Chapter 4

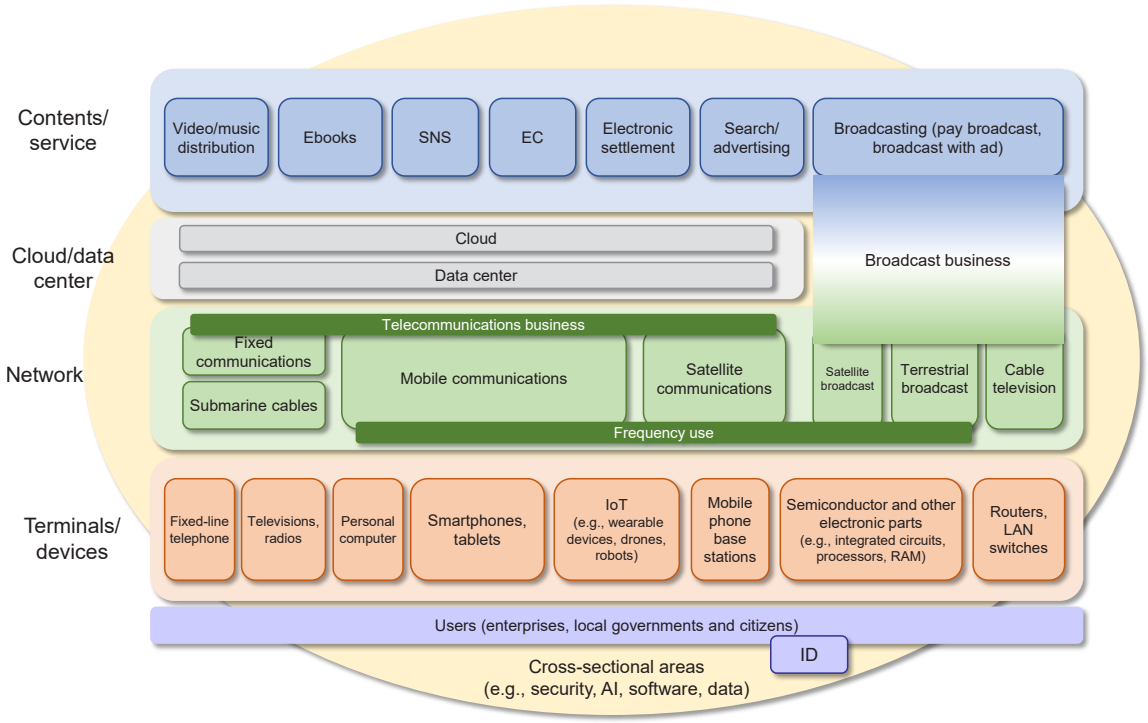
Trends in the ICT Market

Section 1 Trends in the ICT industry

1. Size of the ICT market

The ICT market includes equipment and devices that serve as the interface with users, networks provided by telecommunications carriers and broadcasters, etc., clouds and data centers, content services including video and music distribution, security, and, AI **(Figure 4-1-1-1)**.

Figure 4-1-1-1 Structure of the ICT market by layer



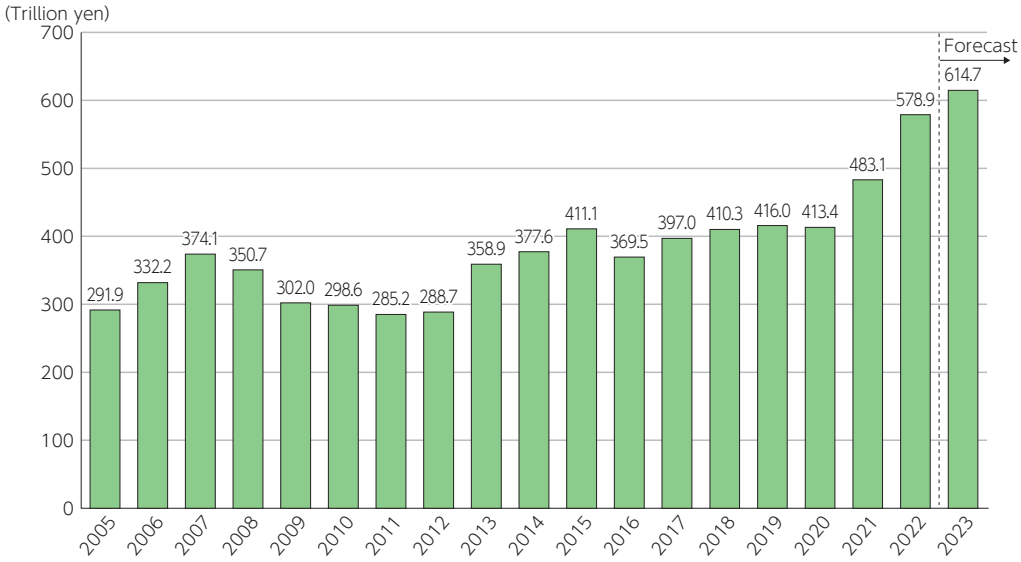
(Source) Created by MIC

Due to the spread of smartphones, cloud service and other factors, the global ICT market (in terms of expenditure)[1] has been on the increase since 2016. In 2022, it increased significantly to 578.9 trillion yen [2] (up 19.8% from the previous year[3]), and is forecasted to increase to 614.7 trillion yen in 2023 [4] **(Figure 4-1-1-2)**.

The Japanese ICT market (in terms of enterprise IT expenditure)[5] is expected to increase significantly to 27.2 trillion yen in 2022 (up 5.2% from the previous year). By industry, growth in banking and investment services (+ 7.9%) and government offices/local government (+ 7.7%) was significant. In addition to cost reductions through automation and labor savings, renewal of legacy systems, and increased investment in efficiency improvements, investment in a wide range of industries is expected to increase as a result of the easing of COVID-19 restrictions.

[1] The ICT market includes data center systems, enterprise software, devices, ICT services, and communications services.a
[2] The average exchange rate for each year is used to convert to yen. In 2023, the average exchange rate between January and March is used (the same applies hereinafter).a
[3] Note that 2022 was also affected by the depreciation of the yen (the same applies hereinafter).
[4] MIC (2023) "Survey Study on the Trends in the Market Environment Surrounding ICT" (the same applies hereinafter)a
[5] The ICT market includes data center systems, software, devices, IT services, telecom services and internal services.a

Figure 4-1-1-2 Changes in global ICT market size (in terms of expenditure)

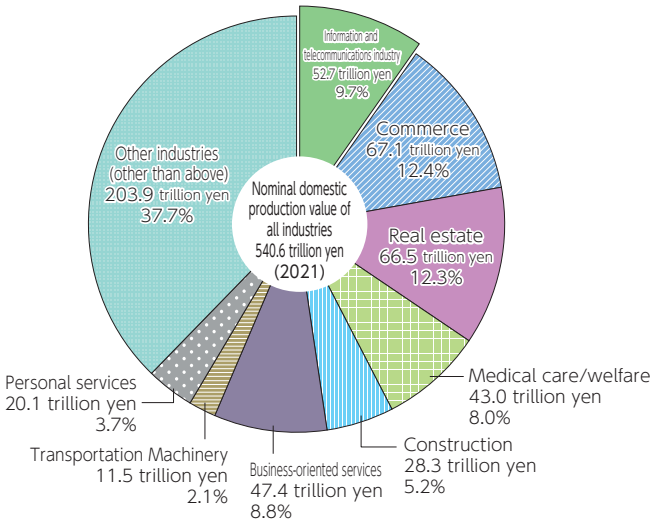


(Source) Statista (Gartner)[6]

2. Gross domestic product (GDP) of the ICT industry[7]

The nominal GDP of the ICT industry in 2021 was 52.7 trillion yen, an increase of 0.8% compared to 52.2 trillion yen in the previous year **(Figure 4-1-2-1, Figure 4-1-2-2)**. Looking at the changes in nominal GDP by sector in the ICT industry, while the trend in most sectors has remained almost flat, the information services sector and the services incidental to the Internet sector are showing increases **(Figure 4-1-2-3)**.

Figure 4-1-2-1 GDP of major industries (nominal)

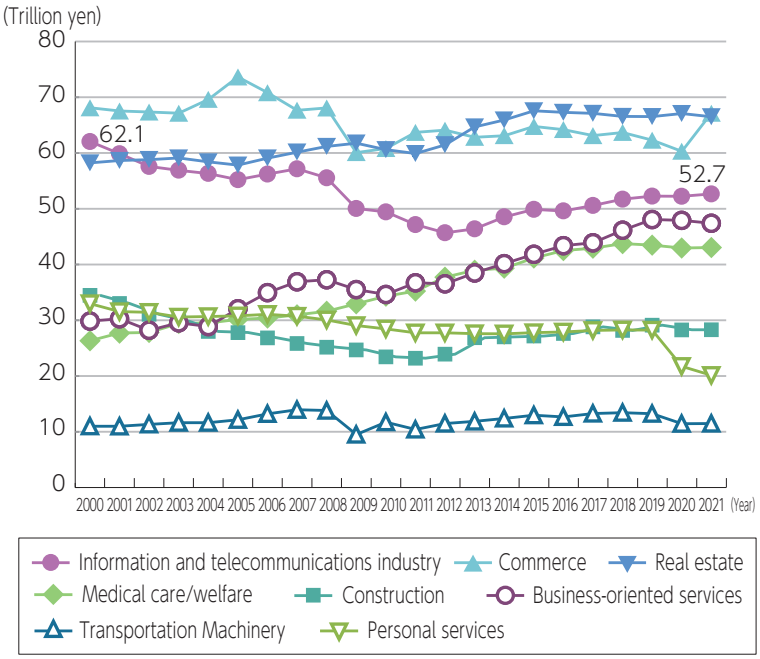


(Source) MIC (2023) "Survey on Economic Analysis of ICT in Fiscal 2022"

[6] https://www.statista.com/statistics/203935/overall-it-spending-worldwide/

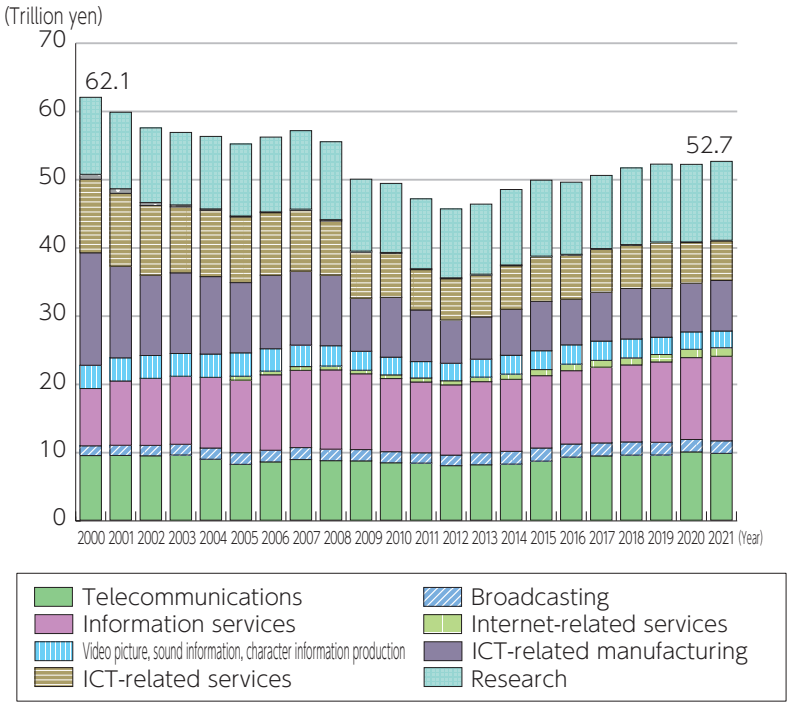
[7] The ICT industry has nine areas: telecommunications, broadcasting, information services, services incidental to the Internet, video/sound/character information production, manufacturing related to information and communications, services related to information and communications, construction related to information and communications, and research.

Figure 4-1-2-2 Changes in nominal GDP of major industries



(Source) MIC (2023) "Survey on Economic Analysis of ICT in Fiscal 2022"

Figure 4-1-2-3 Changes in nominal GDP of the ICT industry



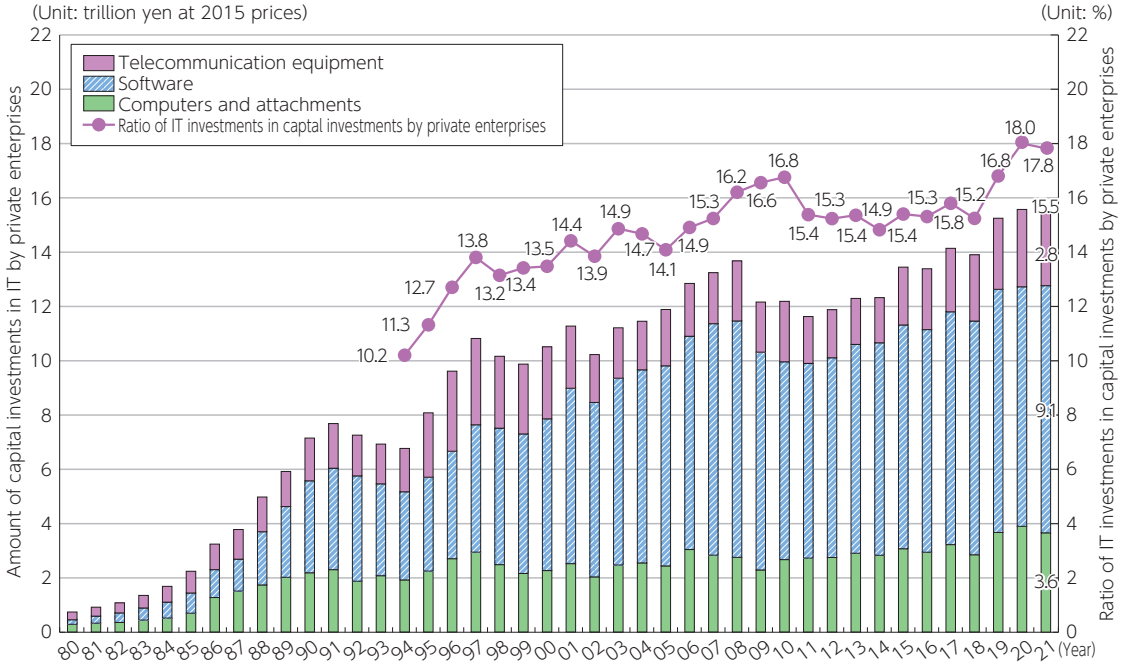
(Source) MIC (2023) "Survey on Economic Analysis of ICT in Fiscal 2022"

3. IT investments[8]

In 2021, IT investment in Japan's private companies was 15.5 trillion yen (down 0.4 % from the previous year) in terms of 2015 prices. By type of IT investment, investments in software (entrusted development and packaged software) accounted for nearly 60% of the total at 9.1 trillion yen. The ratio of IT investments to capital investment by private companies in 2021 was 17.8% (0.2 point decrease from the previous year), with IT investment accounting for a certain position in capital investment (**Figure 4-1-3-1**).

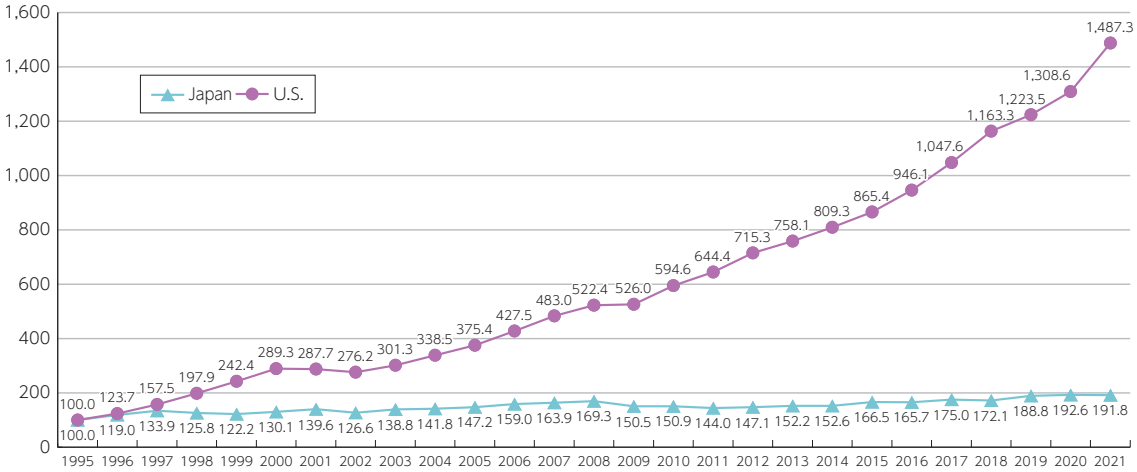
A comparison of the trends in IT investment between Japan and the U.S. shows that although IT investment in the U.S. stalled during the Lehman shock from 2008 to 2009, it has shown a rapid recovery since then, while IT investment in Japan has shown a slower recovery than that in the U.S., although the decline immediately after the Lehman shock was small (**Figure 4-1-3-2**).

Figure 4-1-3-1 Changes in IT investment in Japan



(Source) MIC (2023) "Survey on Economic Analysis of ICT in Fiscal 2022"

Figure 4-1-3-2 Comparison of IT investments in the private sector in Japan and the U.S.



*1995 = indexed as 100 (Japan: 2015 price; U.S.: 2012 price)

(Source) MIC (2023) "Survey on Economic Analysis of ICT in Fiscal 2022"

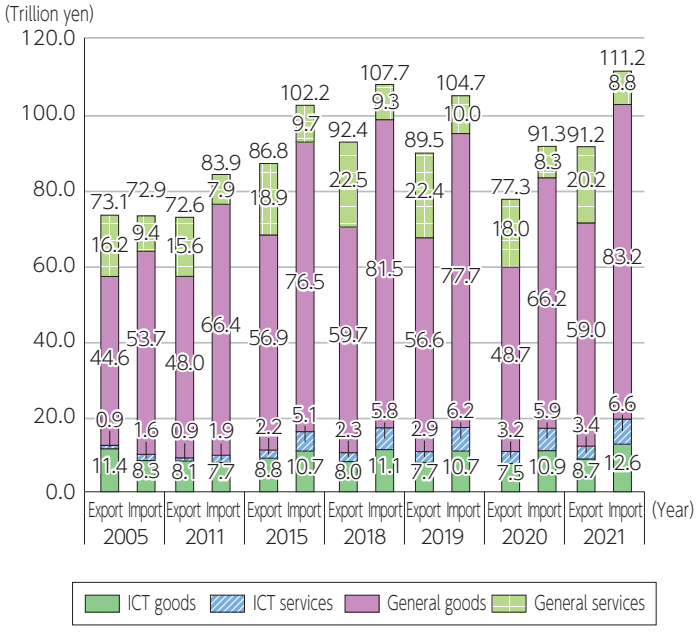
[8] Here, the term refers to investment in information and communications capital goods (computers and attachments, telecommunications equipment, software). The use of cloud services that have spread drastically in recent years is the purchasing of a service rather than the purchasing of capital goods and therefore is not included in IT investment here.

4. Exports and imports in the ICT field

In 2021, nominal value of exports and imports of all goods/services were 91.2 trillion yen and 111.2 trillion yen respectively. Of the above, exports of ICT goods/services[9] were 12 trillion yen (13.2% of all exports), while imports were 19.2 trillion yen (17.3% of all imports). The import surplus of ICT goods was 3.9 trillion yen (up 15.2% from the previous year) and the import surplus of ICT services was 3.3 trillion yen (down 18.7% from the previous year) (**Figure 4-1-4-1**).

