Research Material-251

Digest of Japanese Science and Technology

Indicators 2016

Aug. 2016

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National Institute of Science and Technology Policy, MEXT

This material is the English translation of the executive summary of the "Japanese Science and Technology Indicators 2016" published by NISTEP in August 2016.

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Please specify reference as the following example when citing this NISTEP RESEARCH MATERIAL.

"Japanese Science and Technology Indicators 2016", *NISTEP RESEARCH MATERIAL* No. 251, National Institute of Science and Technology Policy, Tokyo.

DOI：http://doi.org/10.15108/rm251e

Japanese Science and Technology Indicators 2016（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, R&D Expenditure; R&D Personnel; Higher Education; The Output of R&D; and Science, Technology, and Innovation. The multiple relevant indicators (approximately 150 indicators) show the state of Japanese science and technology activities. "Japanese Science and Technology Indicators 2016" includes new indicators and indicators with modified visualization, totally about 10 indicators, such as the global mobility of foreign students (higher education level), the respective situations of technological trade in Japan and the United States, and the external sources of information that companies think important in innovation activities.

Overviewing the latest Japan's situation from "Science and Technology Indicators 2016," it was found that in the Japanese business enterprise sector, the manufacturing industry accounts for 87% of research and development expenditure and for 88% of the researchers. Also, the number of researchers per 1,000 labor force is 547 in the manufacturing industry and 53 in the non-manufacturing industry.

The number of Japanese students studying overseas (1.0% of students worldwide) and the number of students from overseas accepted into higher education institutions in Japan (4.2%) are both small. The country that sent out the largest number of students for overseas studies is China at 20.7%. The United States accepted the largest number of foreign students at higher education institutions (24.0% of students worldwide), followed by the United Kingdom at 12.8%.

The number of scientific publications from Japan remained almost flat in last 10 years, however the position of Japan in the global rank moved down due to a growth of other countries. Japan has remained, however, as the top in the number of patent families since 10 years ago.

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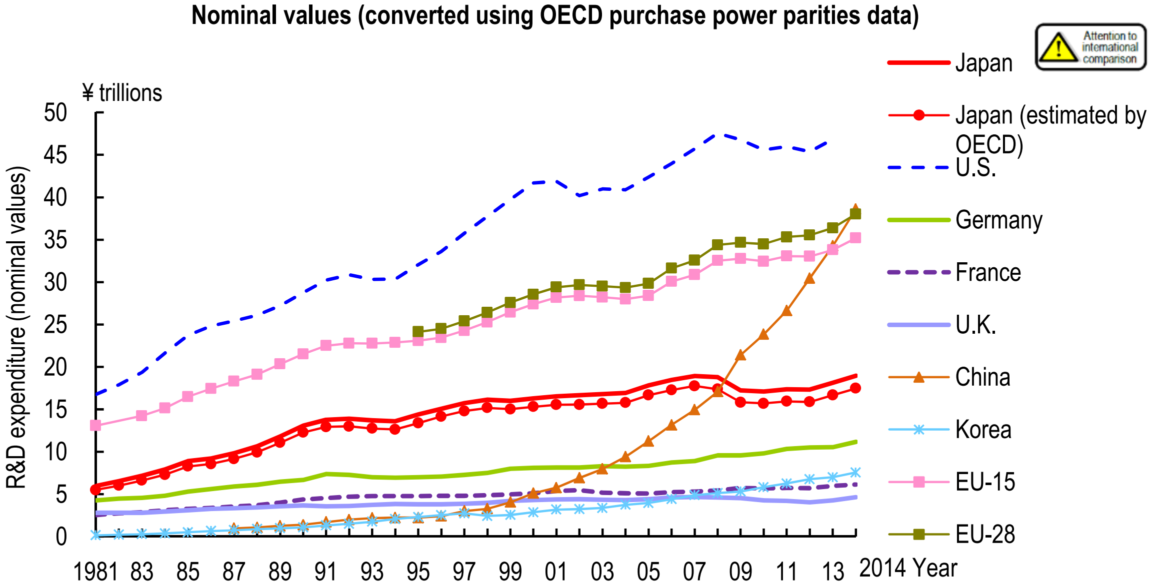
1. Circumstances in Japan and the selected countries in terms of R&D expenditure

(1) Japan's total R&D expenditure was 19.0 trillion yen in 2014 (OECD-estimated Japan: 17.5 trillion yen), the world's third largest after the United States and China.

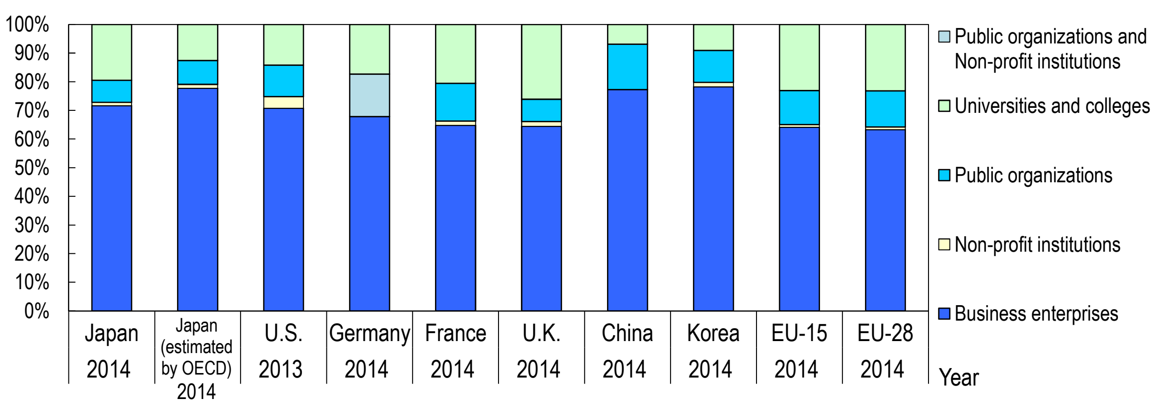
Japan's total R&D expenditure was 19.0 trillion yen in 2014 (OECD-estimated Japan: 17.5 trillion yen). After remaining almost flat since 2009, Japan's R&D expenditure increased 4.6% in 2014 from the previous year (OECD-estimated Japan: 4.8%). The United States' total R&D expenditure was 46.9 trillion yen in 2013, overwhelming all the other countries. After surpassing Japan in 2009, China's total R&D expenditure has constantly increased to 38.6 trillion yen. As to the percentage of R&D expenditure by sector, the business enterprises sector accounts for the largest in the total. This tendency is particularly clear in Asian countries including Japan. In major European countries, the percentages of sectors other than the business enterprises sector are higher compared with the other countries.

[Summary Chart 1] Changes in total R&D expenditure in the selected countries
Nominal values (converted using OECD purchase power parities data)



Reference: Chart 1-1-1, Japanese Science and Technology Indicators 2016 (in Japanese)

[Summary Chart 2] Percentage of R&D expenditure by sector in the selected countries

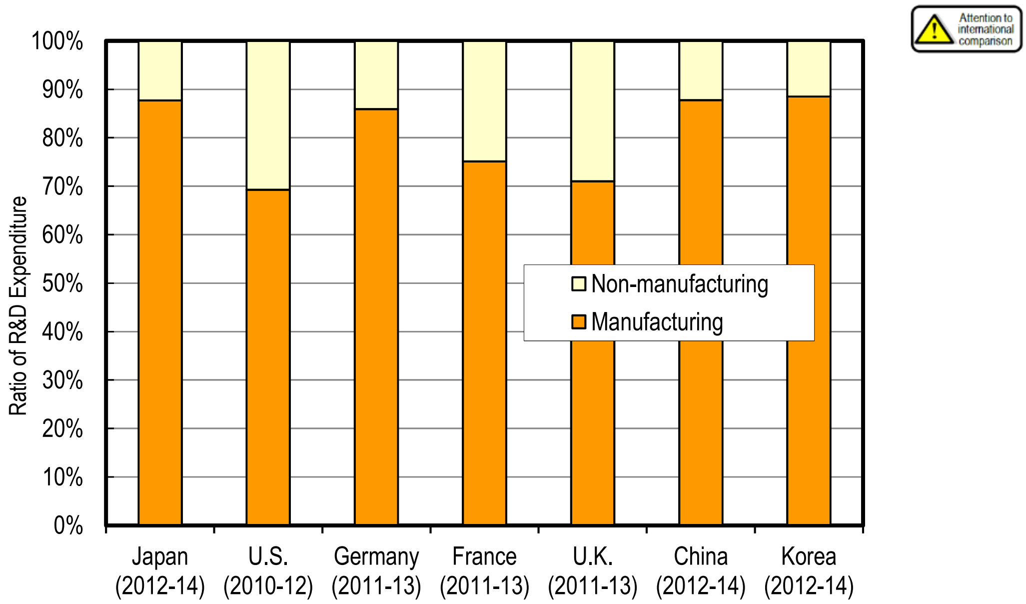


Reference: Chart 1-1-6, Japanese Science and Technology Indicators 2016 (in Japanese)

(2) The ratio of R&D expenditure in the manufacturing industry to that in the non-manufacturing industry varied depending on the country. The percentage of R&D expenditure in the manufacturing industry is relatively high in Japan among the selected countries.

