National Institute of Science and Technology Policy's Key Activities

Ministry of Education, Culture, Sports, Science and Technology
National Institute of Science and Technology Policy

Survey Study of COVID-19

International co-authorship of the COVID-19 papers

Background

- Pandemic outbreak with the spread of COVID-19 infections
  → Call for international collaborations and cooperation to fight COVID-19
- Identification of the effects of COVID-19 on international research activities
  → What is going on with the international and collaborative relationship on the research activities of COVID-19 ?
  It is important to understand the COVID-19 pandemic impact on international cooperation to discuss S&T Cooperation in the Post-COVID-19 Era.

Efforts of the Present Study

1. Capture the publishment status of COVID-19 papers by countries/regions
2. Capture the status of international co-authorship of COVID-19 papers
   (i.e., the overviews and status in active countries)

(*1) Focus on papers identifiable as keeping a certain level of academic quality

(*2) Conduct a comparative analysis of papers registered in journals related to COVID-19 to grasp the difference in trends from normal circumstances

(*3) Analyze trends in the early stage after COVID-19 confirmation (at the end of April 2020)

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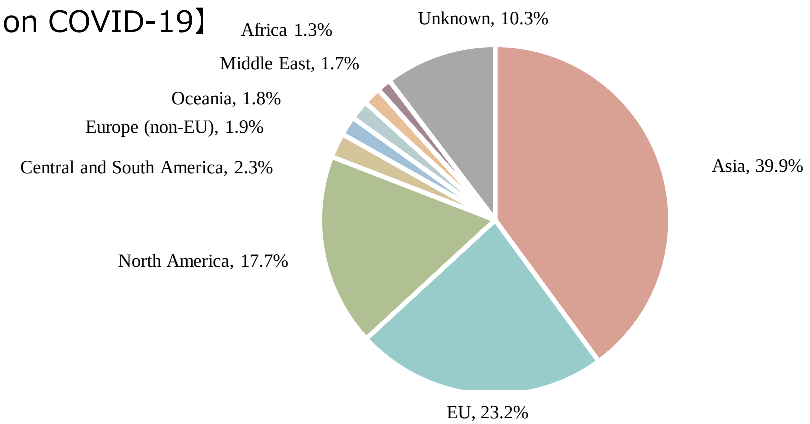
The overviews of publishment of papers

Center for S&T Foresight and Indicators

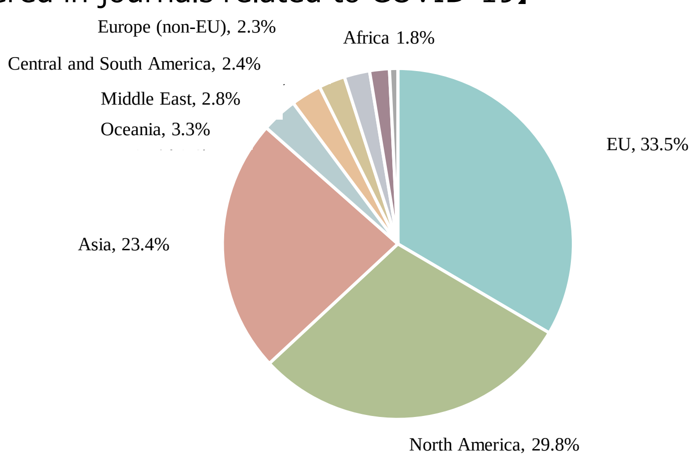
Share of papers by area

- Many research findings in fields closely related to COVID-19 were originally produced in Europe and North America.
- COVID-19 papers were published actively in Asia owing to the location of China, where infections were confirmed early on.

【Papers on COVID-19】



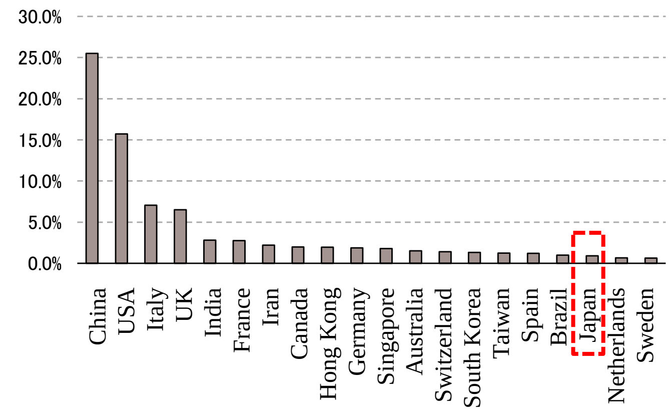
【Papers registered in journals related to COVID-19】



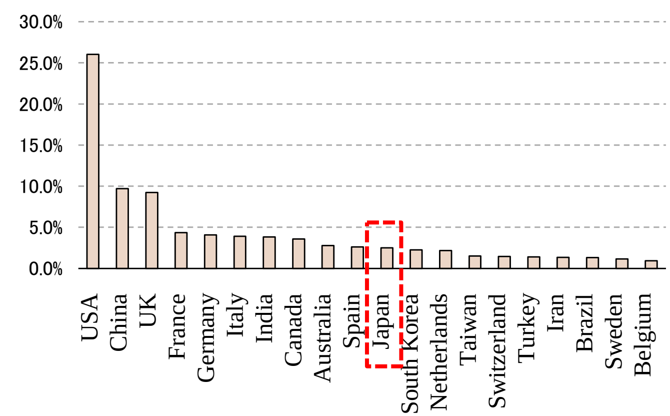
Share of papers by country and region (top 20)

- In the early stages, Japan's output of COVID-19 papers appears low relative to its usual research capabilities.

【Papers on COVID-19】



【Papers registered in journals related to COVID-19】



The Future of Science and Technology Following the COVID-19 Pandemic (1) Objectives and Methods

- Conduct a survey on changes to the mid-to-long term development of science and technology following the COVID-19 pandemic
- Compared with the 11th Science and Technology Foresight (2019)
  - S&T topics that predicted to be realized early at 11th survey tend to be realized even earlier, and those predicted to be realized late tend to realized even later.
  - Rise in the importance of S&T related to infectious diseases, automation, and remote technologies.

Objectives

- National Institute of Science and Technology Policy conducts the 11th Science and Technology Foresight (below, “11th survey”). The survey involves setting 702 S&T topics expected to be realized and giving a questionnaire to 5,352 experts (Feb to Jun, 2019).
- Conduct a survey on changes to the mid-to-long term development of S&T following the COVID-19 pandemic, given that the global spread of COVID-19 may affect S&T progress.

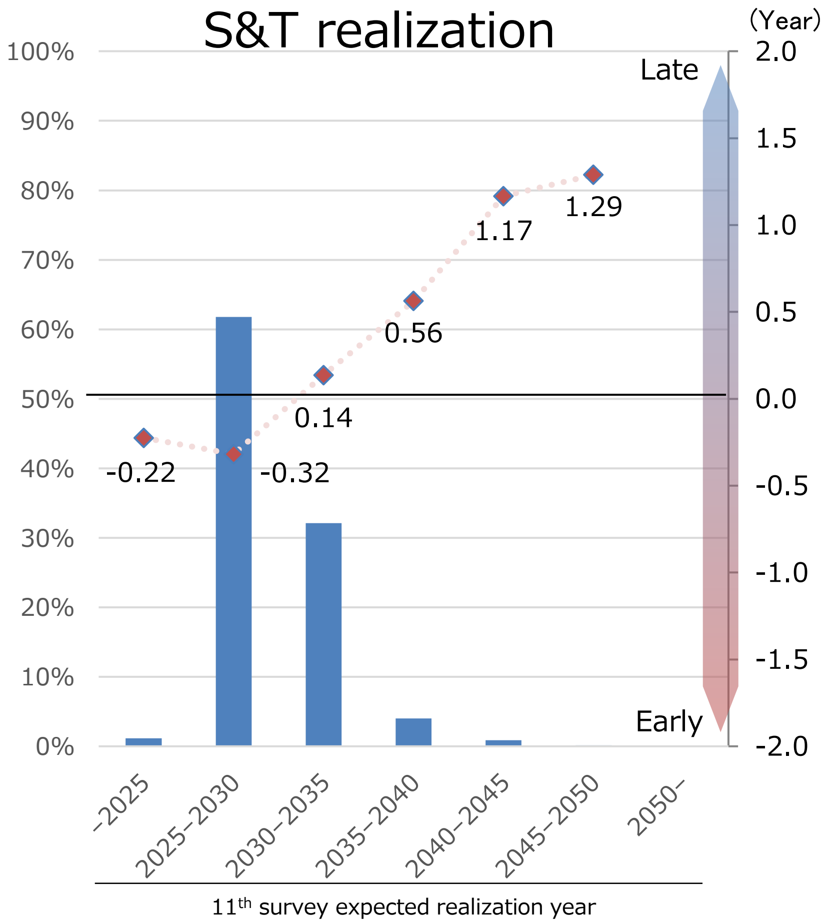
Methods

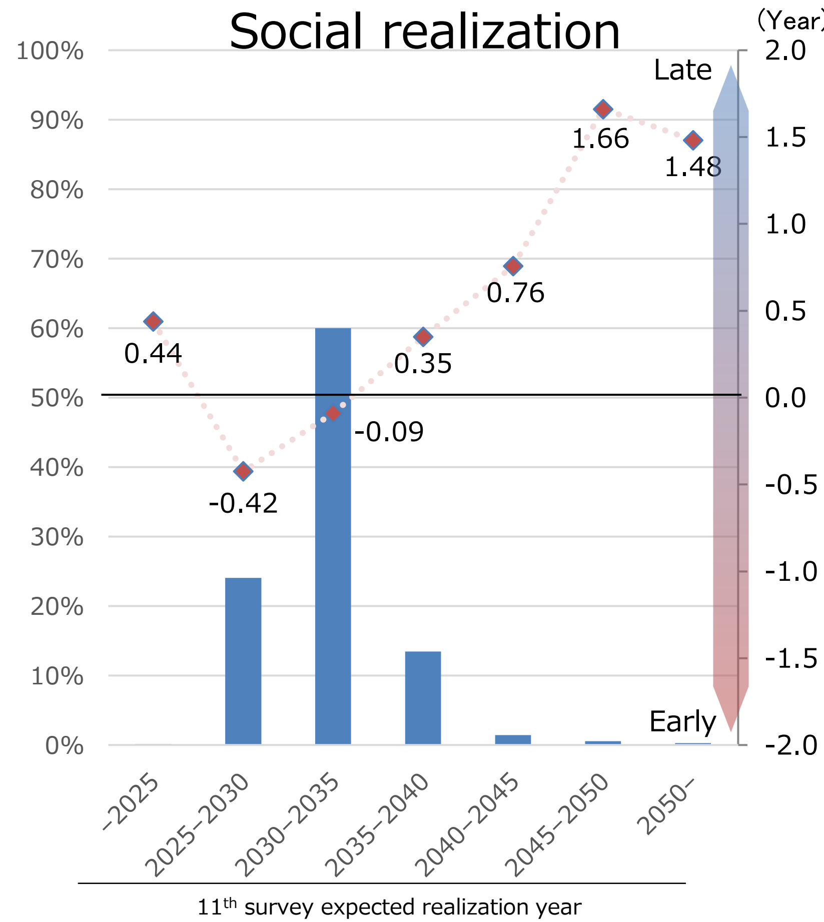
- Conduct a survey on 702 S&T topics, with questions regarding changes following the COVID-19 pandemic.
  - Survey period: September 17, 2020 to October 5, 2020
  - Respondents: 1,914 expert survey members in NISTEP’s expert network
  - State of response: 1,363 people (response rate 71%)
  - Question content: Changes in and importance of expect for S&T realization following the COVID-19 pandemic

The Future of Science and Technology Following the COVID-19 Pandemic (2) Changes in Expected Realization

Center for S&T Foresight and Indicators

- For each S&T topic, compare the expected S&T/social realization year at the time of the 11th survey with the number of years early or late in this survey.
- S&T topics that predicted to be realized early at 11th survey tend to be realized even earlier, and those predicted to be realized late tend to be realized even later.





1) Bar graph (left axis): Distribution of S&T topics by expected realization year segment (11th survey results)
2) Line graph (right axis): Average fluctuation of realization year of topics within a segment. Fluctuations were calculated as follows: Much earlier (-5.0 years), earlier (-3.5 years), somewhat earlier (-1.5 years), no change (0.0 years), somewhat later (+1.5 years), later (+3.5 years), much later (+5.0 years)

The Future of Science and Technology Following the COVID-19 Pandemic (3) S&T Topics With an Earlier Social Realization Year

Center for S&T Foresight and Indicators

- Show the top 10 S&T topics expected to have **earlier social realization** following the COVID-19 pandemic.
- Listed S&T topics include those related to **work and working styles (◆ symbol)** and those related to **infectious diseases and other health crisis management** topics (○ symbol).

Field		Topic	11th Results (Year)	Changes* (Year)
Cities, architecture, civil engineering, traffic	◆	Advanced and integrated worker productivity monitoring technology to improve the health and comfort office workers, and promote improved work efficiency and reformation of working style	2030	−2.7
Cities, architecture, civil engineering, traffic	○	Advanced indoor environmental health monitoring and control technology that suppresses indoor "health disorders" and "outbreaks of infectious disease"	2030	−2.6
Health, Medicine and Life Sciences	○	Ultralight sensors that can be used in the contaminated areas, such as aircrafts, that can quickly detect the infection with specific pathogens, the infectivity to other person, and the susceptibility of uninfected people.	2031	−2.4
ICT, analytics, service science	◆	Transition to a highly productive society with highly free employment configurations, premised on not requiring to go into the office, and having multiple jobs	2030	−2.4
ICT, analytics, service science	◆	Achievement of unmanned factories, unmanned shops, unmanned logistics warehouses, unmanned home deliveries by extensive spread of work robots to the three-product (food, cosmetics and pharmaceuticals) industry, service industry and logistics industry	2029	−2.1
Environment, resources and energy	○	A rapid and accurate detection system for minute amounts of pathogenic microorganisms in public and customer facilities as well as transportation facilities such as airports, harbors, railways, etc.	2032	−2.1
Cities, architecture, civil engineering, traffic	◆	Technology to constantly ascertain and analyze the status of work progress at the construction site using AI, which properly manages and automatically optimizes and modifies processes	2030	−2.1
Health, Medicine and Life Sciences	○	Epidemic prediction and alert system for epidemics of infectious disease by using the comprehensive surveillance system with various medical and web data.	2029	−2.1
Health, Medicine and Life Sciences	○	A system that quantitatively predicts and evaluates the effects of emerging infectious diseases on humans, including the pathogenicity and the potentiality of causing global epidemics, with comprehensive consideration of factors such as the environment, pathogens, and hosts.	2031	−2.1
Materials, devices, processes	◆	High-level VR system (conference, manufacturing management) and a supporting high-speed information distribution system	2027	−2.0

*Years were calculated as follows: Much earlier (−5.0 years), earlier (−3.5 years), somewhat earlier (− 1.5 years), no change (0.0 years), somewhat later (+1.5 years), later (+3.5 years), and much later (+5.0 years)

Effects of COVID-19 on Japanese S&T and Contributions of Scientists and Engineers (1) Survey Overview

- Survey of experts to grasp the effects of the COVID-19 pandemic on S&T and compare with survey results following the Great East Japan earthquake.
- Compared with the survey following the Great East Japan Earthquake (July 2011)
  - Greater apprehensions regarding the effects on Japanese S&T.
  - Greater apprehensions regarding the effects on R&D and on the talent that supports this work.
- Awareness of the following shared with the Great East Japan earthquake survey (July 2011)
  - Need for promotion of policies for S&T/innovation.
  - Spreading the scientifically correct message as experts.

Objectives

In addition to grasping the effects of the COVID-19 pandemic on S&T, gain useful evidence for policy-making for the comprehensive promotion of S&T.