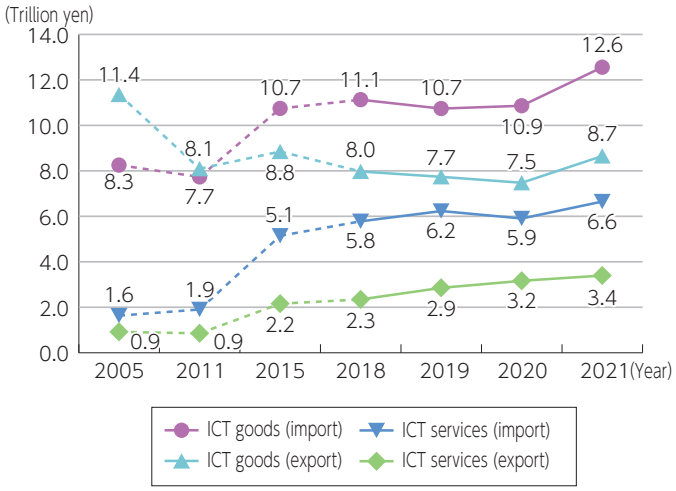
Looking at the change in the value of imports and exports of ICT goods and services, ICT services have consistently had an import surplus since 2005. However, regarding ICT goods, although there was an export surplus in 2005, the trend of an import surplus has continued in recent years due to a subsequent decrease in exports and increase in imports. Furthermore, ICT goods accounts for nearly 70% of both exports and imports of ICT goods and services (**Figure 4-1-4-2**).

Figure 4-1-4-1 Changes in the value of imports and exports of goods and services (nominal)



(Source) Prepared based on the MIC "ICT Industry Linkage Table" (for each fiscal year)

Figure 4-1-4-2 Changes in the value of imports and exports of ICT goods and services (nominal)



*There are different blanks in the data from 2005 to 2018 so trends are shown using dashed lines.

(Source) Prepared based on the MIC "ICT Industry Linkage Table" (for each fiscal year)

[9] In the table of 77 endogenous sectors, ICT goods and services refers to 1 to 43 and general goods and services refers to 44 to 77 (see note 4 at the end of this document). ICT goods includes communications devices such as personal computers and mobile phones, electronic components such as integrated circuits, televisions and radios, etc. and ICT services includes fixed and mobile telecommunications services, broadcasting services, software businesses, newspapers and publications, etc.

5. Trend of R&D in the ICT field

(1) State of research and development expenditure

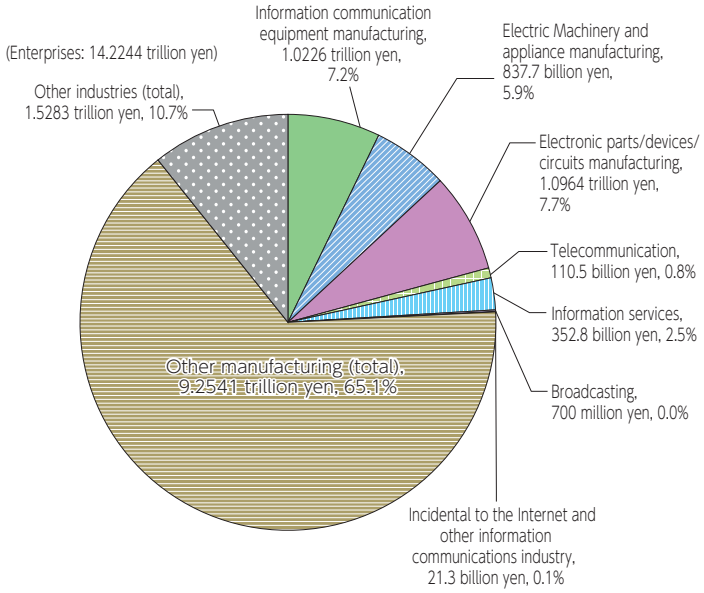
a Changes in R&D expenditures in major countries

In 2019, the U.S. continued to hold the top spot in R&D spending by major countries at 71.6739 trillion yen. China is in second place, followed by the EU and Japan, but Japan's R&D spending has been flat and the gap between the major countries in higher positions is widening.

b State of R&D expenditure in Japan

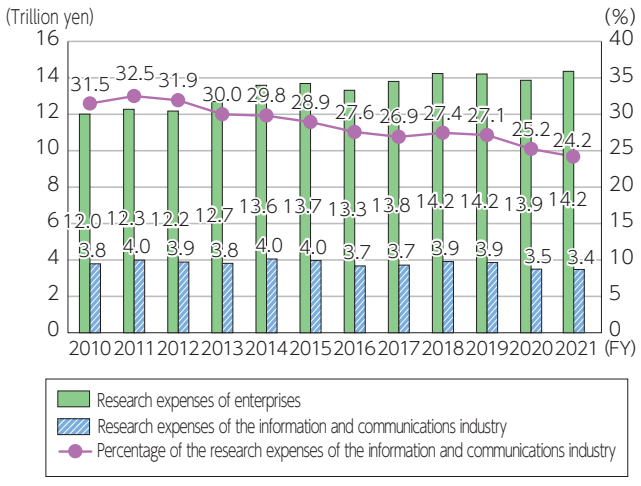
In fiscal 2021, the total expenditure for science and technology R&D in Japan (hereinafter "research expenditure") was 19.7408 trillion yen (sum of the research expenditure of companies, NGOs, public organizations, universities, etc.), which includes expenditure of 14.2244 trillion yen by companies. Of this research expenditure by companies, research expenditure in the ICT industry[10] was 3.4420 trillion yen (24.2%) (**Figure 4-1-5-1**), and in recent years this figure has either trended downward or remained the same (**Figure 4-1-5-2**).

Figure 4-1-5-1 Percentages of research expenditure by companies (fiscal 2021)



(Source) Prepared based on the MIC "2022 Science and Technology Research Survey"[11]

Figure 4-1-5-2 Changes in research expenditure by companies



(Source) Prepared based on the MIC "Science and Technology Research Survey" for each fiscal year[12]

[10] Here, the term refers to information and communications equipment manufacturing, electric machinery and appliance manufacturing, electronic parts/devices/circuits manufacturing, information communications (information services, telecommunications, broadcasting, incidental to the Internet and other information communications industries).
[11] https://www.stat.go.jp/data/kagaku/index.html
[12] https://www.stat.go.jp/data/kagaku/index.html

(2) State of R&D human resources

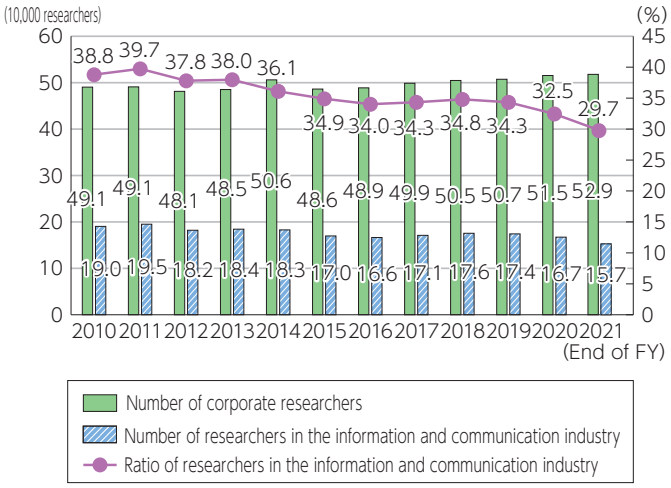
a Changes in the number of researchers in major countries

The number of researchers[13] in all major countries is on the rise. The number of researchers in 2021 in Japan was 690,000, the third largest number after China (2,281,000 in 2020) and the U.S. (1,586,000 in 2019). The most recent year figures for other countries, in descending order, are Germany (452,000 in 2020), South Korea (447,000 in 2020), France (322,000 in 2020), and the United Kingdom (316,000 in 2019).

b Number of researchers in Japan

At the end of fiscal 2021, the number of researchers in Japan (total of the researchers at companies, NGOs, public organizations, universities, etc.) was 908,330, of which 529,053 were at companies. Of the number of researchers at companies, 157,219 (29.7%) were researchers in the ICT industry, and this number has been decreasing in recent years (**Figure 4-1-5-3**).

Figure 4-1-5-3 Changes in the number of researchers at companies



(Source) Prepared based on the MIC "Science and Technology Research Survey" for each fiscal year[14]

Figure (related data) Percentages of the number of researchers at companies by industry (as of March 31, 2022)
Source: Prepared based on the MIC "2022 Science and Technology Research Survey"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00094
(Data collection)

(3) State of patents

In 2020, 597,000 patent applications were filed in the U.S. The percentage of applications filed by non-residents has been on the rise in recent years, suggesting that the U.S. market is attractive overseas. In 2020, the number of applications filed in Japan was 288,000, which was the most after China and the U.S., but the number of patent applications has been decreasing since the mid-2000s, and the gap has widened.

In terms of the changes in the number of patent families[15] by technology area in Japan, the U.S., and China, the information and communications technology percentage is increasing in the U.S. and China, but it is stagnant in Japan.

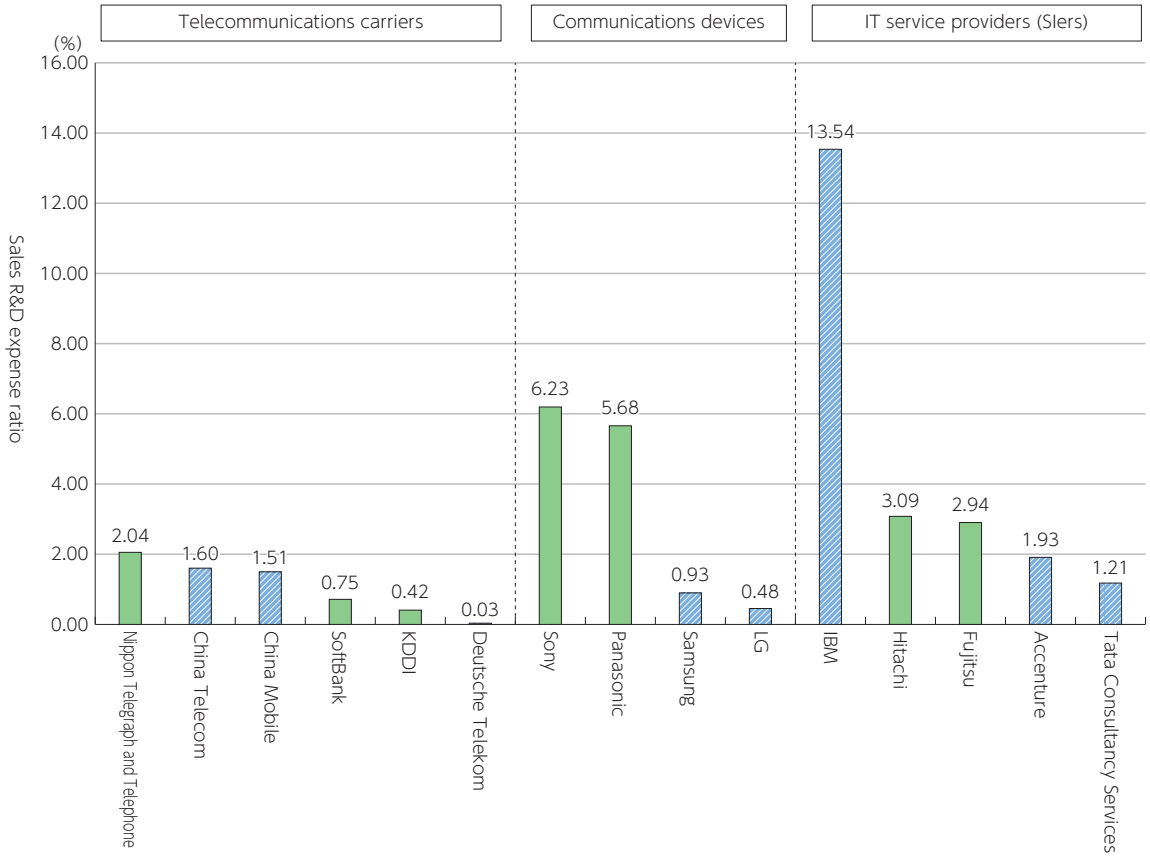
[13] Measured by converting research work into fulltime employment.
[14] https://www.stat.go.jp/data/kagaku/index.html
[15] A patent family is a bundle of patent applications in two or more countries that are linked directly or indirectly by priority rights. Generally, patents with the same content that are filed in more than one country belong to the same patent family. Thus, counting patent families prevents the same application from being counted twice. In other words, the number of patent families is considered to be approximately the same as the number of inventions.
https://www.nistep.go.jp/sti_indicator/2021/RM311_45.html

(4) R&D trends of major domestic and overseas companies in the ICT field

Excluding some companies such as IBM, the percentage of R&D expenditure to sales for major information and communications companies in Japan and overseas in 2021 remains less than 10% **(Figure 4-1-5-5)**.

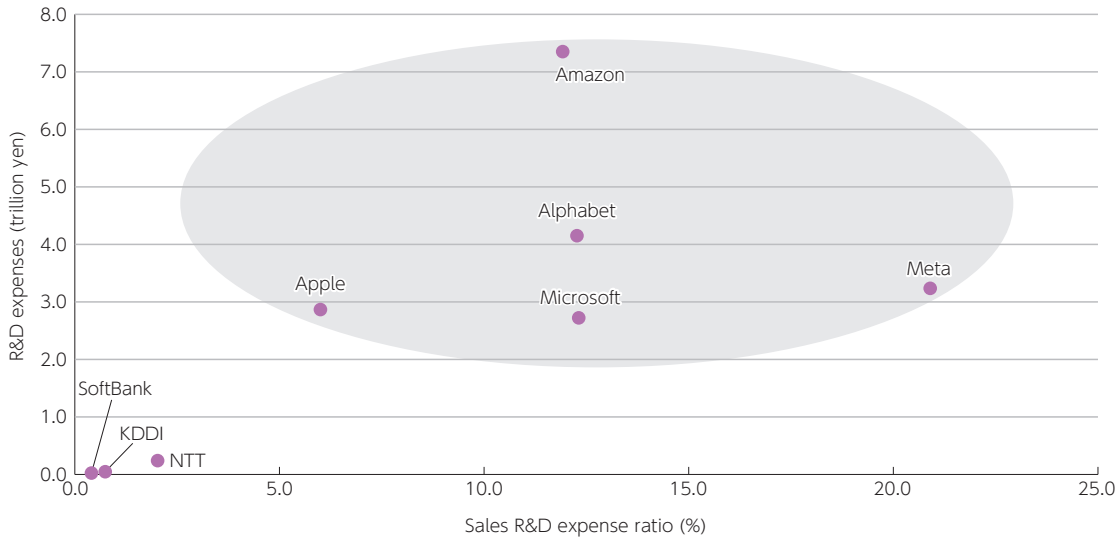
The percentage of R&D expenditure to sales of major Japanese telecom providers in 2021 was 2% at NTT and less than 1% at KDDI and SoftBank, while GAFAM's[16] percentages ranged from 6% to 21%, indicating that they are active in R&D **(Figure 4-1-5-6)**.

Figure 4-1-5-5 Comparison of research and development expenditures by telecommunications carriers, communications devices and IT service providers (2021)



(Source) Prepared based on the annual reports released by companies

Figure 4-1-5-6 Comparison of research and development expenditures between major Japanese companies and GAFAM (2021)



(Source) Prepared based on the annual reports released by companies

[16] Google, Amazon, Facebook, Apple and Microsoft

(5) Examples of research and development of new technologies in the ICT field: Green of ICT using photoelectric fusion technology

Due to the progress of digitalization, the electric power consumption of communications network equipment and data centers, etc. has increased considerably. As global warming intensifies, it is necessary to contribute to the realization of a green society by reducing the power consumption of ICT-related equipment and facilities through the development and introduction of new technologies. Photoelectric fusion technology, a key technology for all-optical networks,[17] is a technology that replaces computer calculations traditionally performed by electricity with processing that uses light. Because light consumes less energy than electricity, this is expected to save a lot of energy.

However, since the light-to-electricity conversion process requires the addition of components and consumes an additional amount of electricity, if this extra electricity consumption exceeds the effect of the power saving mentioned above, overall power saving will not be achieved.

As an element that helps to solve this problem, Photonic Crystal has recently been developed in which extremely small holes are made in silicon used for semiconductors. The smaller the size of the chip (integrated circuit) that performs calculations, the lower the amount of heat generated (= energy loss) when light passes through it, and using photonic crystal enables chips to be made extremely small.

According to the development roadmap of the Innovative Optical and Wireless Network (IOWN) Initiative announced by NTT in 2019, which will realize high-speed, large-capacity communications by utilizing innovative light-centered technologies such as photoelectric fusion, the first step is to establish a technology that connects the chip used for calculation with peripheral components using light, the next step is to connect the chips with each other using light, and the final step in 2030 is to commercialize a photoelectric fusion chip that performs calculations light.

[17] See Section 2 in Chapter 3 of Part 1

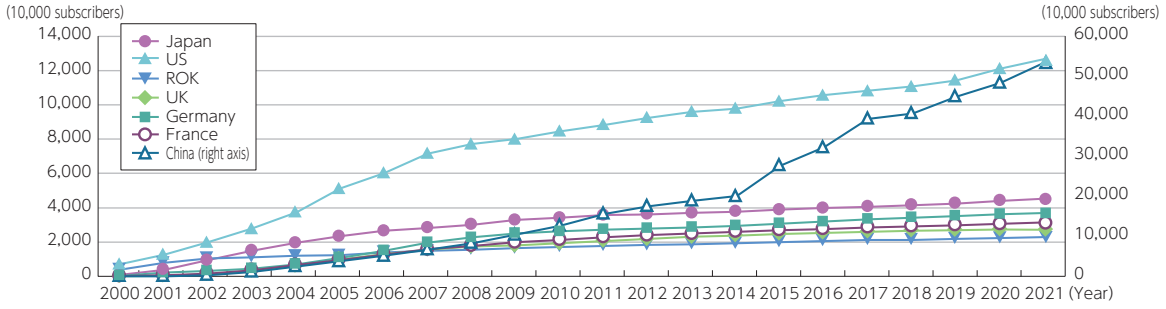
Section 2 Trends in the telecommunications field

1. Trends in the domestic and overseas communications markets

The number of fixed broadband service subscriptions[1] has been increasing in all major countries since 2000 (**Figure 4-2-1-1**). By country, China rose to the top position overtaking the U.S. in 2008 and has been sharply increasing the number since 2015. China's compound annual growth rate (CAGR) from 2000 to 2021 is 62%, which is far higher than the U.S.'s 15% and Japan's 21%.