According to the data on the ratio of R&D expenditure in the manufacturing industry to that in the non-manufacturing industry in the business enterprises sector, the average percentage of R&D expenditure in the manufacturing industry in Japan, Germany, China, and Korea was a little less than 90%. On the other hand, the percentage of R&D expenditure in the manufacturing industry was 70% in the United States and the U.K., and was a little higher than 70% in France. In these countries, the percentage of R&D expenditure in the non-manufacturing industry was higher compared with the other countries.

[Summary Chart 3] The ratio of R&D expenditure in the manufacturing industry to that in the non-manufacturing industry in the business enterprises sector of the selected countries

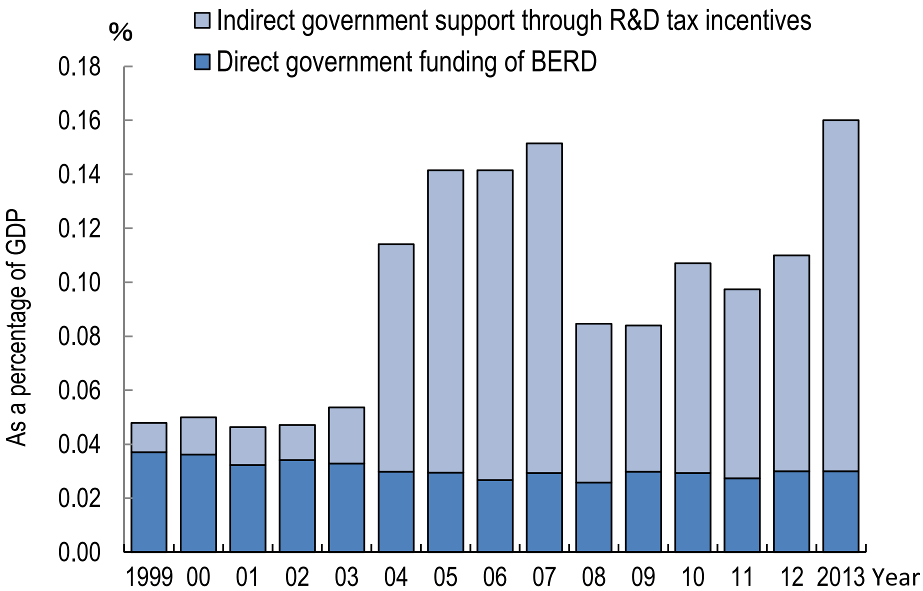


Reference: Chart 1-3-5, Japanese Science and Technology Indicators 2016 (in Japanese)

(3) Direct government funding to business enterprises has been on the decline over the long term. Indirect government support has been on the increase, though the amount of support changed significantly depending on the year.

As seen in the changes in Japan's direct government funding (i.e., the amount funded by the government to support business enterprises' R&D expenditure–expressed as a percentage of GDP) and in the changes in indirect government support (i.e., the amount of deducted corporate tax through R&D tax incentives–expressed as a percentage of GDP), Japan's direct government funding to business enterprises has been on the decline over the long term, but flat in recent years. On the other hand, Japan's indirect government support remarkably increased in 2004, but decreased in 2008 and increased again in 2013. The changes in the amount of R&D tax incentives are attributable to the changes in market conditions (economy, depression) and other factors.

[Summary Chart 4] Japanese government's direct and indirect support to help business enterprises with R&D



Reference: Chart 1-3-8, Japanese Science and Technology Indicators 2016 (in Japanese)

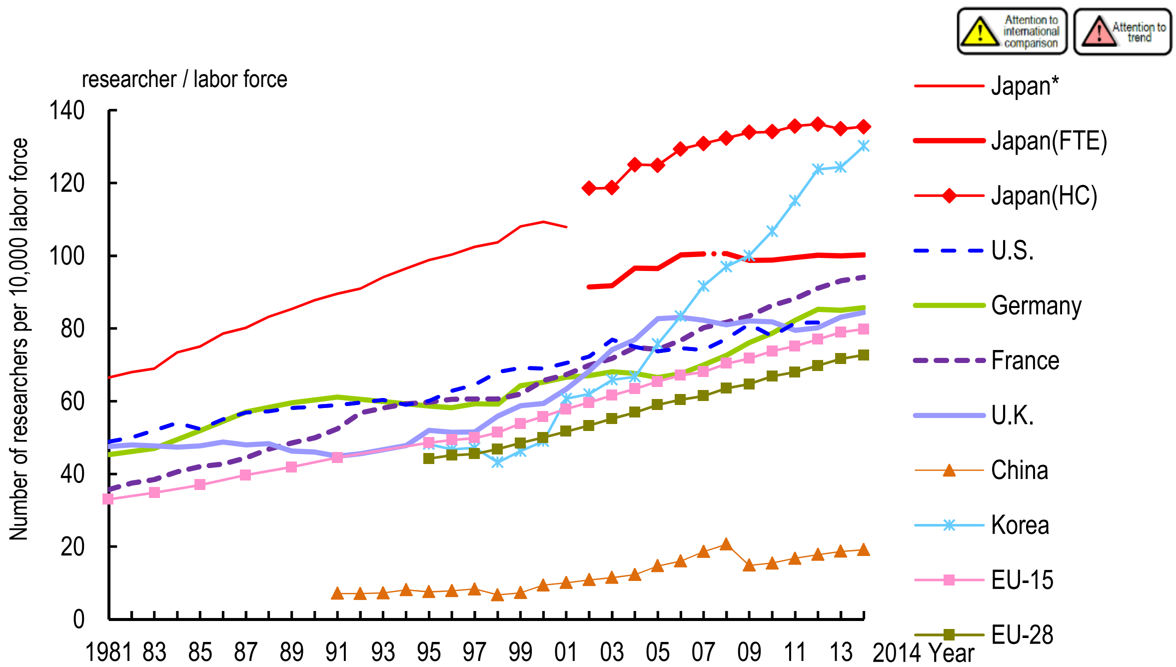
2. Circumstances in Japan and the selected countries in terms of R&D personnel

(1) The number of researchers per 10,000 labor force in Japan has been relatively high among the selected countries. However, the growth of the number in the past 10 years has been slower compared with many of those countries.

As one of the key indicators, the number of researchers is as important as the amount of R&D expenditure. In the first half of the 2000s, the number of researchers (FTE[1]) per 10,000 labor force in Japan was the largest of the selected countries, but Korea took over the top position from Japan in 2009. As of 2014, Japan still maintains a relatively high FTE level among the selected countries.

Balance of the number of researchers by sector revealed that the percentage of researchers in the business enterprises sector in Japan, China, and Korea was higher compared with European major countries. In the past ten years or so, Japan and the U.K. have shown no major changes in all sectors. The other countries have been increasing the number of researchers per 10,000 labor force at a constant pace, especially the number of researchers in the business enterprises shows remarkable growth in Korea.