Content

- Effects of the COVID-19 pandemic on Japanese S&T as a whole and on R&D settings
- S&T that contributes to preparations against emerging infectious diseases, including COVID-19, natural disasters, and composite disasters

Survey Methods

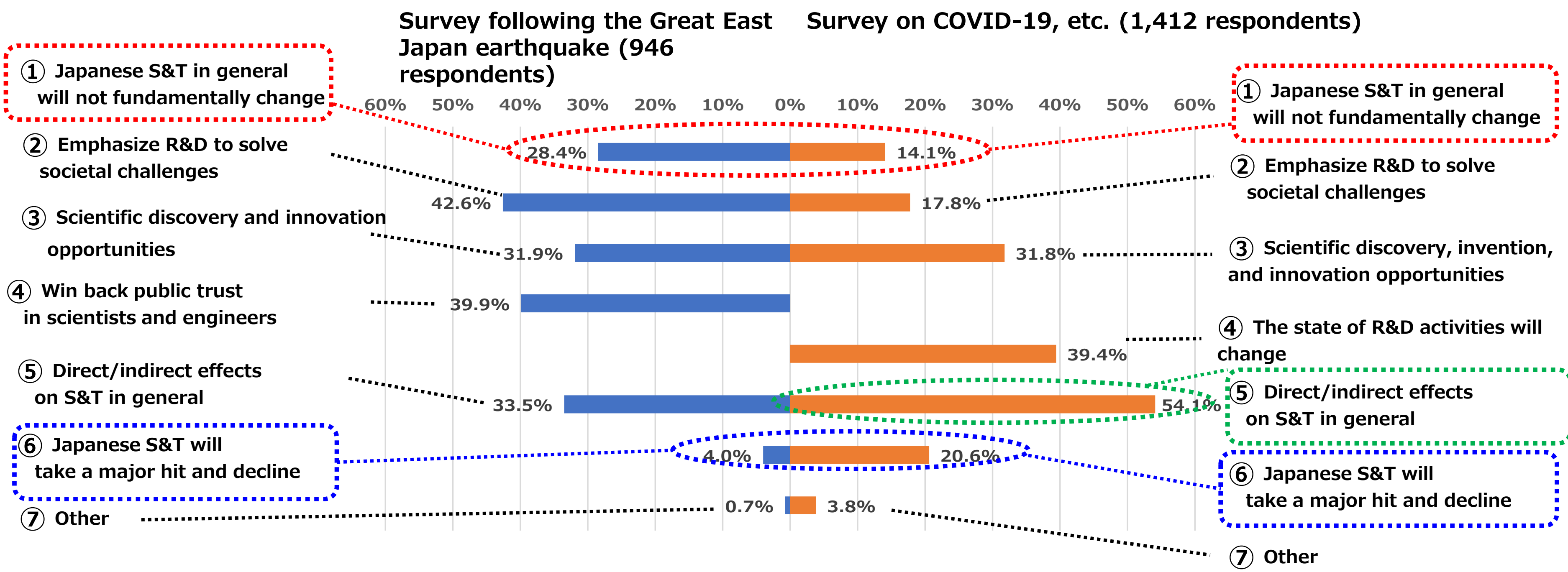
- Survey period: June 3, 2020 to June 15, 2020
- Number of respondents: 1,412 (response rate 73.7%)

Effects of COVID-19 on Japanese S&T and Contributions of Scientists and Engineers (2) Effects on Japanese S&T

Question: How will the Great East Japan Earthquake/COVID-19 and the socioeconomic changes they caused affect or change Japanese S&T in general?

■ In the present survey, the experts have greater apprehensions regarding the effects on Japanese S&T.

- ⑤ "Japanese S&T will be directly and indirectly affected" gained the largest proportion of responses.
- Less than half of the participants responded ① "Even if temporary or regional problems arise, Japanese S&T in general will not fundamentally change."
- The rate of responses ⑥ "I have apprehensions that Japanese S&T will take a major hit and will decline" was over five times greater.



Note 1: Respondents could choose up to 2 options.
Note 2: Please be aware that this is not a precise comparison because the respondents were not always the same people for the two surveys and some answer options were different.
Note 3: Each option here has been simplified; see reference materials for the actual options.

Effects Public Attitude Survey on Science and Technology: Infectious Diseases Including COVID-19

1st Policy-Oriented Research Group

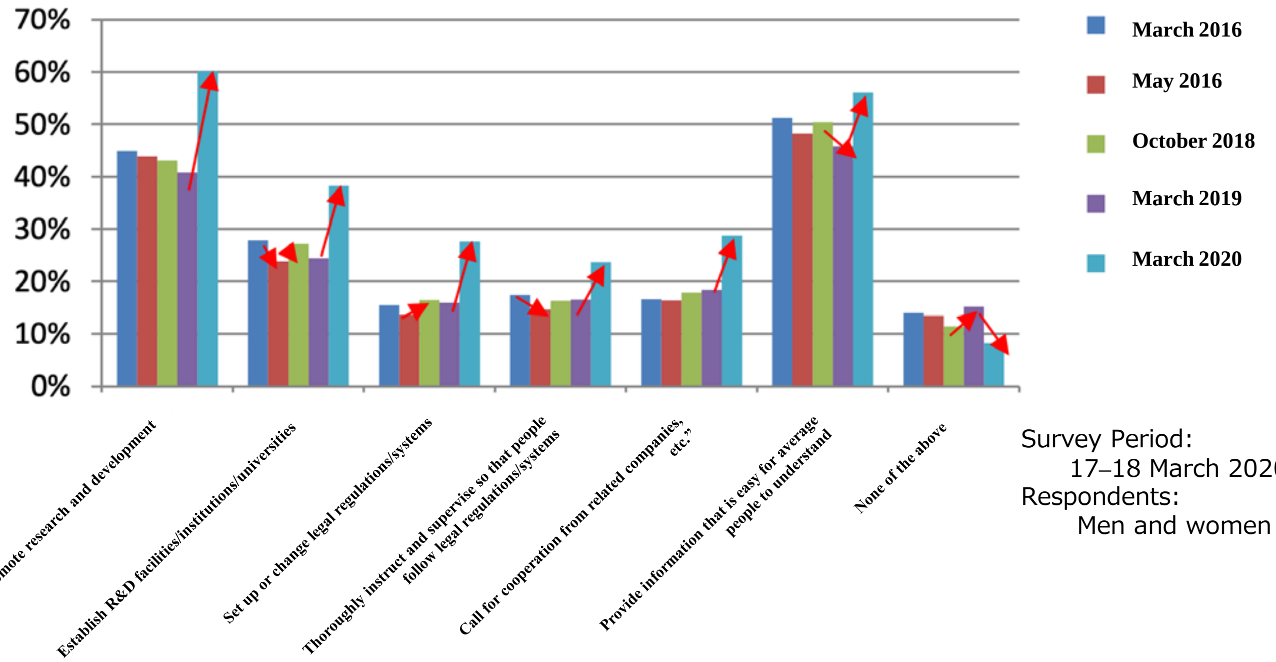
Survey Overview

Online survey conducted in March 2020 on awareness of infectious diseases including COVID-19 as a part of the continuously run Public Attitude Survey on Science and Technology.

Survey Results (Bulletin) Points

When asked about policies the government should take to handle infectious diseases such as COVID-19, a majority of respondents chose “Promote research and development,” and “Provide information that is easy for average people to understand.”

Due to COVID-19, there was an overall **rise in public interest in science and technology**.



Survey Period:
17–18 March 2020
Respondents:
Men and women aged 15 to 69 and a total of 1,500 people

Question item: What do you think the government should do in terms of science and technology to predict and counter infectious diseases such as COVID-19, bird flu, and Ebola? Choose from among the following options (check all that apply)

“Promote research and development;” “Establish R&D facilities/institutions/universities;” “Set up or change legal regulations/systems;” and “Thoroughly instruct and supervise so that people follow legal regulations/systems”

“Call for cooperation from related companies, etc.;” “Provide information that is easy for average people to understand;” and “None of the above.”

(Note: This presentation is a bulletin and provisional tally of the “Infectious disease prediction and countermeasure” section of the Public Attitude Survey on Science and Technology.) Source: April 10, 2020 press release materials

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Japanese Science and Technology Indicators 2020

What are science and technology indicators?

- "Science and Technology Indicators" is a fundamental resource for understanding science and technology activities based on objective and quantitative data in Japan and other major countries*1 (The report was first published in 1991 and is annually published from 2005) *1: US, UK, Germany, France, China, and Korea
- The report classifies science and technology activities into five categories, R&D expenditure; R&D personnel; Higher education and S&T personnel; Output of R&D; and Science, technology, and innovation, and shows the state of Japanese science and technology activities with approximately 170 indicators.

[Key findings]

Trends in S&T activities in Japan as shown by key indicators

R&D expenditure	Number of researchers	Number of scientific publications	Number of highly cited scientific publications
3rd	3rd	4th	9th

China exceeded US and ranked first in R&D expenditure by business enterprises

China exceeded US and ranked first in the number of scientific publications

There has been no change from previous year to Japan's global ranking.

R&D by Japanese business enterprises: From the viewpoints of basic research, utilization of scientific knowledge and doctoral degree holders, and new products/services

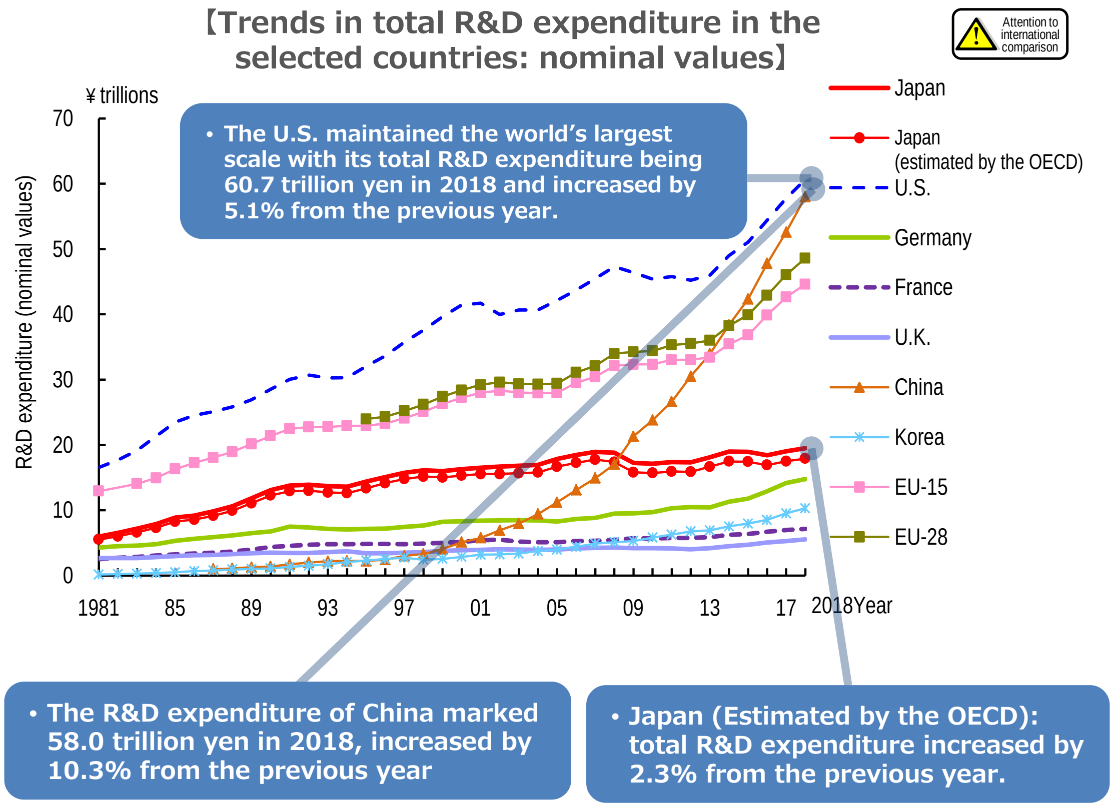
- Japanese scientific findings (research papers) may not be sufficiently utilized by Japanese technologies (patents).
- The proportion of researchers with doctoral degrees among corporate researchers is low in Japan compared to the US.
- Japan has strength in technology yet with a possibility of lagging behind other major countries in terms of international launching of new products or services based on technologies.

Trends in total R&D expenditure in the selected countries

Center for S&T Foresight and Indicators

- Japan's total R&D expenditure was 17.9 trillion yen in 2018 (estimated by the OECD), the world's third-largest after the United States and China.
- Japan's rank in the world in R&D expenditure by sector: business enterprises, the third; universities and colleges, the fourth; public organizations, the fourth.
- China overtook the United States to take the No. 1 spot in R&D expenditure of business enterprises.

【Trends in total R&D expenditure in the selected countries: nominal values】



【R&D expenditure by sector in the selected countries (2018): nominal values)】

	Nominal values (¥ trillions)				
	Business enterprises	Universities and colleges	Public organizations	Non-profit institutions	Total
Japan (estimated by the OECD)	14.2	2.1	1.4	0.2	17.9
U.S.	44.2	7.8	6.2	2.5	60.7
Germany	10.2	2.6	2.0	-	14.8
France	4.7	1.5	0.9	0.1	7.2
U.K.	3.8	1.3	0.3	0.1	5.6
China	44.9	4.3	8.8	-	58.0
Korea	8.3	0.8	1.0	0.1	10.3

	(%)				
	Business enterprises	Universities and colleges	Public organizations	Non-profit institutions	Total
Japan (estimated by the OECD)	79.4	11.6	7.8	1.3	100.0
U.S.	72.8	12.9	10.2	4.2	100.0
Germany	68.8	17.7	13.5	-	100.0
France	65.4	20.5	12.5	1.6	100.0
U.K.	69.1	22.5	6.1	2.2	100.0
China	77.4	7.4	15.2	-	100.0
Korea	80.3	8.2	10.1	1.4	100.0

Note: 1) Japan (Estimated by the OECD) :The OECD-estimated R&D expenditure of universities and colleges in terms of full-time equivalent is used.
2) For Germany, the figure of public organizations include non-profit institutions.

Top 10 countries/regions in terms of the number of papers and the number of highly cited papers (top 10% and top 1%) (based on the fractional counting method)

- **Compared with ten years ago, the number of papers from Japan slightly declined. Due to the growth of other countries, the ranking of Japan has moved down. The decline of Japan is noticeable in highly cited papers.**
- **China overtook the United States to become the world's top in the number of papers.**

PY(Publication Year) 2006 - 2008

All fields	2006 — 2008(PY) (Average)		
	The number of papers		
Country/Region	Fractional counting		
	Papers	Share	World rank
U.S.	234,153	25.0	1
China	73,956	7.9	2
Japan	67,026	7.2	3
Germany	54,749	5.8	4
U.K.	53,059	5.7	5
France	39,252	4.2	6
Italy	32,938	3.5	7
Canada	31,269	3.3	8
India	25,311	2.7	9
Spain	24,736	2.6	10

All fields	2006 — 2008(PY) (Average)		
	The number of adjusted top 10% papers		
Country/Region	Fractional counting		
	Papers	Share	World rank
U.S.	35,516	36.0	1
U.K.	7,086	7.2	2
China	6,598	6.7	3
Germany	6,079	6.2	4
Japan	4,461	4.5	5
France	4,220	4.3	6
Canada	3,802	3.9	7
Italy	3,100	3.1	8
Spain	2,503	2.5	9
Australia	2,493	2.5	10

All fields	2006 — 2008(PY) (Average)		
	The number of adjusted top 1% papers		
Country/Region	Fractional counting		
	Papers	Share	World rank
U.S.	4,251	43.1	1
U.K.	765	7.8	2
Germany	600	6.1	3
China	470	4.8	4
France	385	3.9	5
Canada	383	3.9	6
Japan	351	3.6	7
Netherlands	259	2.6	8
Italy	255	2.6	9
Australia	249	2.5	10

PY(Publication Year) 2016 - 2018

All fields	2016 — 2018 (PY) (Average)		
	The number of papers		
Country/Region	Fractional counting		
	Papers	Share	World rank
China	305,927	19.9	1
U.S.	281,487	18.3	2
Germany	67,041	4.4	3
Japan	64,874	4.2	4
U.K.	62,443	4.1	5
India	59,207	3.9	6
Korea	48,649	3.2	7
Italy	46,322	3.0	8
France	45,387	3.0	9
Canada	41,071	2.7	10

All fields	2016 — 2018 (PY) (Average)		
	The number of adjusted top 10% papers		
Country/Region	Fractional counting		
	Papers	Share	World rank
U.S.	37,871	24.7	1
China	33,831	22.0	2
U.K.	8,811	5.7	3
Germany	7,460	4.9	4
Italy	5,148	3.4	5
Australia	4,686	3.1	6
France	4,515	2.9	7
Canada	4,423	2.9	8
Japan	3,865	2.5	9
India	3,672	2.4	10