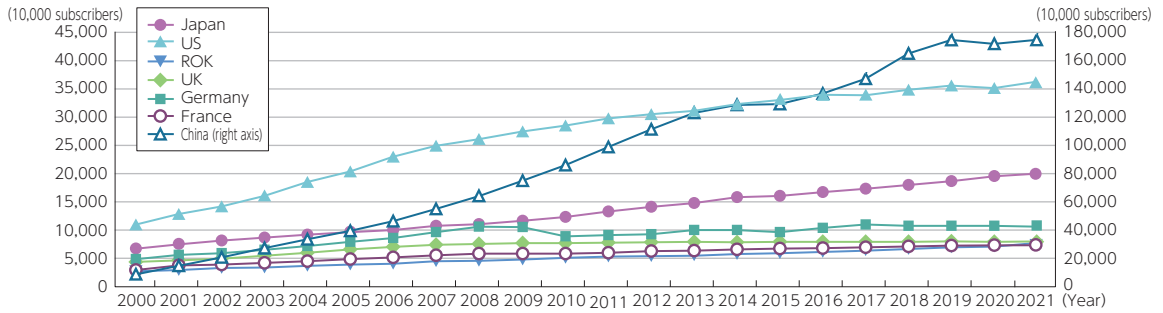
The number of mobile phone subscriptions[2] has also been on the increase in major countries, with China showing an especially sharp increase (**Figure 4-2-1-2**). China's compound annual growth rate (CAGR) from 2000 to 2021 is 15%, which is far higher than the U.S.'s 6% and Japan's 5%. In 2021, the percentage of the number of mobile phone subscriptions compared to the population was 159.7% (63.5 point increase from 2010) in Japan, 107.3% (15.7 point increase from 2010) in the U.S. and 121.5% (57.8 point increase from 2010) in China.[3]

Figure 4-2-1-1 Changes in fixed broadband service subscriptions in major countries



(Source) ITU[4]

Figure 4-2-1-2 Changes in the number of mobile phone subscriptions in major countries



(Source) ITU[5]

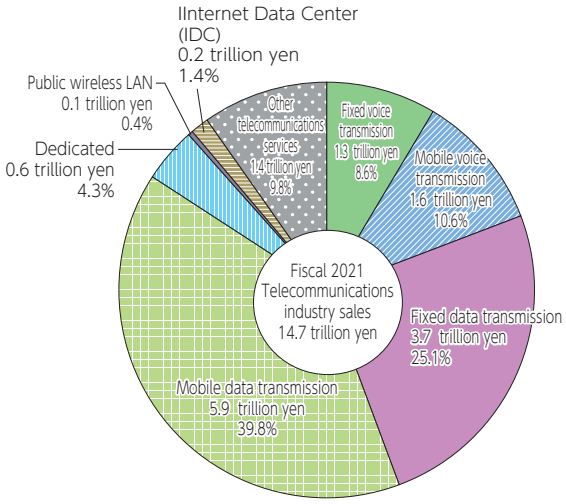
[1] Statistics from ITU. Fixed-broadband subscriptions are shown. Fixed broadband refers to high-speed lines providing a communication speed of 256 kbps or faster for either or both uplink and downlink. High-speed lines include cable modems, DSL, optical fiber and satellite communications, fixed wireless access and WiMAX, etc., but do not include mobile network (cellular system) based data communications subscriptions.
[2] Statistics from ITU. Mobile-cellular subscriptions are shown. The number includes deferred-payment subscriptions and prepaid subscriptions. Prepaid subscriptions are included only when the service was used for a fixed period of time (e.g., three months). Data card and USB modem subscriptions are not included.
[3] Number of mobile subscriptions includes prepaid-based subscriptions.
[4] https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx
[5] https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

2. Current status of the telecommunications field in Japan

(1) Market size

Total sales of the telecommunications industry in fiscal 2021 are estimated to be about 15 trillion yen. Looking at the breakdown, data transmission (fixed and mobile) accounted for about 9.6 trillion yen (65%) and voice transmission accounted for about 2.8 trillion yen (19.2%) (**Figure 4-2-2-1**).

Figure 4-2-2-1 Composition of sales in the telecommunications industry



*1 Fixed voice transmission is the sum of domestic and international services.

*2 Fixed data transmission includes sales through Internet access (ISP, FTTH, etc.), IP-VPN, and wide area Ethernet.

(Source) Prepared based on the MIC "Basic Survey on the Information and Communications Industry"[6]

(2) Number of business operators

The number of telecommunications carriers at the end of fiscal 2022 was 24,272 (334 registered business operators and 23,938 notified business operators), with the number continuing to increase following the previous fiscal year (**Figure 4-2-2-2**).

Figure 4-2-2-2 Changes in the number of telecommunications carriers

End of FY	2015	2016	2017	2018	2019	2020	2021	2022
Number of telecommunication carriers	17,519	18,177	19,079	19,818	20,947	21,913	23,111	24,272

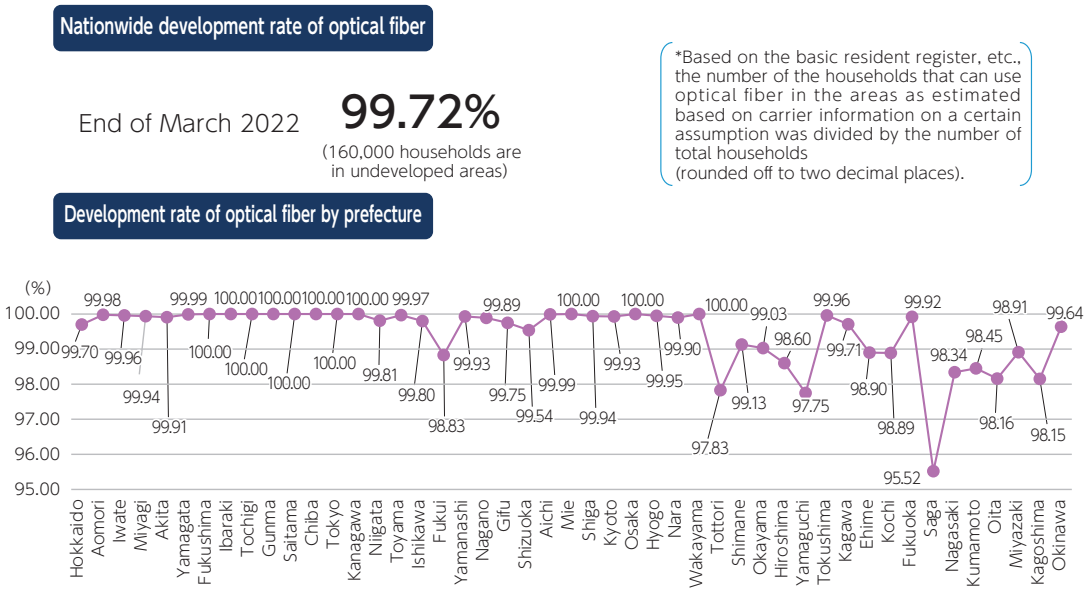
(Source) Information and Communications Statistics Database[7]

[6] https://www.soumu.go.jp/johotsusintokei/statistics/statistics07.html
[7] https://www.soumu.go.jp/johotsusintokei/field/tsuushin04.html

(3) State of infrastructure development

The household coverage rate of optical fiber in Japan at the end of fiscal 2021 was 99.72% (**Figure 4-2-2-3**).

Figure 4-2-2-3 State of preparation of optical fiber as of March 31, 2022 (estimated)



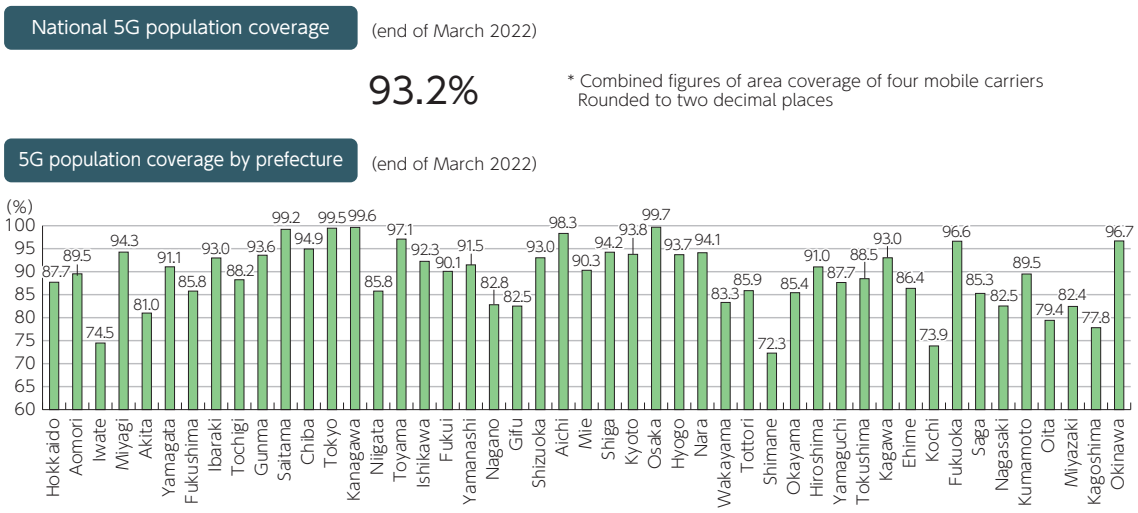
(Source) MIC "Survey on Broadband Infrastructure Coverage Rate at End of Fiscal 2021"[8]

According to the OECD, the percentage of optical fiber connections in total fixed broadband as of June 2022 in Japan is the second highest among member countries, indicating that Japan's digital infrastructure is advanced even by international terms.

Figure (related data) Percentage of optical fiber in fixed broadband in OECD member countries
Source: OECD Broadband statistics. 1.10. Percentage of fiber connections in total fixed broadband, June 2022
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00108 (Data collection)

As of the end of fiscal 2021, Japan's national 5G population coverage rate was 93.2%, and by prefecture, it exceeded 70% in all prefectures (**Figure 4-2-2-4**).

Figure 4-2-2-4 Japan's 5G coverage as percentage of population (as of end of March 2022)

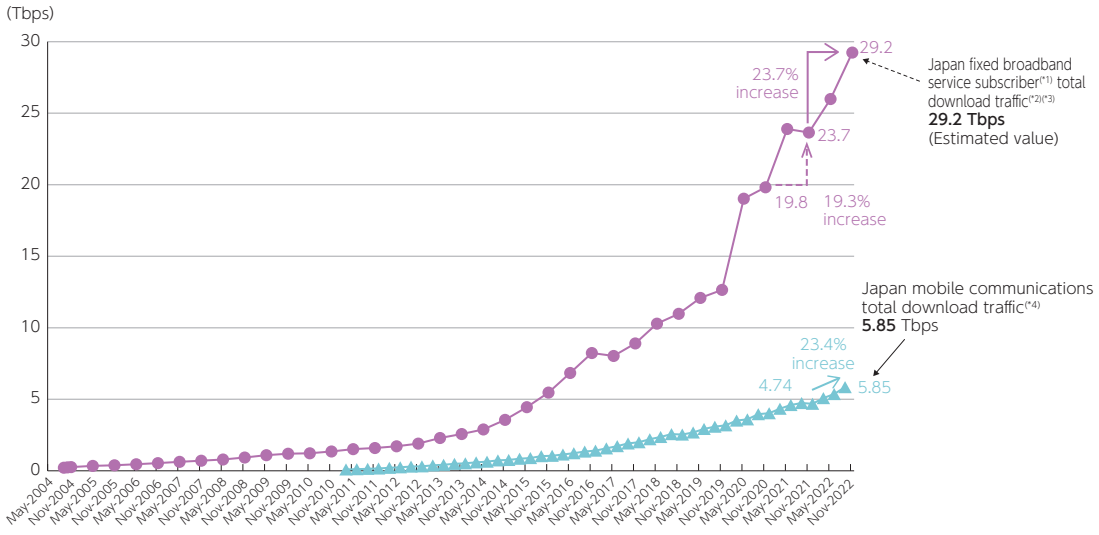


[8] https://www.soumu.go.jp/menu_news/s-news/01kiban02_02000476.html

(4) State of traffic

Total download traffic for fixed broadband service subscribers in Japan has surged since the start of the COVID-19 pandemic. Since then, although the rate of change has fluctuated, it has generally continued to increase. As of November 2022, it was up 23.7% from the same month in the previous year. Total download traffic for mobile communications has also continued to increase on the whole, with an increase of 23.4% as of September 2022 compared to the same month of the previous year (**Figure 4-2-2-5**).

Figure 4-2-2-5 Changes in Internet traffic (fixed systems, mobile systems, download traffic)



*1 Services for individuals (FTTH, DSL, CATV, FWA) (including some corporations)

*2 Prior to May 2011, this also includes some mobile communications traffic to and from mobile phone networks.

3 Since May 2017, the number of cooperating ISPs increased from five to nine, resulting in discontinuities due to aggregated and estimated values based on information from the nine ISPs.

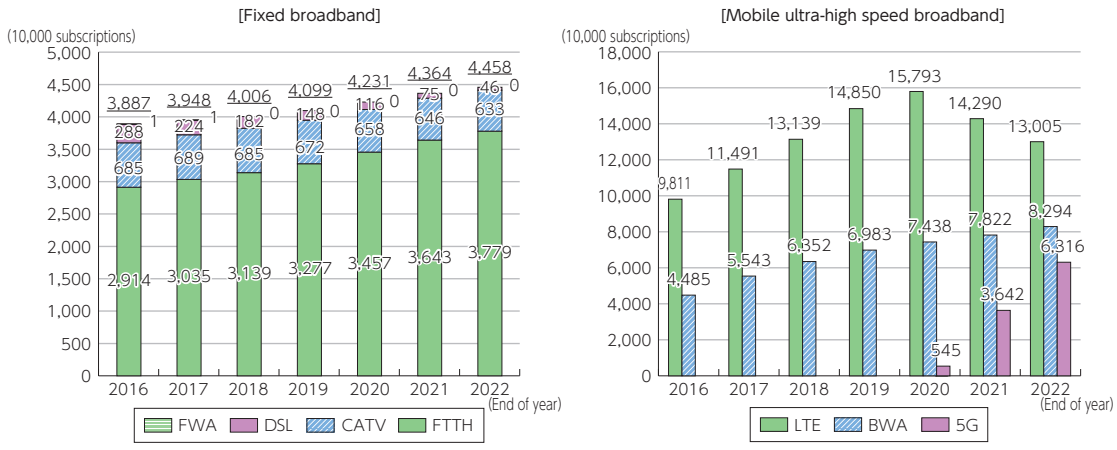
*4 From "MIC Current State of Mobile Communications Traffic in Japan (Sept. 2022)" (measured in March, June, Sept., and Dec.)

(Source) MIC (2023) "Results of Aggregating Internet Traffic in Japan (for November 2022)"[9]

(5) State of broadband usage

As of the end of December 2022, the number of fixed broadband subscriptions[10] was 44.58 million (up 2.2% from the same period of the previous year), and of the mobile ultrafast broadband subscriptions,[11] 130.05 million were 3.9th or 4th generation mobile phones (LTE) (down 9.0% from the same period of the previous year), 63.16 million were 5th generation mobile phones (up 26.74 million from the same period of the previous year), and 82.94 million were BWAs (up 6.0% from the same period of the previous year) (**Figure 4-2-2-6**).

Figure 4-2-2-6 Changes in the number of broadband subscriptions



*The figures for the past differ from those published last year due to revisions in business operator reports.

(Source) Prepared based on the MIC "Quarterly data on the number and share of subscriptions to telecommunications services (Fiscal 2022 Q3 (End of December))"[12]

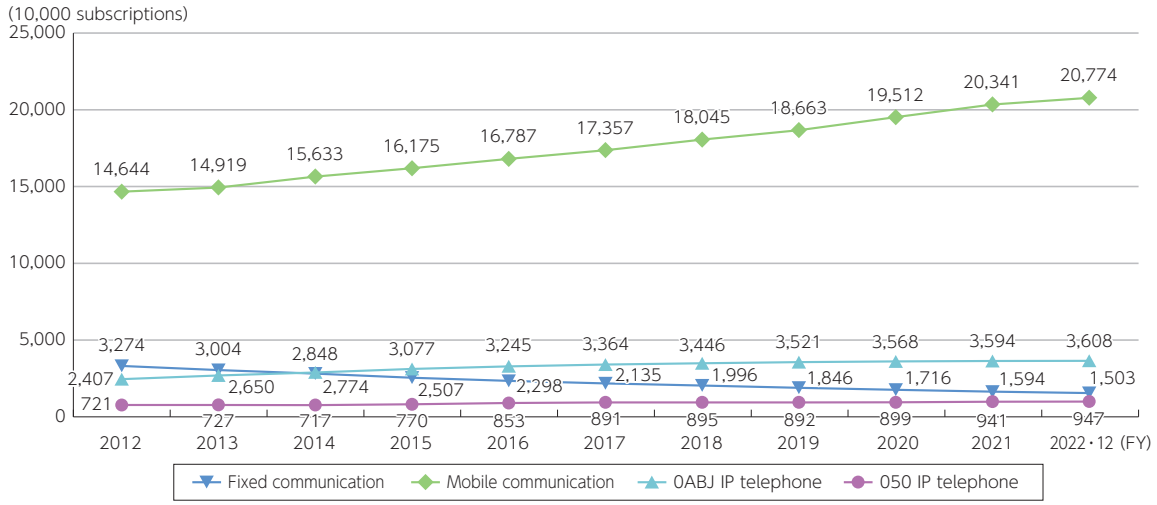
[9] https://www.soumu.go.jp/main_content/000861552.pdf
[10] The number of fixed-line broadband subscriptions is the sum of the FTTH, CATV (limited to coaxial, HFC), DSL, and FWA subscriptions.
[11] This is the number of LTE, BWA, and 5G subscriptions, and does not include 3G or PHS subscriptions.
[12] https://www.soumu.go.jp/menu_news/s-news/01kiban04_02000215.html

(6) State of the number of subscriptions with voice communications services

In recent years, the number of subscriptions to fixed communications (NTT East/West subscribed telephones (including ISDN), chokushu telephones[13] and CATV telephones, excluding 0ABJ type IP phones) has been on a downward trend, while the number of subscriptions to mobile communications (mobile phones, PHS and BWA) and 0ABJ type IP phones has shown solid growth. As of the end of December 2022, the number of subscriptions to mobile communications was approximately 13.8x that of fixed communications (**Figure 4-2-2-7**).

As of the end of December 2022, the share of each business operator by number of subscriptions in the mobile communications market was NTT DOCOMO with 36.1% (down 0.5 points from the same period of the previous year, 41.7% when including provision related to MVNOs), KDDI Group with 27.0% (down 0.1 points from the same period of the previous year, 30.4% when including provision related to MVNOs), Softbank with 20.9% (±0 points, 25.7% when including provision related to MVNOs), Rakuten Mobile with 2.2% (down 0.1 points from the same period of the previous year), and MVNOs with 13.8% (up 0.6 points from the same period of the previous year) (**Figure 4-2-2-8**).

Figure 4-2-2-7 Changes in the number of subscriptions to voice communications services



*1 For fiscal 2022, data up to the end of December was used, so care must be taken when comparing over time.

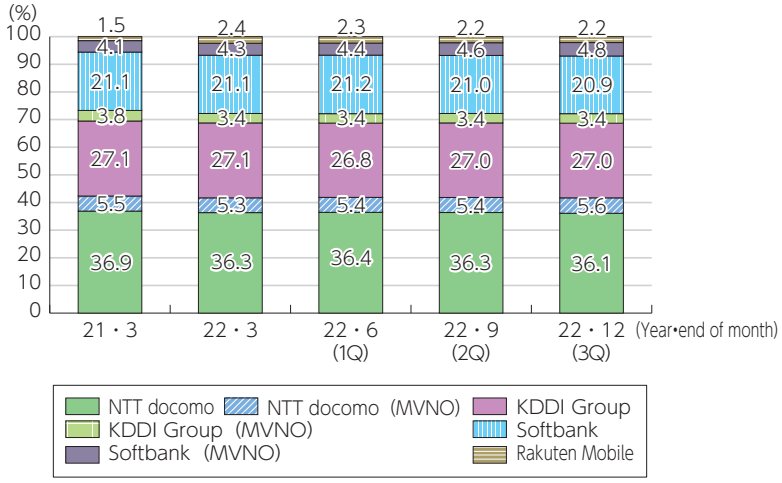
*2 Mobile communications is the sum of mobile phones, PHS, and BWA.

