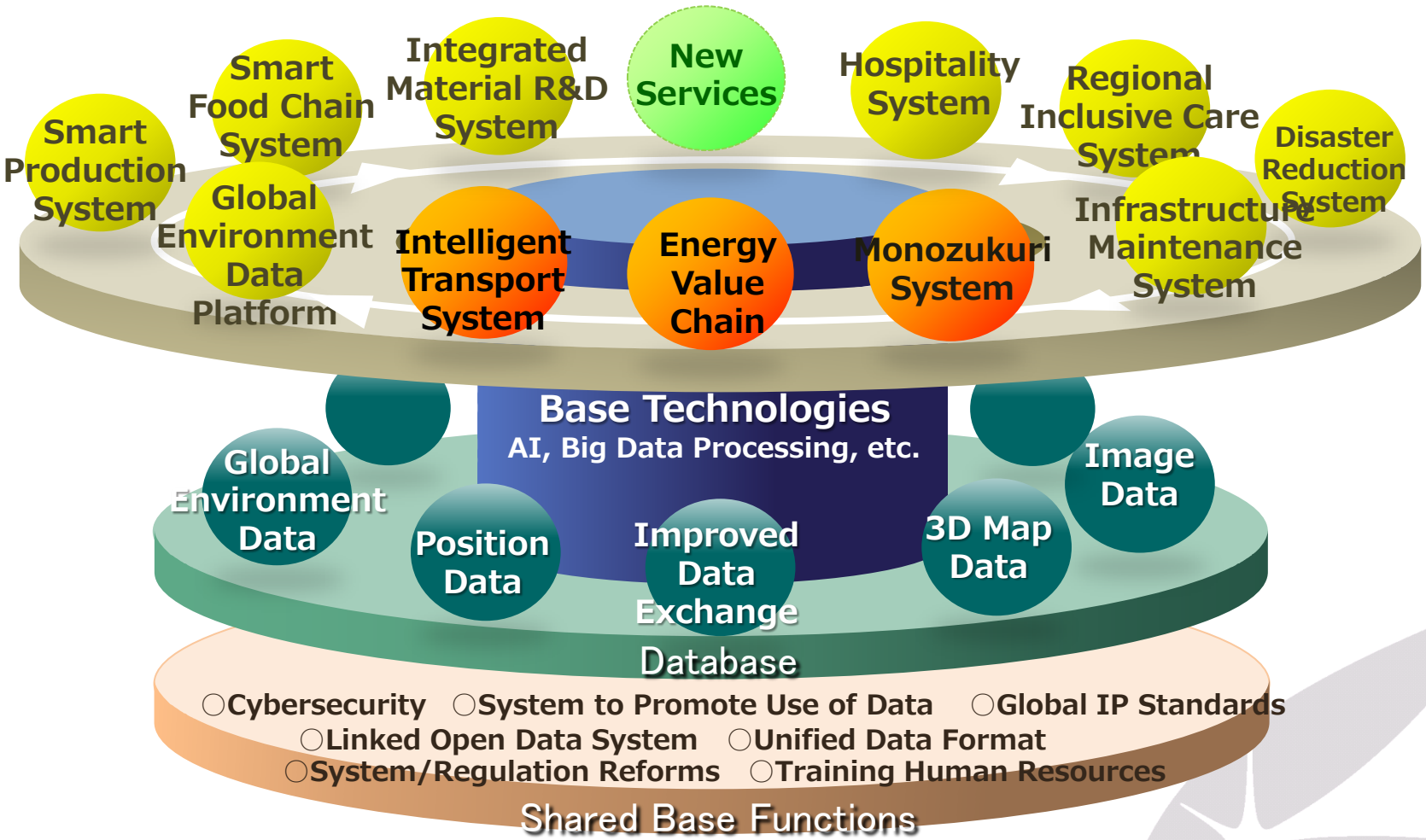
“Society” at the heart

- Technology-driven versus Human-centered
- Society backed by STI
  - With a particular eye on IoT, AI, Big data, Robotics, …
- Value of openness, sustainability and inclusiveness
- Everybody on board

Ultimate goal:
- **Achieving economic growth & well-being**
- **Addressing societal challenges**
- **Contributing to the global prosperity**

- Exploratory fields
- Socially responsible STI
- Framework conditions to be revisited

Exploratory fields



R&D on Artificial Intelligence Technology

- Leading ministries
  - MEXT ➡ Riken (FY2016: 6.5 billion yen: USD 65 million)
  - METI ➡ AIST (FY2016: 16.3 billion yen: USD 163 million)
  - MIC ➡ NICT (FY2016: 2.2 billion yen: USD 22 million)
- Coordinated by the AI Technology Strategy Council (2016-)
- “User ministries” such as the Ministry of Infrastructure, the Ministry of Agriculture, and the Ministry of Health participating to the Council