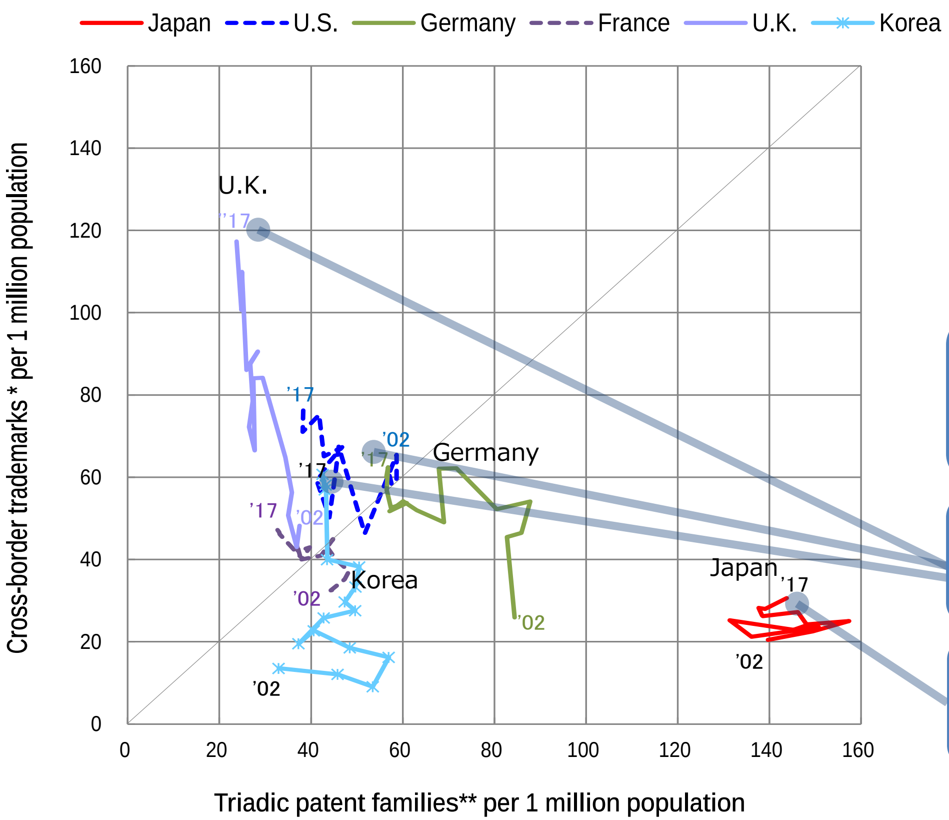
All fields	2016 — 2018 (PY) (Average)		
	The number of adjusted top 1% papers		
Country/Region	Fractional counting		
	Papers	Share	World rank
U.S.	4,601	31.3	1
China	2,692	18.3	2
U.K.	985	6.7	3
Germany	766	5.2	4
Australia	478	3.3	5
Canada	438	3.0	6
France	437	3.0	7
Italy	389	2.6	8
Japan	328	2.2	9
Netherlands	294	2.0	10

[Methods of counting papers]
(Fractional counting method) When one paper is co-authored by Japanese Organization A and US Organization B, this method counts Japan as 1/2 and the US as 1/2. This method indicates the degree of contribution to the production of papers.
(Whole counting method) When one paper is co-authored by Japanese Organization A and US Organization B, this method counts Japan as 1 and the US as 1. This method indicates the degree of participation in the production of papers.
For counting, both the methods are based on the countries of the organizations with which the authors are affiliated.

Note: The number of Articles and Reviews was counted. Papers were sorted by publication year (PY). The number of citations was as of the end of 2019.
Aggregation was performed by NISTEP using Web of Science XML (SCIE, the end-of-2019 version) provided by Clarivate Analytics

Cross-border trademark applications and patent applications (per 1 million population)

- **Japan has strength in technology yet with a possibility of lagging other selected countries in international launching of new products or services based on their technologies.**



[Meaning of the number of trademark applications as an indicator]
The number of trademark applications is related to concretizations of innovations in the forms of new product or service introductions, or marketing activities thereof. In this sense, the number of trademark applications is considered as data that reflect the relationship between innovations and markets.

- **Countries with more trademark applications than patent family applications in the latest year are the United Kingdom, the United States, France, Korea, and Germany.**
- **In Korea, the United Kingdom, and Germany, the number of trademark applications surged in the period between 2002 and 2017.**
- **Japan is the only country with fewer trademark applications than patent family applications in the latest year.**

Note: 1)* For the definition of cross-border trademarks, "Measuring Innovation: A New Perspective" released by the OECD is followed. The specific definition is as follows.
・The number of trademarks in Japan, Germany, France, the U.K. and Korea is the number filed with the U.S. Patent and Trademark Office (USPTO).
・The number of trademarks for the U.S. is the average of (i) and (ii).
(i)The corrected number of the U.S. applications, based on the ratio of Japanese and the U.S. applications to the Office for Harmonization in the Internal Market (OHIM) = (number of the U.S. applications to the OHIM / number of Japanese applications to the OHIM) × number of Japanese applications to the USTPO
(ii)The corrected number of the U.S. applications, based on the ratio of European and the U.S. applications to the Japan Patent Office (JPO) = (number of the U.S. applications to the JPO / number of EU-15 applications to the JPO) × number of EU-15 applications to the USTPO
2)**Cross-border patent applications mean the number of triadic patent families (patents with the same content submitted to Japan, the U.S. and Europe).

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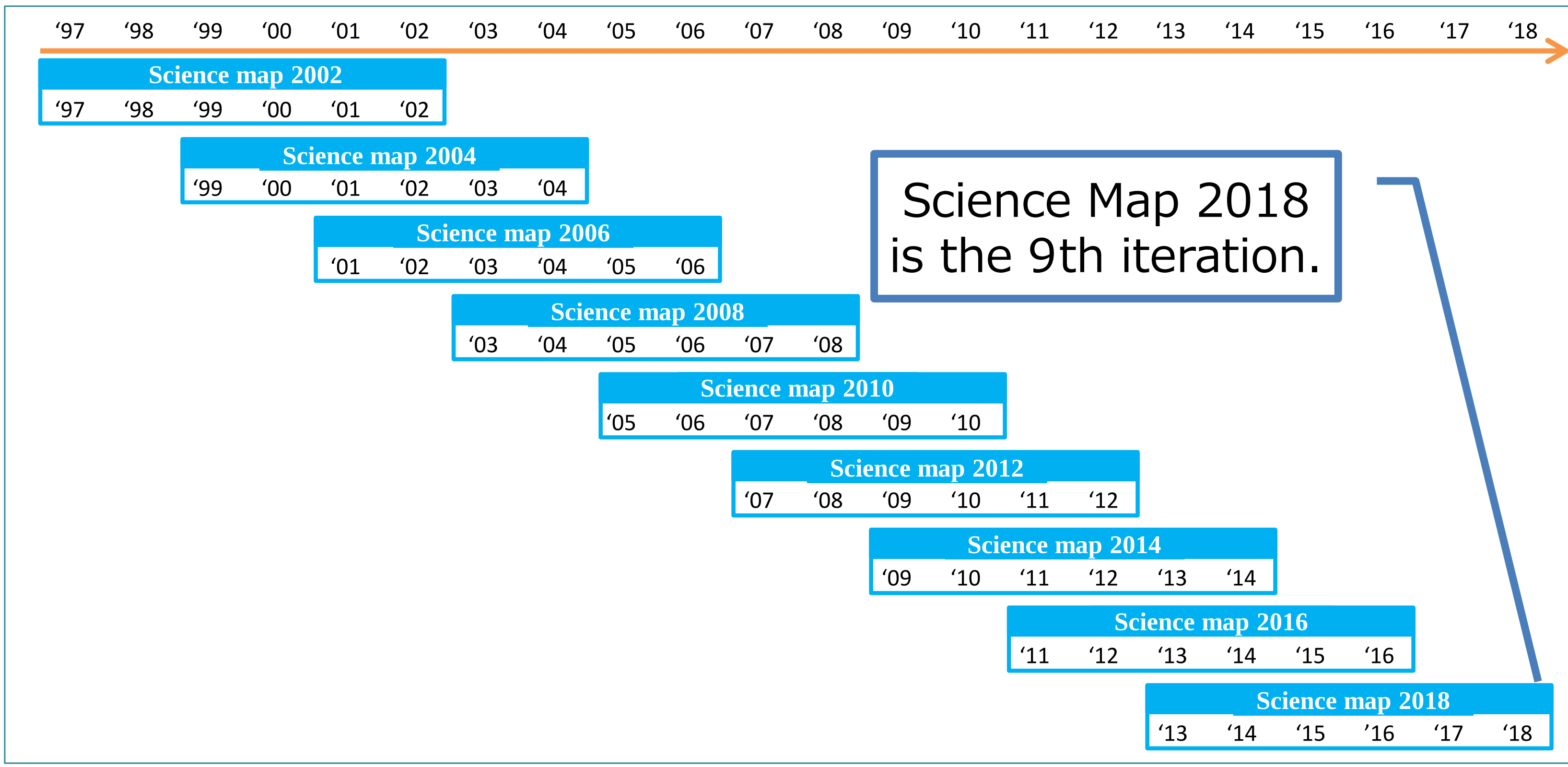
Science Map 2018

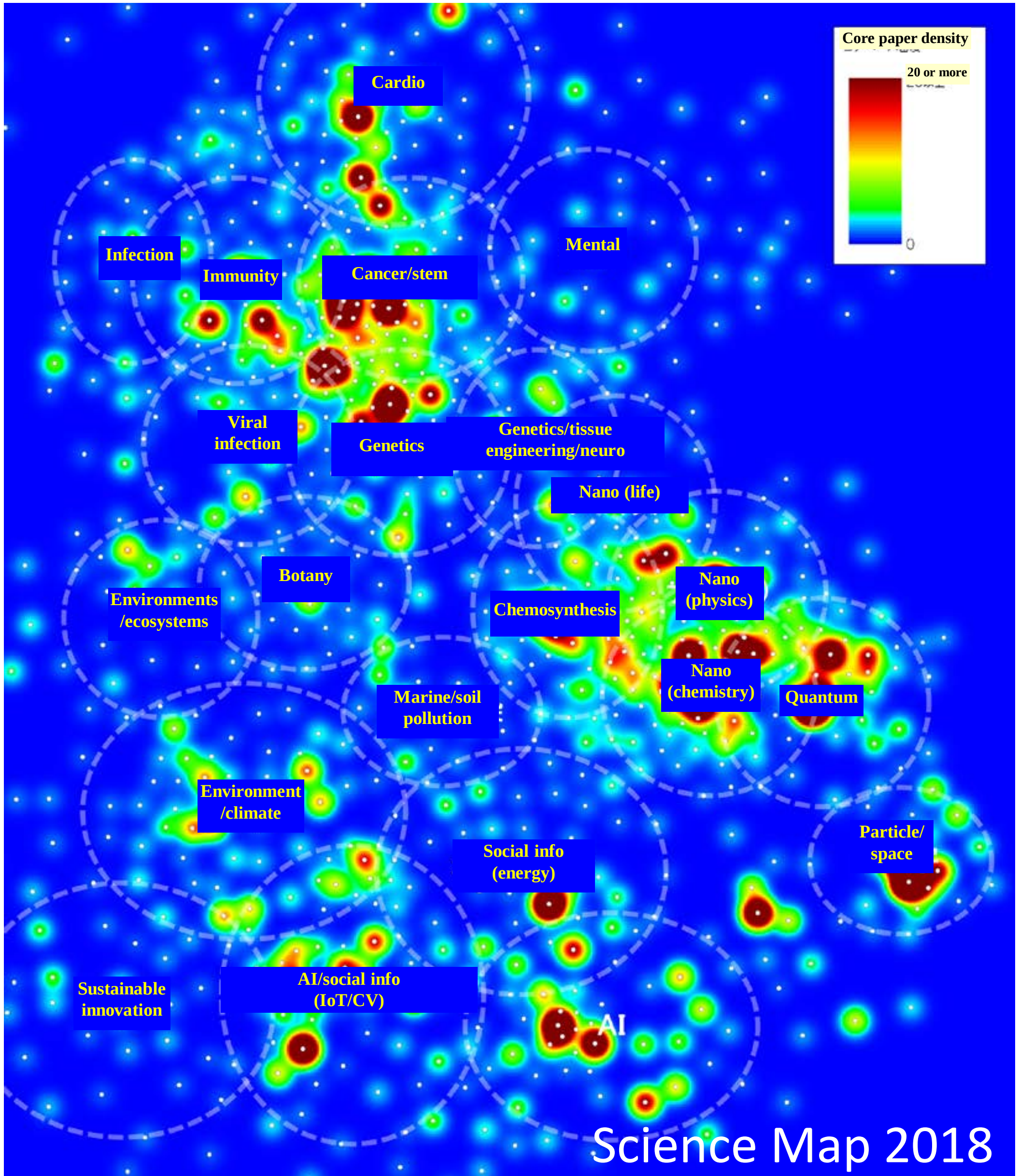
What is the Science Map?

- At NISTEP, we analyze **scientific paper databases** to find **what areas attract international attention and plot them as abstract visualizations** on the **Science Map** to analyze global research trends and Japan's contributions to them.
- The latest one, Science Map 2018, pulls **papers from between 2013 and 2018** in the **top 1% of citation amounts** and **groups them by co-citation relationships**, thereby displaying what research areas are attracting international attention.



Science Map 2018

Center for S&T Foresight and Indicators



- The Science Map 2018 displays 902 areas that are attracting global attention based on data from 2013-2018.

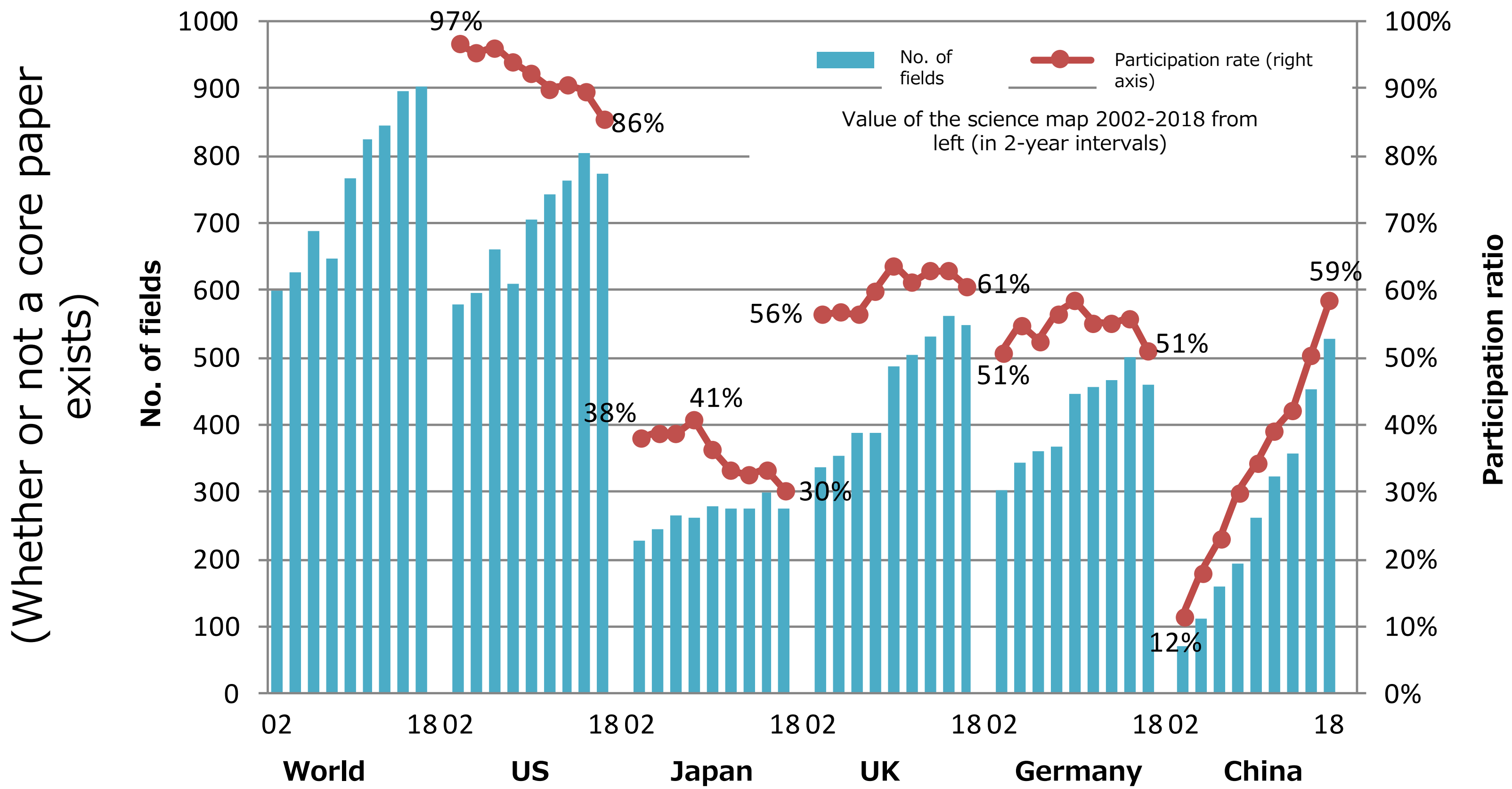
No.	Research field group	Short version
1	Cardiovascular disease research	Cardio
2	Infectious disease research	Infection
3	Immunology research	Immunity
4	Cancer genome analysis/gene therapy, stem cell research	Cancer/stem
5	Mental illness research	Mental
6	Viral infection research	Viral infection
7	Gene expression control research	Genetics
8	Tissue engineering & neural research	Tissue engineering/neuro
9	Botany research	Botany
10	Environment and ecosystems research	Environment/ecosystems
11	Environment/climate change research	Environment/climate
12	Marine & soil pollution research	Marine/soil pollution
13	Chemosynthesis research	Chemosynthesis
14	Nanoscience research (life science)	Nano (life)
15	Nanoscience research (physics)	Nano (physics)
16	Nanoscience research (chemistry)	Nano (chemistry)
17	Quantum information processing/solid state physics	Quantum
18	Particle/space theory research	Particle/space
19	AI-related research	AI
20	AI/social information infrastructure related research (IoT/CV etc.)	AI/social info (IoT/CV etc.)
21	Social information infrastructure-related research (energy etc.)	Social info (energy)
22	Sustainable development/innovation	Sustainable innovation

Note 1: This map was created with a force-directed placement algorithm, so vertical and horizontal position mean nothing. Position relative to other areas is what has meaning. The map in this technical report places life sciences in the top left and cosmology research in the bottom right.
Note 2: Each white dot is the position of a research areas, while each dotted white circle represents a group of areas. There are a number of research areas with few instances of co-citations that are placed too far away from the center to be displayed on the above map. The dotted white lines that represent groups of areas are a visual aid based on general research content. If a research areas does not fall within a group, it means that it does not reach the minimum amount of related areas to have a group. It has no bearing on the importance of the research.
Data: NISTEP collected and analyzed data based on Clarivate's Essential Science Indicators (NISTEP ver.) and Web of Science XML (SCIE, late 2019 version).