*3 For mobile communications since fiscal 2013, figures are adjusted for intra-group transactions. Adjusted for intragroup transactions means when an MNO receives mobile phone and BWA services as an MVNO from another MNO in the same group and then provides them together with their own services on a single mobile phone, etc., the contracts are counted as one contract instead of two contracts.

(Source) Prepared based on the MIC "Publication of quarterly data on the number and share of subscriptions to telecommunications services (Fiscal 2022 Q3 (End of December))"

[13] Chokushu telephone is a subscribed telephone service by telecommunications carriers other than NTT East/West and includes choku subscription, choku subscription ISDN, new-type chokushu and new-type chokushu ISDN.

Figure 4-2-2-8 Changes in share of mobile communications subscriptions (adjusted for intra-group transactions) by business operator



*1 Adjusted for intragroup transactions means when an MNO receives mobile phone and BWA services as an MVNO from another MNO in the same group and then provides them together with their own services on a single mobile phone, etc., the contracts are counted as one contract instead of two contracts.

*2 The share of the KDDI Group includes KDDI, Okinawa Cellular and UQ Communications.

*3 The share of MVNOs is calculated by MNO group that provides services and is indicated by the supplementary note (MVNO) after the name of the MNO group.

*4 Rakuten Mobile's share as an MNO. MVNO services provided by Rakuten Mobile are included in NTT DOCOMO (MVNOs) and KDDI Group (MVNOs).

(Source) Prepared based on the MIC "Publication of quarterly data on the number and share of subscriptions to telecommunications services (Fiscal 2022 Q3 (End of December))"

(7) International comparison of telecommunications charges

Comparing communications charges in Tokyo (Japan) with New York (U.S.), London (UK), Paris (France), Dusseldorf (Germany) and Seoul (Korea) (total of six cities), as of March 2023, charges for smartphones in Tokyo (4G, business operator with the top MNO share, new contract) are low for plans with a monthly data capacity of 5 GB and 20 GB, and medium level for plans with a monthly data capacity of 50 GB and 100 GB.

Regarding fixed-telephone charges, the basic rate and local-call rate for three minutes at 12:00 on a weekday are at a medium level.

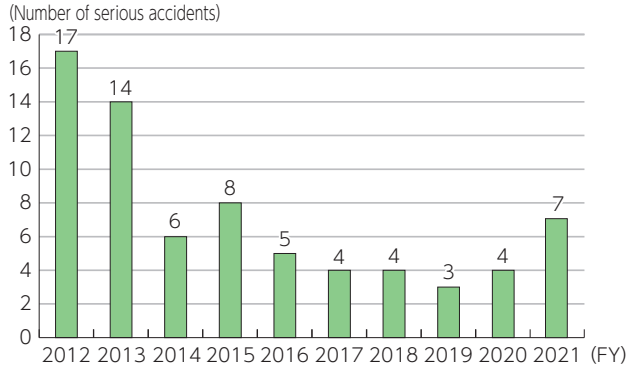
Figure (related data) International comparison of mobile phone charges by model (fiscal 2022)
Source: MIC "FY2022 Survey on Domestic-Overseas Price Difference of Telecommunication Service"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00126
(Data collection)

Figure (related data) International comparison of fixed telephone charges based on individual charges (fiscal 2022)
Source: MIC "FY2022 Survey on Domestic-Overseas Price Difference of Telecommunication Service"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00127
(Data collection)

(8) State of the occurrence of telecommunications service accidents

In fiscal 2021, 6,696 accidents that required quarterly reporting were reported, and of these accidents seven were serious accidents,[14] with this number on the rise since fiscal 2019 **(Figure 4-2-2-9)**.

Figure 4-2-2-9 Changes in the number of serious accidents



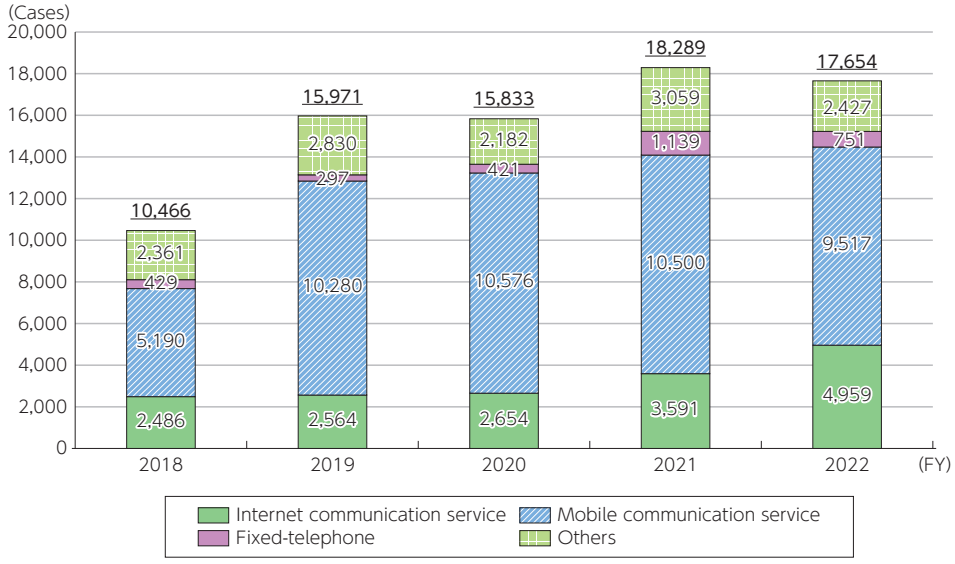
(Source) MIC "Accidents in Telecommunications Services (Fiscal 2021)"[15]

(9) Complaints and requests for consultation on telecommunications services, and requests for consultation on illegal and harmful information

a Complaints and requests for consultation on telecommunications services

The number of complaints and consultations on telecommunications services received by MIC in fiscal 2022 was 17,654, which is a decrease from the previous year **(Figure 4-2-2-10)**. In addition, the complaints and consultations received by consumer centers nationwide and MIC by service were most frequently related to MNO services **(Figure 4-2-2-11)**.

Figure 4-2-2-10 Changes in the number of complaints and inquiries received by MIC

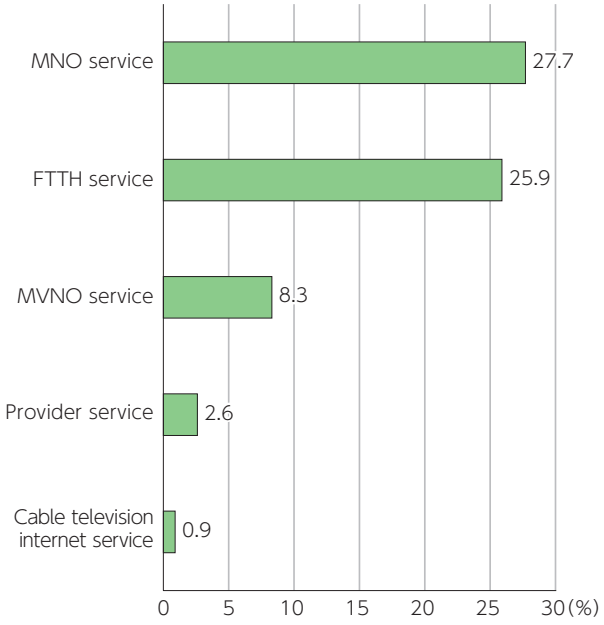


(Source) Created by MIC

[14] Accidents falling under Article 28 of the Telecommunications Business Act "When a serious accident specified by an Ordinance of the Ministry of Internal Affairs and Communications has occurred with respect to telecommunications activities, (the telecommunications carrier) shall report without delay to the Minister for Internal Affairs and Communications to that effect including its reason or cause."

[15] https://www.soumu.go.jp/menu_news/s-news/01kiban05_02000263.html
*Number of reports from business operators. With regard to serious accidents, from fiscal 2008, a decline in the quality of a telecommunications service is also classified as a serious accident, and from fiscal 2015, reporting standards have been set for each category of telecommunications service, rather than uniformly for telecommunications services, so changes from year to year cannot be simply compared.

Figure 4-2-2-11 Breakdown of complaints and consultations received by consumer centers nationwide and the Ministry of Internal Affairs and Communications (random sample of those received between April 2022 and September 2022)



*There is a possibility that ISP services provided together with FTTH lines are only included in provider services.

(Source) MIC "Regular Meeting for Monitoring Consumer Protection Rules and ICT Service Reliability (14th meeting)"

b Requests for consultation on illegal and harmful information, etc.

The number of consultations received by the Illegal and Harmful Information Consultation Center (Illegal Harmful Hotline) operated by the Ministry of Internal Affairs and Communications, continues to remain high, with 5,745 consultations in fiscal 2022. (**Figure 4-2-2-12**). In fiscal 2022, the five business operators that were the source of most consultations were Twitter, Google, Meta, 5 Channel, and Bakusai (**Figure 4-2-2-13**).

Figure 4-2-2-12 Changes in the number of consultations regarding illegal and harmful information

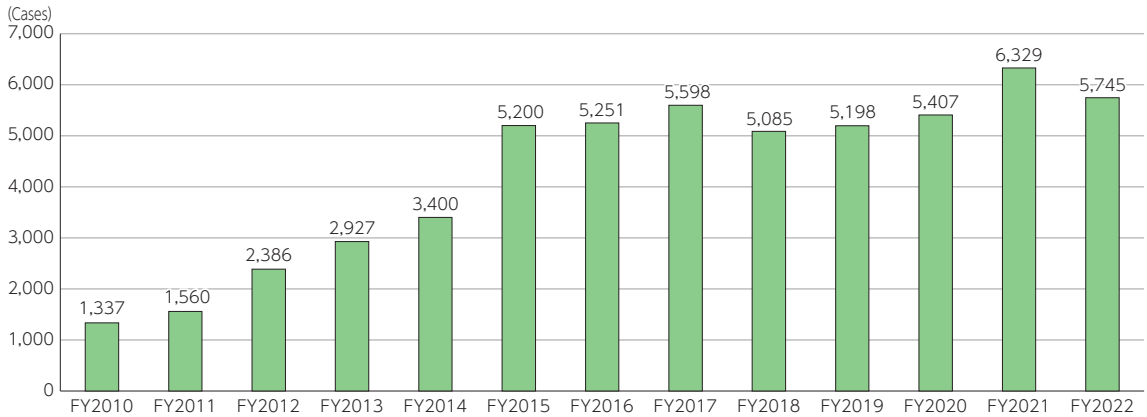
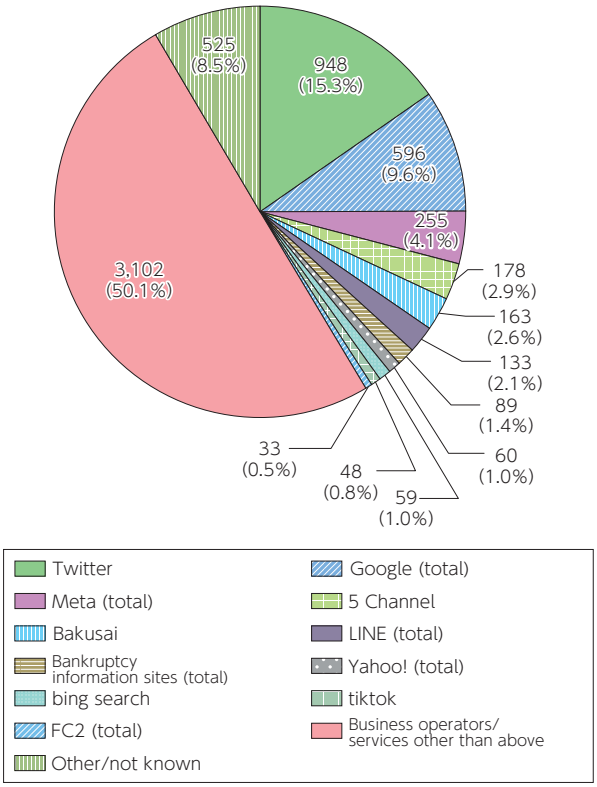


Figure 4-2-2-13 Breakdown of the number of consultations provided at the Illegal Harmful Hotline by business operator



Business operator, service, etc.		Number of requests	Percentage
Twitter		948	15.3%
Google (total)		596	9.6%
	Search	229	
	YouTube	158	
	map	180	
	Other	29	
Meta (total)		255	4.1%
	Instagram	199	
	Facebook	55	
	Whatsapp	1	
5 Channel		178	2.9%
Bakusai		163	2.6%
LINE (total)		133	2.1%
	Livedoor services (*2)	61	
	Services in LINE applications	72	
Bankruptcy information sites (total)		89	1.4%
Yahoo! (total)		60	1.0%
	Search	17	
	Auction	14	
	Advice	14	
	News	5	
	Other	10	
bing search		59	1.0%
tiktok		48	0.8%
FC2 (total)		33	0.5%
Business operators/services other than above		3,102	50.1%
Other/not known			8.5%

*1 Breakdown of the number of consultations (work): By business operator/service (n=6,189) <fiscal 2022> *Number of consultations (work): 5,745 cases

*2 LINE sold the livedoor service on December 27, 2022, so responses from January 2023 are not included.

*3 Total number of consultations (work), and counseling centers do not determine whether or not individual consultations constitute a violation of rights.

*4 Since data is compiled by entering a representative domain for each work case, it is not strictly compiled statistical information because there are cases where an applicable domain covers multiple sites.

*5 Some use their own domains, so the actual domain may not be known.

3. New trends in the communications field

(1) Virtualization

Virtualization is a technology that integrates and reproduces multiple pieces of hardware (servers, OSs, CPUs, memory, networks, etc.) in software to enable the use of hardware of any specifications without being bound by physical limitations. Depending on the hardware to be virtualized, various virtualization solutions are offered, including server virtualization, desktop virtualization, storage virtualization, and network virtualization.

Against the backdrop of the rise of cloud services, the growing adoption of network virtualization and automation, and the strategic initiatives of major companies, advances in network virtualization technology are accelerating globally. In Japan, too, it has become an established method for constructing and operating infrastructure in data centers, and is experiencing a gradual growth trend due to the growing need for faster and more efficient network construction and operation within corporate LANs.

In 2021, Japan's client virtualization solution (on-premises) market size (sales) was approximately 621.5 billion yen (down 1.9% from the previous year), showing negative growth for the second consecutive year. By vendor, Fujitsu, Hitachi, NEC, Itochu Techno Solutions (CTC), Kindryl Japan, NTT Data, and Hewlett-Packard Japan were the top vendors in that order.

Figure (related data) Market revenue share of domestic client virtualization solutions (on-premises) by vendor sales (2021)
Source: IDC "Japan Virtual Client Computing Market Share" (July 6, 2022)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00136 (Data collection)

(2) Open-RAN

Regarding the radio access networks (RAN) of telecommunications carriers, initiatives to update the configuration of network equipment, such as to Open RAN[16] that enables multiple vendors, are underway in various countries. According to GSMA Intelligence, as of 2023 there were 18 telecommunications carriers commercially deploying Open RAN, but more than 80 telecommunications carriers have expressed interest or announced plans to deploy a solution.[17]

For example, Dish Network in the U.S. is building a cloud-native Open RAN-based 5G SA network that achieved 20% population coverage as of June 2022.

In Europe, five of the largest telecommunications carriers (Deutsche Telekom, Orange, Telefonica, Vodafone, Telecom Italia Mobile) are co-promoting Open RAN, saying they will support the development of Open RAN technology to enable deployment in populated areas.[18] Vodafone also launched Europe's first commercial Open RAN in a populated area in the UK in May 2023.[19]

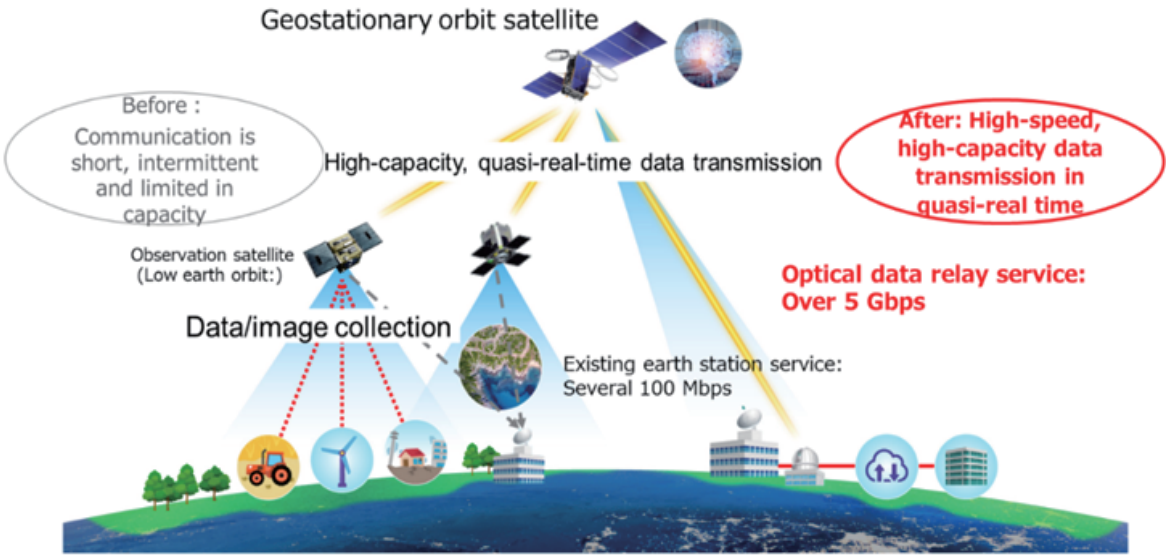
In December 2022 in Japan, NTT DOCOMO, KDDI, SoftBank, and Rakuten Mobile established Japan OTIC (Open Testing & Integration Centre) in Yokosuka Cityas a center for testing and certification based on the standards stipulated by the O-RAN ALLIANCE. The OTICs that have so far been established in countries in Europe and elsewhere, is led by one major telecom operator and is believed to be the first in the world to be jointly established and operated by multiple telecommunications carriers.[20] In January 2023, KDDI began commercial deployment of O-RAN-compliant 5G virtual base stations using Fujitsu wireless equipment and Samsung Electronics wireless controllers.[21] NTT DOCOMO launched the OREX brand in February 2023 and announced that it will work with global communications device vendors to strengthen its support system for global telecommunications carriers to implement Open RAN.[22] In addition, Rakuten Symphony, a subsidiary of Rakuten, is also engaged in external sales of Open RAN, with sales of $476 million in fiscal 2022.[23]

[16] Open Radio Access Network. Mobile Front Haul that is interface between Distributed Unit (DU) and Radio Unit (RU) is standardized as O-RAN Front Haul by the O-RAN Alliance. The standardization is expected to facilitate provision of communications network equipment by various vendors and at the same time facilitate area building and lower equipment procurement costs.
[17] GSMA [Industry moves to execute on open RAN potential]
https://www.gsma.com/futurenetworks/latest-news/industry-moves-to-execute-on-open-ran-potential/
[18] "Major European operators accelerate progress on Open Ran maturity, security and energy efficiency"
https://newsroom.orange.com/major-european-operators-accelerate-progress-on-open-ran-maturity-security-and-energy-efficiency/?lang=en
[19] Vodafone "Vodafone's first Open RAN sites deliver better connectivity in busy seaside towns"
https://www.vodafone.com/news/technology/vodafone-first-open-ran-sites-better-connectivity-busy-seaside-towns
[20] Yokosuka City Website
https://www.city.yokosuka.kanagawa.jp/4430/documents/20221220_japan-otic.pdf
[21] KDDI news release https://news.kddi.com/kddi/corporate/newsrelease/2023/01/24/6508.html
[22] NTT DOCOMO news release
https://www.docomo.ne.jp/binary/pdf/info/news_release/topics_230227_00.pdf
NTT DOCOMO now provides Open RAN support for overseas telecommunications carriers to five companies: KT in Korea, DISH Wireless in the U.S., Singtel in Singapore, and Smart Communications and Vodafone Group in the UK.
[23] Rakuten Group financial results https://corp.rakuten.co.jp/investors/documents/results/2022.html

a Non-terrestrial network (NTN)

The construction of a non-terrestrial network (NTN) is intended to expand communications coverage to seamlessly connect land, sea and air. For example, in August 2022, T-Mobile in the U.S. announced plans to allocate a portion of its mid-band frequency band allocated to mobile phones to communication with SpaceX's Starlink satellite, which will be launched in 2023, to enable communication with remote areas that are currently outside the service area, and a beta version of the new service is expected to be available as early as 2023. In Japan, Space Compass, Inc., which was established by NTT and SKY Perfect JSAT Corporation, plans to launch an optical data relay service in fiscal 2024 that enables large-capacity, near-real-time data transmission by transmitting a vast amount of data collected in space by observation satellites to the ground via geostationary orbit satellites (**Figure 4-2-3-1**). In addition, Japan Radio Co., Ltd., SKY Perfect JSAT Corporation, the Graduate School of Engineering of the University of Tokyo, and the National Institute of Information and Communications Technology, in cooperation with the European Space Agency (ESA), Eurescom, and the Fraunhofer FOKUS Institute, conducted the first Japan-Europe joint experiment on satellite 5G integrated control including geostationary satellite links in Japan from January to February 2022, and succeeded in transmitting 5G control signals, 4K images, and IoT data over long-distance 5G networks between Japan and Europe.

