Research Material-311

Digest of Japanese Science and Technology

Indicators 2021

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Japanese Science and Technology Indicators 2021 (ABSTRACT)

"Science and Technology Indicators" is a basic resource for understanding Japanese science and technology activities based on objective and quantitative data. It classifies science and technology activities into five categories, such as 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 160 indicators. The report is published annually to show the latest results of the analyses of scientific publications and patent applications conducted by the NISTEP.

This edition of "Science and Technology Indicators 2021" includes new indicators such as "the share of each industry in total value added in selected countries" and "the status of trademark applications to and from selected countries". As columns related to "Science, technology and society", "Science communication by research institutes" and "People's awareness on information and confidence to online news" were introduced.

Overviewing the latest Japan's situation from "Science and Technology Indicators 2021," it was found that the R&D expenditure and the number of researchers in Japan are the third largest in selected countries (Japan, U.S., Germany, France, U.K., China and Korea). The number of scientific publications in Japan (fractional counting method) is the fourth in the world. Japan continues to be the world first place in the patent family (patent applications to more than two countries). These trends have continued from the previous two editions, but in terms of the number of scientific publications with high citations (fractional counting method), Japan has moved from ninth to tenth in the world. China surpassed the United States for the first time and ranked first among selected countries in scientific publications with high citations (fractional counting method).

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1. Japan's trends in key indicators

Japan’s trends in key indicators are as shown below. Most of Japan’s rankings have unchanged from the previous edition of this report except for the number of adjusted top 10% papers, which dropped to the 10th place. Although Japan keeps the third rank behind the U.S. and China in many indicators, Japan shows smaller growth than other selected countries in many cases as described later.

[Summary Chart 1] Japan's trends in key indicators

Indicators	Changes in Japan's ranking	Japan’s figures	Note
R&D expenditure	No. 3→No. 3	18.0T yen	No. 1: U.S., No. 2: China
Business enterprises	No. 3→No. 3	14.2T yen	No. 1: U.S., No. 2: China
Universities and colleges	No. 4→No. 4	2.1T yen	No. 1: U.S., No. 2: China, No. 3: Germany
Public organizations	No. 4→No. 4	1.4T yen	No. 1: China, No. 2: U.S., No. 3: Germany
Number of Researchers	No. 3→No. 3	682K	No. 1: China, No. 2: U.S.
Business enterprises	No. 3→No. 3	507K	No. 1: China, No. 2: U.S.
Universities and colleges	No. 3→No. 3	136K	No. 1: China, No. 2: U.K.
Public organizations	No. 3→No. 3	31K	No. 1: China, No. 2: Germany
Number of scientific papers (fractional counting)	No. 4→No. 4	66K	No. 1: China, No. 2: U.S., No. 3: Germany
Number of adjusted top 10% scientific papers (fractional counting)	No. 9→No. 10	4K	No. 1: China, No. 2: U.S., No. 3: U.K., No. 4: Germany, No. 5: Italy, No. 6: Australia, No. 7: Canada, No. 8: France, No. 9: India
Number of patent families	No. 1→No. 1	62K	
The trade balance ratios for high R&D intensive industries	No. 6→No. 6	0.7	No. 1: Korea, No. 2: Germany, No. 3: China, No. 4: France, No. 5: U.K.
The trade balance ratios for medium high R&D intensive industries	No. 1→No. 1	2.5	
Number of trademark applications to countries other than country of residence (Number of classes)	No. 6→No. 6	132K	No. 1: U.S., No. 2: China, No. 3: Germany, No. 4: U.K., No. 5: France

Note:
1) The “Changes in Japan's rankings” compares the latest year and the previous year. The “Japan’s figures” is for the latest year.
2) Except for the number of papers and the number of adjusted top 10% papers, the rankings are within the following selected countries: Japan, the U.S., Germany, France, the U.K., China, and Korea.
3) As for the number of researchers, the U.S. is excluded from the rankings in “Universities and colleges” and “Public organizations” as data have not been published for universities and colleges since 2000 and for public organizations since 2003, so the U.S. is excluded from the said rankings. The overall number of researchers in the U.S. is an estimate figure.
Reference: Chart 1-1-1, Japanese Science and Technology Indicators 2021 (in Japanese)

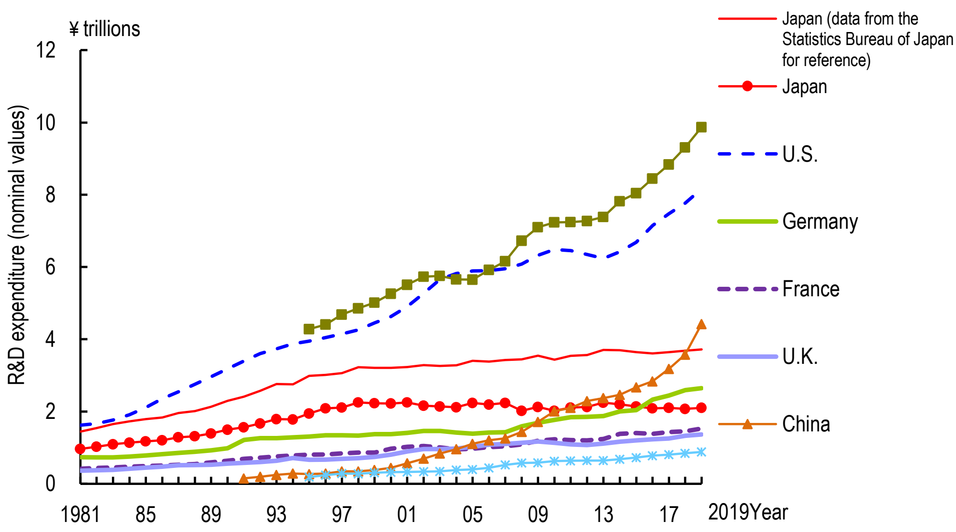
2. R&D expenditure: circumstances in Japan and the selected countries

(1) The growth of R&D expenditure in Japan's "universities and colleges" and "public organizations" sectors is smaller compared to the other selected countries.

The U.S has maintained the top position among the selected countries in R&D expenditure in the "universities and colleges" sector. China surpassed Japan (as estimated by OECD) in 2012. The R&D expenditure of China's "public organizations" sector surpassed that of the U.S. in 2013 and is the highest among the selected countries in 2019. Germany's R&D expenditure has been on the rise since the mid-2000s and has surpassed Japan's since 2010.

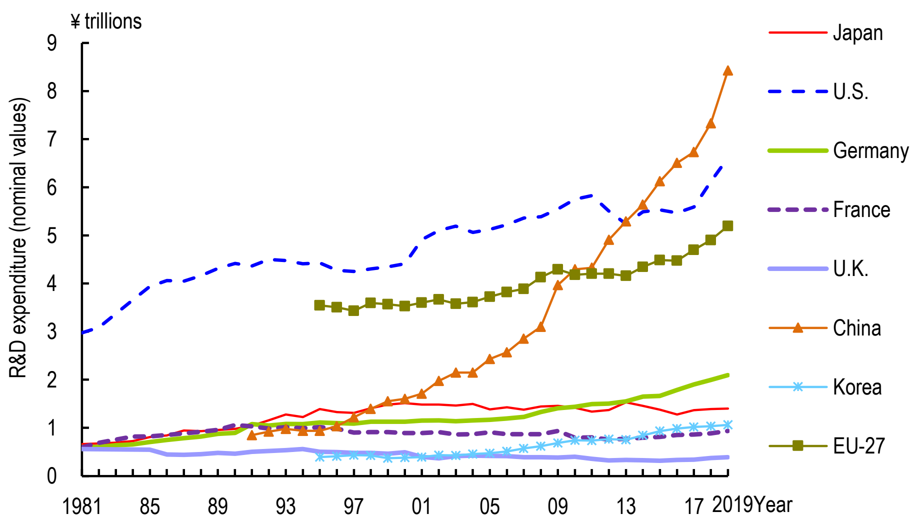
[Summary Chart 2] Nominal values of R&D expenditures by "universities and colleges" and "public organizations" (based on OECD purchase power parities data)

(A) Universities and colleges



Reference: Chart 1-3-11, Japanese Science and Technology Indicators 2021 (in Japanese)