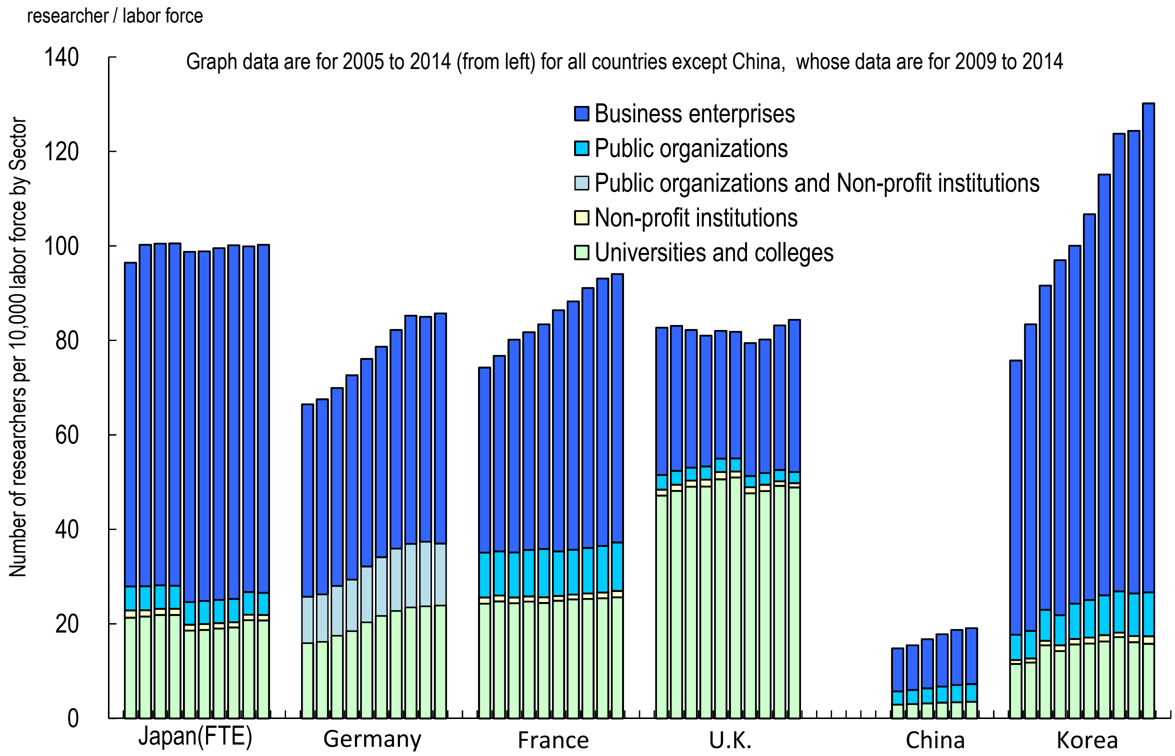
[Summary Chart 5] Changes in the number of researchers per 10,000 labor force



Reference: Chart 2-1-5, Japanese Science and Technology Indicators 2016 (in Japanese)

[1]There are two types of methods for counting the number of researchers: by counting the actual number (HC: Head Count) and by taking account of the degree of engagement in research (FTE: full-time conversion). Since the number of researchers is counted on the basis of FTE in the selected countries, it is appropriate that the number in Japan (FTE) be used when comparing it with other countries.

[Summary Chart 6] Changes in the number of researchers per 10,000 labor force by sector

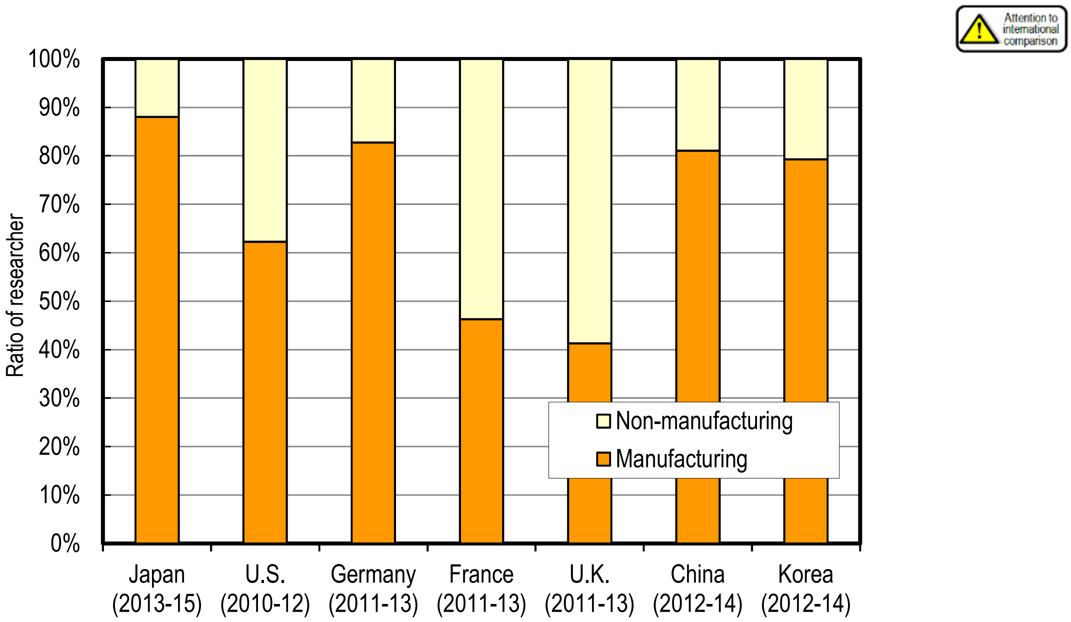


Reference: Chart 2-1-7, Science and Technology Indicators 2016, and Reference Statistics B (in Japanese)

(2) The ratio of researchers in the manufacturing industry to those in the non-manufacturing industry varied depending on the country. Particularly in the U.K. and France, the percentage of researchers in the non-manufacturing industry was higher than 50%.

According to the data on the ratio of researchers in the manufacturing industry to those in the non-manufacturing industry in the business enterprises, the percentage of researchers in the manufacturing industry was about 90% in Japan and about 80% in Germany, China, and Korea. On the other hand, the percentage of researchers in the manufacturing industry was around 60% in the United States and less than 50% in France and the U.K. In these countries, the percentage of researchers in the non-manufacturing industry was remarkably higher than the other countries. When comparing this with the ratio of R&D expenditure in the manufacturing industry to that in the non-manufacturing industry, which was described in [Summary Chart 3], the percentage of researchers in the non-manufacturing industry had a tendency to show a higher percentage. In contrast, for Japan and Germany, the ratio of R&D expenditure in the manufacturing industry to that in the non-manufacturing industry and the ratio of researchers in the manufacturing industry to those in the non-manufacturing industry are the same.

[Summary Chart 7] The ratio of researchers in the manufacturing industry to those in the non-manufacturing industry in the business enterprises sector of the selected countries