Figure 4-2-3-1 Overview of optical data relay service



(Source) Nippon Telegraph and Telephone Corporation "NTT and SKY Perfect JSAT Corporation agree to establish Space Compass, Inc."

Section 3 Trends in the broadcasting and content fields

1. Broadcasting

(1) Size of the broadcasting market

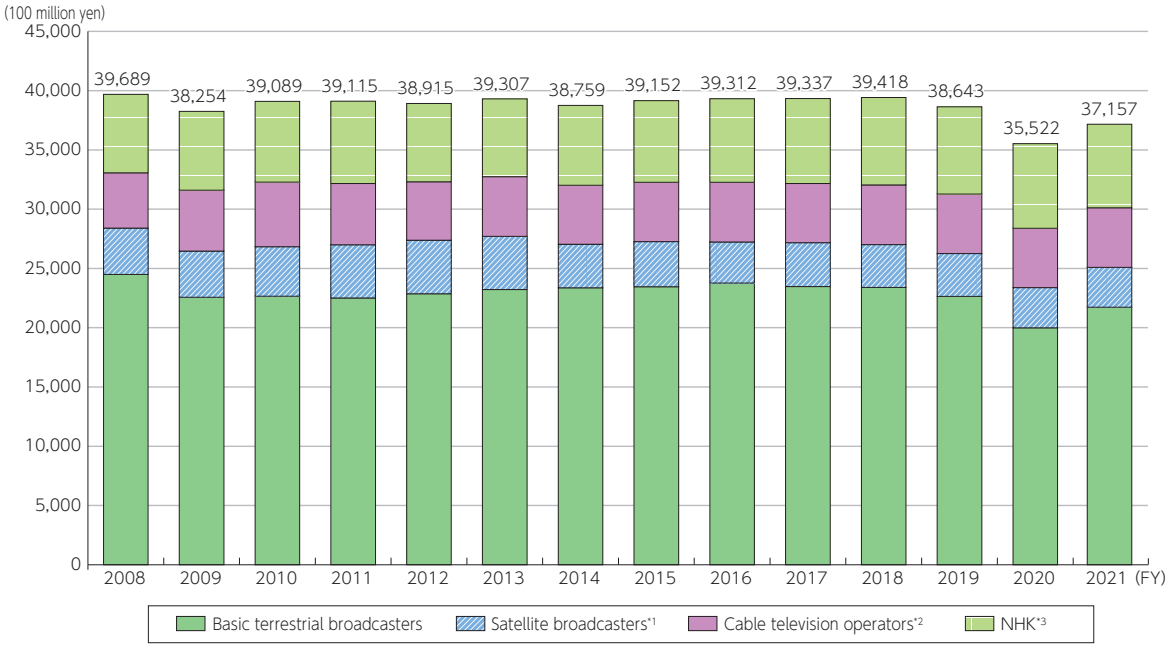
a Sales of broadcasters

In Japan, broadcasting is conducted through a dual system. NHK operates broadcasting based on subscription fee income and private broadcasters operate broadcasting based on advertising revenue or broadcasting fees. In addition, the Open University of Japan operates broadcasting for education.

Net sales of broadcasters as a whole, including revenues from broadcasting operations and revenues from non-broadcasting operations, increased from fiscal 2020 to 3.7157 trillion yen in fiscal 2021 (up 4.6% from the previous fiscal year).

Looking at the breakdown, total sales of private basic terrestrial television broadcasters were 2.1701 trillion yen (up 8.5% from the previous fiscal year), total sales of private satellite broadcasters were 341.8 billion yen (up 0.9% from the previous year), total sales of cable TV operators were 499.0 billion yen (down 0.3% from the previous year) and ordinary business income of NHK was 704.8 billion yen (down 1.2% decrease from the previous year) **(Figure 4-3-1-1)**.

Figure 4-3-1-1 Changes in the size of the broadcasting industry market (total sales) and market breakdown



*1 Calculated based on operating revenues related to the satellite broadcasting business.

*2 Up to fiscal 2010, cable TV operators were commercial corporations that conducted independent broadcasting using facilities approved under the former Cable Television Broadcasting Act (including facilities registered under the former Broadcast Act for Use of Telecommunications Services that uses a broadcasting system equivalent to the facilities), and from fiscal 2011, cable television operators are registered general broadcasters (limited to commercial corporations) that conduct independent broadcasting using cable telecommunications equipment (with both excluding operators using the IP multicast method).

*3 NHK's value is ordinary business income.

*4 Community broadcasters who are also engaged in cable television are excluded.

(Source) Prepared based on the MIC "Income and Expenditures of Private Broadcasters" and NHK "Financial Statements" for each fiscal year

In 2022, advertising expenditures of private basic terrestrial broadcasters totaled 1.7897 trillion yen, with 1.6768 trillion yen pertaining to television broadcasting and 112.9 billion yen pertaining to radio broadcasting.[1]

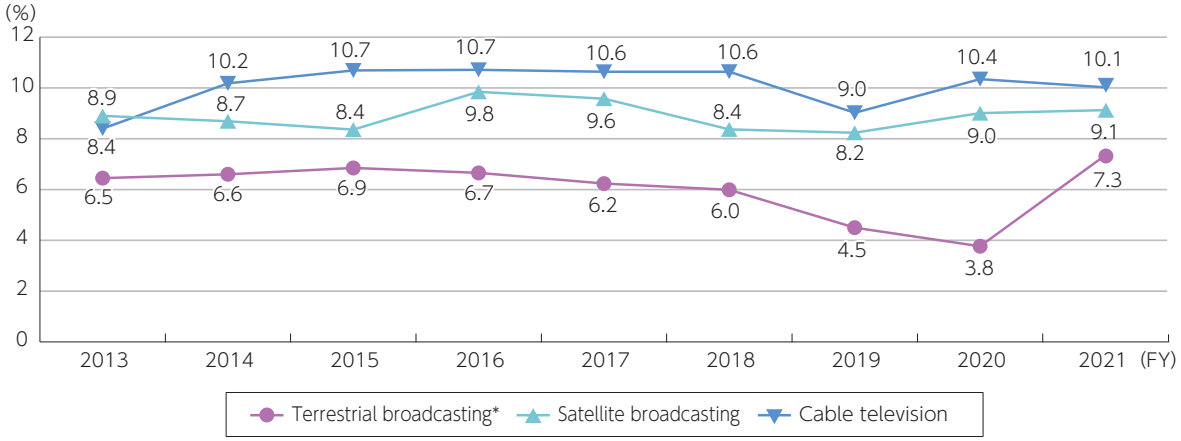
Figure (related data) Changes in advertising expenditures of terrestrial private broadcasters
Source: Prepared based on Dentsu's "Advertising Costs in Japan"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00141
(Data collection)

[1] For details on the entire advertising market, see "2 Advertising" in Section 3-2 of Chapter 3.

b Financial status of private broadcasters

Private basic terrestrial broadcasters (operating profit on sales was 7.3% in fiscal 2021), private satellite broadcasters (operating profit on sales was 9.1% in fiscal 2021) and cable TV operators (operating profit on sales was 10.1% in fiscal 2021) all continued to post profits following fiscal 2020 (**Figure 4-3-1-2**).

Figure 4-3-1-2 Changes in operating profit on sales of private broadcasters



*Basic terrestrial broadcasting excluding community broadcasting

(Source) Prepared based on the MIC "Income and Expenditures of Private Broadcasters" for each fiscal year. etc.

(2) Number of business operators

At the end of fiscal 2022, the breakdown of private broadcasters was 534 private basic terrestrial broadcasters (including 339 broadcasters conducting community broadcasting) and 42 private satellite broadcasters (**Figure 4-3-1-3**).

Figure 4-3-1-3 Changes in the number of private broadcasters

At the end of fiscal year				2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Terrestrial	Television broadcast (Single operation)	VHF		16	93	93	94	94	98	94	94	95	95	95	96	96
		UHF		77												
	Basic satellite broadcasting	Medium -wave (AM) broadcasting		13	13	13	14	14	14	14	14	15	15	15	16	16
		Ultrashort wave (FM) broadcasting		298	307	319	332	338	350	356	369	377	384	384	388	390
			Community broadcasting of the above	246	255	268	281	287	299	304	317	325	332	334	338	339
		Short wave		1	1	1	1	1	1	1	1	1	1	1	1	1
	Television/radio broadcasting (combined operation)			34	34	34	33	33	33	33	33	32	32	32	31	31
	Text broadcasting (single operation)			1	1	0	0	0	0	0	0	0	0	0	0	0
	Multimedia broadcasting					1	1	1	4	4	4	6	6	2	2	0
	Subtotal			440	449	461	475	481	500	502	515	526	533	529	534	534
Satellite	Basic satellite broadcasting	BS broadcasting		20	20	20	20	20	20	19	19	22	22	20	22	21
		110 degrees east longitude CS broadcasting		13	13	22	23	23	23	23	20	20	20	20	20	20
	General satellite broadcasting			91	82	65	45	7	5	4	4	4	4	4	4	4
	Subtotal			113	108	92	72	46	44	41	39	41	41	39	42	42
Cable television	General cable broadcasting pertaining to registration (limited to operators of voluntary broadcasting)	Broadcasting using former authorized facilities (limited to operators of voluntary broadcasting)		502	556	545	539	520	510	508	504	492	471	464	464	–
		Broadcasting using former cable services		26												
			IP multicast broadcasting of the above	5	5	4	3	3	3	5	5	5	5	5	4	–
	Subtotal			528	556	545	539	520	510	508	504	492	471	464	464	–

*1 The number of television broadcasters (single operation) at the end of fiscal 2015 included five operators (including one which also operates basic terrestrial broadcasting) conducting basic terrestrial broadcasting for mobile reception.

*2 Regarding satellite broadcasters, based on the amended Broadcast Act that came into force in June 2011, BS broadcasting and 110 degrees east longitude CS broadcasting are counted as basic satellite broadcasting while other satellite broadcasting is counted as general satellite broadcasting.

*3 Some satellite broadcasters operate two or more types of broadcasting (BS broadcasting, 110 degrees east longitude CS broadcasting, and general satellite broadcasting) so the totals of each column do not match the values in the subtotal column. Furthermore, from fiscal 2011, only operating broadcasters are included.

*4 Regarding cable television operators, up to fiscal 2010, former approved facilities operators under the former Cable Television Broadcasting Act and registered operators under the former Act on Broadcast on Telecommunications Services were included, and from fiscal 2011, registered general broadcasters conducting independent broadcasting using cable telecommunication facilities under the Broadcast Act are included (regarding IP multicast broadcasting, up to fiscal 2010, it is included in former broadcasting using cable services, and from fiscal 2011 it is included in registered general broadcasters conducting independent broadcasting using cable telecommunications equipment).

(Source) Prepared based on the MIC "Current State of Cable Television"[2] (only the values for cable TV operators)

(3) State of the provision of broadcasting services

a Terrestrial television broadcasting

Nationwide, 127 companies (including 31 combined operation companies) were providing private terrestrial television broadcasting at the end of fiscal 2022.

Figure (related data) Number of available private terrestrial television broadcasting channels (fiscal 2022)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00144
(Data collection)

[2] https://www.soumu.go.jp/main_content/000504511.pdf

b Terrestrial radio broadcasting

Medium-wave (AM) broadcasting services are provided by local private basic terrestrial broadcasters (47 companies at the end of fiscal 2022).

Ultrashort wave (FM) broadcasting services are provided by local private basic terrestrial broadcasters (390 companies at the end of fiscal 2022). Of these broadcasters, 339 are community broadcasters for some districts of a municipality in principle.

Short wave broadcasting is conducted by one private basic terrestrial broadcaster as of the end of fiscal 2022.

c Multimedia broadcasting

As of the end of fiscal 2022, there are no private basic broadcasters conducting V-Low multimedia broadcasting using the 99 MHz to 108 MHz frequency band that became available through the digitalization of terrestrial television broadcasting.

d Satellite broadcasting

(a) Basic satellite broadcasting

BS broadcasting is conducted by NHK, the Open University of Japan and private broadcasters (21 companies as of the end of fiscal 2022) using the satellites of the Broadcasting Satellite System Corporation, and 110 degrees east longitude CS broadcasting is conducted by private broadcasters (20 companies as of the end of fiscal 2022) using the satellites of SKY Perfect JSAT Corporation.

Since December 2018, new 4K and 8K satellite broadcasting is being conducted for 18 programs of 10 companies in BS and 110 degrees east longitude CS broadcasting. In the field of dextrorotation BS broadcasting, in March 2022, three companies (BS Yoshimoto Co., LTD., BS Shochiku Tokyu Co., Ltd. and Japanet Broadcasting Co., Ltd.) that were authorized for basic satellite broadcasting in November 2019 opened free channels with diverse themes including regional revitalization.

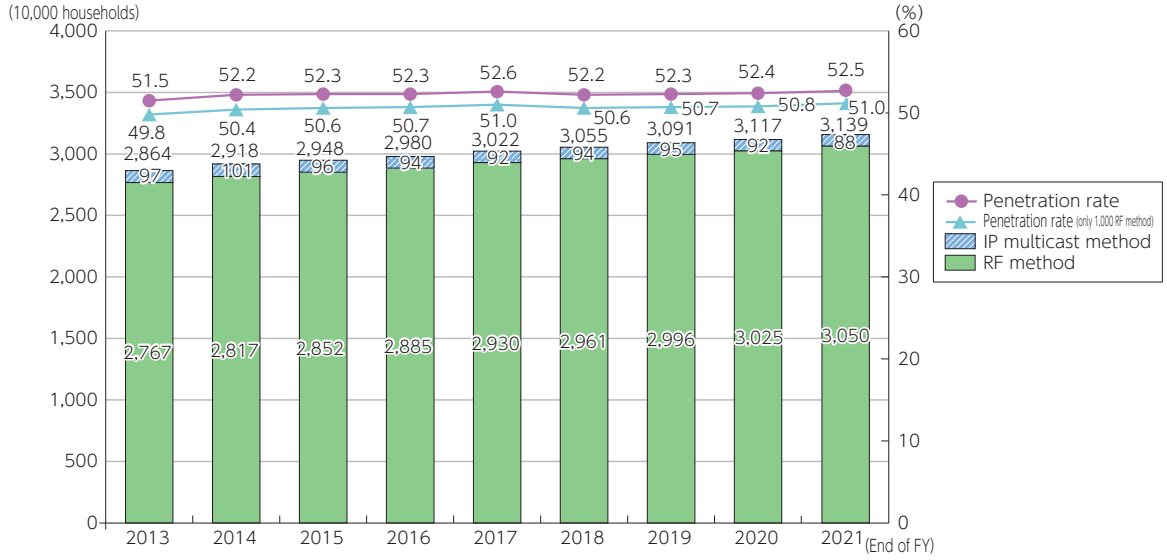
(b) General satellite broadcasting

General satellite broadcasting is conducted by private broadcasters (4 companies as of the end of fiscal 2022) using the satellites of Sky Perfect JSAT Corporation.

e Cable television

The number of cable TV operators was 464 at the end of fiscal 2021. Cable television provides multichannel broadcasting including re-transmission of terrestrial and satellite broadcasting and independent broadcasting channels. The number of subscribed households receiving services through cable telecommunications equipment (with 501 terminals or more) performing independent broadcasting as per their registration is approximately 31.39 million and penetration rate of all households is approximately 52.5% (**Figure 4-3-1-4**).

Figure 4-3-1-4 Changes in the number of subscribed households and penetration rate for receiving services from cable telecommunications equipment that provide independent broadcasting as per their registration



*1 The penetration rate is calculated from the number of households in the Basic Resident Register.

*2 The number of subscribed households with the RF method means the total number households (including the number of households with radio interference) connected to the cable telecommunications equipment as per their registration.

(Source) Prepared based on the MIC "Current State of Cable Television"[3]

[3] https://www.soumu.go.jp/main_content/000504511.pdf

(4) State of NHK

a State of domestic broadcasting by NHK

At the end of fiscal 2022, the number of domestic NHK broadcasting channels was 9: two channels for terrestrial television broadcasting; three channels for radio broadcasting; and four channels for satellite television broadcasting **(Figure 4-3-1-5)**.

Figure 4-3-1-5 NHK domestic broadcasting (end of fiscal 2022)

Category			Number of channels
Terrestrial broadcasting	Television broadcasting		2
	Radio broadcasting	Medium-wave (AM) broadcasting	2
		Ultrashort wave (FM) broadcasting	1
Satellite broadcasting (BS broadcasting)	Television broadcasting		4

*1 The radio broadcasting frequency is also indicated by the channel.

*2 With regard to television broadcasting, analog television broadcasting ended on March 31, 2021, and all broadcasting has been shifted to digital broadcasting.

b NHK's international television and radio broadcasting

NHK's international television and radio broadcasts to Japanese and foreign nationals overseas and covers almost the entire world (**Figure 4-3-1-6**).

Figure 4-3-1-6 NHK's international television and radio broadcasting (plan as of April 2023)

	Television		Radio
	For overseas Japanese	For foreigners	For overseas Japanese and foreigners
Broadcasting hours	Around 5 hours a day	24 hours a day	75 hours 7 minutes in total per day
Budget	19..8 billion yen (FY2023 NHK budget)		4.9 billion yen (same as on the left)
Language	Japanese	English	18 languages
Service area	Almost all over the world		Almost all over the world
Satellites used / Transmission facilities	Foreign satellites, CATV, etc.		Domestic transmitting stations, overseas relay stations, etc.