(B) Public organizations

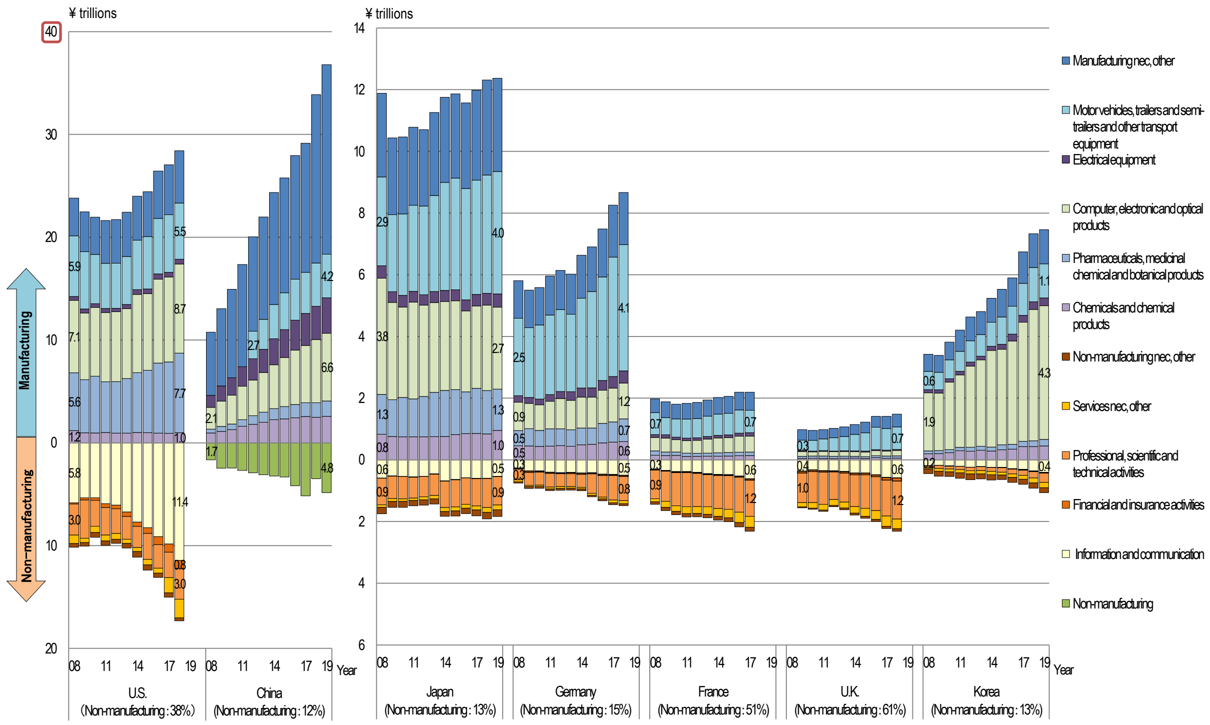


Reference: Chart 1-3-1, Japanese Science and Technology Indicators 2021 (in Japanese)

(2) In Japan, Germany, China and Korea, the R&D expenditure in the manufacturing industry tends to be larger to the expenditure in the non-manufacturing industry. In the U.S., the manufacturing industry is the larger, but the non-manufacturing industry also has a sizeable share.

With regard to the R&D expenditure of the business enterprises sector by industry in the most recent year, the following industries have undertaken large-scale expenditure in the respective countries: the "information and communication industry" in the United States, the "motor vehicles, trailers and semi-trailers and other transport equipment industry" in Japan and Germany, the "professional, scientific and technical activities industry" in France and the United Kingdom, and the "computer, electronic and optical products industry" in China and Korea.

[Summary Chart 3] Business enterprise R&D expenditure by industry in the selected countries



Note:
Figures in parentheses indicate the percentage of the non-manufacturing industry for the latest year in each country.
Reference: Chart 1-3-6, Japanese Science and Technology Indicators 2021(in Japanese)

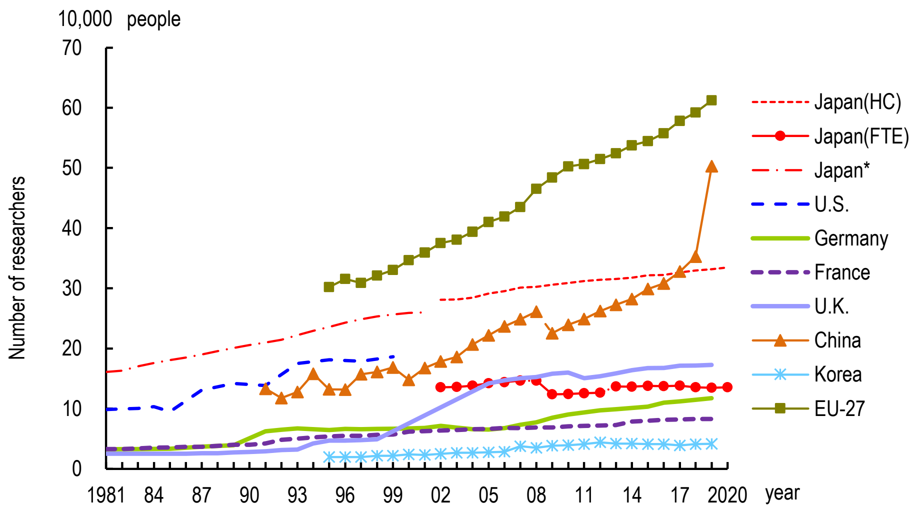
3. R&D personnel: circumstances in Japan and the selected countries

(1) The growth of the number of researchers in Japan's "universities and colleges" and "public organizations" sectors is smaller than that in other selected countries.

The numbers of Chinese researchers in the "universities and colleges" and "public organizations" sectors are large and growing rapidly. In the "universities and colleges" sector, the U.K. and Japan (in FTE: Full-time equivalent) follow China; while the number of researchers in the U.K. is increasing, this number has fallen in Japan by 1.5% compared to five years ago. In the "public organizations" sector, Germany and Japan follow China; while the number of researchers in Germany is trending upward, in Japan this number has increased with only 2.5% compared to five years ago.

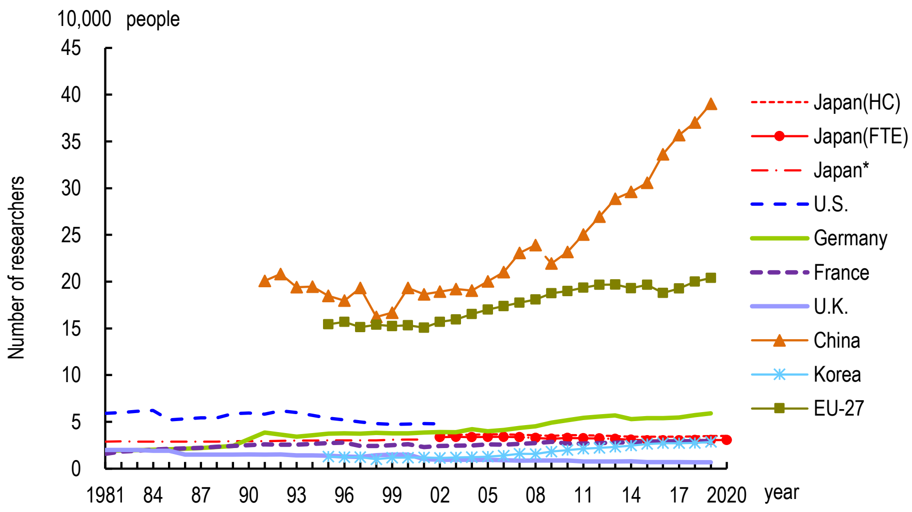
[Summary Chart 4] Trends in the number of researchers in "universities and colleges" and "public organizations"

(A) Universities and colleges



Reference: Chart 2-2-10, Japanese Science and Technology Indicators 2021 (in Japanese)