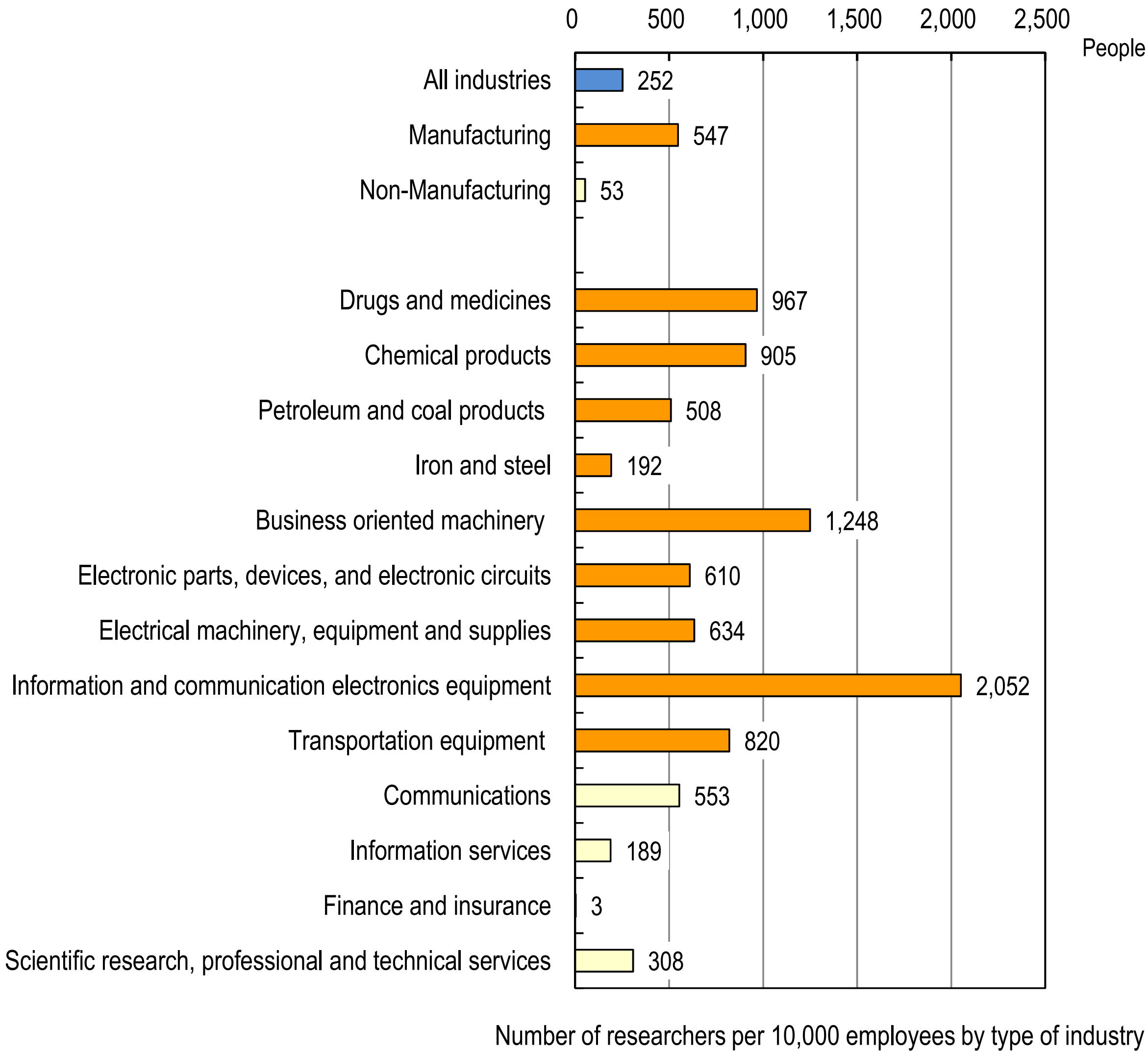
Reference: Chart 2-2-5, Japanese Science and Technology Indicators 2016 (in Japanese)

(3) In Japan, the number of researchers per 10,000 employees for each industry classification was larger in the manufacturing industry than in the non-manufacturing industry.

In Japan, the number of researchers per 10,000 employees for each industry classification is larger in the manufacturing industry (547) than in the non-manufacturing industry (53). The number of researchers engaged in the "information and communication electronics equipment" in the manufacturing industry is the largest at 2,052, which is followed by the "business oriented machinery" and "drugs and medicines".

On the other hand, in the non-manufacturing industry, the numbers of researchers engaged in the "communications" (553) and the "scientific research, professional and technical services" (308) are relatively large, though smaller compared with those in the manufacturing industry.

[Summary Chart 8] Number of researchers per 10,000 employees for each industry classification in Japan (2015)



Reference: Chart 2-2-7, Japanese Science and Technology Indicators 2016 (in Japanese)

3. The situation in Japan in terms of graduates of universities and colleges

(1) The percentage of the graduates in science and engineering who found employment in the non-manufacturing industry (except research and education) was 72.0% of the graduates of a bachelor's program and 42.2% of the graduates of a master's program. Those percentages have been on the increase over the long term. On the other hand, the percentage of graduates who found employment in the non-manufacturing industry (except R&D) of a doctor's program has slightly declined over the past 10 years to 22.2%.

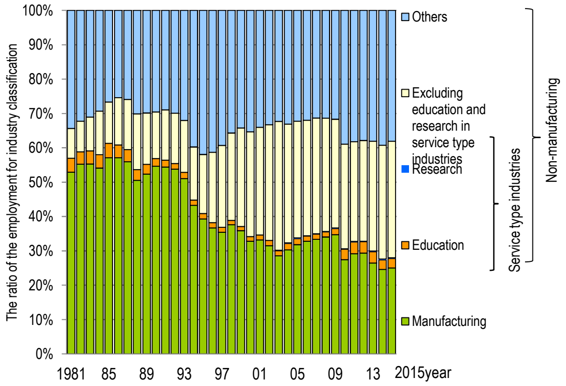
The data for each industry classification show that 50–60% of the graduates of a bachelor's program in science and engineering found employment in the "manufacturing industry" in the 1980s. Since then, that percentage has constantly declined to 25.0% in 2015. In contrast, the percentage of the graduates of a bachelor's program in science and engineering who found employment in the non-manufacturing industry (except the research and education) has increased to 72.0% in 2015.

In the 1980s, 70–80% of the graduates of a master's program in science and engineering found employment in the "manufacturing industry." Since then that percentage has constantly decreased to 60% in 2010 and then to 55.6% in 2015. In contrast, the percentage of the graduates of a master's program in science and engineering who found employment in the non-manufacturing industry (except the research and education) has increased to 42.2% in 2015.

About 30% of the graduates of a doctor's program in science and engineering found employment in the "manufacturing industry," and the percentage was 28.3% in 2015. The percentage of the graduates of a doctor's program in science and engineering who found employment in the "education" (e.g., schools) reached 50% in the middle of the 1980s. However, entering the 2000s, that percentage declined to a little less than 30% but the percentage in 2015 was 31.9%. Similarly, the percentage of the graduates of a doctor's program in science and engineering who found employment in the "research" (e.g., academic and R&D institutions) was 17.6% in 2015. On the other hand, the percentage of the graduates of a doctor's program in science and engineering who found employment in the non-manufacturing industry (except the research and education) has slightly declined in the past 10 years to 22.2% in 2015.

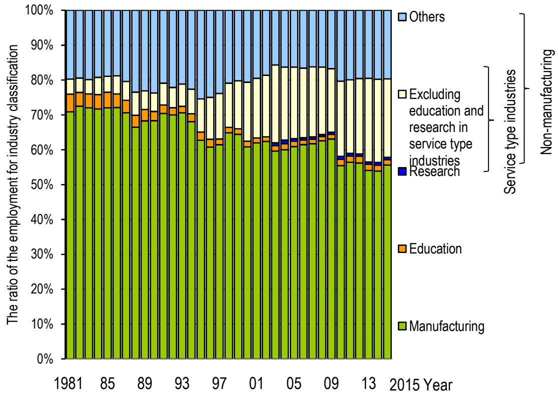
[Summary Chart 9] Employment status by industry classification of graduates in science and engineering

(A) Graduates of a bachelor's program in science and engineering



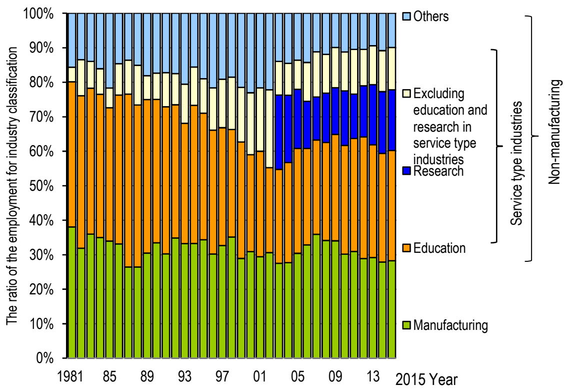
Reference: Chart 3-3-4, Japanese Science and Technology Indicators 2016 (in Japanese)

(B) Graduates of a master's program in science and engineering



Reference: Chart 3-3-5, Japanese Science and Technology Indicators 2016 (in Japanese)

(C) Graduates of a doctor's program in science and engineering



Reference: Chart 3-3-6, Japanese Science and Technology Indicators 2016 (in Japanese)

Notes:1) The number of graduates who found employment includes work-study students.