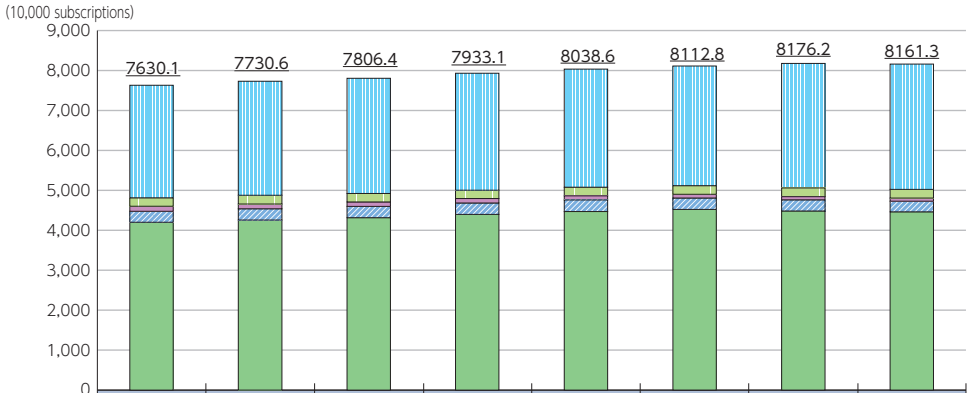
*The number of broadcasting hours of international TV broadcasting for foreigners includes the broadcasting hours of Japan International Broadcasting (JIB).

(5) State of broadcasting service usage

a Number of subscribers

The number of subscribers to broadcasting services in fiscal 2021 increased from the previous fiscal year for cable television and decreased for other broadcasting services (**Figure 4-3-1-7**).

Figure 4-3-1-7 Number of subscribers to broadcasting services



	2014	2015	2016	2017	2018	2019	2020	2021
Cable television	2,817.0	2,852.0	2,885.0	2,930.3	2960.7	2,995.9	3,117.1	3,138.5
110 degrees east longitude CS	212.0	219.5	209.3	208.4	213.7	215.8	218.3	217.1
124/128 degrees east longitude CS	125.4	120.3	114.4	109.4	102.7	93.1	84.4	76.6
WOWOW	275.6	280.5	282.3	287.6	290.1	285.5	279.1	268.0
NHK	4,200.1	4,258.3	4,315.4	4397.4	4,471.4	4,522.5	4,477.3	4,461.1
Satellite contract, etc.	1,911.3	1,993.3	2,066.7	2147.6	2,221.5	2,289.1	2,274.2	2,271.5

*1 The number of subscribers to terrestrial broadcasting (NHK) is the number of NHK subscriptions of all subscription types.

*2 The number of subscribers to satellite contracts, etc. is the number of NHK satellite contracts and special contracts.

*3 The number of WOWOW subscribers is the number of WOWOW subscriptions.

*4 The number of subscribers of 124/128 degrees east CS is the number of Sky Perfect! premium service subscriptions.

*5 The number of subscribers of 110 degrees east CS is the number of Sky Perfect! subscriptions.

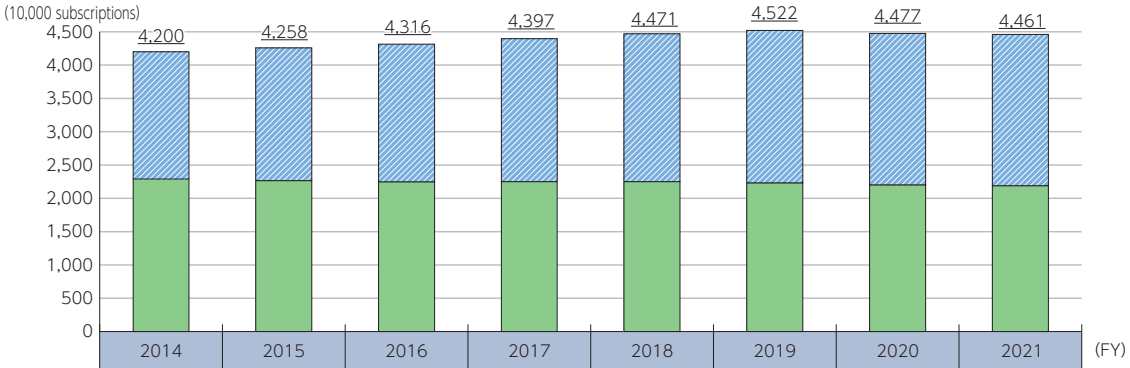
*6 The number of households subscribed to cable television is the number of households subscribed to cable telecommunications equipment that carry out independent broadcasting as per their registration.

(Source) Prepared based on material from the Japan Electronics and Information Technology Industries Association, Japan Cable Laboratories, and NHK,and the MIC "Current State of Satellite Broadcasting" and "Current State of Cable Television"

b Number of subscriptions to NHK

In fiscal 2021, the number of NHK subscriptions was 44.61 million, consisting of about 21.90 million terrestrial contracts (ordinary and color), 22.70 million satellite contracts and about 10,000 special contracts (**Figure 4-3-1-8**).

Figure 4-3-1-8 Changes in the number of NHK broadcast subscriptions



	2014	2015	2016	2017	2018	2019	2020	2021
Special contract	1	1	1	1	1	1	1	1
Satellite contract	1,910	1,992	2,066	2,146	2,220	2,288	2,273	2,270
Terrestrial contract	2,289	2,265	2,249	2,250	2,250	2,233	2,203	2,190
Total	4,200	4,258	4,316	4,397	4,471	4,522	4,477	4,461

(Source) Prepared based on material from NHK

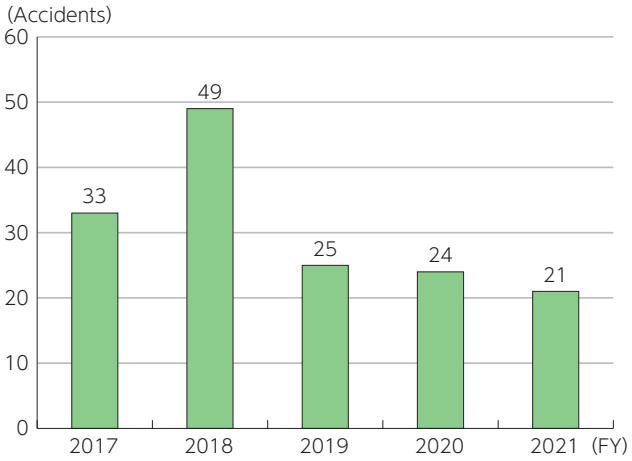
(6) Ensuring of security and reliability of broadcasting equipment

Due to the highly public nature of broadcasting as a means of widely and instantly transmitting important information such as information necessary for daily life and disaster information, the broadcasting equipment that supports this requires a high level of safety and reliability.

In fiscal 2021, the number of broadcasting suspension accidents that occurred was 339, of which 21 (about 6%) were serious accidents[4] (**Figure 4-3-1-9**). In the light of these accidents, initiatives to prevent similar accidents have been promoted by sharing the cases in the industry in addition to reliable implementation of recurrence prevention measures by individual business operators.

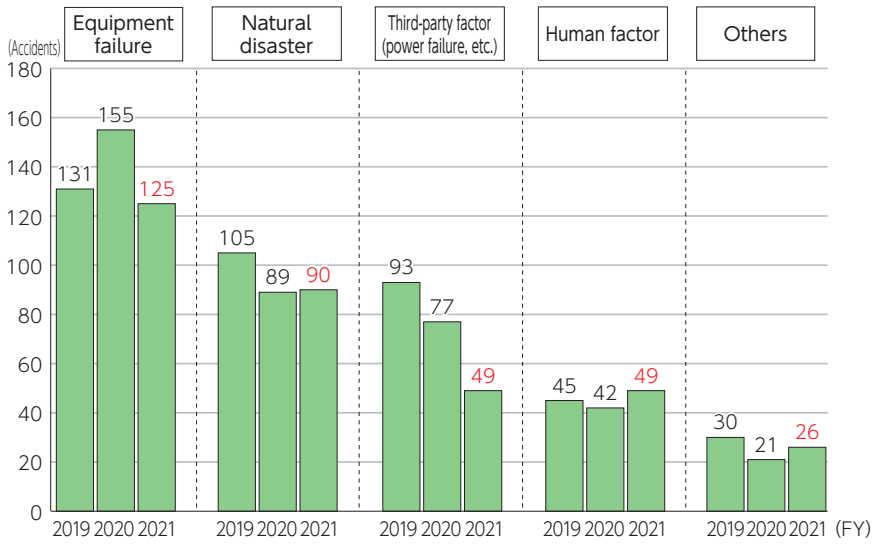
The number of terrestrial and satellite broadcasting suspension accidents that occurred was 262, which was the smallest number since fiscal 2011 when aggregation started. The number of cable broadcasting accidents has decreased compared to fiscal 2020, and the number of serious accidents was the lowest in the last five years. The top cause for the occurrence of broadcasting suspension accidents continued to be equipment failure, followed by natural disasters (**Figure 4-3-1-10**).

Figure 4-3-1-9 Changes in the number of serious accidents



(Source) Prepared based on the MIC "State of the Occurrence of Broadcasting Suspension Accidents"[5] (fiscal 2021)

Figure 4-3-1-10 Changes in the number of broadcasting suspension accidents by cause



(Source) Prepared based on the MIC "State of the Occurrence of Broadcasting Suspension Accidents (fiscal 2021)"[6]

[4] Accidents falling under Articles 113, 122 or 137 of the Broadcast Act: "If the suspension of broadcasting caused by the equipment for basic broadcasting or other major accident stipulated in the Ministerial Ordinance of the Ministry of Internal Affairs and Communications occurs, the approved basic broadcaster must report such matter as well as the reason or cause without delay to the Minister for Internal Affairs and Communications."

[5] https://www.soumu.go.jp/menu_news/s-news/02ryutsu08_04000508.html

[6] https://www.soumu.go.jp/menu_news/s-news/02ryutsu08_04000508.html

2. Content market

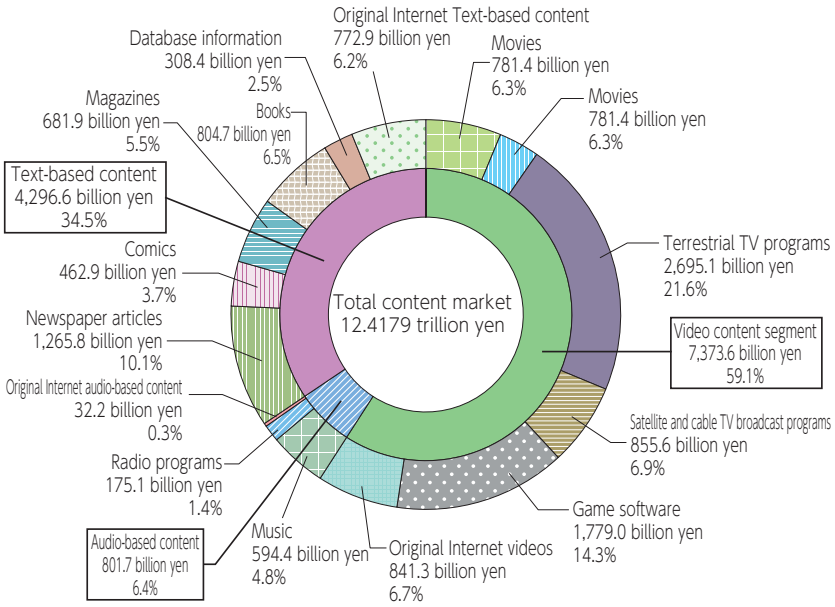
(1) Size of the Japanese content market

a Market overview

The Japanese content market was valued 12.4719 trillion yen in 2021. By content segment, video-based content accounted for about 60% of the market. Text-based content and audio-based content accounted for about 35% and 6% respectively[7] **(Figure 4-3-2-1)**.

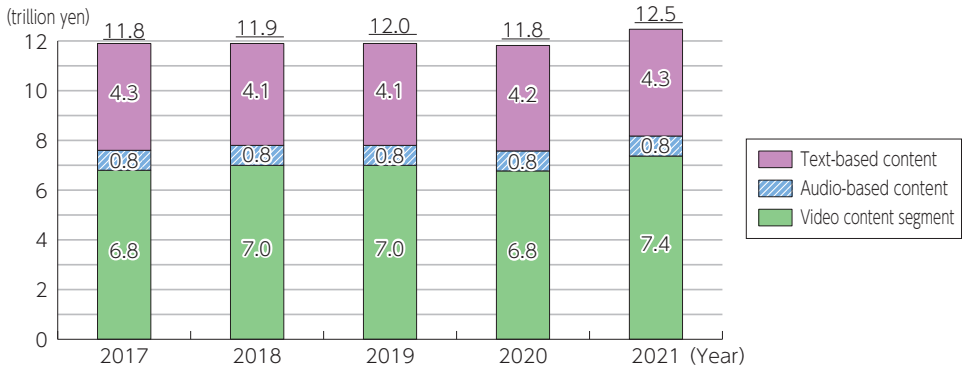
The size of the content market increased significantly in 2021, despite a decline the previous year. By content type, video-based content has increased significantly **(Figure 4-3-2-2)**.

Figure 4-3-2-1 Breakdown of the Japanese content market (2021)



(Source) MIC Institute for Information and Communications Policy "Survey on Media/Software Production and Distribution"

Figure 4-3-2-2 Changes in size of the Japanese content market (by content type)



(Source) MIC Institute for Information and Communications Policy "Survey on Media/Software Production and Distribution"

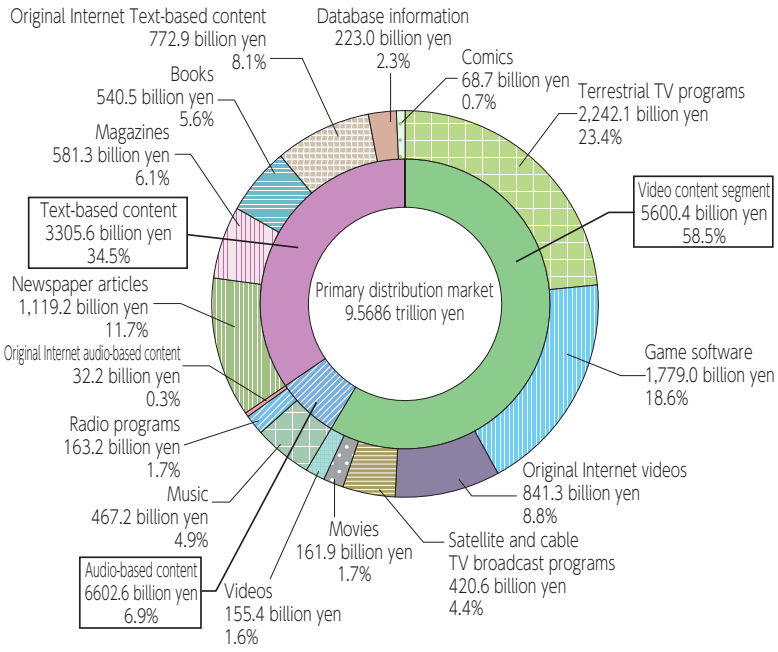
[7] Rather than aggregation by media, market size was calculated and analyzed after aggregation according to distribution stage such as primary distribution and multi-use with a focus on the original nature of the content.

b State of multi-use

The size of the primary distribution market was 9.5686 trillion yen in 2021, a significant increase from the previous year. The primary distribution market is 5.6004 trillion yen for video-based content, 3.3056 trillion yen for text-based content, and 662.6 billion yen for audio-based content **(Figure 4-3-2-3)**.

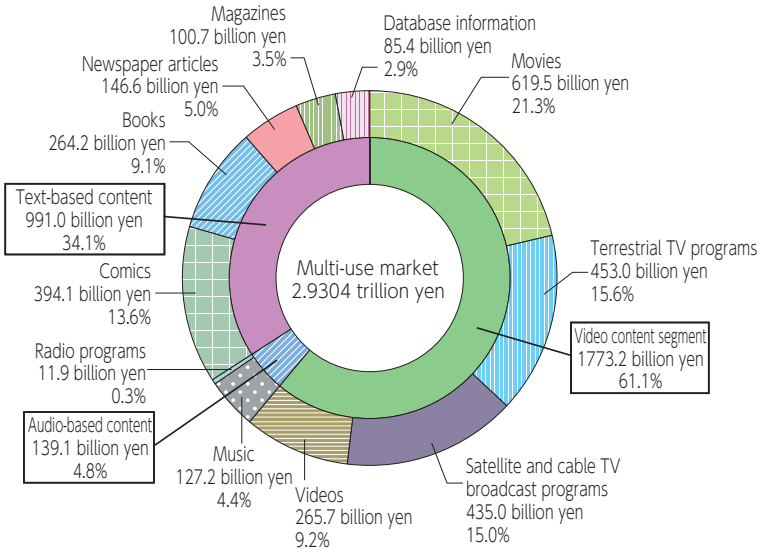
Compared to this, the size of the multi-use market was 2.9034 trillion yen, down from the previous year. The breakdown is 1.7732 trillion yen for video-based content, 991.0 billion yen for text-based content and 139.1 billion yen for audio-based content **(Figure 4-3-2-4)**.

Figure 4-3-2-3 Breakdown of primary distribution market (2021)



(Source) MIC Institute for Information and Communications Policy "Survey on Media/Software Production and Distribution"

Figure 4-3-2-4 Breakdown of multi-use market (2021)



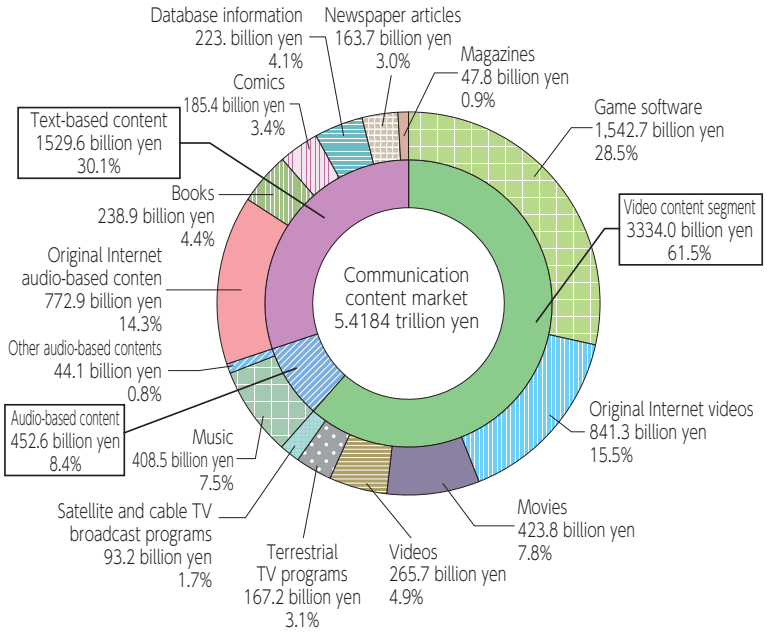
(Source) MIC Institute for Information and Communications Policy "Survey on Media/Software Production and Distribution"

c Communication content market

In the content market, the market size of communication content for personal computers and mobile phones, etc. via the internet is valued at 5.4184 trillion yen. As for market composition by content segment as a percentage, video-based content, text-based content and audio-based content account for 61.5%, 30.1% and 8.4% respectively (**Figure 4-3-2-5**).