(B) Public organizations

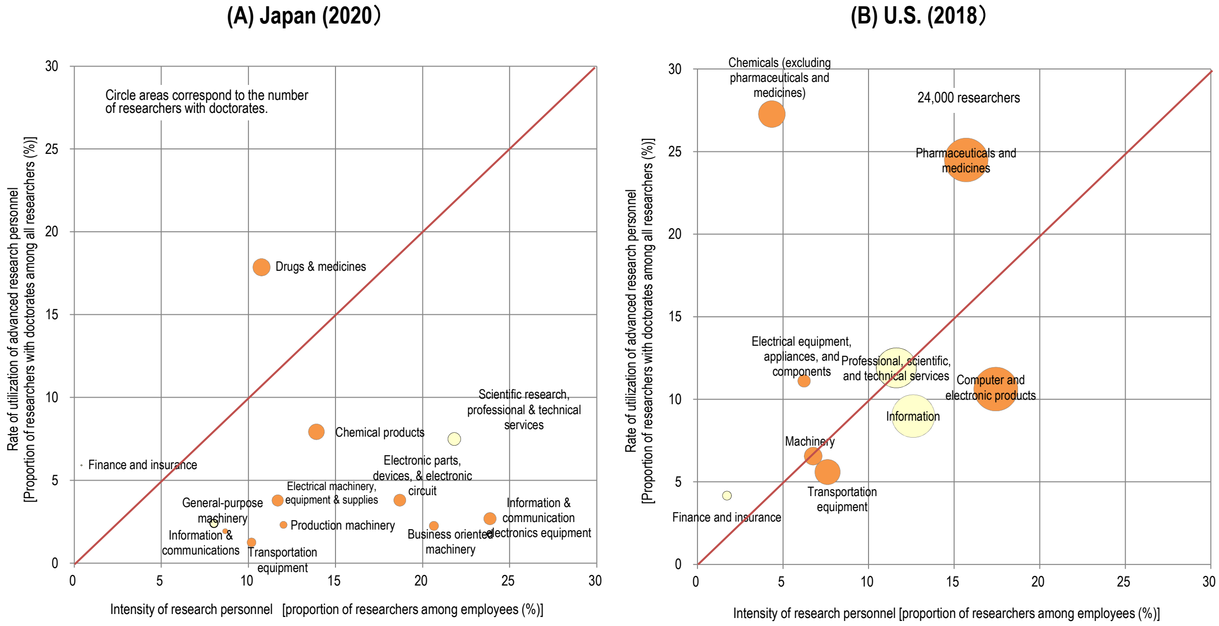


Reference: Chart 2-2-1, Japanese Science and Technology Indicators 2021 (in Japanese)

(2) The rate of utilization of advanced research personnel (the proportion of researchers with doctorate degrees among all researchers) is low in Japan, compared with the United States.

The proportion of researchers with doctorate degrees among all researchers is at least 5% in most the industries shown in the figure in the United Stetes, while the proportion is less than 5% in many industries in Japan. It suggests that Japan tends to be low in utilization of advanced research personnel compared with the United States.

[Summary Chart 5] Relationship between the intensity of research personnel and the rate of utilization of advanced research personnel by industry

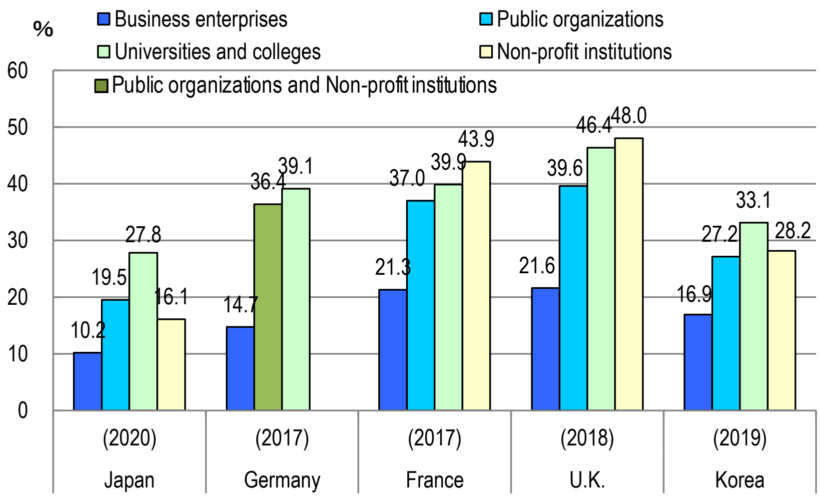


Note:
The intensity of research personnel is the proportion of researchers (HC) among employees. The rate of utilization of advanced research personnel is the proportion of researchers with doctorate degrees among all researchers (HC). For both Japan and the United States, this analysis covered business enterprises engaging in R&D. Orange circles denote manufacturing sectors, yellow circles non-manufacturing sectors.
Japan: For the industrial classification of Japan, an industrial classification system for scientific and technological research and surveys based on the Japan Standard Industry Classification was used.
U.S.: For the industrial classification of the United States, the North American Industry Classification System (NAICS) was used.
Reference: Chart 2-2-10, Japanese Science and Technology Indicators 2021 (in Japanese)

(3) Although the percentage of female researchers in Japan is lower than that in other selected countries, the percentage of women among newly hired researchers has been increasing.

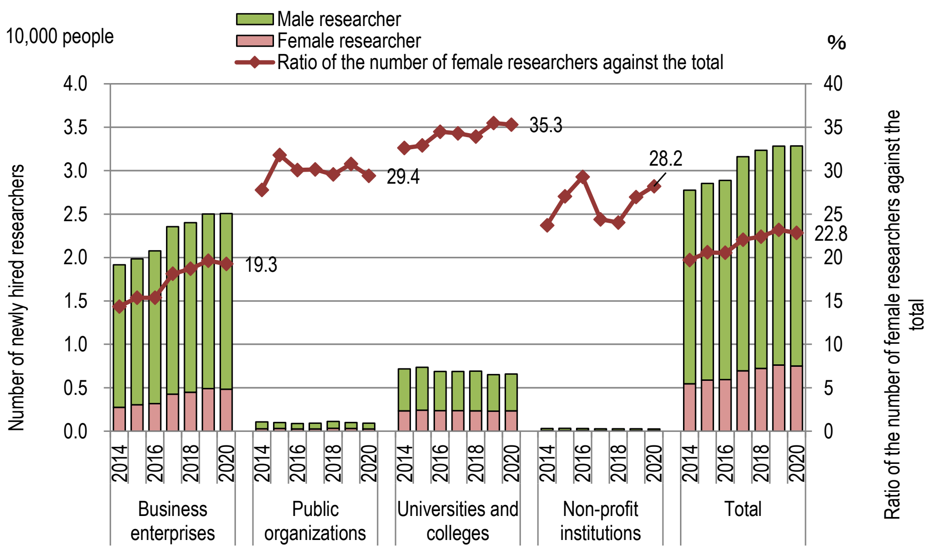
The percentage of women among all researchers is the lowest in business enterprises in all the selected countries. The percentage of female researchers in Japan is the lowest in each sector compared to the other countries. In Japan, the percentage of newly hired female researchers tends to be higher than the percentage of women among all researchers regardless of the sector.

[Summary Chart 6] Shares of female researchers of the selected countries by sector



Reference: Chart 2-1-11, Japanese Science and Technology Indicators 2021 (in Japanese)

[Summary Chart 7] Newly hired researchers by gender in Japan



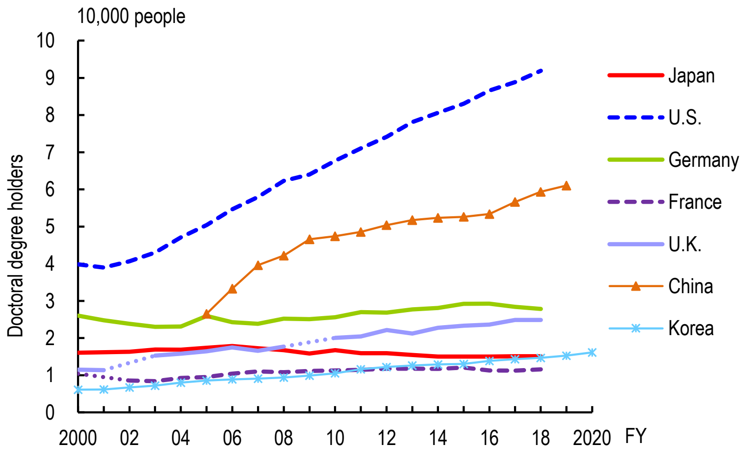
Reference: Chart 2-1-18(A), Japanese Science and Technology Indicators 2021 (in Japanese)

4. Students and graduate students: situations in Japan and selected countries

(1) The number of new doctoral degree recipients in Japan is on the decline.

Comparing the latest year's data for each country, the U.S. had the largest number of new doctoral degree recipients (92,000), followed by China (61,000) and Germany (28,000). Japan had 15,000 new doctoral degree recipients. Compared to FY2000 (FY2005 for China), the number has more than doubled in Korea, China, the U.S., and the U.K. Germany and France have remained almost flat, while Japan's number peaked in FY2006 and has been on a slight downward trend since.