2) The following is the details of the service-related industries.
Education: Those who found employment at schools. For example, those who became faculties of universities fall under this category.
Research: Those who found employment at academic or R&D institutions (of which data have been collected since 2003).
Others: Information and communication, medical welfare, etc.

3) "Others" in the non-manufacturing industry include construction, wholesale and retail, finance, and insurance, public services, etc.

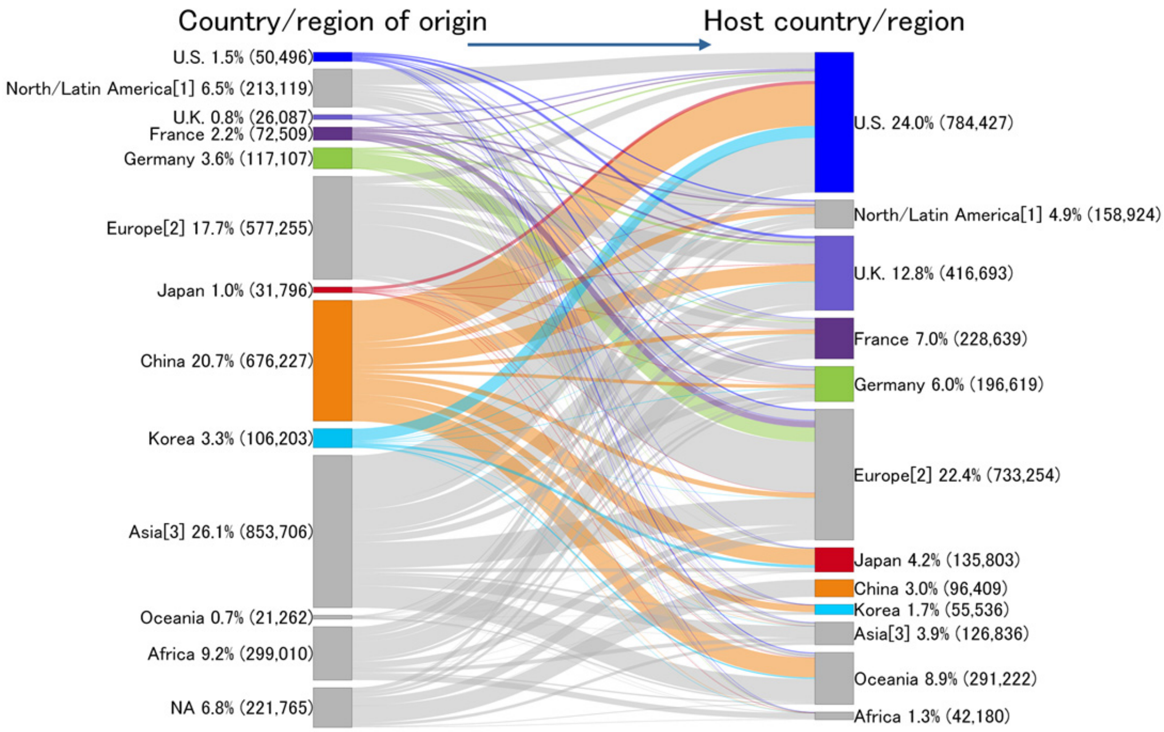
(2) Among the selected countries, Japan sending a smaller number of students to other countries and also hosting a smaller number of students from other countries.

Global relationship between the country/region of origins of foreign students and the country/region hosting those students at higher education (ISCED[2] level 5–8) shows that China, among the selected countries, is sending the largest number of students to many countries around the world, accounting for 20.7% of the world total. Following China, Germany is sending the second largest number of students to foreign countries (3.6% of the world total). On the other hand, the U.K. is sending the smallest number of students to other countries, accounting for 0.8% of the world total. Japan and the United States are among the countries that are sending a small number of students overseas (1.0% and 1.5%, respectively).

In terms of host country/region, the United States is hosting the largest number of foreign students, accounting for 24.0% of the world total. Following the United States, the U.K. is the second largest hosting country (12.8%), followed by France (7.0%), Germany (6.0%), Japan (4.2%), China (3.0%), and Korea (1.7%).

While sending many students to foreign countries, China and Korea are hosting only a small number of foreign students. In contrast, while not sending many students overseas, the United States and the U.K. are hosting many foreign students. Among the selected countries, Japan sending a smaller number of Japanese students to other countries and also hosting a smaller number of students from other countries.

[Summary Chart 10] Country/region of origins and host country/region of foreign students with high-level education (ISCED level 5–8) (2013)



Notes:1) Students with education level equivalent to ISCED 2011 level 5–8 (such as Japanese colleges including two-year colleges and technical colleges)
2) Foreign students refer to students who do not hold nationality of a host country/region.
3) China includes Hong Kong.
Reference: Chart 3-5-2, Japanese Science and Technology Indicators 2016 (in Japanese)

[2] ISCED (International Standard Classification of Education) developed by UNESCO. The latest version is ISCED 2011.

4. Circumstances in Japan and the selected countries in terms of R&D output

(1) The number of Japanese scientific publications remains at the same level as it was ten years ago. However the position of Japan in the global rank moved down due to a growth of other countries.

This section looks at the number of scientific publications as one of the R&D outputs from Japan and the selected countries. Using the fractional counting method that measures the degree of contribution to paper production, the number of Japanese papers is ranked in 3rd place after the United States and China (the average of PY2012–2014). As to the number of adjusted top 10% papers, Japan is ranked in 7th place after the United States, China, the U.K., Germany, France, and Italy. As to the number of adjusted top 1% papers, Japan is ranked in 9th place after the United States, China, the U.K., Germany, France, Canada, Australia, and Italy.

The number of Japanese papers remains at the same level as it was ten years ago, but because of the growth of other countries, Japan has moved down in the world rank. The trend is particularly clear in high-impact papers such as the adjusted top 10% papers and adjusted top 1% papers.

[Summary Chart 11] Top 10 countries/regions in terms of the number of papers, the number of adjusted top 10% papers, and the number of adjusted top 1% papers (based on the fractional counting method)

All fields	1992 — 1994		
	The number of papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	179,568	32.1	1
Japan	45,598	8.2	2
U.K.	41,028	7.3	3
Germany	37,377	6.7	4
France	29,154	5.2	5
Canada	22,987	4.1	6
Russia	22,469	4.0	7
Italy	17,097	3.1	8
India	11,441	2.0	9
Australia	11,309	2.0	10

All fields	2002— 2004(PY) (Average)		
	The number of papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	213,319	26.5	1
Japan	67,475	8.4	2
Germany	51,205	6.3	3
U.K.	49,984	6.2	4
China	42,236	5.2	5
France	36,825	4.6	6
Italy	28,926	3.6	7
Canada	26,019	3.2	8
Spain	20,373	2.5	9
Russia	20,022	2.5	10

All fields	2012 — 2014(PY) (Average)		
	The number of papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	269,016	20.5	1
China	191,043	14.5	2
Japan	64,730	4.9	3
Germany	64,072	4.9	4
U.K.	58,208	4.4	5
India	46,426	3.5	6
France	44,973	3.4	7
Korea	42,747	3.3	8
Italy	42,513	3.2	9
Canada	38,852	3.0	10

All fields	1992 — 1994(PY) (Average)		
	The number of adjusted top 10% papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	27,434	49.2	1
U.K.	4,628	8.3	2
Japan	3,240	5.8	3
Germany	3,220	5.8	4
France	2,586	4.6	5
Canada	2,553	4.6	6
Netherlands	1,393	2.5	7
Italy	1,278	2.3	8
Australia	1,110	2.0	9
Sweden	997	1.8	10

All fields	2002— 2004(PY) (Average)		
	The number of adjusted top 10% papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	32,239	40.1	1
U.K.	6,144	7.6	2
Germany	5,297	6.6	3
Japan	4,593	5.7	4
France	3,569	4.4	5
Canada	2,959	3.7	6
China	2,909	3.6	7
Italy	2,479	3.1	8
Netherlands	1,944	2.4	9
Australia	1,802	2.2	10