Percentage of Areas in which Japan Participates is Stagnant

Center for S&T Foresight and Indicators

- Areas in which Japan participates: **25 fewer than 2016 (299 → 274).**
- Percentage of areas Japan contributes to: 33% (Science Map 2016) → **30% (Science Map 2018)**
- The UK and Germany: Number of areas has declined. Percentages are 61% for the UK and 51% for Germany.
- China: Number and percentage of contributing areas has notably increased (59%)



Data: NISTEP collected and analyzed data based on Clarivate's Essential Science Indicators (NISTEP ver.) and Web of Science XML (SCIE, late 2019 version).

NISTEP TEITEN Survey

Analytical Report for NISTEP Expert Survey on Japanese S&T and Innovation System (NISTEP TEITEN survey)

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY POLICY

*Latest version was published on April 6, 2020

Center for S&T Foresight and Indicators

The survey aims to qualitatively track the changes in the status of S&T and innovation creation during the S&T Basic Plan by continuously conducting a fixed questionnaire survey with a group of first-rate researchers and experts from industry, academia and public institutes. (It is like an S&T version of TANKAN (an economic survey of enterprises in Japan) by the Bank of Japan)

→ It was launched along with the beginning of the third S&T Basic Plan

→ NISTEP TEITEN survey 2019 (conducted in the autumn of 2019; response rate: 90.6%) is the fourth round of the annual surveys that have been conducted during the Fifth S&T Basic Plan (FY2016-FY2020)

Form of questions: multiple choice questions on a six-point scale from "insufficient" to "sufficient" to collect subjective opinions.

Group of respondents from universities and public institutes: About 2,000 persons

Directors, administrative staff, front-line instructors and researchers, principal investigators of large-scale R&D projects of universities and public institutes

Respondents were asked <u>to answer about the situation in their department or organization</u>

Solid arrows: main parts to answer

Dotted arrows: parts to partially answer

Group of respondents from broader innovation system: About 700 persons

Industry experts (e.g., directors in charge of R&D), program directors of funding agencies, principal investigators of large-scale R&D projects, etc.

Respondents were asked to <u>answer about the general situation in Japan</u>

Each of the two groups of respondents answered questions relevant to their group.

Question category	Sub-category (total no. of questions: 63)
(1) Researchers at universities and public institutes	Development of young researchers and youth who aspire to become researchers; Performance evaluation of female, foreign and other researchers
(2) Research environment and funding	Research environment, facilities and equipment; intellectual and information infrastructure; publication and sharing of research findings and data; S&T budget, etc.
(3) Academic/basic research and research cost management	Academic/basic research; research cost management
(4) Industry-academia-government collaboration and innovation policy	Knowledge transfer and new value creation among industry academia and government; intellectual property management; reginal revitalization; cultivation of S&T innovation talent; construction of innovation systems
(5) University reform and functional enhancement	University management; leadership of the president and university executives
(6) Relation with society and enhancement of promotional functions	Relation with society; S&T diplomacy; provision of advice to policy makers; leadership role; etc.

\+

Questions for descriptive answers: received around 9,300 answers

In-depth survey (setting a specific theme per year for detailed understanding of it; 5 questions under a them for FY2019)

Questions with positive responses and whose time-series responses have improving trends

- **Questions with positive responses: "contribution of KAKENHI (Grants-in-Aid) to exploration of new issues and challenging research," "leadership of the president and university executives," "personnel systems to allow female researchers to achieve their full potential," etc.**
- **Questions whose responses have improved since the initial year (FY2016): "improvement of the environment for female researchers to achieve their full potential," "knowledge transfer/value creation through venture start-up," "cultivation of talent with entrepreneurship," etc.**

（A） Questions with positive responses

Rank	Question item	IV※
1	Contribution of KAKENHI (Grants-in-Aid) to exploration of new issues and challenging research	5.2
2	Leadership situation of the president and university executives	4.9
3	Personnel systems (recruitment, promotion, etc.) to allow female researchers to achieve their full potential	4.9
4	Mechanisms for sharing research facilities, equipment and instruments within the organization	4.8
5	Guidance to enable doctoral students independently find and pursue their research themes	4.6
6	New value creation through industry-academia-government collaboration and cooperation	4.5
7	Researcher performance evaluation based not only on research papers but on various perspectives	4.4
8	Efforts to promote organizational collaboration among industry, academia and the government	4.4
9	The university's ability for collecting and analyzing information on education, research and university management	4.4
10	Status of needs-oriented research at universities and public institutes for the local community	4.4

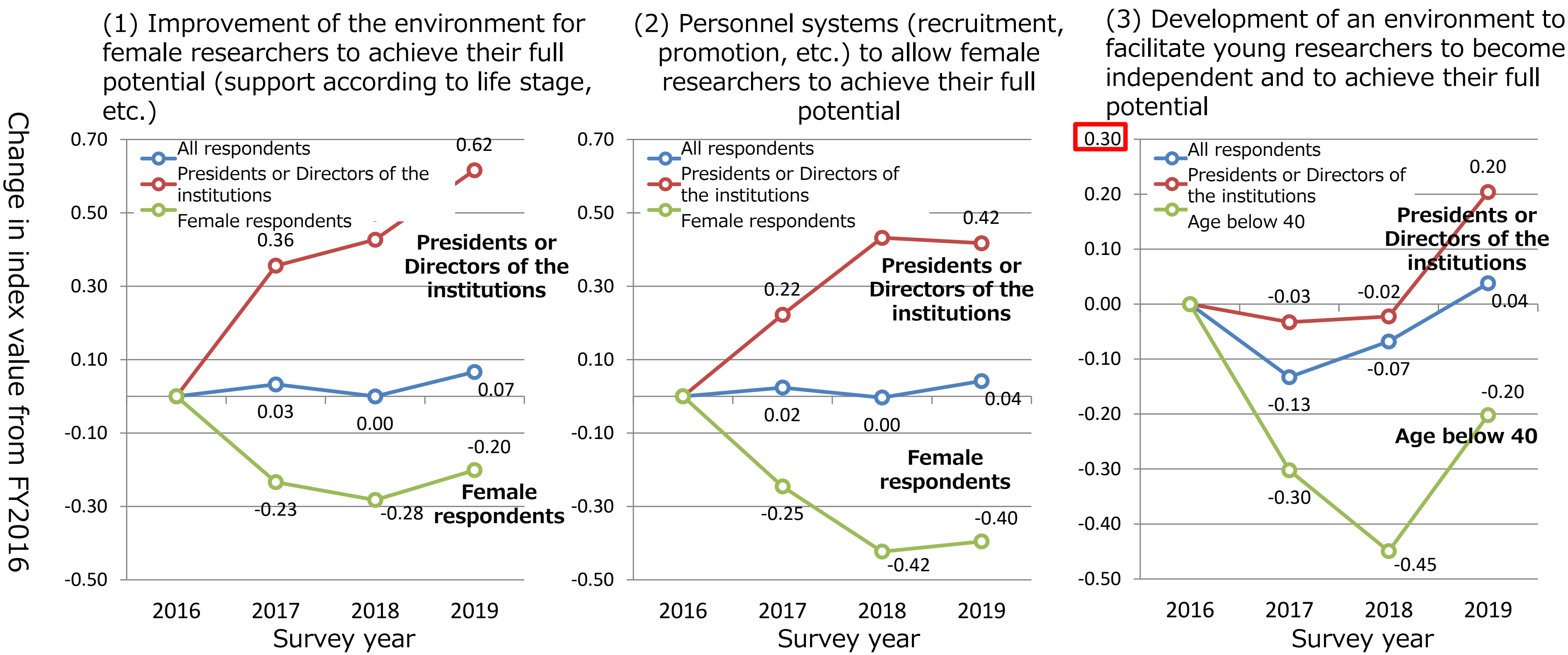
（B） Questions whose responses have improved since FY2016

Rank	Question item	IV※ Change
1	Improvement of the environment for female researchers to achieve their full potential (support according to life stage, etc.)	0.07
2	Status of knowledge transfer and new value creation through establishment of ventures and business development	0.06
3	Cultivation of talent with entrepreneurship in the university	0.06
4	Undergraduate education to inspire awareness of social issues and to motivate to pursue related research	0.05
5	Personnel systems (recruitment, promotion, etc.) to allow female researchers to achieve their full potential	0.04
6	Development of an environment to facilitate young researchers to become independent and to achieve their full potential	0.04
7	Efforts to promote organizational collaboration among industry, academia and the government	0.02

※ IV(Index value) is a 0-10 scale score, which is converted from the results of the multiple-choice questions on a six-point scale from "insufficient" to "sufficient".

Improvement of the environment for female/young researchers to achieve their full potential

- Responses from female respondents show upward trends from FY2018 to FY2019 on questions regarding the improvement of the environment (1) and personnel systems (2) to allow female researchers to achieve their full potential.
- Responses from respondents below the age of 40 show a significant upturn from FY2018 to FY2019 on questions regarding the development of the environment to facilitate young researchers to become independent and achieve their full potential (3).



※ Index value is a 0-10 scale score, which is converted from the results of the multiple-choice questions on a six-point scale from “insufficient” to “sufficient”.

The 11th S&T Foresight

Overview of the 11th Foresight

Center for S&T Foresight and Indicators

- National S&T Foresight in Japan has been conducted on a five-year basis since 1971. These surveys are designed to gain a picture of what S&T will look like in the future. NISTEP has been implementing these surveys since the fifth survey in 1992.
- This is an outline of the 11th survey conducted in 2019. The survey envisions the future of science and technology and the future of society; it then merges these two to envision the future of society in relation to scientific and technological developments.
- It takes a medium- to long-term forward view of 30 years (by the year of 2050) and the target year is 2040.
- In this survey, ICTs such as AI-related technologies were used for the collection and analysis of information (natural language processing, etc.).

Identifying trends in science, technology, and society (horizon-scanning)

Future of society (visioning)

Vision Workshop (approx. 100 participants), Regional Workshops (6 locations＋Central Workshop and Academic Collaboration Workshop; approx. 340 participants in total), International Workshop (14 countries, approx. 60 participants)

Four values and 50 visions of the future

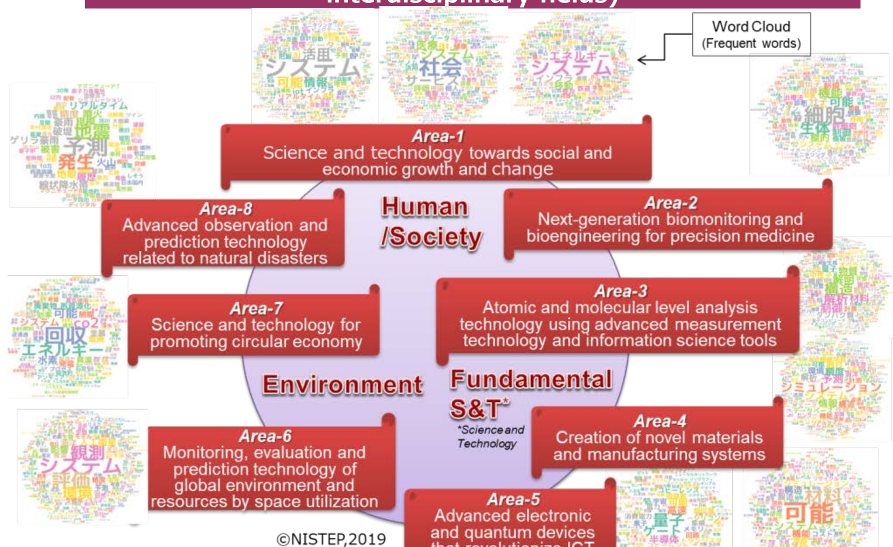
Humanity | Inclusion | Sustain-ability | Curiosity

Future of Science and Technology (Delphi survey)

- Questionnaires given to experts (approx. 5,300 experts from the NISTEP Experts Network, JST, Research Map, etc.)
- Experts judge from various fields (total of 79 members of the S&T Foresight Committee and its subcommittees in respective fields)

702 S&T topics (7 fields/59 sections)

Close-up areas of science and technology for the future (8 areas with high potential of multidisciplinary and interdisciplinary fields)



Others: 8 areas based on specific fields

Future of society through S&T development (scenario)

Intangible-individual

A society of coexistence, rethinking what it means to be human and recognizing diversity

Intangible-social

A flexible society in which the real and the virtual are harmonized

What about people's thoughts? What about the virtual world?

Flexible society brought about by reviving and rethinking humanity

Tangible-individual

A society that enhances *individuality* through fusing maintenance/recovery of human functions with digital assistance

Tangible-social

A society in which personal customization and general optimization coexist, allowing individuals to have their own unique lifestyles

What about human functions? What about society and the environment?

Survey on Open Science

Survey on open science

➢ Survey on the actual status of research data publication and open access to research papers

- Conducted every other year since 2016 to understand the actual status of open science centering on data publication.
- Survey items: Current status of publication of research data and research papers (OA); use status of published data; experience in preparing a DMP (since 2018 survey)
- The number of researchers who have the experience of publishing data has remained flat or slightly decreased while the number of those who have prepared DMP has slightly increased.

➢ Survey on the use and recognition of preprints

- Conducted monitoring of the sharing and publication of preprints as a driver for open science
  - ✓ Analysis of preprints in arXiv

    Analysis of preprints archived in arXiv (OA repository known for its collection of research papers in physics, mathematics, information science among other fields). Often cited in information science, a field evolving so rapidly that journal peer review can hardly catch up with the research cycle.
  - ✓ Survey on the utilization and perception of preprints

    Younger researchers tend to be more active in accessing and publishing preprints. Difference in the use and recognition of preprints were also significant between different types of affiliated organization and research fields.

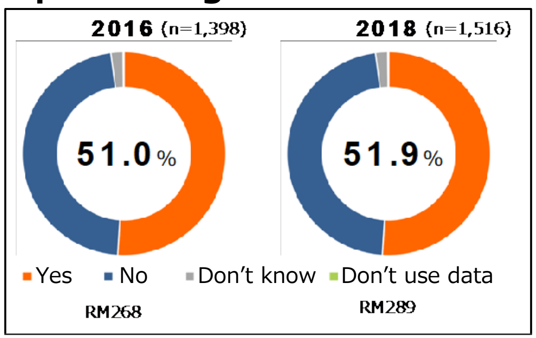
    The main reasons for and against publishing preprints: “to gain recognition and secure priority rights to the research findings” and “to focus on submission to peer-reviewed journals,” respectively.