[Summary Chart 8] Changes in the number of new doctoral degree recipients in the selected countries

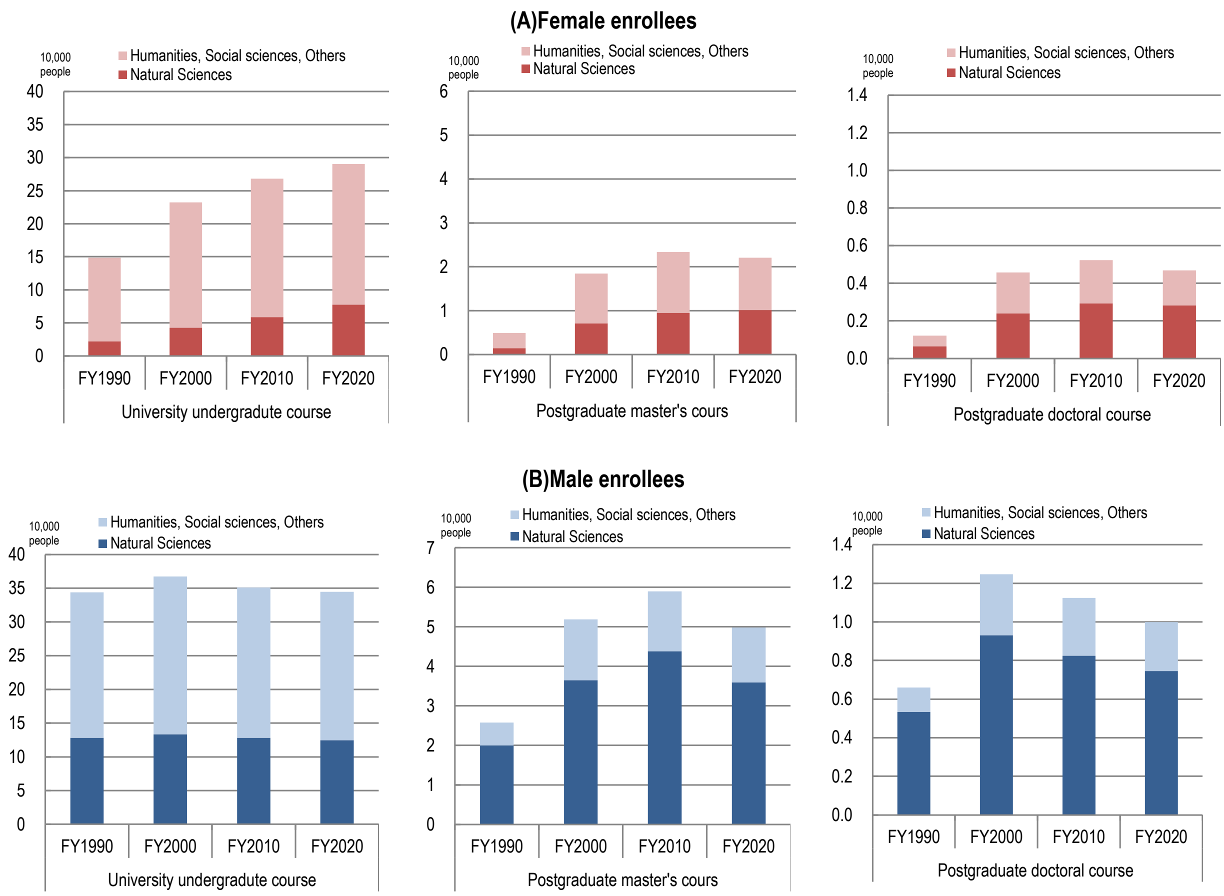


Note:
The number of new doctoral degree recipients in the United States is the value calculated by subtracting all the figures for “Professional fields” (formerly referred to as “First-professional degrees”) from the figures for “Doctor’s degrees” stated in the “Digest of Education Statistics.”
Reference: Chart 3-4-4(A), Japanese Science and Technology Indicators 2021 (in Japanese)

(2) The number of male students newly enrolled in doctoral courses in Japan has been declining. The number of their female counterpart had increased over long term but has decreased slightly in the past 10 years.

Looking at the number of students newly enrolled in undergraduate, master's, and doctoral programs in Japan at the four different points in time, the number of new female enrollees in undergraduate departments increased throughout, while the number of those in master's and doctoral programs increased until the third time point (FY 2010) and then it was slightly lower at the fourth (FY 2020). The number of new male enrollees in undergraduate departments and doctoral programs increased until the second time point (FY2000), and then decreased. The decrease in the number of new enrollees in doctoral programs is particularly pronounced.

[Summary Chart 9] Numbers of students enrolling in undergraduate departments, master's programs, and doctoral programs



Reference: Chart 3-2-7, Japanese Science and Technology Indicators 2021 (in Japanese)

5. R&D outputs: circumstances in Japan and the selected countries

(1) Compared with ten years ago, the number of Japanese papers has been stable, which results in the drop in the ranking due to the increase in the number in other countries. The decline of Japan's ranking is noticeable in highly cited papers (the number of adjusted top 10% papers and adjusted top 1% papers). China ranked first in the world both in the number of papers and of adjusted top 10% papers.

In terms of the number of scientific papers, which is one measure of R&D outputs, the number of Japanese papers (the average of PY2017–2019) is ranked 4th after China, the United States, and Germany, when counted by the fractional counting method that measures the degree of contribution to paper production. Japan ranked 10th in the number of adjusted top 10% papers, down one place from the previous time frame China surpassed the U.S. and ranked first in the world in the number of adjusted top 10% papers as well.

[Summary Chart 10] Top 10 countries/regions in terms of the number of papers, the number of adjusted top 10% papers (based on the fractional counting method)

All fields	1997 — 1999 (PY) (Average)		
	The number of papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	202,446	28.3	1
Japan	62,684	8.8	2
Germany	50,931	7.1	3
U.K.	50,325	7.0	4
France	37,436	5.2	5
Canada	24,350	3.4	6
Italy	24,062	3.4	7
Russia	22,731	3.2	8
China	19,575	2.7	9
Spain	16,544	2.3	10

All fields	2007 — 2009(PY) (Average)		
	The number of papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	242,115	23.4	1
China	95,939	9.3	2
Japan	65,612	6.3	3
Germany	56,758	5.5	4
U.K.	53,854	5.2	5
France	41,801	4.0	6
Italy	35,911	3.5	7
Canada	33,846	3.3	8
India	32,467	3.1	9
Korea	28,430	2.7	10

All fields	2017 — 2019 (PY) (Average)		
	The number of papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
China	353,174	21.8	1
U.S.	285,717	17.6	2
Germany	68,091	4.2	3
Japan	65,742	4.1	4
U.K.	63,575	3.9	5
India	63,435	3.9	6
Korea	50,286	3.1	7
Italy	47,772	2.9	8
France	44,815	2.8	9
Canada	42,188	2.6	10

All fields	1997 — 1999 (PY) (Average)		
	The number of adjusted top 10% papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	30,610	42.8	1
U.K.	5,973	8.4	2
Germany	4,847	6.8	3
Japan	4,336	6.1	4
France	3,532	4.9	5
Canada	2,849	4.0	6
Italy	2,046	2.9	7
Netherlands	1,797	2.5	8
Australia	1,628	2.3	9
Spain	1,309	1.8	10