All fields	2012 — 2014(PY) (Average)		
	The number of adjusted top 10% papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	38,964	29.7	1
China	18,052	13.8	2
U.K.	8,196	6.2	3
Germany	7,827	6.0	4
France	4,924	3.8	5
Italy	4,528	3.4	6
Japan	4,331	3.3	7
Canada	4,296	3.3	8
Australia	3,929	3.0	9
Spain	3,665	2.8	10

All fields	1992 — 1994(PY) (Average)		
	The number of adjusted top 1% papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	3,136	56.2	1
U.K.	457	8.2	2
Germany	304	5.4	3
Japan	264	4.7	4
Canada	230	4.1	5
France	215	3.8	6
Netherlands	132	2.4	7
Switzerland	107	1.9	8
Italy	101	1.8	9
Australia	101	1.8	10

All fields	2002— 2004(PY) (Average)		
	The number of adjusted top 1% papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	3,897	48.5	1
U.K.	647	8.0	2
Germany	484	6.0	3
Japan	364	4.5	4
France	292	3.6	5
Canada	270	3.4	6
China	234	2.9	7
Netherlands	191	2.4	8
Italy	186	2.3	9
Switzerland	169	2.1	10

All fields	2012 — 2014(PY) (Average)		
	The number of adjusted top 1% papers		
	Fractional counting		
Country/Region	Papers	Share	World rank
U.S.	4,691	35.7	1
China	1,643	12.5	2
U.K.	932	7.1	3
Germany	759	5.8	4
France	459	3.5	5
Canada	408	3.1	6
Australia	405	3.1	7
Italy	353	2.7	8
Japan	340	2.6	9
Spain	303	2.3	10

Note: The number of articles and reviews was counted. Papers were sorted by publication year (PY). The number of citations are as of end of 2015.
Reference: Chart 4-1-6, Japanese Science and Technology Indicators 2016 (in Japanese)

(2) Japan has been ranked high in the number of patent families in the past ten years, and the majority of those patent applications were filed in the United States.

This section looks at the status of patent applications by analyzing the number of patent families, which is a proxy to measure the number of inventions in an internationally comparable manner. Between 1989 and 1991, the United States was ranked in 1st place and Japan in 2nd place. Between 1999 and 2001, and between 2009 and 2011, Japan was ranked in 1st place and the United States in 2nd place. The increase in the number of Japanese patent families is attributable to the increase in oversea patent applications.

In order to analyze globalization of patent applications, countries/regions to which patent applications were field from selected countries were analyzed. Japan is filing 43.0% (excluding patent filing in home country) of its patent families in the United States. In the past 10 years, while Japan has been increasing the percentage of its patent applications in China, the percentage of its patent applications in Europe has been declining. The United States has been increasing the percentage of its patent applications in Asia, particularly in China in recent years. Compared with Germany, the U.K. has been increasing the percentage of its patent applications in the United States more than at the European Patent Office. China has been increasing the percentage of its patent applications in the United States.

[Summary Chart 12] Patent families by selected country/region

(A) Number of patent families (top 10 countries/regions)

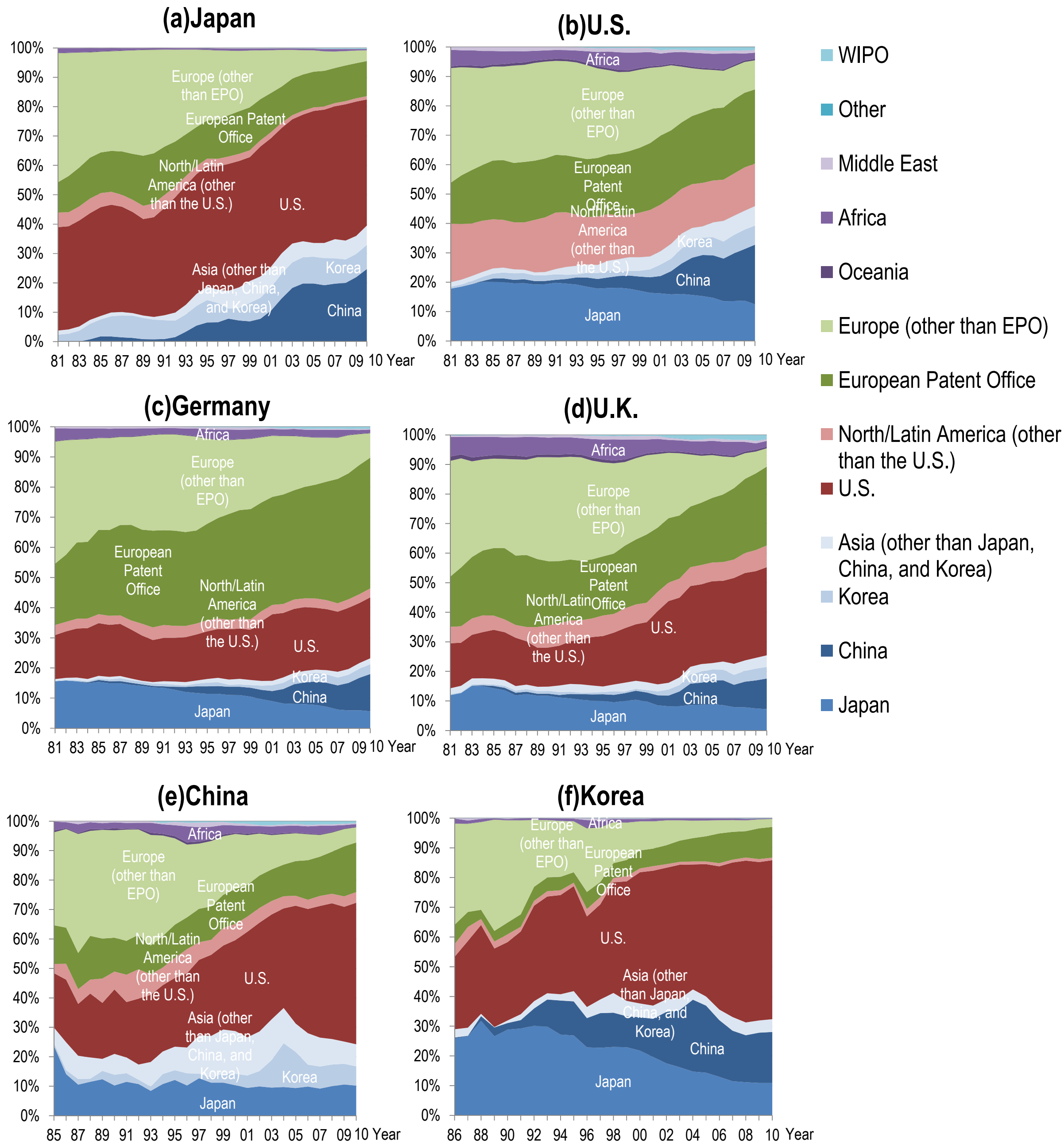
1989 - 1991(Average)			
	Number of patent families		
Country/Region	Whole counting		
	Patent Families	Share	World rank
U.S.	22,534	27.4	1
Japan	22,135	27.0	2
Germany	14,360	17.5	3
France	5,702	6.9	4
Yemen	4,757	5.8	5
Italy	2,669	3.3	6
Switzerland	2,172	2.6	7
Netherlands	1,681	2.0	8
Canada	1,505	1.8	9
Sweden	1,206	1.5	10

1999 - 2001(Average)			
	Number of patent families		
Country/Region	Whole counting		
	Patent Families	Share	World rank
Japan	42,731	27.8	1
U.S.	41,554	27.1	2
Germany	26,466	17.2	3
France	8,986	5.9	4
Yemen	8,338	5.4	5
Korea	5,978	3.9	6
Italy	4,361	2.8	7
Netherlands	3,990	2.6	8
Canada	3,857	2.5	9
Switzerland	3,362	2.2	10

2009 - 2011(Average)			
	Number of patent families		
Country/Region	Whole counting		
	Patent Families	Share	World rank
Japan	61,229	28.3	1
U.S.	46,417	21.5	2
Germany	29,929	13.9	3
Korea	18,501	8.6	4
China	13,715	6.3	5
France	11,141	5.2	6
Taiwan	10,892	5.0	7
Yemen	8,453	3.9	8
Canada	5,807	2.7	9
Italy	5,460	2.5	10

Reference: Chart 4-2-5, Japanese Science and Technology Indicators 2016 (in Japanese)

(B) Selected countries/regions in which patent families were filed



Notes:1) Patent applications filed in home countries/regions are excluded.