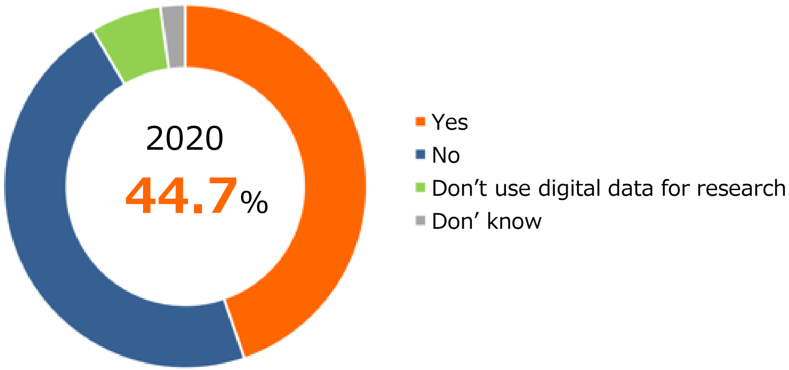
Survey on open science: Actual status of research data publication and OA publication of research papers

Research Unit for Data Application

- Main results
  - 2020 survey saw a slight decrease in the number of researchers who have the experience of publishing data and slight increase in the number of those who have the experience of preparing a DMP
  - Concerns about data publication (2018 survey): Fear of data being used without mentioning the citation source; Concerns about the ownership of data and related contracts; Fear of someone publishing a research paper before I do, etc.
  - Obstacles to data publication (2018 survey): human resource, time, and funding

Do you have the experience of **publishing data**?

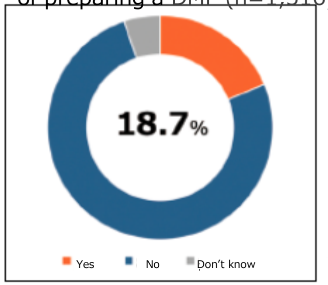




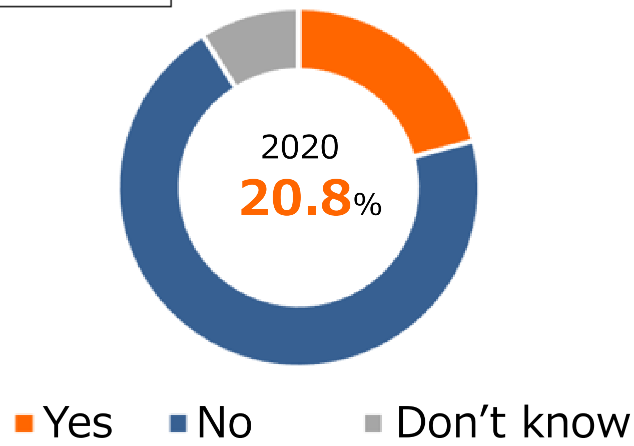
(n=1,268)

Do you have the experience of preparing a **data management plan (DMP)**?

Figure 7: Researchers with the experience of preparing a DMP (n=1,516)



2018

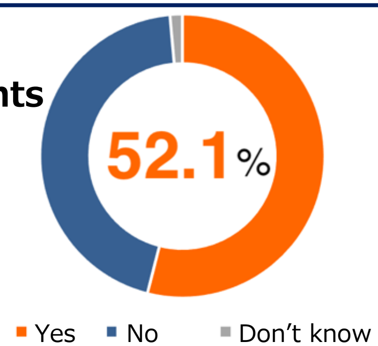


Survey on open science: Utilization and perception of preprints

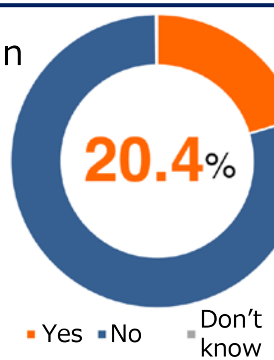
Research Unit for Data Application

- Main results
  - The younger the researcher, the higher the ratio of those having accessed and published preprints. Differences in the use and recognition of preprints were also observed between different types of affiliated organizations and research fields.
  - The main reasons for publishing preprints were "to gain recognition and secure priority rights to the research findings." Other reasons included those related to employment or promotion.
  - The main reason for not publishing preprints was "I want to focus on submitting research papers to peer-reviewed journals"

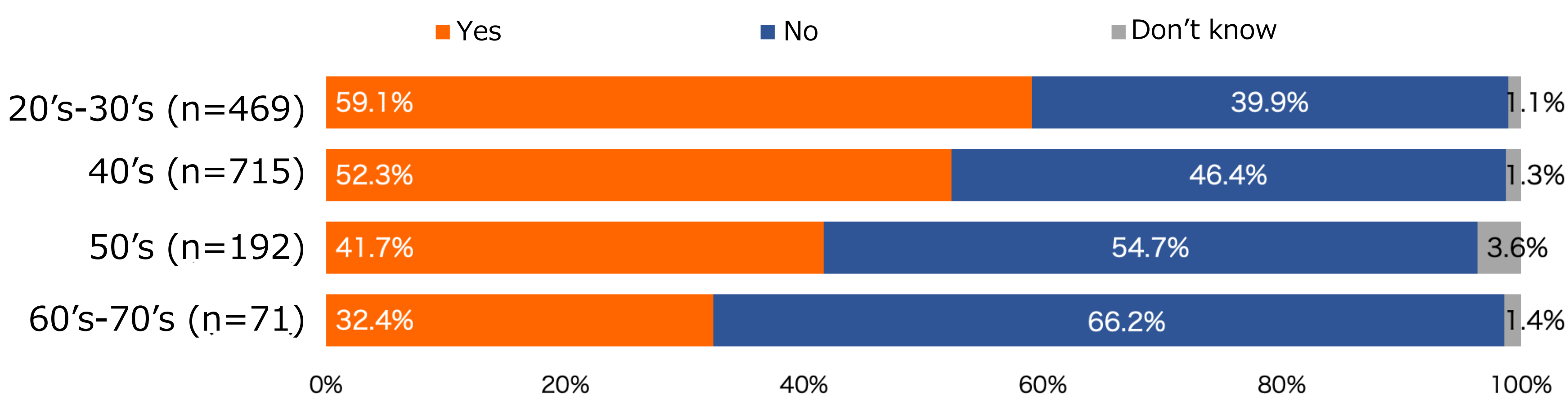
Experience in **utilizing preprints** (n=1,448)



Experience in **publishing preprints** (n=1,448)



Experience in **utilizing preprints by age group** (n=1,448)



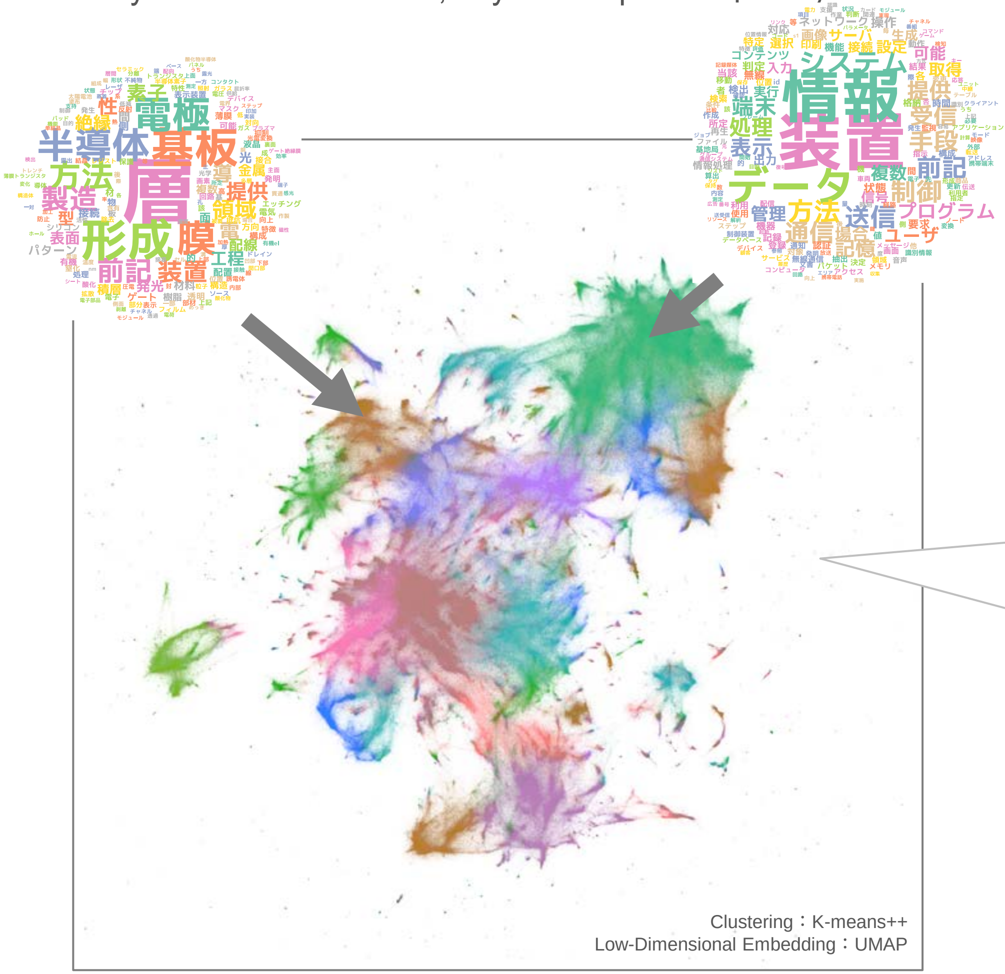
Patent analysis

Contents based patent analysis : a characteristics of university-launched ventures, universities, companies, etc.

1. Mapping of approximately 4 million of all published patent gazettes by content similarity

← Analyze trends as a whole, beyond simple disciplinary classification

Development of a new scale of distance (similarity) between individual patents and a new classification axis that can detect interdisciplinary issues and grasp the relationship between fields.



Overall picture and content characteristics of the patent space

Technical points:

With existing methods[*1], it took several weeks to calculate the data, which was nearly 300TB. Calculated in units of several days, with about 6GB of data.

*1 Younge, K. A. and Kuhn, J. M.: Patent-to-Patent Similarity, SSRN (2016)

Analytical point:.

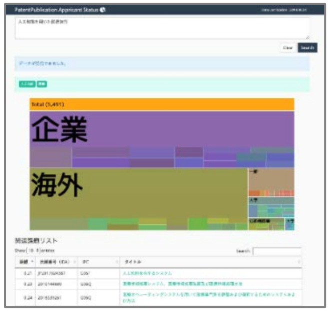
Defining the "distance" between patents based on the meaning[*2], "how similar" is expressed numerically.

*2 Similarity calculation using Word Embedding

Each point is individually patented (about 4 million patents) (300 dimensions are reduced to 2 dimensions).

Color is the result of 16 classifications of nearby objects in 300 dimensional space.

Each classification was visualized with frequent words and characterized.



The information system for analysis and visualization has been constructed and is being utilized.

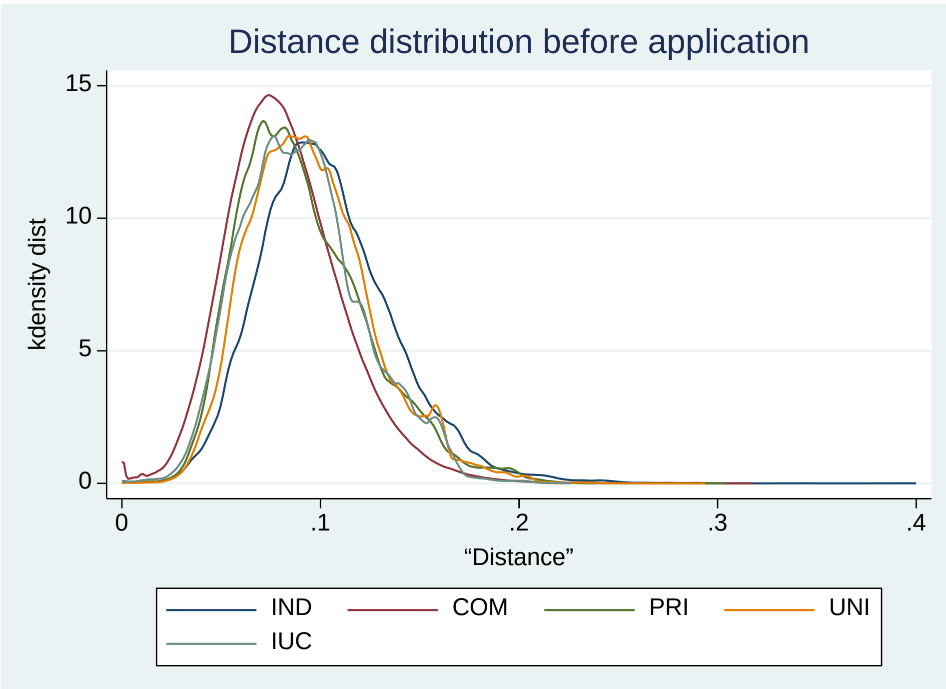
Tabulate and drill down by applicant type after a fuzzy search

Motohashi, et.al. : A method of extracting content information from patent documents and comparison of their characteristics by applicant type by using the vector space model of distributed expressions, NISTEP, DISCUSSION PAPER No.175, 2019

Contents based patent analysis :
a characteristics of university-launched ventures, universities, companies, etc.

2. Analysis of application trends and characteristics for each type of organization.

Conducted analysis using new scales and classification axes



Distribution of distance from 200 patents in the vicinity within 5 years before filing, by applicant type

Point1 :

Companies file in areas where there are already many similar patents

Point2 :

Individuals file in areas where there aren't many similar patents.

Point3 :

Universities, public institutions, and industry-university cooperation patents are between individuals and companies.

It is not an area where there are no exact similarities, nor is it an area where subtle differences claim novelty

Relatively speaking, the university has taken the path of pioneering its own field
Industry-academia cooperation is a little more different than companies.

Since this method can be used for any kind of documents, we are considering developing it into a mixed analysis of papers and patents and a mixed analysis of patents in other countries.

Motohashi, et.al. : A method of extracting content information from patent documents and comparison of their characteristics by applicant type by using the vector space model of distributed expressions, NISTEP, DISCUSSION PAPER No.175, 2019

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY POLICY

Japanese National Innovation Survey

Japanese National Innovation Survey 2018: Survey methodology and other survey metadata

1st Theory-Oriented Research Group

		Fifth Round of the Survey (2018)
Survey period		November 2018
Reference period		2015–2017
Sample attributes	**Sample unit**	Enterprises (not enterprise groups) (The survey population was identified based on information provided from the Business Register Database)
	Fields of economic activities	Agriculture, forestry, fishery, mining, construction, manufacturing, energy and utility, services (excluding certain economic activities)
Geographical scope		Enterprises located in Japan
Size of sample enterprises		Enterprises with 10 or more persons employed
Survey population		505,917 enterprises
Sampling method	**Stratified sampling−Simple random sampling without replacement:** Economic activity fields (86 categories) × enterprise size classes (5 classes) <Census for enterprises in the top two size classes>	
	Maximum sampling error was set	
Sample size		30,280 enterprises
Number of valid responses		9,439 enterprises
Response rate		31%
Methodological reference		*Oslo Manual 2018* (4th edition)

Status of “open innovation”

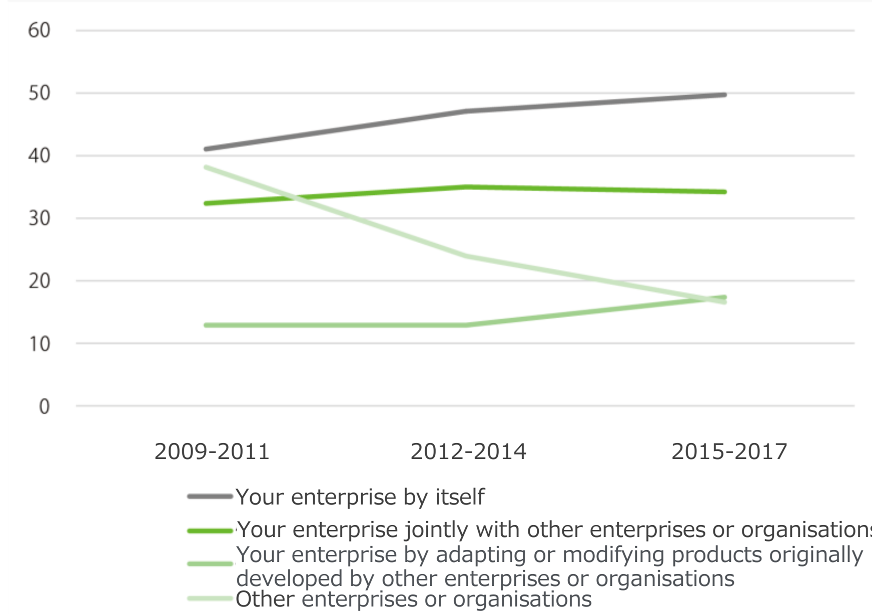
- While co-operative relations between organisations for development have not seen a significant change, there is a gradual decrease in the ratio of enterprises that claim “products developed by other enterprises or organisations” as product innovation.