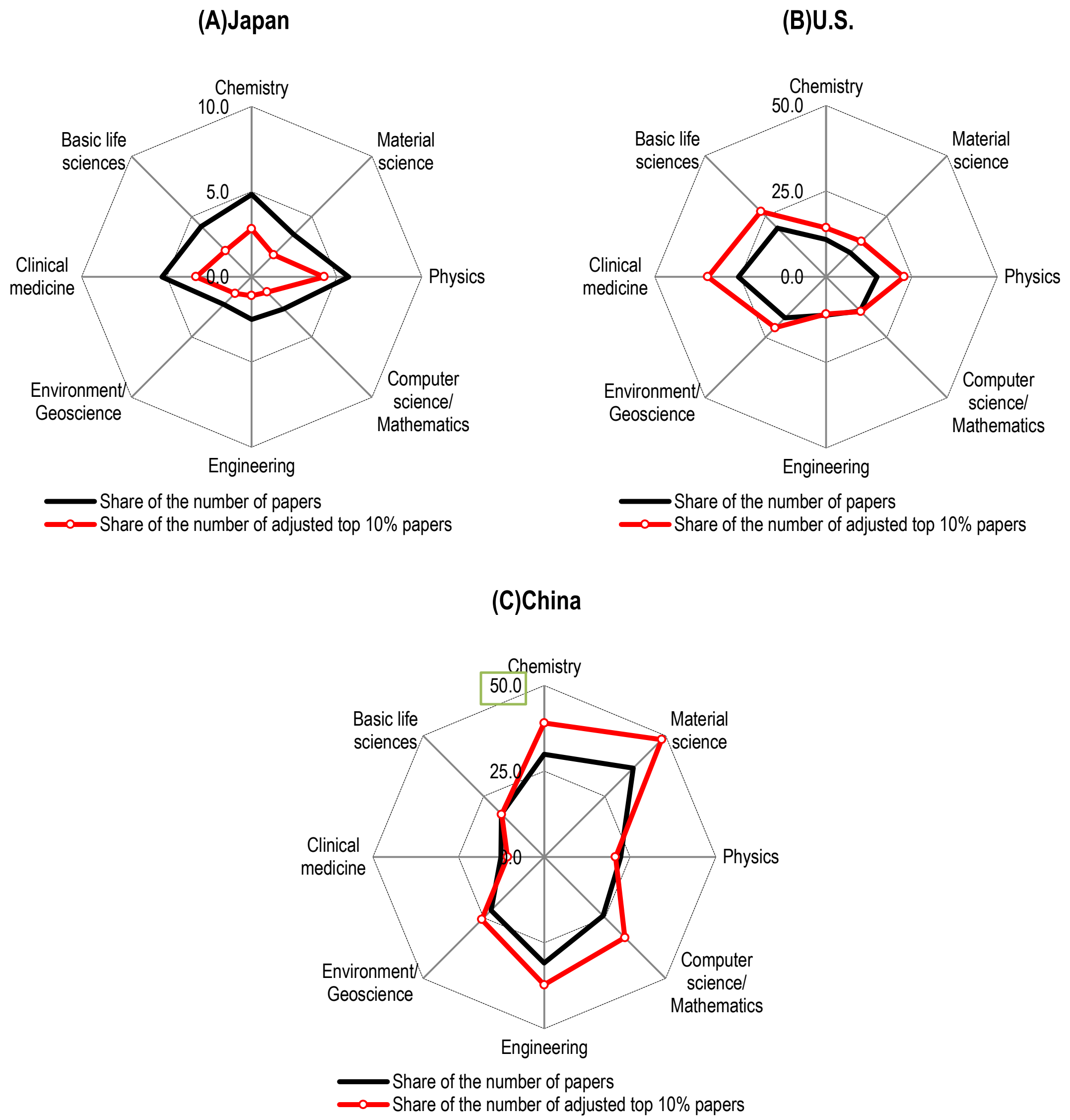
All fields	2007 — 2009(PY) (Average)		
	The number of adjusted top 10% papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	36,196	34.9	1
China	7,832	7.6	2
U.K.	7,250	7.0	3
Germany	6,265	6.0	4
Japan	4,437	4.3	5
France	4,432	4.3	6
Canada	3,951	3.8	7
Italy	3,279	3.2	8
Australia	2,711	2.6	9
Spain	2,705	2.6	10

All fields	2017 — 2019 (PY) (Average)		
	The number of adjusted top 10% papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
China	40,219	24.8	1
U.S.	37,124	22.9	2
U.K.	8,687	5.4	3
Germany	7,248	4.5	4
Italy	5,404	3.3	5
Australia	4,879	3.0	6
Canada	4,468	2.8	7
France	4,246	2.6	8
India	4,082	2.5	9
Japan	3,787	2.3	10

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 2020.
Reference: Chart 4-1-6, Japanese Science and Technology Indicators 2021 (in Japanese)

Comparing the shares of the number of adjusted top 10% papers by field, the shares of "physics," "clinical medicine," and "chemistry" are higher in Japan than those of other fields. In the U.S., the shares of "clinical medicine," "basic life sciences," and "physics" are high. In China, the shares of "material science," "chemistry," "engineering," and "computer science/mathematics" are high.

[Summary Chart 11] A comparison of the share of the papers and adjusted top 10% papers in main countries by field (%, 2017–2019, fractional counting)



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 2020.
Reference: Chart 4-1-10, Japanese Science and Technology Indicators 2021 (in Japanese)

(2) Japan has maintained the 1st position in the world in the number of patent families (patents filed in two or more countries/regions) in the past ten years. Japan's shares in "information and communications technology" and "electrical engineering" are declining as China's shares increase.

This section examines the status of patent applications by analyzing the number of patent families, which is the number of inventions created in each country/region measured in an internationally comparable manner.

Between 1994 and 1996, the United States was ranked the first and Japan the second. Between 2003 and 2005 and between 2013 and 2015, Japan was ranked the first and the United States the second. The increase in the number of Japanese patent families is attributable to the increase of patent applications to multiple countries instead of any single country. China's number of patent families has been steadily increasing although it was ranked fifth between 2014 and 2016.

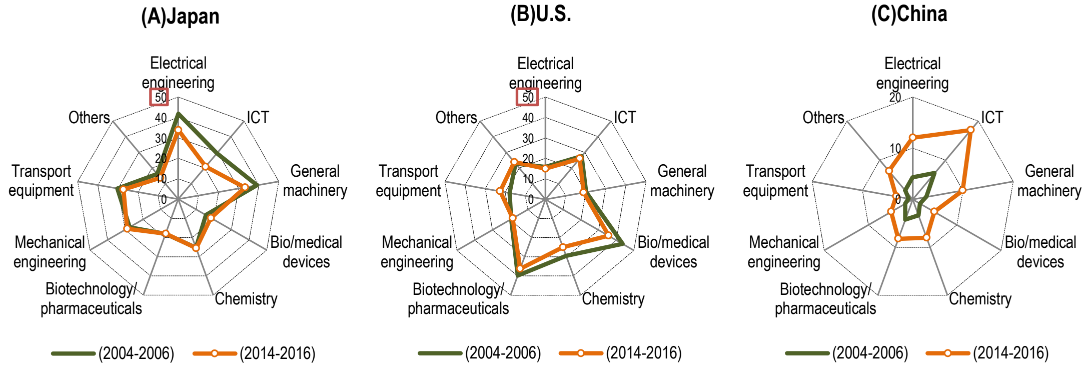
In terms of technological fields, Japan has high shares in "electrical engineering" and "general machinery"; the U.S. has high shares in "biomedical devices" and "biotechnology/pharmaceuticals"; and China has high shares in "information and communications technology" and "electrical engineering." Compared to 10 years ago, China's shares have expanded while Japan's shares in "information and communications technology" and "electrical engineering" have shrunk.

[Summary Chart 12] The number of patent families by selected country/region: top 10 countries/regions

1993 - 1995(Average)				2003 - 2005(Average)				2013 - 2015(Average)			
Country/Region	Number of patent families (Whole counting)			Country/Region	Number of patent families (Whole counting)			Country/Region	Number of patent families (Whole counting)		
	Patent Families	Share	World rank		Patent Families	Share	World rank		Patent Families	Share	World rank
U.S.	26,066	28.7	1	Japan	57,034	29.6	1	Japan	61,753	26.3	1
Japan	24,470	26.9	2	U.S.	48,219	25.0	2	U.S.	54,150	23.0	2
Germany	15,147	16.7	3	Germany	27,678	14.4	3	Germany	26,895	11.4	3
France	5,839	6.4	4	Korea	15,979	8.3	4	Korea	23,963	10.2	4
U.K.	4,894	5.4	5	France	10,210	5.3	5	China	21,191	9.0	5
Italy	2,658	2.9	6	U.K.	8,569	4.4	6	France	11,167	4.8	6
Korea	2,582	2.8	7	Taiwan	6,890	3.6	7	Taiwan	10,760	4.6	7
Switzerland	2,254	2.5	8	China	5,921	3.1	8	U.K.	8,754	3.7	8
Netherlands	1,914	2.1	9	Netherlands	5,034	2.6	9	Canada	5,253	2.2	9
Canada	1,904	2.1	10	Canada	4,924	2.6	10	Italy	4,232	1.8	10

Note:
Figures in "3 countries or more" and "2 countries" correspond to patent families through joint international patent appcilation.
Reference: Chart 4-2-8, Japanese Science and Technology Indicators 2021 (in Japanese)

[Summary Chart 13] Comparison of the shares of patent families by technological fields in the selected countries (%, 2004-2006 and 2014-2016, whole counting)