Socially responsible STI

- STI and Society
  - Co-creation of STI
    - Dialogue and collaboration
    - Empowering stakeholders
    - Science advise for policy making
      - Science for policy
    - Ethical, Legal and Social Implications (ELSI)
  - Research integrity
- Putting into practice
  - Bioethics Committee ➡ Interim Report on Genome Editing (April 2016)
  - Advisory Board on Artificial Intelligence and Human Society ➡ Report on Artificial Intelligence and Human Society (March 2017)

http://www8.cao.go.jp/cstp/tyousakai/ai/summary/aisociety_en.pdf

Comprehensive Strategy on STI 2017

- Priorities
  1. Making “Society 5.0” a reality
  2. Implementing the “Public & Private Investment Expansion Initiatives for STI”
     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”
     - 1% of GDP

R&D Investment Priority Target

【2018】

- Cyber space platform technologies (AI, IoT, Big Data)
- Physical space platform technologies (Sensor, Actuator, Device, Robotics, Photonics, Quantum)
- Construction and infrastructure maintenance technologies & Natural disaster prevention and reduction technologies

【Candidates for 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

Reactions and Actions!

SDGs friendly?

- Reactions and reactions!
  - Competing against or enveloping “Industry 4.0”?
    - Empathy around “Society 5.0”
  - “Technology first” (e.g. Cyber Physical Systems) or “Societal challenges first”?
    - So critical to take action today!
  - Too utopic!
    - Positive thinking is so needed today!
  - Too vague!
    - Space for anyone to propose his/her own version

Generating debate!

- Actions
  - Keidanren (Japan Business Federation) ➡ “Action plan to realize Society 5.0” (Feb. 2017)

Challenges ahead!

- Consolidating fundamentals
  - How to identify key enabling technologies?
- Space for innovative business models
  - Coupled with enabling technologies?
  - Regulatory issues!
- Addressing societal challenges
  - Need for a paradigm shift in technology?
- Designing “Society 5.0”
  - Co-evolution of society and technology!

ROLE OF UNIVERSITY? IMPLICATION FOR

A quick eye on the history of science

- In ancient Greece
  - Plato's idea about "science" ➡ Pure & disinterested (e.g. geometry)
- University of Bologna (11th century)
  - Initiated by students and teachers (grammar, rhetoric and logic ➡ Law)
- Rise of "modern science" (17th century)
  - Idea of "mastering the nature"
  - Foundation of scientific method (e.g. hypothesis, experimentation, empirical verification,…)
- Karl Popper's "Falsifiability" (20th century)

Space for something new?

In the 21st century context

- Ongoing technological & organisational transformation
  - Power of Internet accompanied with cloud computing & enhanced computational capacity
    - Access & treatment of information: Instantaneous, anytime, anywhere, at almost no cost (in theory)
  - Emergence of shared economy & platform economy
    - Decentralized & connected organisation
- "Going Digital: Making the Transformation Work for Growth and Well-being" (OECD, 2017-18)

What about science?

Toward “Open Science”

- Science is “open” by construction!
  - History of science
- Theoretically YES, but in reality NOT SO SURE!
  - Access to knowledge
    - Conditions for use, ownership, cost, …
  - Access to research data
    - At the discretion of researchers, unexplored negative data, cost, …
  - Reserved to professionals
- However, thanks to the power of the Internet and Digitalisation
  - 21st century context

➡ Tentative to make science “OPEN”!

University boosting innovation

- Training, empowering and connecting people
  - Different layers of professionals
    - Including “game changer”
- Through research activities
  - Collaborative works (enabling tech), tech-transfer, start-ups
- Taking advantage of high performance infrastructure
  - Space for collaboration and source of inspiration
- Diffusing the value of “innovation”
  - e.g. Stanford’s idea about the “community of engineers”
- Experimenting new breed of innovation
  - e.g. Social innovation, Inclusive innovation,…

Implication for university?

- University able to respond to ever-increasing demands and expectations?
  - Core value of university to be revisited
- "University diverted from its fundamental mission of education and basic research"
  - Myth or Reality?
- Space for university to act proactively?
  - Given exiting institutional framework, including state's funding mechanism, governance structure, and shared values among faculties and staff

Are Students winner or loser?

University Reform!

University may considered…

- Stepping from “exogenous reform” to “endogenous reform”
- Mainstreaming student-centered approach
- Use of alumni network
- …

- Responsibility as a social institution