The size of the market for communication content has been still growing in recent years. By content type, video-based content continues to increase due to growth in movies, net originals, and game software, etc., while text-based content is also increasing thanks to growth in original internet content, and together these contribute to the expansion of the communication content market (**Figure 4-3-2-6**).

Figure 4-3-2-5 Breakdown of the communication content market (2021)



(Source) MIC Institute for Information and Communications Policy "Survey on Media/Software Production and Distribution"

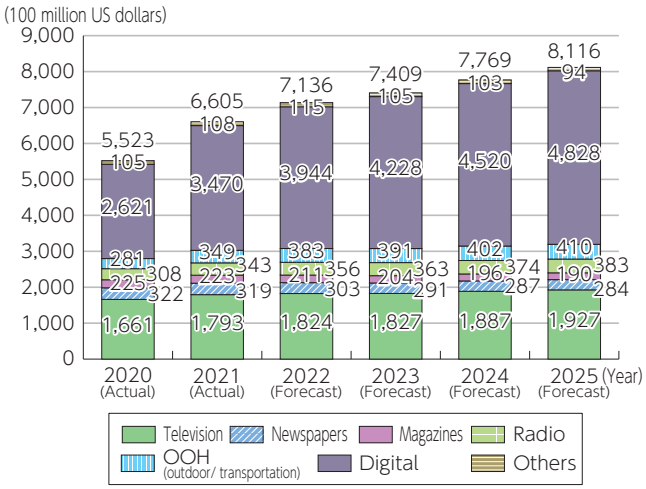
Figure 4-3-2-6 Changes in the size of the telecommunications content market (by content type)

(Source) MIC Institute for Information and Communications Policy "Survey on Media/Software Production and Distribution"

(2) Advertising

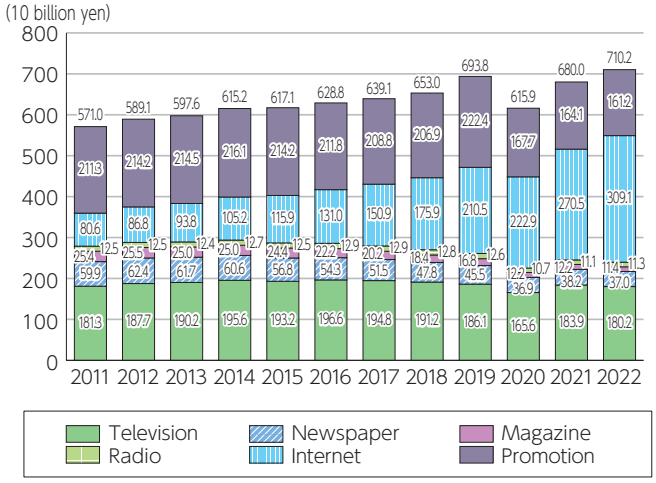
Looking at the global advertising market, digital advertising is expected to reach $394.4 billion in 2022, up 13.7% from the previous year, and increase to 55.3% of total advertisement spending **(Figure 4-3-2-7)**. The Japanese digital advertising market is also growing significantly. In 2022, Internet advertising was 3.912 trillion yen and advertising in the four formats of the mass media[8] was 2.3985 trillion yen, with the difference widening after Internet advertising overtook mass media advertising for the first time in 2021 **(Figure 4-3-2-8)**.

Figure 4-3-2-7 Changes and forecast in global advertising expenditures by media type



(Source) Prepared based on Dentsu Group's "Global Advertisement Spend Growth Rate Forecast (2022 to 2025)"

Figure 4-3-2-8 Changes in advertising expenditure by media in Japan[9]



(Source) Prepared based on Dentsu's "Advertising expenditure in Japan (each year)"[10]

Figure (related data) Changes in global total advertising expenditure
Source: Dentsu Group "Global Advertisement Spend Growth Rate Forecast (2022 to 2025)"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00161
(Data collection)

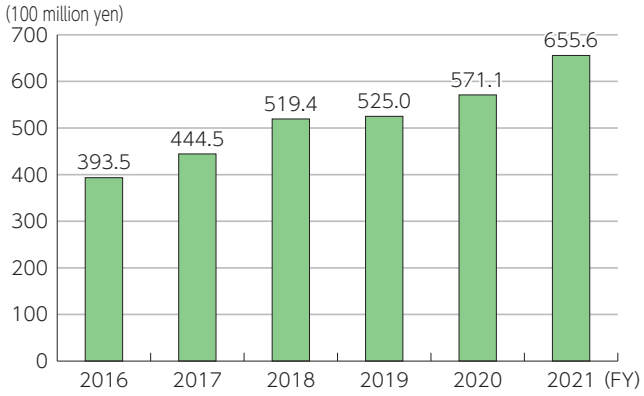
[8] Television media, newspapers, magazines, radio.
[9] Since 2019, advertisements on EC platforms for selling goods and the event field are included in the advertisement expenditure in Japan to estimate the advertisement market. Data for 2018 and before is not retroactively adjusted.
[10] https://www.dentsu.co.jp/knowledge/ad_cost/index.html

(3) Trends in the export of broadcasting content from Japan

In fiscal 2021, the value of broadcasting content exports continued to increase and reached 65.56 billion yen **(Figure 4-3-2-9)**.

With the growth of video streaming services, the value of program broadcasting rights and video release rights, etc. decreased, while the percentage of Internet distribution rights increased.

Figure 4-3-2-9 Changes in the value of broadcasting content exports from Japan



*1 Value of broadcasting content exports: Total sales to overseas of program broadcasting rights, Internet distribution rights, video/DVD rights, program format remake rights, and merchandising rights, etc.

*2 Calculated based on questionnaire responses submitted by NHK, key private broadcasting stations, semi-key private broadcasting stations, local stations, satellite broadcasters, CATV operators, and production companies, etc.

(Source) Prepared based on the MIC "Analysis of the Current Status of Overseas Expansion of Broadcasting Content"

Figure (related data) Changes in the value of Japan's broadcasting content exports by rights
(Source) Prepared based on the MIC "Analysis of the Current Status of Overseas Expansion of Broadcasting Content"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00163
(Data collection)

Figure (related data) Changes in the value of Japan's broadcasting content exports by entity
(Source) Prepared based on the MIC "Analysis of the Current Status of Overseas Expansion of Broadcasting Content"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00164
(Data collection)

Section 4 Trends of radio wave usage in Japan

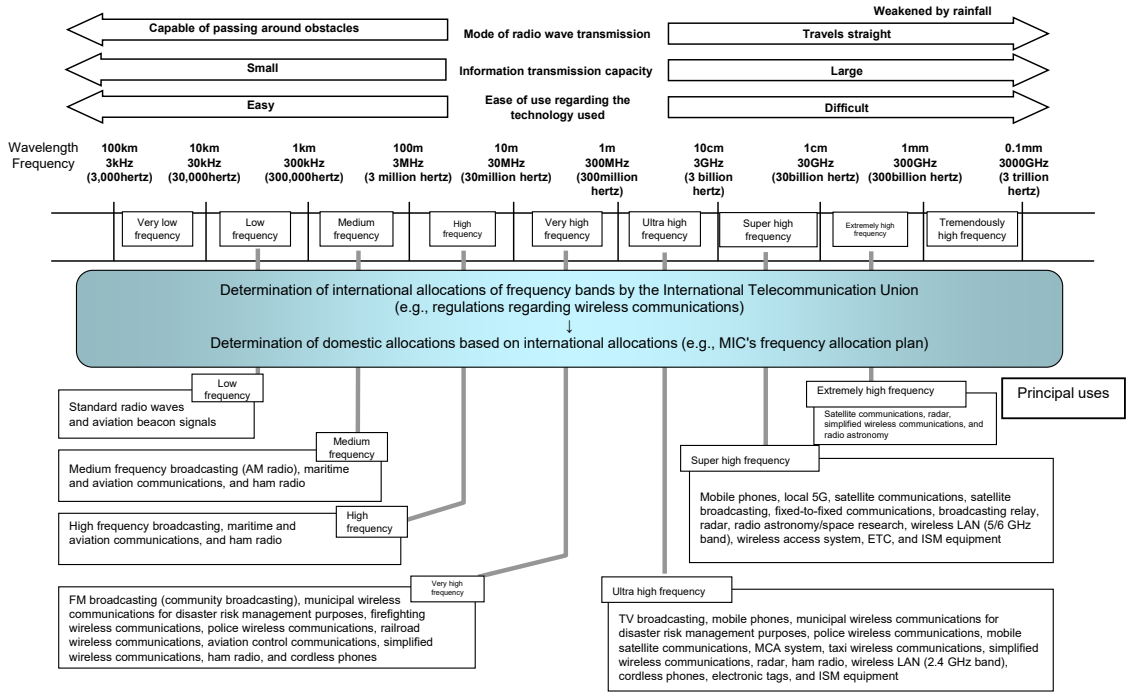
1. Principal use by frequency band

Regarding frequency, the radio regulations stipulated by the International Telecommunication Union (ITU) Convention establishes the allocation of international frequencies by dividing the world into three regions and defines the category of operations for each frequency band.

In order to help applications for radio station licenses, etc., MIC has established the Frequency Assignment Plan[1] based on international allocation and the Radio Act, which defines the frequencies that can be assigned, category of operations, purposes, conditions, etc. When establishing or changing a plan, the Radio Regulatory Council is consulted.

The main uses and characteristics of each frequency band in Japan are shown in (**Figure 4-4-1-1**).

Figure 4-4-1-1 Main uses and characteristics of each frequency band in Japan



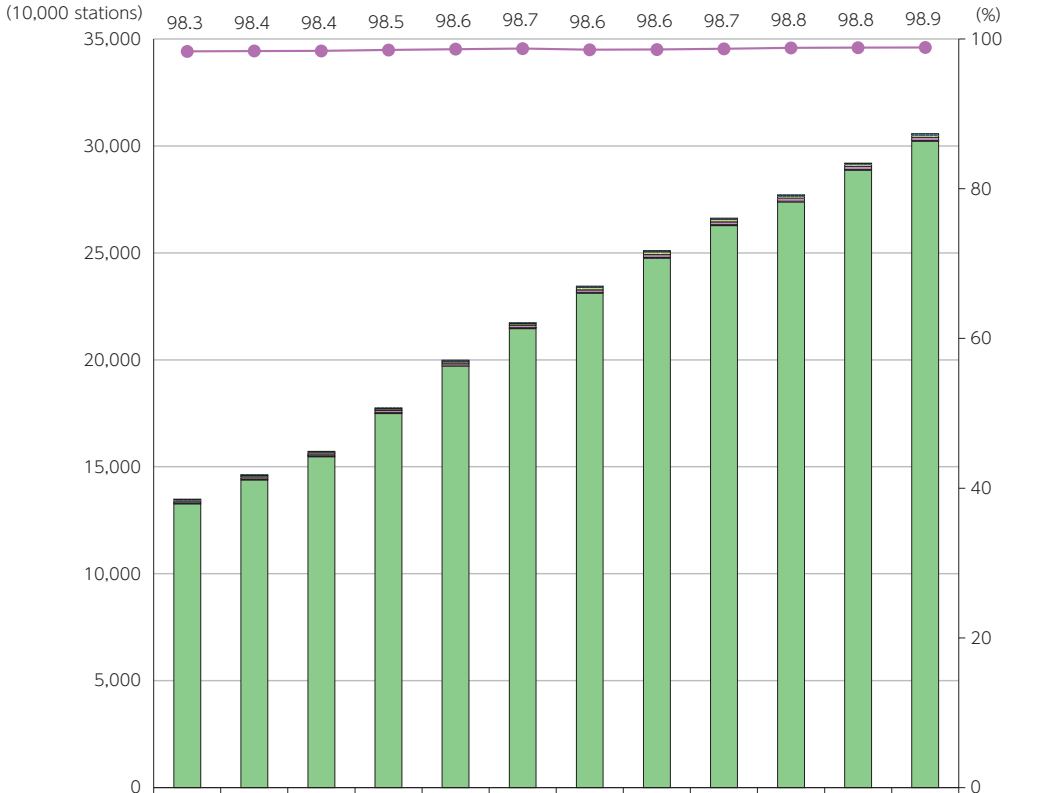
Spectrum	Wave length	Characteristics
Very low frequency	10 to 100km	Propagating along ground surface, waves of this spectrum can go over low hills. Being capable of propagating in water, the spectrum can be used for seabed exploration
Low frequency	1 to 10km	Being capable of propagating to very distant places, the spectrum is used by standard frequency stations to inform radio clock, etc. of time and frequency standard.
Medium frequency	100 to 1000m	Capable of propagating through reflection off the E-layer of the ionosphere that is formed at the height of about 100km, the spectrum is used mainly for radio broadcasting.
High frequency	10 to 100m	Capable of reaching the other side of the globe by being reflected off the F-layer of the ionosphere that is formed at the height of about 200 to 400km and by repeating reflection between F-layer and the ground surface. Widely used for ocean ship and international flight plane communication, international broadcasting and amateur radio.
Very high frequency	1to 10m	Waves of this spectrum propagate rather straight and are not easily reflected off the ionosphere, butare capable of reachingthe other side of mountains and buildings to a certain extent. The spectrum is widely used for a variety of mobile communications including emergency and fire emergency radio.
Ultra high frequency	10cm to 1m	Waves of this spectrum have stronger tendency to propagate straight compared with very high frequency, butare capable of reachingthe other side of mountains and buildings to a certain extent. The spectrum is widely used mostly for a variety of mobile communication systems including mobile phones, and digital television broadcasting and microwave ovens.
Super high frequency	1to 10cm	Due to the strong tendency to propagate straight, this spectrum is suitable for emission to a specific direction. It is mainly used for fixed trunk circuits, satellite communication, satellite broadcasting and wireless LAN.
Extremely high frequency	1mm to 10mm	With strong tendency to propagate straight, waves of the spectrum can transmit very large information quantity, but not very far in bad weather due to rain or fog. For this reason, the spectrum is used for relatively short-distance radio access communication and image transmission systems, simplicity radio, car collision prevention radar and radio telescopes for astronomical observation.
Tremendously high frequency	0.1mm to 1mm	The spectrum has nature similar tolight. It is rarely used for communication but used for radio telescopes for astronomical observation as is the case of Extremely high frequency.

[1] Frequency Assignment Plan: https://www.tele.soumu.go.jp/j/adm/freq/search/share/index.htm

2. Changes in the number of radio stations

The number of radio stations (excluding license-free radio stations such as wireless LAN terminals) at the end of fiscal 2022 was 305.67 million, an increase of 4.7% from the previous year, including 302.19 million mobile phones and other land mobile stations (increase of 4.7% from the previous fiscal year). At 98.9%, the percentage of mobile phones and other land mobile stations is at a high level. The number of convenience radio stations also increased to 1.43 million (up by 0.9% from the previous fiscal year) **(Figure 4-4-2-1)**.

Figure 4-4-2-1 Changes in the number of radio stations



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Other	43	46	50	50	55	49	49	55	59	61	51	55
Base stations	58	63	68	71	70	73	125	132	117	95	108	112
Convenience stations*2	77	84	90	97	105	112	118	125	132	137	142	143
Amateur stations	44	44	44	44	44	43	43	41	40	39	38	37
Land mobile stations*1	13,266	14,388	15,472	17,493	19,711	21,457	23,109	24,748	26,278	27,379	28,859	30,219
Percentage of land mobile stations	98.3	98.4	98.4	98.5	98.6	98.7	98.6	98.6	98.7	98.8	98.8	98.9

*1 Land mobile station: A radio station (such as a mobile phone devices) operated while moving on land or stopped at an unspecified point.

*2 Convenience radio station: A radio station that performs simple radio communication.

3. Satellites

In the field of satellite communications, Japan is working to powerfully advance social implementation and international standardization of the results of the development for realizing the expansion of communication coverage for seamless connection of land, sea and air (non-terrestrial network (NTN) technology that includes satellites and HAPS).

Due to their wide coverage, high broadcast possibilities, disaster resistance and other advantages, communication satellites including geostationary satellites and non-geostationary satellites are used for in-house channels, communications with mountainous regions and isolated islands where use of terrestrial channels is difficult, mobile satellite communications services for ships and aircraft, and communications at the time of disaster. Some communication satellites are used for satellite broadcasting (CS broadcasting).

(1) Geostationary satellites

Rotating in a geosynchronous orbit at a height of 36,000 km above the equator with an orbital period matching the Earth's rotation period, geostationary satellites appear to maintain a fixed position when observed from the earth. The high position enables three geostationary satellites to cover the entire earth except for the polar regions, and these satellites are used for fixed and mobile satellite communications. Due to the long distance from the earth to satellites, the transmission delay is long and high output is required from terminals, which makes terminal downsizing difficult.

Figure (related data) Major geostationary satellites used for communications services in Japan (at the end of fiscal 2022)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00167
(Data collection)

(2) Non-geostationary satellites

Non-geostationary satellites travel in an orbit that is not geostationary and is generally at a lower altitude than geostationary orbits. For this reason, the transmission delay of non-geostationary satellites is shorter and terminal output is smaller, which makes it possible to make the terminals smaller and mobile. Communication in polar regions is possible, which is difficult in a geostationary orbit on the equator. However, as satellites pass over an area in a short period of time, it is necessary to simultaneously operate a large number of satellites in order to cover a wide area while ensuring communicable time.

Figure (related data) Major non-geostationary satellites used for communications services in Japan (at the end of fiscal 2022)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00168
(Data collection)

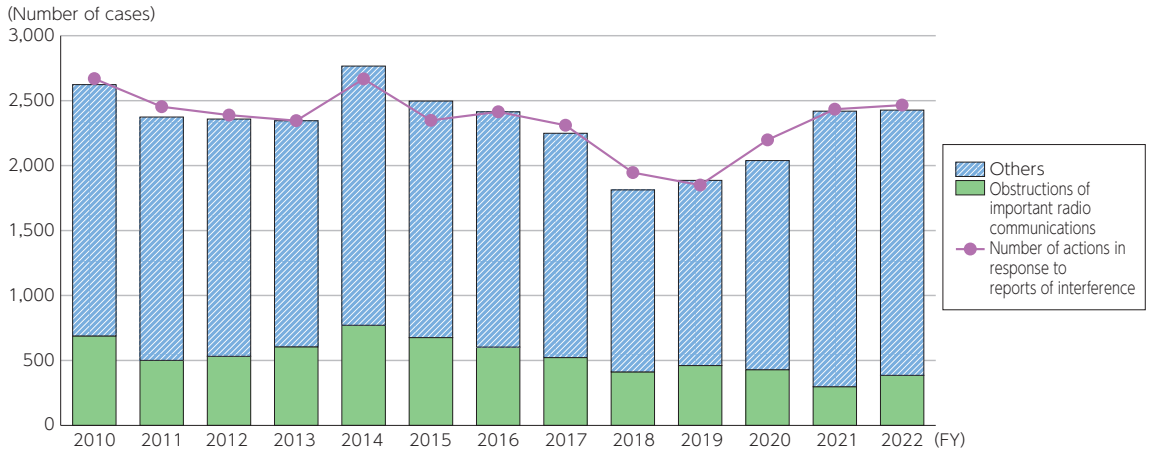
4. Radio wave monitoring to eliminate obstruction of important radio communications, etc.