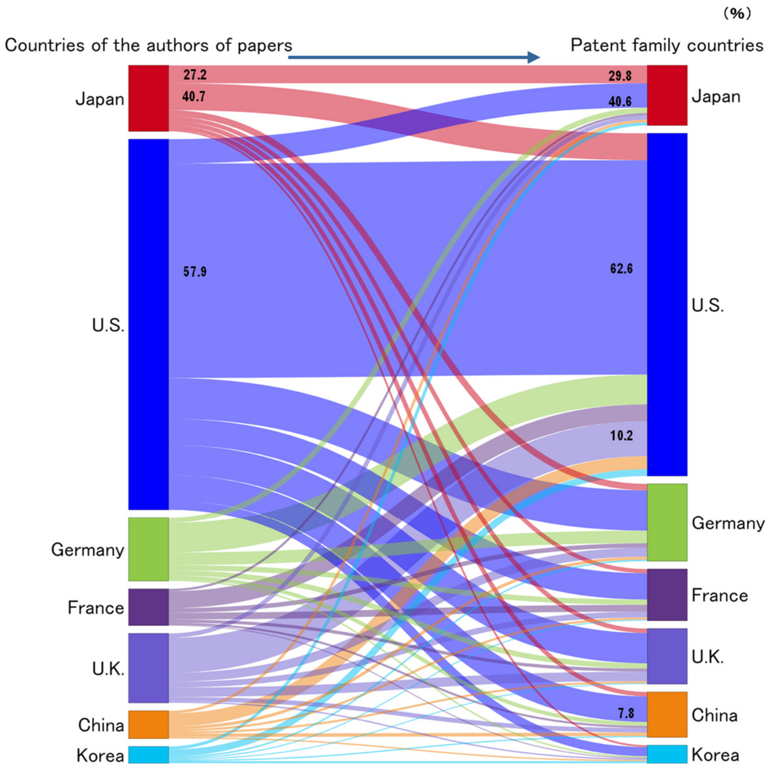
Note:
Same as Summary Chart12. The item "ICT" in Summary Chart 13 stands for "information and communications technology."
Reference: Chart 4-2-10, Japanese Science and Technology Indicators 2021 (in Japanese)

(3) It is the U.S. papers that are most cited by the patent families of any of the selected countries.

To see the linkage between science and technology (science linkage), an analysis was conducted using the information on papers cited by patent families (filed in 2009-2016). Japanese papers account for 29.8% of all the papers cited by patent families originating from Japan. However, the largest percentage of papers cited by Japanese patent families are from the U.S. (40.6%). It is the U.S. papers that are most cited by the patent families of any of the selected countries. In the U.S., the U.K.'s papers are the second-most cited (10.2%), after the U.S. papers.

China's patent families tend to cite papers from their own country at a lower rate (7.8%) than patent families of other selected countries do. In addition, the share of Chinese papers cited by patent families is smaller than China's share in the number of papers.

[Summary Chart 14] Linkage between science and technology among the selected countries



Reference: Chart 4-3-4, Japanese Science and Technology Indicators 2021 (in Japanese)

6. Science, technology, and innovation: circumstances in Japan and the selected countries

(1) The U.S. is the largest trading partner country/region for Japan's technology imports and exports (between unaffiliated companies). For the U.S., China is the largest technology importer, and the U.K. the largest technology exporter (between unaffiliated companies).

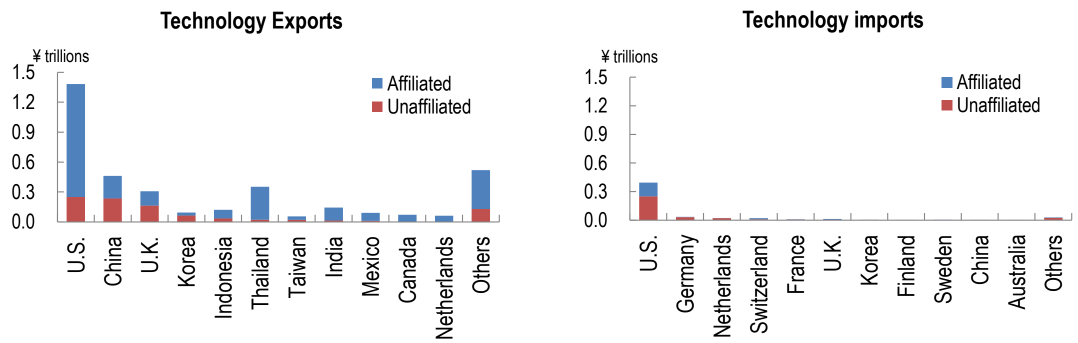
In terms of Japan’s international technology trade between unaffiliated companies the U.S. is the largest importer of Japan's technology by value (249.2 billion yen), followed by China (236.3 billion yen). Also, Japan buys technology from the U.S. more than any other country by value, and some 60% of such trade (valued 250.3 billion yen) is made between unaffiliated companies.

In terms of the U.S.’s international technology trade between unaffiliated companies, China is the largest technology importer from the U.S. by value (451.3 billion yen), followed by Japan (383.2 billion yen). The U.S. buys technology from the U.K. more than from any other country by value in terms of trade between unaffiliated companies, while Japan becomes the largest technology supplier for the U.S. when it comes to trade between affiliated companies. China is not included in the largest trading partner countries/regions for technology imports by the U.S.

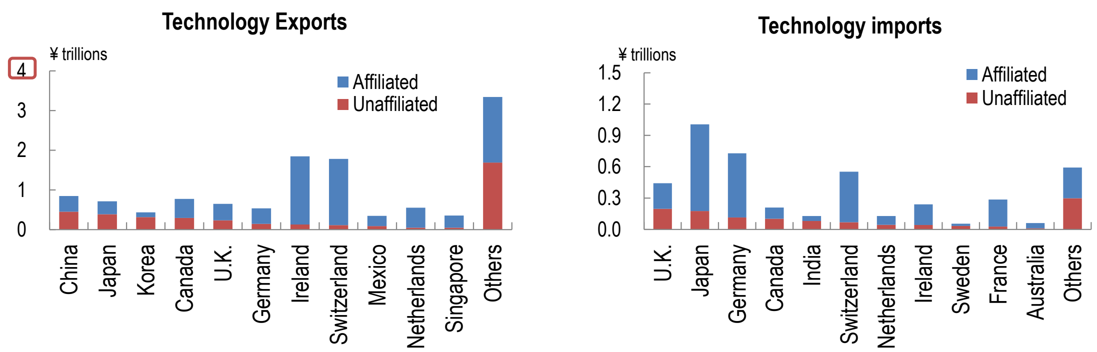
[Summary Chart 15] Technology exports and imports by partner country/region: Japan vs. the United States（2019）

Attention to international comparison

(A)Japan



(B)U.S.



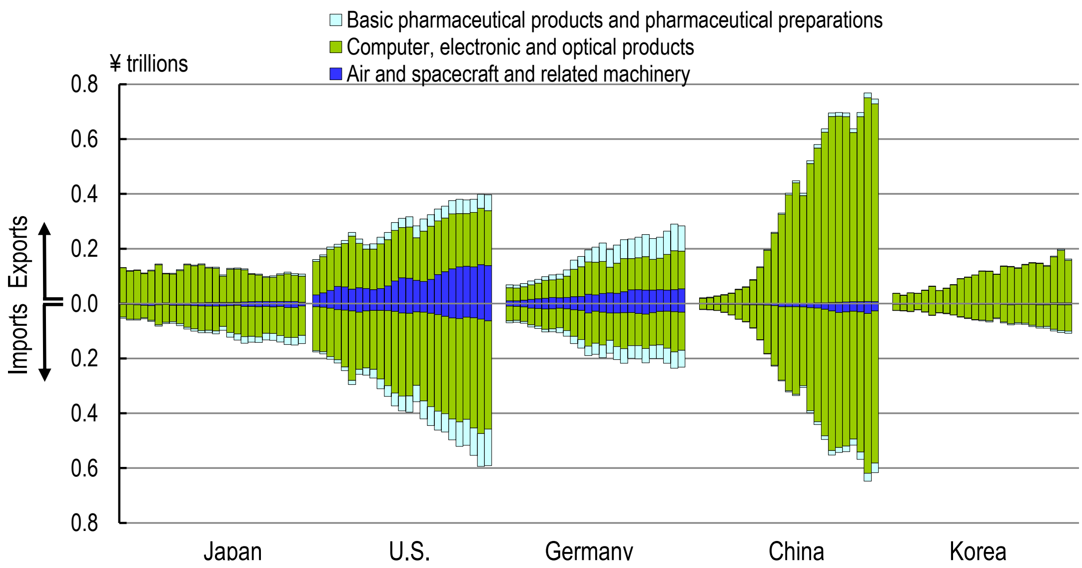
Note:
1) The definition of affiliated companies is different between Japan and the United States, which requires attention in international comparison. The following are major differences in the definition of affiliated companies between the two countries.
2) Japan: A parent company owns more than 50% of the stake of its subsidiary company.
The types of Japanese technology trade include 1) patent right, utility model right, and copyright, 2) design right, 3) technical know-how service and technical guidance (except ones provided free of charge), and 4) technical assistance to developing countries (including government-commissioned assistance).
The amounts for Japan are financial-year-based.
3) U.S.: If a company directly or indirectly owns 10% or more of equity or a voting right of another company, the subsidiary company is called an affiliated company.
The types of U.S. technology trade include 1) Trademarks, 2) Franchise fees, 3) Outcomes of research and development include patents, industrial processes, and trade secrets, 4) Computer software, 5) Movies and television programming, 6) Books and sound recordings, 7) Broadcasting and recording of live events.
Reference: Chart 5-2-4, Japanese Science and Technology Indicators 2021 (in Japanese)

(2) The trade balance ratio shows Japan's high R&D intensive industries are in trade deficit while medium-high R&D intensive industries are in trade surplus.