2) A patent family is a group of patents filed in two or more countries, directly or indirectly related to each other by priority rights. In many cases, the same patents filed in multiple countries belong to the same patent family.

Reference: Chart 4-2-11, Japanese Science and Technology Indicators 2016 (in Japanese)

5. Circumstances in Japan and the selected countries in terms of science, technology, and innovation

(1) Japan and the United States are dependent on each other in the technology trade, but Japan's dependence on the United States is more remarkable.

Japan's largest trading partner in terms of technology export is the United States. This holds true for technology export to Japanese affiliated and unaffiliated companies located in the United States. On the other hand, the United States' largest trading partner in terms of technology export to unaffiliated companies is Taiwan. For the United States, Ireland is its largest partner in terms of technology export to its affiliated companies. This is because Ireland imposes the lowest level of corporate tax in the EU region (as of 2014). As this example indicates, technology trade between affiliated companies includes factors other than technological competence.

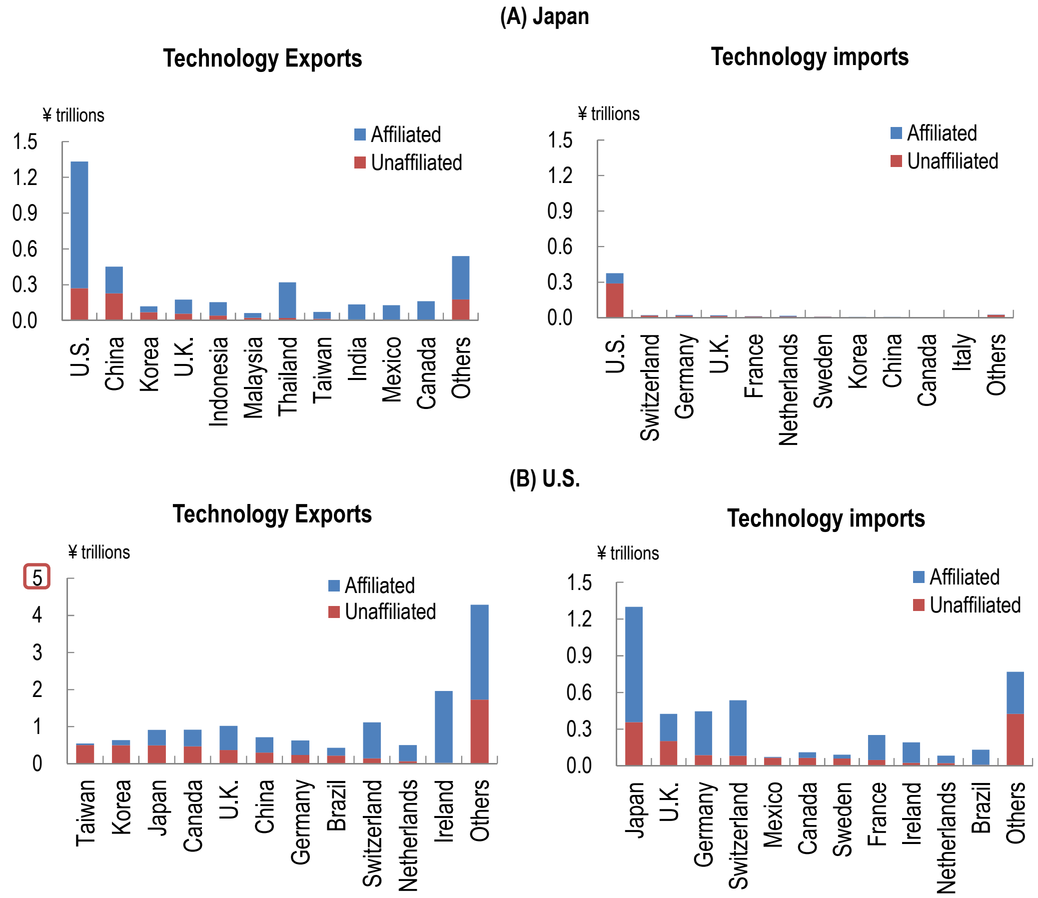
Japan's largest trading partner in terms of technology import is the United States. This holds true for technology import to U.S. affiliated and unaffiliated companies located in Japan. In addition, the United States' largest trading partner in terms of technology import is Japan. This holds true for technology import to Japanese affiliated and unaffiliated companies located in the United States. Japan depends heavily on the United States particularly in technology import.

(2) The increase in Japan's technology trade balance (exports/imports), excluding its affiliated companies, indicates that Japan is increasing its technical competitiveness.

The balance of technology trade ratios of Japan and the United States excluding their affiliated companies shows that the ratio of Japan, which used to hover around 1.0, started to rise in the latter half of the 2000s, increasing to as high as 2.3 in 2014. This indicates that Japan's relative competitiveness in technology has been increasing over time. The ratio of the United States has been hovering around 4.0. The ratio in 2014 was 3.5.

[Summary Chart 13] Technology exports and imports by partner country/region: Japan vs. the United States (2014)

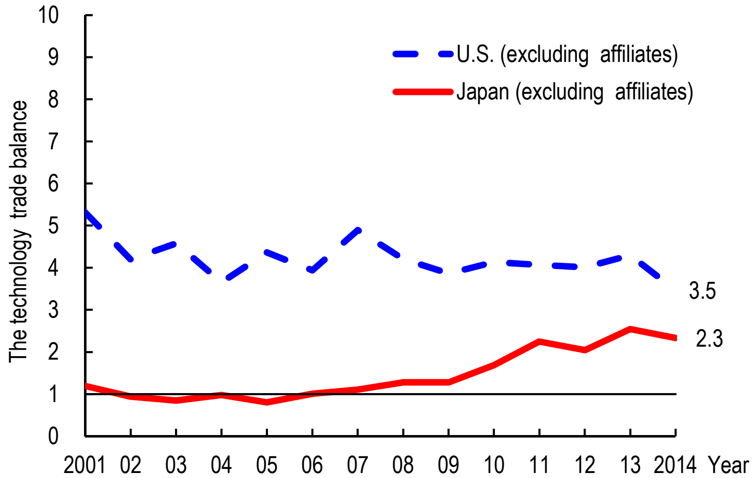
Attention to international comparison



Notes:1) The amounts for Japan are financial-year-based.
2) 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:
[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).
[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) industrial processes, 2) computer software, 3) trademarks, 4) franchise fees, 5) audio-visual and related products, and 6) other intellectual properties.
Reference: Chart 5-1-5, Japanese Science and Technology Indicators 2016 (in Japanese)

[Summary Chart 14] The balance of technology trade of Japan and the United States excluding their affiliated companies