Figure 3.5: Co-operation in innovation activities – non-business partners (2015–2017): Ratio (%) to all innovation-active enterprises

Source: Report on the Japanese National Innovation Survey 2018 (J-NIS 2018), Statistics Tables 49 and 50

Trends in the developer of product innovation

Figure 3.2: The organization that originally developed the product innovation (time trends): Ratio (%) to all enterprises that realised product innovations



Source: Report on the Japanese National Innovation Survey 2018 (J-NIS 2018), Statistics Table 47, *NISTEP REPORT* No.170, *NISTEP REPORT* No.156

- The ratio of those enterprises pursuing innovation through collaboration with universities and public research institutes as well as with other enterprises is high particularly among large-sized enterprises.

Japanese National Innovation Survey 2020: Survey methodology and other survey metadata

1st Theory-Oriented Research Group

		Sixth Round of the Survey (2020)
Survey period		November 2020
Reference period		2017–2019 (2020 for certain items)
Sample attributes	**Sample unit**	Enterprises (not enterprise groups) (The survey population was identified based on information provided from the Business Register Database)
	Fields of economic activities	Agriculture, forestry, fishery, mining, construction, manufacturing, energy and utility, services (excluding certain economic activities)
Geographical scope		Enterprises located in Japan
Size of sample enterprises		Enterprises with 10 or more persons employed
Survey population		Approximately 480,000 enterprises
Sampling method	**Stratified sampling−Simple random sampling without replacement:** Economic activity fields (87 categories) × enterprise size classes (5 classes) <Census for enterprises in the top two size classes>	
	Maximum sampling error was set	
Sample size		Approximately 31,000 enterprises
Methodological reference		*Oslo Manual 2018* (4th edition)
Publication of survey results		By November 2021

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY POLICY

Japanese National Innovation Survey 2020: Newly added items (1/2) – COVID-19

1st Theory-Oriented Research Group

Product innovation to adapt to COVID-19

7 New or Improved Goods or Services

7-1 New or improved goods or services*7 which have been introduced on the market by your enterprise (during the three years from 2017 to 2019 and in 2020 for respond to COVID-19)
Please tick (✓) one circle ○ of either "Yes" or "No" in each of (a) and (b).

*7) In this survey, "a new or improved good (service)" refers to the one that **differs significantly** from your enterprise's previous goods (services) and that has been introduced on the market. The new or improved good (service) means the good (service) that is **new to the firm**. It includes the one that differs significantly from your enterprise's previous good (service) even if it is the same one as the good (service) that has already been introduced on the market by other enterprises.

	[x] During the three years from 2017 to 2019		[y] To respond to COVID-19 in 2020	
	Yes	No	Yes	No
(a) New or improved **good** which has been implemented on the market (include digital goods)	○	○	○	○
(b) New or improved **service** which has been implemented on the market (include digital services)	○	○	○	○

Process innovation to adapt to COVID-19

<Excerpt from the questionnaire is omitted here>

Effects of COVID-19 on innovation activities

10 Effects of COVID-19 on Innovation Activities

10-1 Effects of COVID-19 on the innovation activities in your enterprise (in 2020)
Please tick (✓) all boxes ☐ where they are applicable in [a] and [b]. However, if there is nothing applicable, please tick the box "Not affected" only.

	Affected		Not affected
	Advanced	Hampered	
[a] Effects on **R&D activities** (9-1 (g))	☐	☐	☐
[b] Effects on **other innovation activities** (9-1 (a)–(f)) (excluding R&D)	☐	☐	☐

Usage of digitalisation and the purpose

6-4 Usage of digitalisation (during the three years from 2017 to 2019)

Please tick (✓) all boxes ☐ where they are applicable as the purpose of usage in each of the digitalisation [a] to [e]. However, if there is nothing applicable, please tick the box "Not used" only.

Purpose of usage	Used: Improving existing goods or services	Used: Introducing new goods or services	Used: Process automation or cost reduction	Used: Data analysis and collection, or decision support	Used: Others	Not used
[a] **Internet of Things (IoT)**	☐	☐	☐	☐	☐	☐
[b] **Cloud computing services**	☐	☐	☐	☐	☐	☐
[c] **Big data analysis**	☐	☐	☐	☐	☐	☐
[d] **Machine learning (AI)**	☐	☐	☐	☐	☐	☐
[e] **3D printing**	☐	☐	☐	☐	☐	☐

Participation in the OECD Project on the Analysis of Business R&D

OECD microBeRD Project Phase 1 (2016–2019)

- Focus: R&D input additionality
  - Cross-country project based on confidential micro-aggregated data for 2000–2017 pooled in 20 OECD member countries:
    Estimation of the effects of R&D tax incentives on business R&D expenditures
  - Country-specific analysis of firm-level data:
    Regression analysis directly based on microdata of respective countries and undertaken within each country using a harmonised and distributed methodology

Participating countries

Confidential microdata of participating countries

OECD

Run statistical code on microdata

Non-confidential harmonised output

R&D statistical survey data

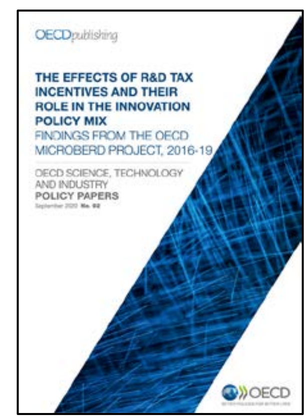
Microdata from the Survey of Research and Development were used for Japan

Corporate tax data

Microdata was not used for Japan

R&D tax incentives design information

Project report



https://doi.org/10.1787/65234003-en.

International comparison of direct government funding of business R&D and tax incentives for R&D

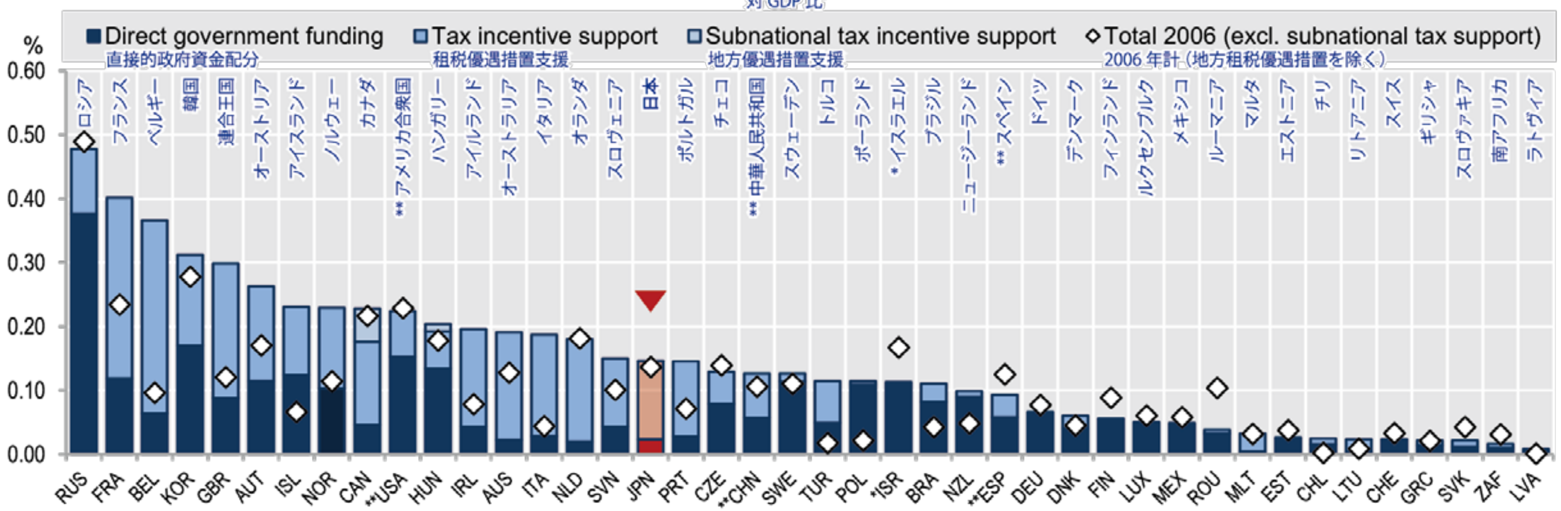
1st Theory-Oriented Research Group

企業研究開発に係る直接的政府資金配分及び研究開発税制優遇措置：2017 年（最新年）

Figure 2. Direct government funding of business R&D and tax incentives for R&D, 2017 (nearest year)

As a percentage of GDP

対 GDP 比



* Data on tax support not available. ** Data on subnational tax support not available

租税支援に関するデータが利用不可　地方租税支援に関するデータが利用不可

Source: OECD, R&D Tax Incentive Database, http://oe.cd/rdtax, December 2019.

Source: OECD (2019), “R&D Tax Incentives: Japan, 2019”, www.oecd.org/sti/rd-tax-stats-japan.pdf, Directorate for Science, Technology and Innovation, December 2019.

- Japan ranks around the middle in the international ranking concerning the total amount of direct government funding and tax incentives for business R&D among OECD members and other countries.

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY POLICY

Survey on Research and Development Activities of Firms in the Private Sector

Outline of Survey on Research and Development Activities of Firms in the Private Sector

2nd Theory-Oriented Research Group

Survey on Research and Development Activities of Firms in the Private Sector

- **A type of R&D statistics in the broad sense**
  - **Measurement of qualitative data on trends in business R&D, etc.**
  - **To complement the quantitative data (e.g. R&D expenditure) obtained by the Survey of Research and Development**
  - **Measurement of data on the use of science and technology policy and systems enforced and provided by the government**
  - **Definitions and categorizations used in the survey are based on the OECD Frascati Manual…**
    - While also ensuring consistency with the Survey of Research and Development

Implementation of Survey on Research and Development Activities of Firms in the Private Sector 2020

- **The survey questionnaire was sent to companies having capital of at least 100 million yen among those firms confirmed to be performing internal R&D activities in the Survey of Research and Development of 2019**
- **Survey period: Aug. – Dec. 2020**
- **Survey population: 3,797 firms (provisional)**
- **No. of firms that responded: 1,996 firms (provisional) ⇒ Response rate: 52.6%**
- **Period covered in the survey scope: Business activity in AY2019**
- **Preliminary report published on Jan. 29, 2021**
- **Full report to be published in June 2021**

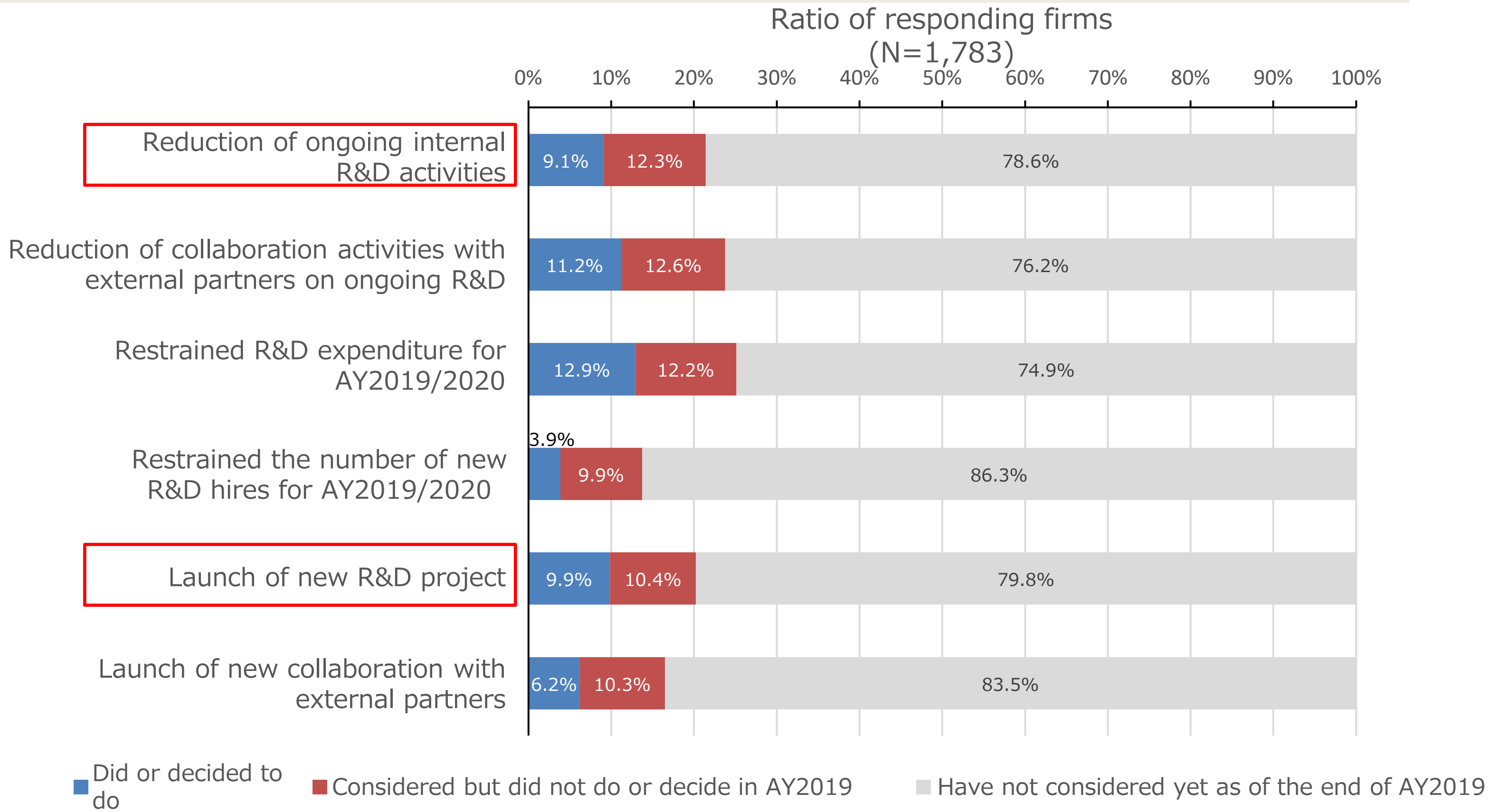
While the response rate may not be high enough to provide solid evidence, the survey does provide various clues for consideration

Response to the COVID-19 pandemic

2nd Theory-Oriented Research Group

- 9.1% of the responding firms reduced or decided to **reduce ongoing internal R&D activities** in AY2019
- Meanwhile, 9.9% of the responding firms launched or decided to **launch a new R&D project** in AY2019, exceeding the ratio of firms that reduced or decided to reduce R&D activities

The following questionnaire results show the answers to questions asking whether the respondent's firm did or decided to reduce (restrain, or launch) R&D activities "as a response to the COVID-19 pandemic and associated changes in the social and economic conditions (including future outlook)" rather than simply asking whether their firm reduced (restrained, or launched) R&D activities.