In many countries, "computer, electronic and optical products" dominate the trade in high R&D intensive industries in terms of both import and export values. The trade balance ratio (of the latest year for each country) shows that Japan and the U.S. are in trade deficit while Germany, China, and Korea are in trade surplus. In terms of the export value of medium-high R&D intensive industries (of the latest year for each country), "motor vehicles, trailers and semi-trailers" account for the largest share in Japan and Germany, "chemicals and chemical products" being the largest in the U.S. and Korea, and "electrical equipment" in China. The trade balance ratio shows that Japan, Germany, China, and Korea are in trade surplus while the U.S. is in trade deficit.

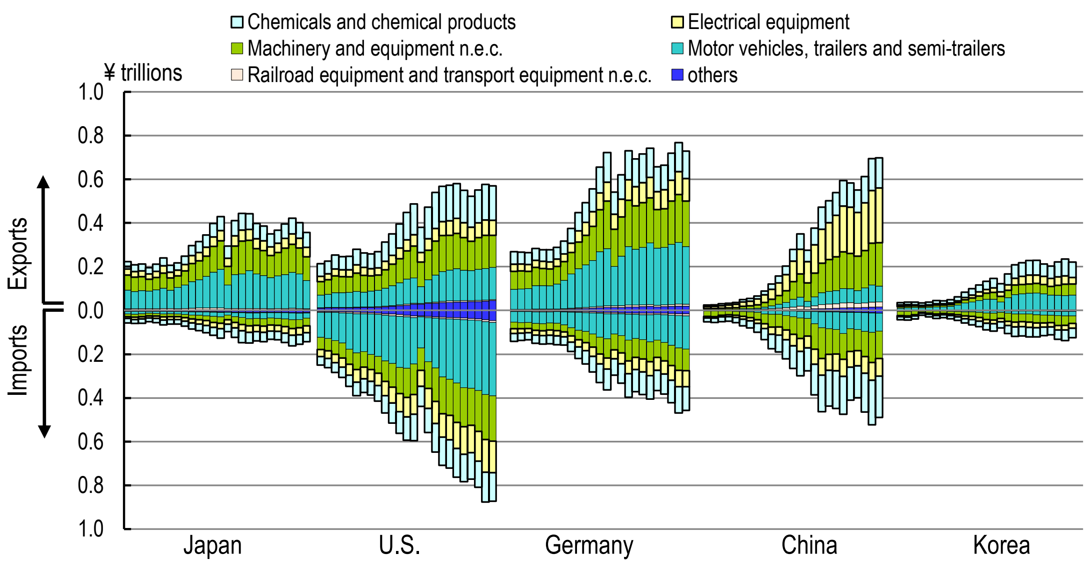
[Summary Chart 16] Trends in the value of industrial trade in the selected countries

(A) High R&D intensive industries



Reference: Chart 5-2-3, Japanese Science and Technology Indicators 2021 (in Japanese)

(B) Medium-high R&D intensive industries



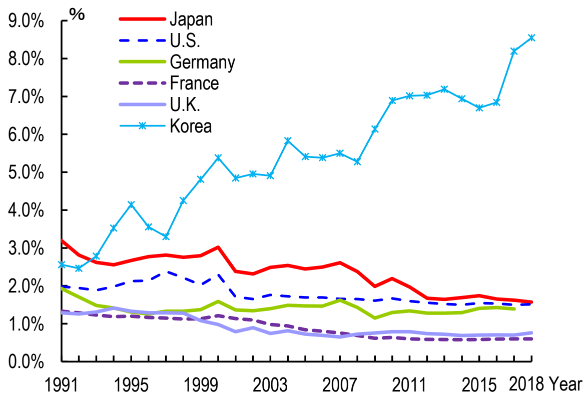
Reference: Chart 5-2-5, Japanese Science and Technology Indicators 2021 (in Japanese)

(3) In Japan, the share of "computer, electronic and optical products" is falling in the gross value added of all industries, that of "basic pharmaceutical products and pharmaceutical preparations" is flat, and that of "motor vehicles, trailers and semi-trailers" is on the rise.

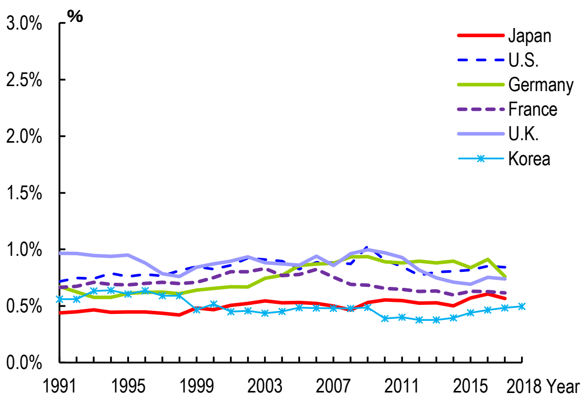
Looking at the shares of "computer, electronic and optical products," "basic pharmaceutical products and pharmaceutical preparations," and "motor vehicles, trailers and semi-trailers" in the gross value added of all industries in the selected countries, the share of "computer, electronic and optical products" has grown significantly in Korea, and the share of "basic pharmaceutical products and pharmaceutical preparations" has remained flat in all countries. In "motor vehicles, trailers and semi-trailers," Germany, Japan, and Korea are on a long-term upward trend, while the U.K., the U.S., and France are declining slightly or remaining flat.

[Summary Chart 17] Shares in gross value added in the selected countries

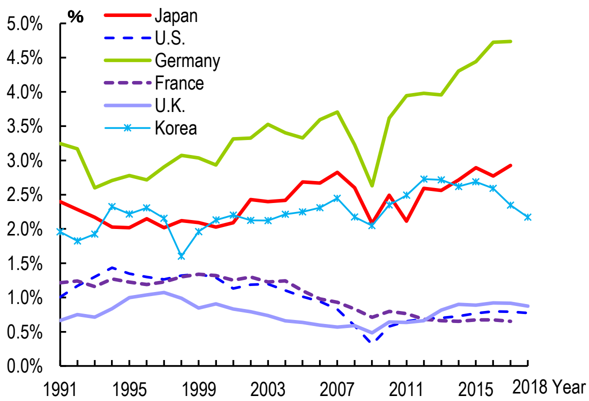
(A) Computer, electronic and optical products