Attention to international comparison

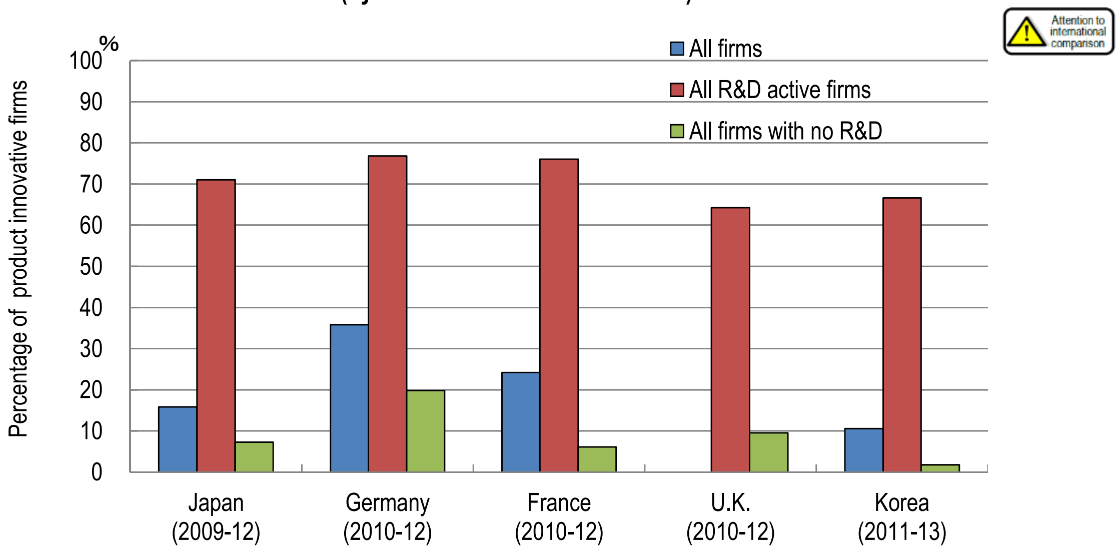


Note: The notes for Summary Chart 13 are applied to this chart.
Reference: Chart 5-1-2, Japanese Science and Technology Indicators 2016 (in Japanese)

(3) The percentage of firms that achieved product innovation was higher with the firms that were involved in R&D activities than with the firms that were not.

The percentage of firms that achieved product innovation (introducing new products and services) by the involvement in R&D activities revealed that percentage was higher with firms that were involved in R&D activities in all countries. The percentage was the highest in Germany at 76.9%, followed by France at 76.0% and Japan at 71.0%.

[Summary Chart 15] Percentage of firms that achieved product innovation in the selected countries (by involvement in R&D activities)

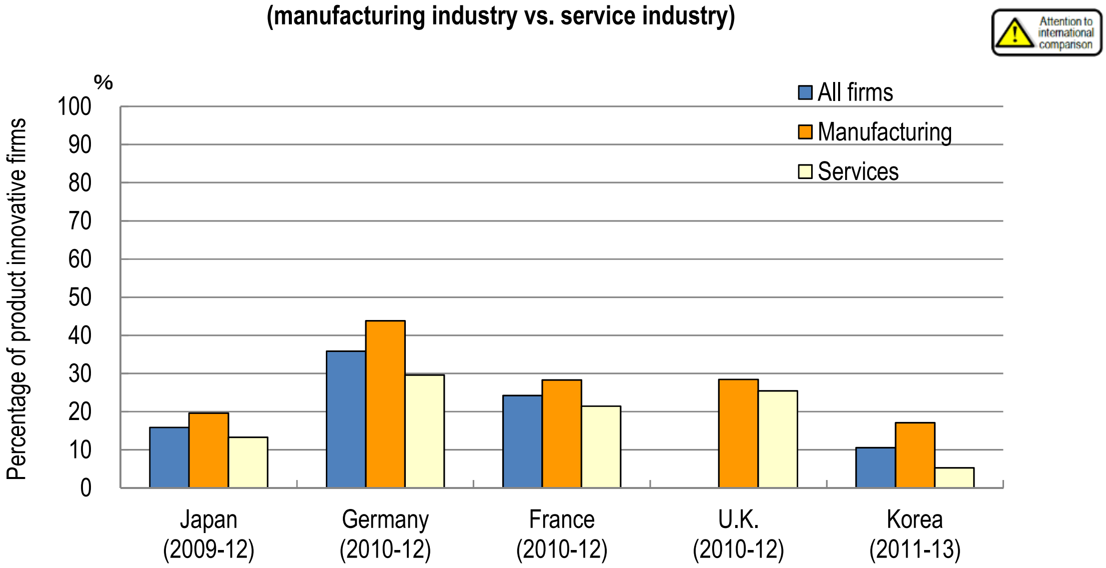


Notes:1) Korea looks at the entire manufacturing industry as the industrial classification for product innovation surveys, while other countries look at the only core target industries that CIS2010 designates. So, this requires attention when internationally comparing the values for all firms.
2) The value for "all firms" in the U.K. is not shown.
Reference: Chart 5-4-2, Japanese Science and Technology Indicators 2016 (in Japanese)

(4) The percentage of firms that achieved product innovation was higher in the manufacturing industry than in the service industry. The percentages of Japanese firms that achieved product innovation in the manufacturing industry and the service industry were lower than European countries.

In all countries, the percentage of firms that achieved product innovation was higher in the manufacturing industry than in the service industry. Between the manufacturing industry and the service industry, the difference in the percentage of firms that achieved product innovation is the largest in Korea and the smallest in the U.K.

[Summary Chart 16] Percentage of firms that achieved product innovation in the selected countries (manufacturing industry vs. service industry)



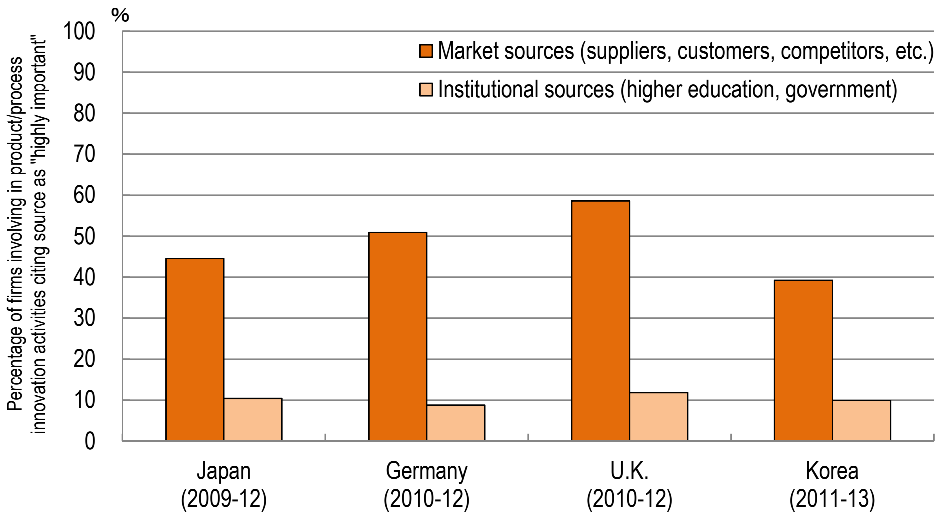
Note: The value for "all firms" in the U.K. is not shown.
Reference: Chart 5-4-3, Japanese Science and Technology Indicators 2016 (in Japanese)

(5) In all countries, firms that were involved in product/process innovation activities attached importance to market related information as external sources of information.

This section looks at the external sources of information to which firms involved in product/process innovation activities attach importance. If the information is classified into "market related (e.g., suppliers, customers, competitors)" and "institution related (e.g., higher education institutions, government organizations)," the importance of "market related" is greater in all countries, and 40–60% of firms consider it very important. On the other hand, about 10% of firms consider "institution related" information very important.

[Summary Chart 17] External sources of information for firms involved in product/process innovation activities in the selected countries

Attention to international comparison



Note: This survey targeted firms involved in product/process innovation activities (including ongoing and suspended activities).
Reference: Chart 5-4-5, Japanese Science and Technology Indicators 2016 (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. Items that allow time-series comparisons as well as comparisons among the selected countries based on data that are updated each year in principle are collected.

Use of original statistical data published by authorities in each country

Wherever possible, statistical data published by authorities in each country are used as the sources of data for indicators appearing in Japanese Science and Technology Indicators. Every effort has been made to clarify each country's method of collecting statistics and how it differs from other countries' methods.

NISTEP conducted analysis of paper and patent databases

Paper data were aggregated and analyzed by NISTEP using Thomson Reuters Web of Science.

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 conform to OECD manuals and other materials. However, differences in methods of collecting data or scope of focus do in fact 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.

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RESEARCH MATERIAL No. 251

Digest of Japanese Science and Technology Indicators 2016

August 2016

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National Institute of Science and Technology Policy (NISTEP)
Ministry of Education, Culture, Sports, Science and Technology (MEXT)
Japan

DOI：http://doi.org/10.15108/rm251e

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