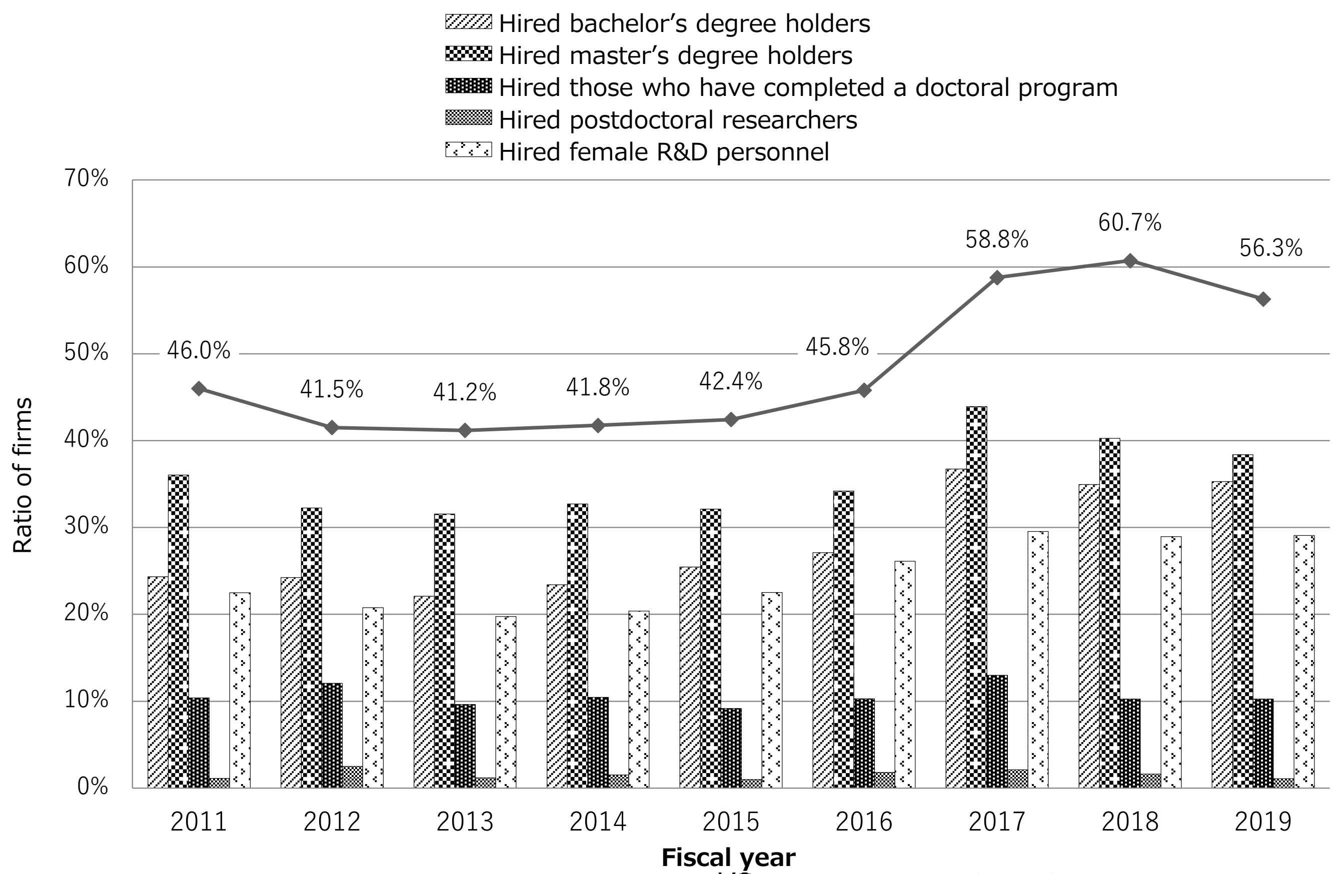


Source: NISTEP Preliminary Report on Survey on Research and Development Activities of Firms in the Private Sector 2020, published Jan. 29, 2021

Trends in firms hiring R&D personnel: By educational background and other attributes

2nd Theory-Oriented Research Group

- The ratio of firms that hired R&D personnel (regardless of new graduates or mid-career) in AY2019 slightly decreased from the previous year to 56.3% and was the lowest in the last three years. However, the ratio was third largest in the entire period since AY2011.
- The ratio of firms that hired bachelor's degree holders in AY2019 slightly increased from previous year, whereas those that hired master's degree holders decreased for two consecutive years and those that hired Ph.D. graduates showed a slight decrease and marked the third lowest figure in the entire period since AY2011.
- The ratio of firms that hired female researchers slightly increased in AY2019 maintaining an upward trend for the last several year



Source: NISTEP Preliminary Report on Survey on Research and Development Activities of Firms in the Private Sector 2020, published Jan. 29, 2021

Development of Data and Information Infrastructure (SciREX Program)

SciREX Data and Information Infrastructure (Development of base data on industrial R&D)

2nd Theory-Oriented Research Group

Overview

- Provide infrastructure for systematically utilizing various data to analyze R&D and innovation in Japanese industries.
- To this end, SciREX promotes (1) the development of databases including a dictionary of corporate names, (2) experimental and research initiatives to enhance data infrastructure.

Recent experimental initiatives

(1) Development of a dictionary of corporate names and related data

Continuous data development and publication

- Continuously updated and published (7 times) data in the dictionary of corporate names and link tables

<u>Increase in included data during the 2nd phase</u>

- Actual no. of corporations: ~7,000 → ~11,000
- No. of corporate records: ~12,000 → ~25,000
- Patents and link records: ~10,000,000 → ~11,500,000

Enhanced functions of the dictionary of corporate names

- Added enterprises with a certain level of increase in the number of filed patents to cover small scale enterprises including ventures.
- Created a link table linked to the dictionary of names of universities and public organizations.
- Added ~2,000 unlisted enterprises from the dictionary of names of universities and public organizations.
- Added the enterprise ID number (specified and published by the National Tax Agency) as a new data item to improve connectivity with external data.
- Created and made available a connection table with US patent data.
- Created and made available a connection table with NISTEP design and trademark registration table.
- Added university spin-off ventures to the dictionary of corporate names.

(2) Enhancing data infrastructure (experimental and research initiatives)

Consideration of the contents of data development

- Enhanced the contents by obtaining feedback and reflecting opinions and requests from researchers, etc. who use the dictionary of corporate names.
- The developers also use the dictionary to conduct their own research.
- Yasuo Nakayama, Mitsuaki Hosono, Hiroyuki Tomizawa, "Comprehensive Survey on Patent Applications Based on Inventions by National University Researchers" NISTEP Research Material No. 266. (Dec. 2017)

Advanced efforts

- Conducted research on inventor name-based aggregation and algorithms that form the basis for analyzing patent data on the individual inventor level.
- Conducted research on ways to identify the "hub researchers" since identification of hub researchers is useful for analyzing the structure of knowledge creation networks.
- Exchanged views with AI researchers of the Center for Advanced Intelligence Project, RIKEN on information processing technologies for the development of the dictionary of corporate names.

Importance of industrial data development

- Infrastructure is important not only to support policies for promoting science and technology but also policies for facilitating innovation to contribute to society and economy
- Likewise, it is important to study not only policies targeted at universities and public organizations which are in the jurisdiction of MEXT, but also industrial policies.

[Reference] Functions of the dictionary of corporate names

- Significantly improved the quality of patent data (eliminated the need of data cleaning and name-based aggregation)
- Reduced the data processing burden of policy and innovation researchers
  - E.g.: Tremendous data processing used to be necessary to reflect historical information of business enterprises including M&A and change in name.
- Conducted microdata analysis on themes for which only macrodata analysis used to be conducted
  - E.g.: Deepened analysis from country level to individual enterprise level
- Concatenated data of different types such as input data and output data
  - E.g.: Concatenation of R&D expenditure data and patent data
  - E.g.: Concatenation of data from METI Basic Survey of Japanese Business Structure and Activities and NISTEP Survey on Research and Development Activities of Firms in the Private Sector

SciREX Data and Information Infrastructure (Infrastructure development to contribute to policy making and promotion of comprehensive use)

SciREX

2nd Theory-Oriented Research Group

Overview

- Develop data, etc. for publication to raise awareness about STI policies and enable analysis by wide ranging users.
- Particularly promote the development of data and information that help visualize the effects of and researches conducted with R&D investments by the government.

Recent main outcomes: Search tools and other deliverables

(published on the NISTEP website)

White Paper on Science and Technology Search

- Tool for searching across all the texts contained in MEXT White Paper on Science and Technology (from 1958 to 2019) enabling researchers to understand changes in S&T policy trends over time
- Equipped with a feature to count the number of times a certain word appears in the text and an ambiguous search function for searching with not only the exact keyword but also its synonyms.

Database of Basic Policies by Category

- Published the full texts of the First to Fifth Science and Technology Basic Plan and its predecessor, Report of the Council for Science and Technology Policy, as well as the Comprehensive Strategy on Science, Technology and Innovation, and Integrated Innovation Strategy
- Search functions similar to those of the White Paper on Science and Technology Search will be added

Delphi Survey Search

- Allows searching of all the results of the NISTEP Delphi Survey conducted for a total of 11 times from 1971 to 2019

NISTEP TEITEN Survey Search

- Allows searching of all the results of NISTEP TEITEN Survey (2011-2015), displaying data by the attributes of the institution or individual or in chronological order, and searching responses to open-ended questions.

Concept of NISTEP data and information infrastructure

- Promote entry into STI policy research from various domains
- Data and information infrastructure freely accessible by anyone

→ Basis for bottom-up policy development

→ Ensuring accountability to the public

Website of MEXT White Paper on Science and Technology Search

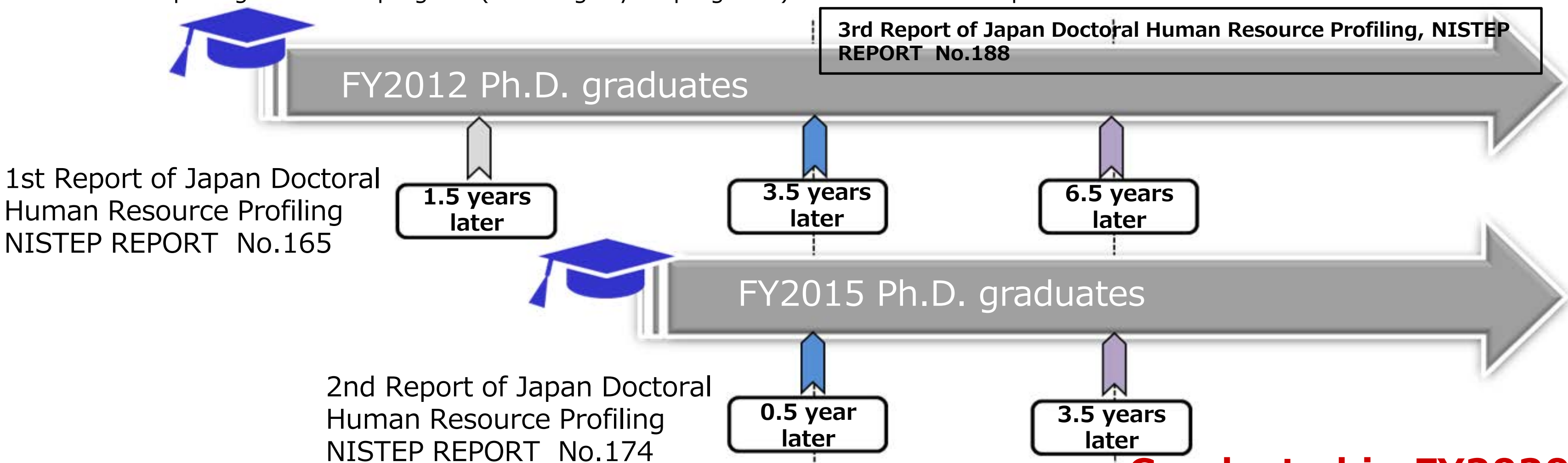
Survey on Ph.D. Graduates, etc.

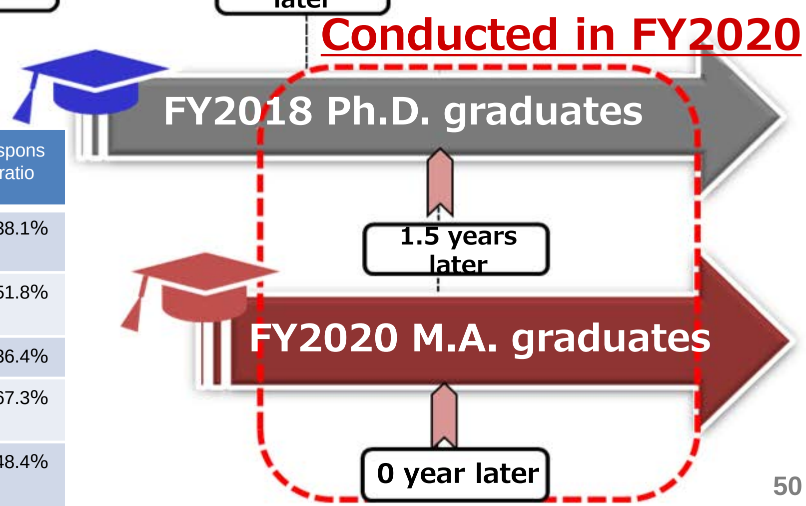
Japan Doctoral Human Resource Profiling (JD-Pro)

1st Policy-Oriented Research Group

[Survey overview]

- Aiming to understand the career pathways of Ph.D. holders who are expected to be important leaders for science and technology innovation, NISTEP conducted a **complete survey** of all those who completed a doctoral program in a specific year to understand the status of doctoral programs and the employment/research status after graduation. Later, we conducted a **panel survey** of the initial survey respondents as a follow-up to understand the changes in their employment and research status.
- In Nov. 2019, we conducted a follow-up survey of the 2012 cohort and 2015 cohort, 6.5 years and 3.5 years respectively after the initial complete survey. The results were published in Nov. 2020.
- In Nov. 2020, we conducted a follow-up survey of the 2018 cohort 1.5 years after the initial survey. We also started a new survey to track the status of students who were completing a master's program (including 6-year programs). The results will be published within FY2021.





New survey to track those expecting to complete a master's program (including 6-year programs)

No.	Conducted in	Cohort names	Survey scope	Survey population	Effective responses	Response ratio
1st	Apr. 2011	2012 cohort (1.5 years later)	All FY2012 Ph.D. graduates	13,276	5,052	38.1%
2nd	Nov. 2016	2012 cohort (3.5 years later)	Respondents of the 1st survey	5,044	2,614	51.8%
		2015 cohort (0.5 years later)	All FY2012 Ph.D. graduates	13,517	4,922	36.4%
3rd	Nov. 2019	2012 cohort (6.5 years later)	Respondents of the 2nd survey	2,614	1,758	67.3%
		2015 cohort (3.5 years later)	Respondents of the 1st survey	4,922	2,381	48.4%

How useful are the skills gained through your doctoral education?

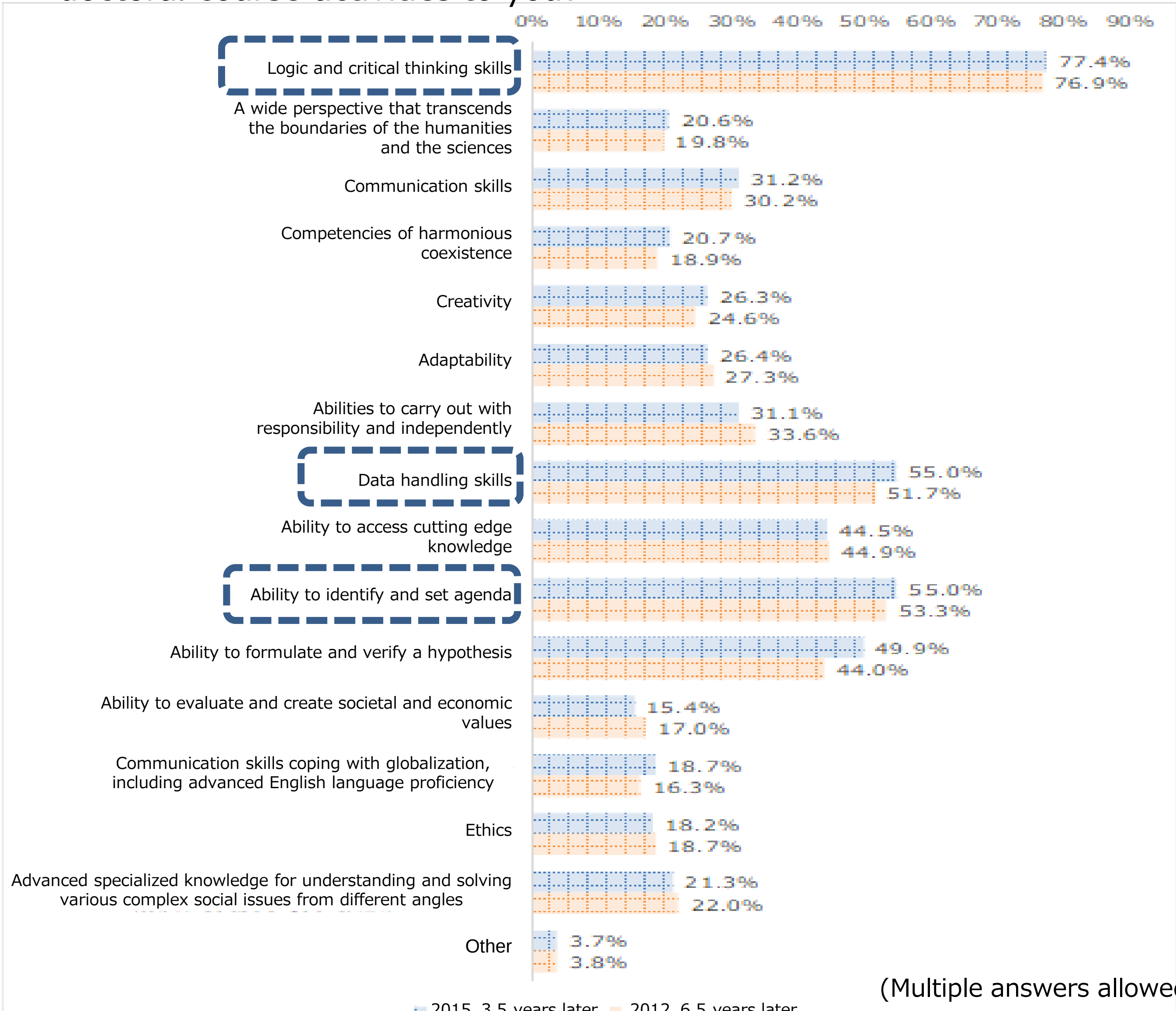
1st Policy-Oriented Research Group

◇ In both 2012 and 2015 cohorts, the largest number of respondents answered **”Logic and critical thinking skills**“ were useful.