(B) Basic pharmaceutical products and pharmaceutical preparations



(C) Motor vehicles, trailers and semi-trailers



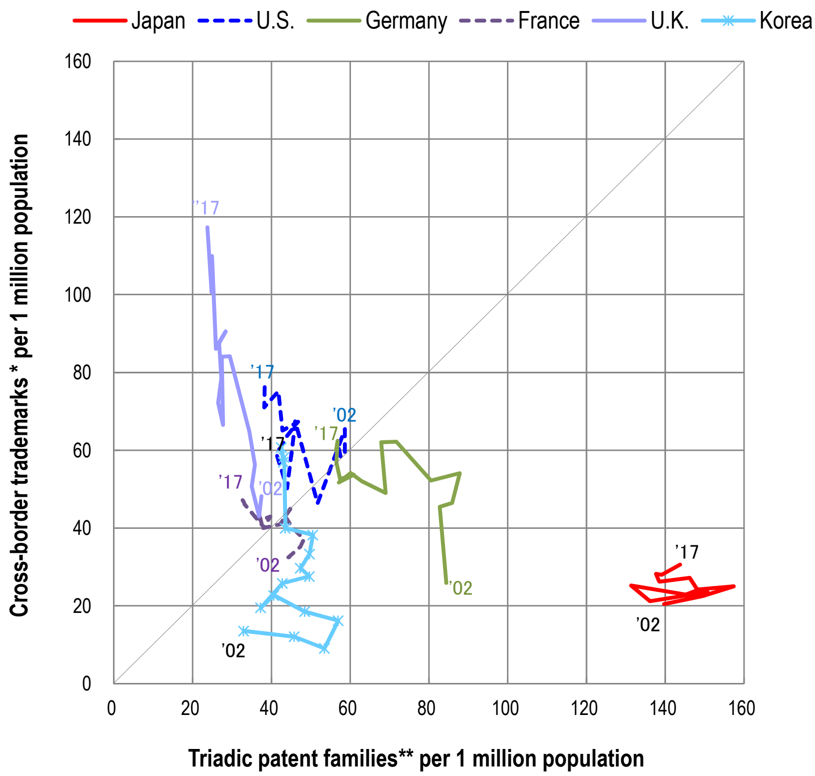
Note:
Value added is calculated by subtracting intermediate input (products that are necessary to produce goods and services and are invested as costs) from gross output (products) by residents of the country.
Reference: Chart 5-2-7, Japanese Science and Technology Indicators 2021 (in Japanese)

(4) Japan has strength in technology yet with a possibility of lagging other selected countries in terms of international launching of new products or services based on their technologies

When comparing the numbers of cross-border applications for trademarks and patent families per million populations, Japan is the only country with fewer trademark applications than patent family applications in the latest year.

In Korea, the United Kingdom, and Germany, the number of trademark applications surged in the period between 2002 and 2018.

[Summary Chart 18] Cross-border trademark applications and patent applications (per 1 million population)

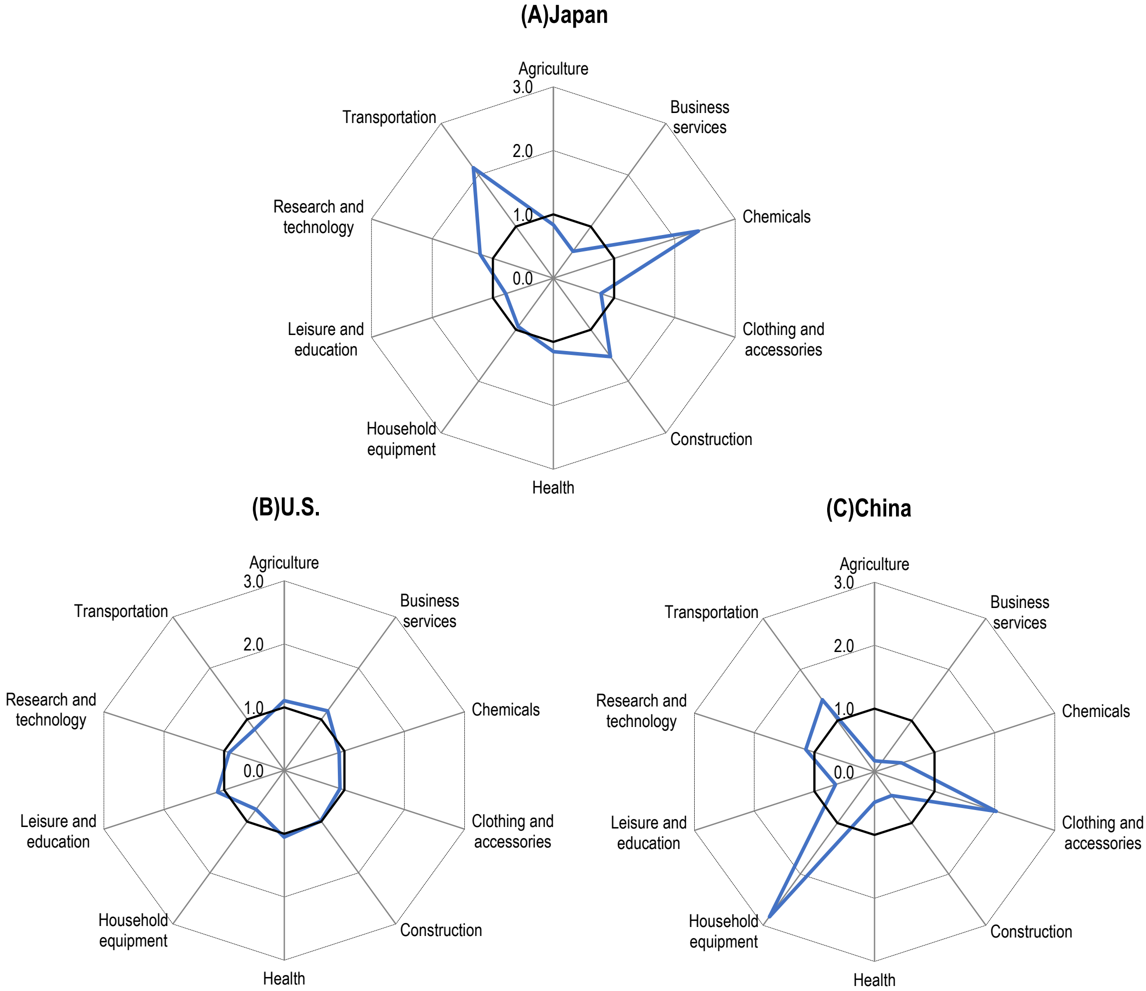


[Meaning of the number of trademark applications as an indicator]
The number of trademark applications is related to concretizations of innovations in the forms of new product or service introductions, or marketing activities thereof. In this sense, the number of trademark applications is considered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

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).
Reference: Chart 5-3-3, Japanese Science and Technology Indicators 2021 (in Japanese)

Looking at the industry sector composition based on the International Classification of Goods and Services (Nice Classification) in trademark applications to the U.S., Japan has many trademark applications related to "chemicals" and "transportation." China has many trademark applications related to "household equipment" and "clothing and accessories."

[Summary Chart 19] Industry sector composition based on Nice Classification in trademark applications from the selected countries to the U.S. (specialization coefficient)



Note:

1) For a correspondence table between Nice Classification and industry sectors, "Annex B. Composition of industry sectors by Nice goods and services classes" in "World Intellectual Property Indicators 2020" by WIPO was consulted.
2) Applications for international registration using the Madrid System (international applications) and direct applications
3) The number of classes is measured. Data shown are specialization coefficients, which represent the ratio of applications (number of classes) to the U.S. by a particular country against applications to the U.S. from all countries, both in a particular industry sector. (Specialization coefficient = Composition rate of industry sector A (e.g. household equipment) in trademark applications from a particular country to the U.S. / Composition rate of industry sector A in trademark applications from all countries to the U.S.). The totals for 2017-2019 are used.

Reference: Chart 5-3- 4(C), Japanese Science and Technology Indicators 2021 (in Japanese)

Characteristics of the Japanese Science and Technology Indicators

"The Japanese Science and Technology Indicators" is published annually to present the most recent statistics/indicators at the time of publication. The statistics/indicators are selected considering the following two conditions: 1) the indicators should allow either of the time-series comparison or the comparison among the selected countries and 2) the indicators should be possible to update annually in principle.

NISTEP conducted analysis of paper and patent databases

Paper data were aggregated and analyzed by NISTEP using Web of Science provided by Clarivate Analytics. Patents family data were aggregated and analyzed by NISTEP using PATSTAT (the patent database of the European Patent Office).

Use of "reminder marks" for international comparisons and time-series comparisons

The reminder marks "attention to international comparison" and "attention to trend" have been attached to graphs where they are required. Generally, the data for each country are collected in line with the OECD's manuals. However, differences in methods or scope of collecting data exist, and therefore attention is necessary when making comparisons in some cases. Such cases are marked "attention to international comparison." Likewise, for some time series data, data could not be continuously collected under the same conditions due to changes in statistical standards. Cases where special attention is required when reading chronological trends are marked "attention to trend." Specifics for such points requiring attention are provided in the notes of individual charts.

In order to download the collection of statistics (numerical data for the graphs in this report)

The numerical data for the graphs in this report can be downloaded from the following URL or 2D barcode.

https://www.nistep.go.jp/research/indicators

The references shown below the summary charts in this report indicate the table numbers in the collection of statistics.

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