◇ Next came the “**Ability to identify and set agenda” and “Data handling skills.”**

◇ Followed by **”Ability to formulate and verify a hypothesis” and “Ability access cutting edge knowledge.”**

When thinking about principle job, how useful is each of the following doctoral course activities to you?



(Multiple answers allowed)

Source: 3rd Report of Japan Doctoral Human Resource Profiling, NISTEP REPORT No.188, (Nov. 2020) National Institute of Science and Technology Policy

Japan Graduates Database (JGRAD)

1st Policy-Oriented Research Group

Participating universities

- **Data of participating universities' graduates** are made available

Registration support →

← **Data of graduates**

MEXT NISTEP

Japan Graduates Database (JGRAD)

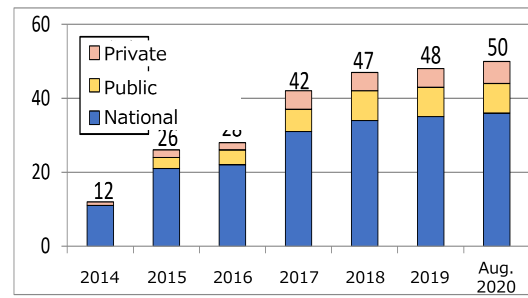
- Web-based Database
- Data are **not disclosed to public** (information sharing is restricted to participating universities)
- **Provides registrants with information on career paths, etc.*** on the database

Collaboration ↔

Japan Science and Technology Agency (JST)

JREC-IN Portal

researchmap



Participating universities

JGRAD Japan Graduates Database

Registrants input/update data

Graduates update their own **career information**

While enrolled in a doctoral program	The final year of a doctoral program	After completing a doctoral program
Initial registration ・Basic information ・Information while enrolled in a doctoral program	**Input data when graduating** ・Information while enrolled in a doctoral program (earned degrees, etc.) ・E-mail address for contact after graduation ・Career information	**Update data after graduating** ・Update career information as necessary after graduation (the administrative office will send requests for updating information)

***About information provision to registrants on the database**

・Job offer information on **JREC-IN Portal**
・Collaboration with **researchmap**
・Collection and distribution of **career information (as role models)**

✓ Participation of **50 universities** as of January 2021 (36 national, 8 public and 6 private universities)

✓ **Over 24,000 registrants** as of January 2021

Survey on Postdoctoral Fellows Regarding Employment and Careers <preliminary report>

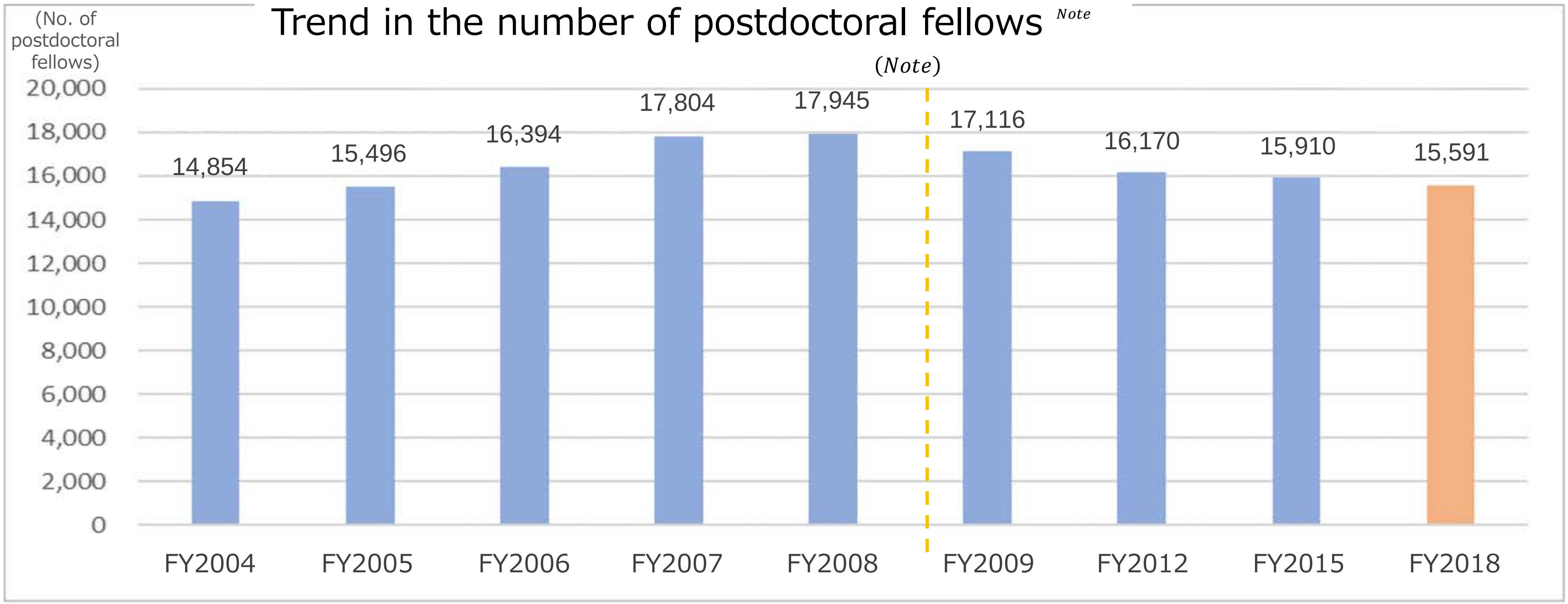
1st Policy-Oriented Research Group

◇ Policy makers expect to be using evidence in making their decisions for HRST. NISTEP conducted the survey of employment and career status of postdoctoral fellows in universities and public research institutes to contribute policy making process.

◇ A total of 1,176 institutes were covered in the FY2018 survey including universities (excluding junior colleges), inter-university research institutes, national research institutes, public test and research institutes, R&D agencies.

◇ The number of postdoctoral fellows has continued to decrease over the last decade.

Trend in the number of postdoctoral fellows *Note*



(Note) The survey was conducted on postdoctoral fellows who were employed at universities and research institutes for two months or more in FY2012. There is possibility that the same person was counted for employment at multiple institutes. The figures for up to FY2008 cannot be simply compared with those of FY2009 and after, because up to FY2008 postdoctoral fellows used to be counted by funding source and therefore difficult to determine whether the same person had been counted multiple times. The figure given for FY2018 is a preliminary figure.

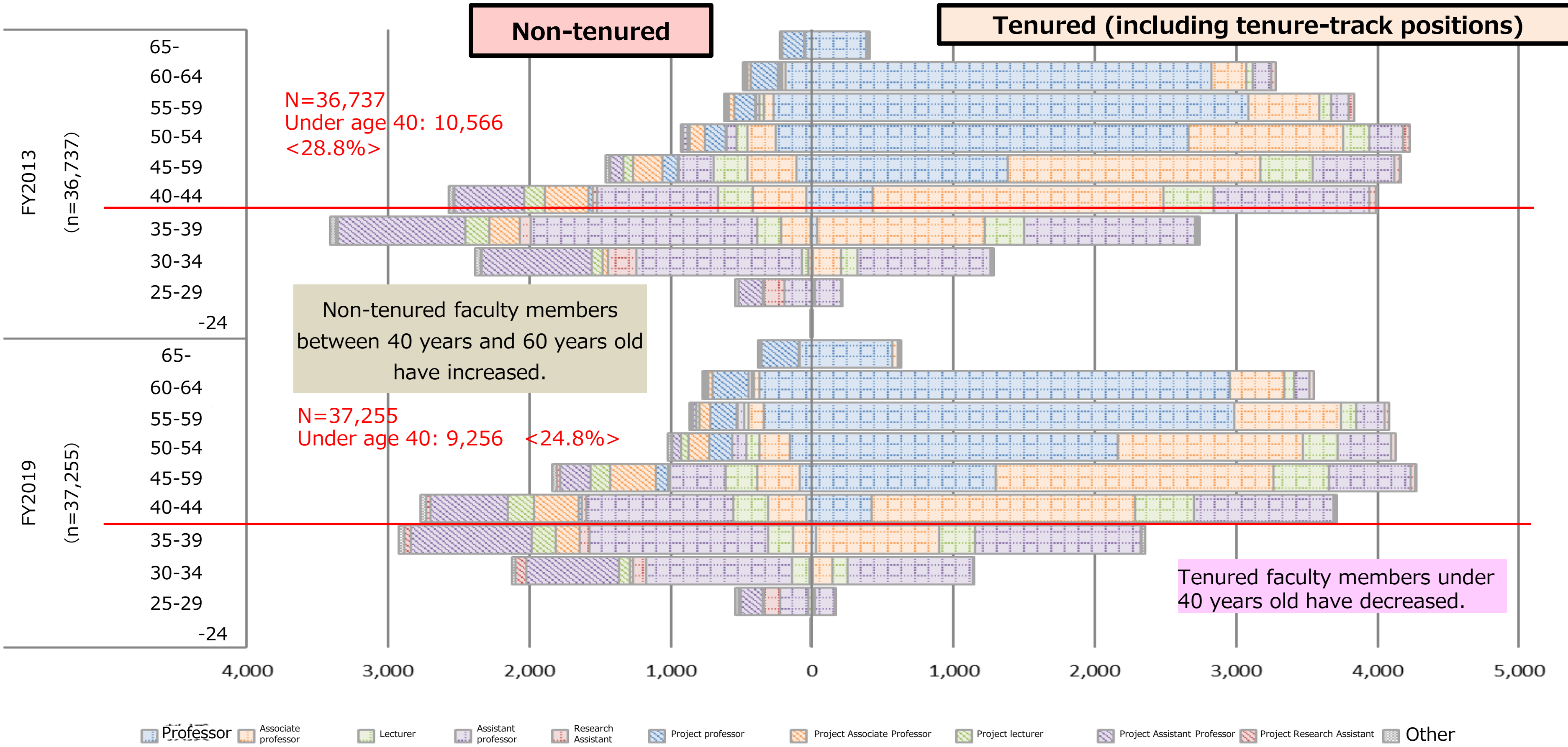
Source: The Survey on Postdoctoral Fellows Regarding Employment and Careers in Japan (preliminary edition; Sep. 2020) MEXT NISTEP, Knowledge Infrastructure Policy Division, Science and Technology Policy Bureau, MEXT.

Survey on Employment Status of Instructional Staff at 18 Research Universities <preliminary report>

RU18 Survey

1st Policy-Oriented Research Group

◇ The largest employers of Ph.D. graduates are universities. The aim is to inform STI human resource policies by understanding the status of tenured and non-tenured faculty members at research universities .
◇ The survey covered 18 research universities to which either of the following conditions apply: 1) member of the Research University 11 (RU11); 2) Recipient of "focused support (iii)" of the Management Expenses Grants for National University Corporations
◇ The non-tenured faulty members between 40 and 60 years old have increased, while tenured faculty members under 40 years old have decreased.



Source: Employment Status of Instructional Staff at 18 Research Universities (preliminary report; Aug. 2020) MEXT NISTEP, Knowledge Infrastructure Policy Division, Science and Technology Policy Bureau, MEXT.

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY POLICY

Public Attitudes to Science and Technology

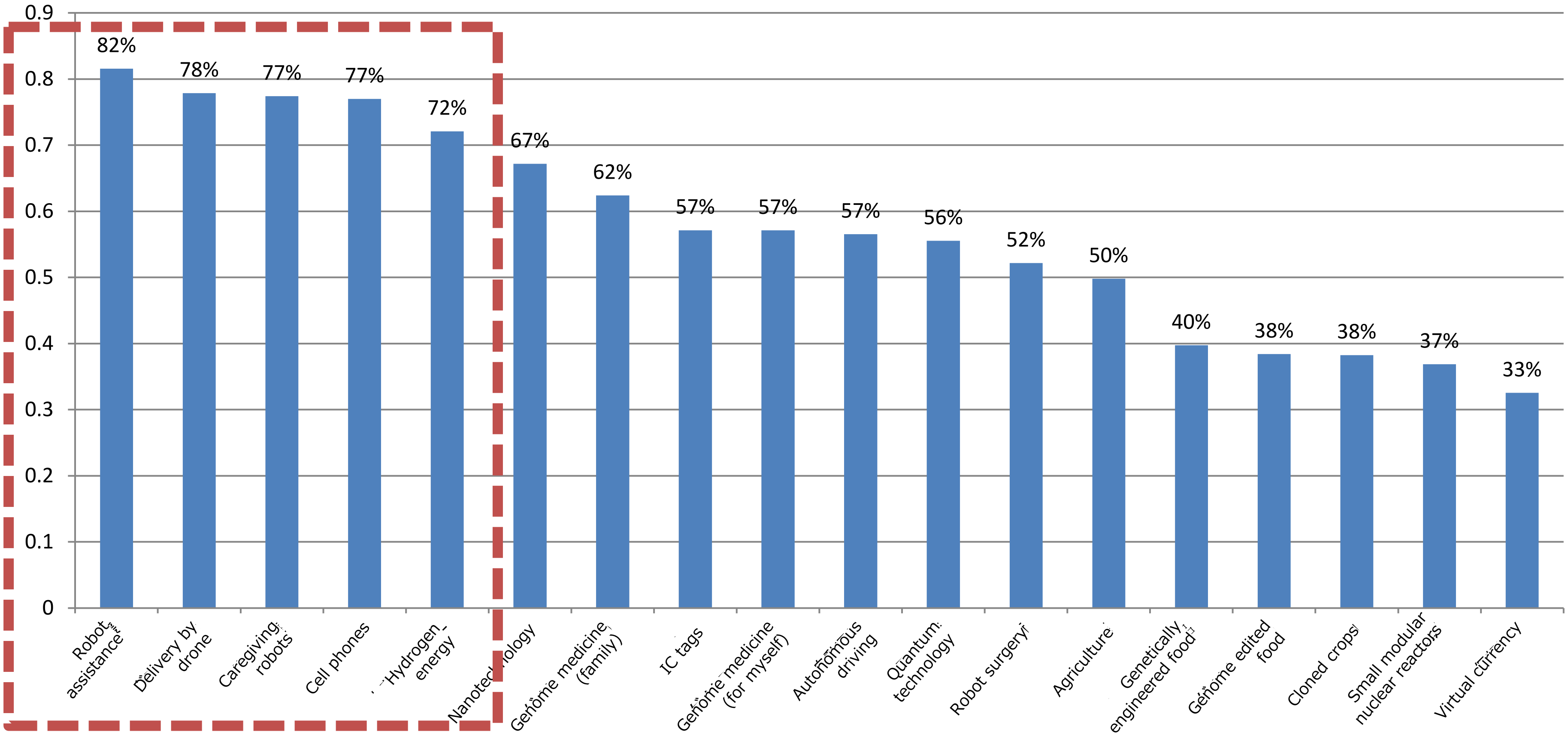
Survey of Public Attitudes Toward and Understanding of Science & Technology

1st Policy-Oriented Research Group

- Gaining understanding, trust, and support from society is essential for science and technology to meet social expectations. NISTEP has been conducting Internet surveys to understand public interest and trust in science and technology since 2009.
- N=3,000; equal gender distribution and equal number of respondents in each age group (10’s to 60’s); For those respondents who dropped out of the questionnaire, a different respondent with the same attributes was selected and invited to answer the questionnaire.

◇ Survey of Public Attitudes Toward and Understanding of Science & Technology: Social Acceptance of New Technology (2020)

Technologies that attracted the highest acceptance were robot assistance, delivery by drone, caregiving robots, cell phones (5G), and hydrogen energy in descending order. Technologies for use in daily life seemed to be better accepted.



Source: Survey of Public Attitudes Toward and Understanding of Science & Technology: Social Acceptance of New Technology, NISTEP RESEARCH MATERIAL No. 296, Aug. 2020