Using sensor station equipment installed on steel towers and building roofs in major cities across the country and vehicles for searching for unlicensed radio stations, MIC is investigating sources of radio emissions that jam important radio communications including fire/emergency radio, aeronautical/maritime radio and mobile phones and is cracking down on unlicensed radio stations. In addition, MIC has established DEURAS, which is a system that detects emission sources of radio waves including unlicensed radio stations that cause obstructions in the radio usage environment, and is using it to monitor radio waves.[2]

In fiscal 2022, there were 2,432 reports of jamming and obstruction, an increase of 13 from the previous fiscal year, including 385 reports of obstructions to important radio communications, an increase of 87 (up 29.2%) from the previous fiscal year. In fiscal 2022, the number of actions[3] taken for jamming and obstruction reports was 2,466 (**Figure 4-4-4-1**).

Additionally, the number of unlicensed radio stations found in fiscal 2022 was 4,481, down 4,053 (30.5% decrease) compared to the previous year. The number of actions taken in fiscal 2022[4] increased by 297 (up 35.8%) from the previous year to 1,098 actions taken, which breaks down is 94 prosecutions (6.1% of all actions taken) and 1,004 guidance actions (93.9% of all actions taken) (**Figure 4-4-4-2**).

Figure 4-4-4-1 Changes in the number of reports of jamming and obstruction of radio stations and the number of actions taken



Number of reports of interference or obstruction	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	(FY)
Obstructions of important radio communications	689	501	532	605	771	676	603	522	412	461	429	298	385	
Others	1,934	1,873	1,826	1,740	1,995	1,821	1,811	1,727	1,401	1,425	1,610	2,121	2,047	
Total	2,623	2,374	2,358	2,345	2,766	2,497	2,414	2,249	1,813	1,886	2,039	2,419	2,432	

Number of actions in response to reports of interference or obstructions

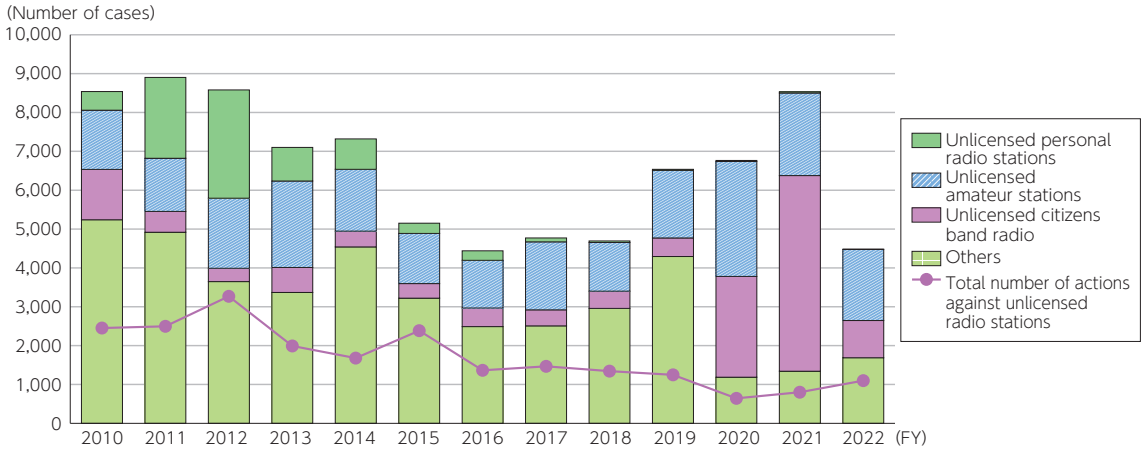
Number of actions in response to reports of interference	2,669	2,453	2,389	2,346	2,667	2,348	2,414	2,310	1,946	1,850	2,198	2,434	2,466

[2] Regarding obstructions to important radio communications, in fiscal 2010, DEURAS established a 24-hour system for receiving obstruction reports and have been working to promptly eliminate them. As an international radio wave monitoring facility registered with the International Telecommunication Union (ITU), DEURAS plays a role in HF and cosmic radio wave monitoring.

[3] The number of actions taken includes actions in response to reports made in the previous fiscal year, for which action had not previously been taken.

[4] The number of actions taken includes actions in response to reports made in the previous fiscal year, for which action had not previously been taken.

Figure 4-4-4-2 Changes in the number of reports of unlicensed radio stations and the number of actions taken



(FY)

Number of unlicensed radio stations found		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Stations found	Unlicensed personal radio stations	479	2,081	2,788	865	784	265	245	99	40	28	25	32	3
	Unlicensed amateur stations	1,525	1,367	1,803	2,225	1,592	1,291	1,229	1,749	1,253	1,739	2,959	2,126	1,831
	Unlicensed citizens band radio	1,295	538	342	642	404	375	478	414	443	477	2,594	5,035	958
	Others	5,239	4,917	3,648	3,369	4,541	3,221	2,489	2,508	2,958	4,293	1,187	1,341	1,689
	Total	8,538	8,903	8,581	7,101	7,321	5,152	4,441	4,770	4,694	6,537	6,765	8,534	4,481

Number of actions against unlicensed radio stations

Number of actions	Prosecution	262	249	231	228	215	230	168	168	208	189	62	49	94
	Guidance	2,190	2,247	3,038	1,764	1,465	2,156	1,196	1,300	1,136	1,058	581	752	1,004
	Total	2,452	2,496	3,269	1,992	1,680	2,386	1,364	1,468	1,344	1,247	643	801	1,098

Section 5 Trends related to ICT equipment and devices in Japan and overseas

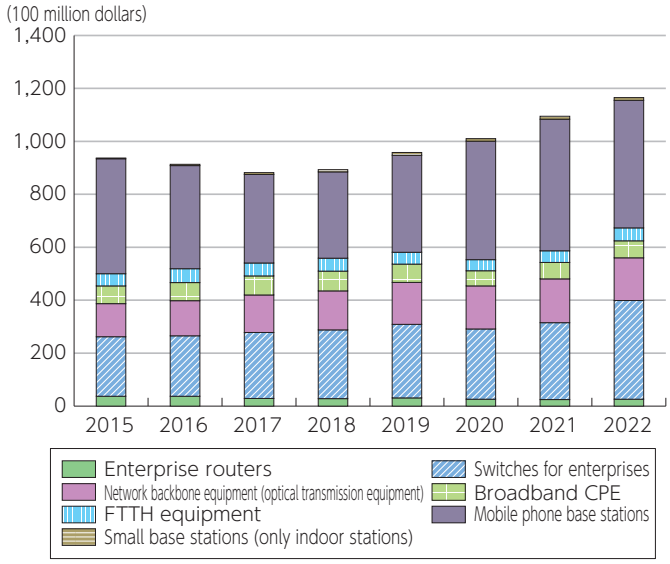
1. Trends in the ICT equipment market in Japan and overseas

(1) Market size

The value of global shipments of network equipment has been increasing since 2017 and reached 15.3287 trillion yen (up 27.6% from the previous year) in 2022 (**Figure 4-5-1-1**). Mobile phone base stations and switches for enterprises accounted for a major part of shipments.

Japan's production of network equipment had been decreasing from the first half of the 2000s, but it started to gradually increase in 2018, and then started to decrease again in 2021, and in 2022 it decreased to 660.7 billion yen (down 14.7% from the previous year). Looking at the breakdown, production of telephone application equipment[1] and exchangers decreased with the shift from fixed telephones to mobile and IP telephones, and today, wireless application devices[2] and other wireless communications equipment[3] are major segments. Production of base station communication equipment has fluctuated greatly. It stagnated from 2016 when investments in 4G came to an end, but increased in 2020, then decreased again in 2022. Production of network connection equipment used for IP communications[4] started to increase in 2019 but decreased from 2021. Production of conveyance equipment[5] increased mainly due to digital transmission equipment from 2019, but started to decrease from 2021.

Figure 4-5-1-1 Changes in the value of global network equipment shipments



(Source) Omdia

(2) Market change by equipment type

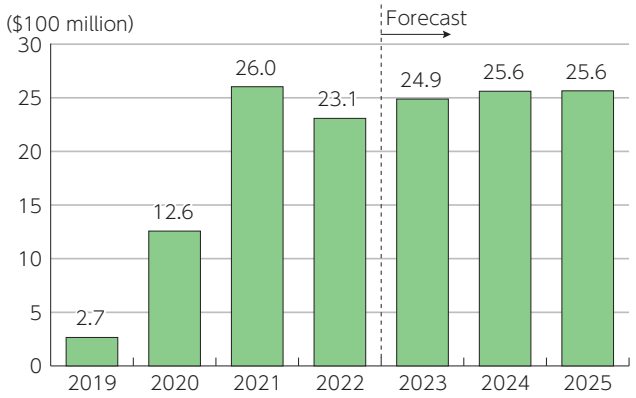
a 5G base stations

In 2022, the size (value of shipments) of the global market for 5G base stations (macrocells) was 3.9876 trillion yen (up 23.5% from the previous year), and 303.5 billion yen in Japan (up 6.2% from the previous year)[6] (**Figure 4-5-1-2**). Both markets are expected to peak moderately but remain high. Furthermore, in 2022, in terms of market share (value of shipments) of 5G base stations (macrocells), Huawei had the greatest share with 29.8%, followed by Ericsson with 25.1%, and Nokia with 15.3%. As such, major overseas companies accounted for a major share of the 5G base stations (macrocells) market (value of shipments), and the international competitiveness of Japanese companies is low.

However, as of 2021, Japanese companies are expected to account for 34% of the global market (in terms of sales) for electronic components embedded in cell phone base stations and smartphones, indicating that they have the potential to compete regarding Beyond 5G (**Figure 4-5-1-3**).

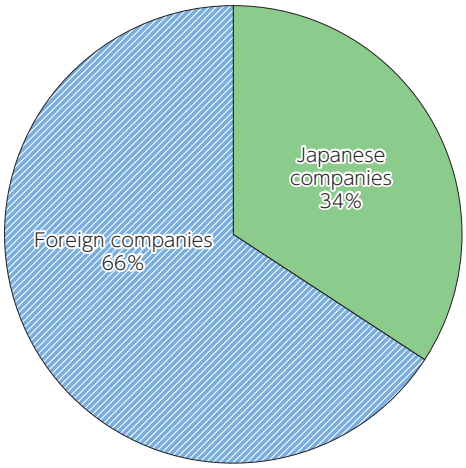
[1] Key telephone systems and interphones
[2] Maritime/aeronautical radars, wireless location measuring devices, telemeter/telecontrol apparatus, etc.
[3] Satellite/terrestrial fixed communications equipment, maritime/aeronautical communications equipment, transceivers, etc.
[4] Routers, hubs, gateways, etc.
[5] Digital transmission devices, power line carrier devices, CATV carrier devices, optical transmission devices, etc.
[6] In dollar terms, the market was down 11.3% from the previous year.

Figure 4-5-1-2 Size (value of shipments) of the Japanese 5G base stations (macrocells) market



(Source) Omdia

Figure 4-5-1-3 Share of global electronic components market (in terms of sales) (2021)



(Source) Omdia

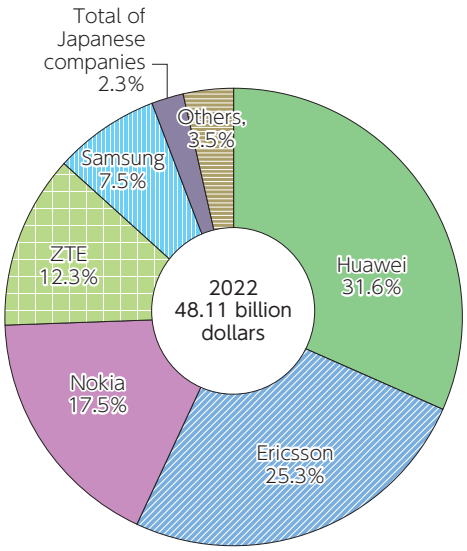
Figure (related data) Global 5G base stations (macrocells) market size (value of shipments)
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00173
(Data collection)

Figure (related data) Global 5G base stations (macrocells) market share (value of shipments)
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00175
(Data collection)

b Macrocell base stations (including 5G)

In terms of the value of shipments in the global market in 2022, Huawei led the market with 31.6%, followed by Ericsson with 25.3%, and Nokia with 17.5%, while Japanese companies accounted for a total of 2.3%. (**Figure 4-5-1-4**).

Figure 4-5-1-4 Share of the global macrocell base station market (value of shipments in 2022)



(Source) Omdia

c Enterprise routers

In terms of the value of shipments in the global market in 2022, Cisco led the market with 66.3%, followed by H3C with 9.0% and Huawei with 6.0%.

In terms of the value of shipments in the Japanese market in 2022, Cisco led the market with 35.1%, followed by NEC with 26.6%, and Yamaha with 23.3%.

Figure (related data) Global enterprise router market share
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00178
(Data collection)

Figure (related data) Japanese enterprise router market share
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00179
(Data collection)

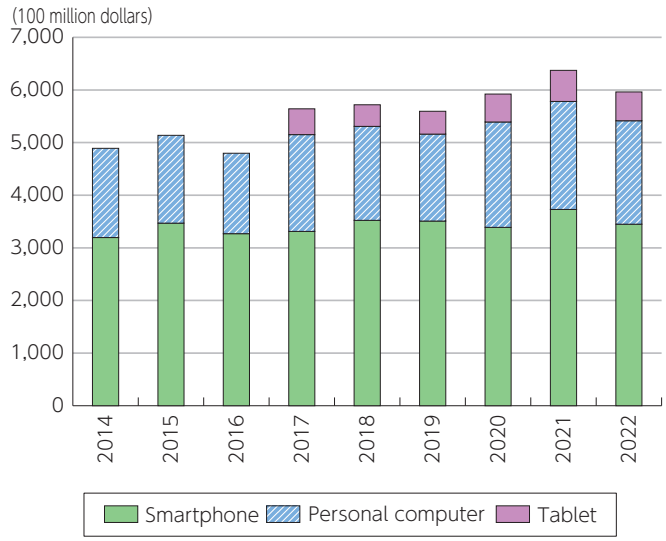
2. Trends in the ICT device market in Japan and overseas

(1) Market size

The value of global shipments of information devices has been increasing since 2016 and reached 92.2574 trillion yen (up 15.8% from the previous year) in 2022[7] (**Figure 4-5-2-1**). In breakdown, smartphones and personal computers account for a major part.

The value of Japan's production of information devices was on the decrease up to 2017, then increased again 2018, but started to decrease again in 2020 and fell to 956.7 billion yen (down 7.7% from the previous year[8]) in 2022. In breakdown, PHS and mobile phones[9] accounted for the major part of the market up to the mid-2010s, but decreased thereafter, and currently desktop computers, laptop computers and information devices[10] form the major part of the market.

Figure 4-5-2-1 Changes in the value of global information device shipments



*Tablets have been counted since 2017

(Source) Omdia

(2) Change in the market by device type

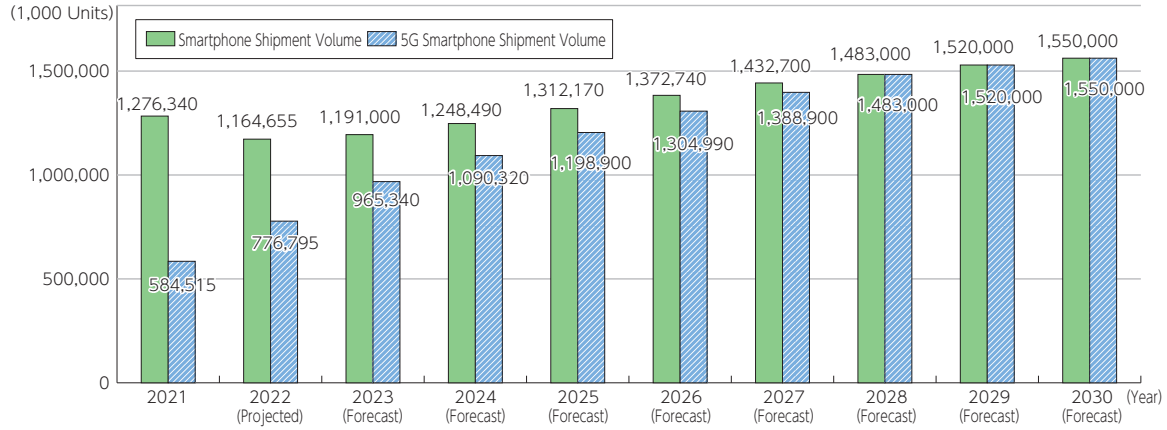
a Smartphones (5G)

Global shipments volume of 5G smartphones totaled 584.52 million units in 2021, accounting for 46% of all smartphones (1,276.34 million units). From 2028, 100% of smartphones is expected to support 5G, and the number of smartphones is forecasted to grow to 1.55 billion units by 2030 (**Figure 4-5-2-2**).

Shipments of 5G smartphones in Japan totaled 17.53 million units in 2021, up 67.7% from the previous year. From 2024, 100% of smartphones will support 5G, and the number of smartphones is forecasted to grow to 32.18 million by fiscal 2027 (**Figure 4-5-2-3**).

[7] In dollar terms, the market was down 3.3% from the previous year.
[8] This is affected by the fact that the value of PHS and mobile phones can no longer be calculated so is not recorded.
[9] Since fiscal 2019, the value of mobile phone and PHS production is no longer disclosed, so the values for radio communications equipment (including satellite communications equipment) are used after deducting the values of broadcasting equipment, fixed communications equipment (satellite and terrestrial), other terrestrial mobile communications equipment, maritime/aeronautical mobile communications equipment, base station communications equipment, other radio communications equipment and associated radio equipment.
[10] External memories, printers, monitors, etc. Information kiosk terminal devices are excluded because their production was not disclosed in some years.

Figure 4-5-2-2 Transition and Forecast of Global Shipment Volume of Smartphones & 5G Smartphones



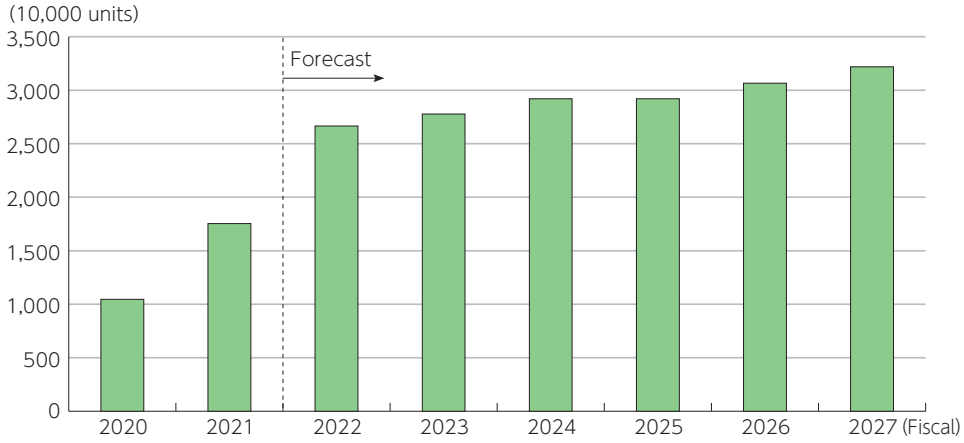
*1 Based on the shipment volume at manufacturers.

*2 The values for 2022 are those projected, and the values after 2023 are those forecasted.

*3 Number of 5G smartphones are included in the number of smartphones.

(Source) Yano Research Institute Ltd., "Global Market of Mobile Phone Subscriptions and Shipment Volume: Key Research Findings 2022", February 7, 2023

Figure 4-5-2-3 Shipments of 5G smartphones in Japan



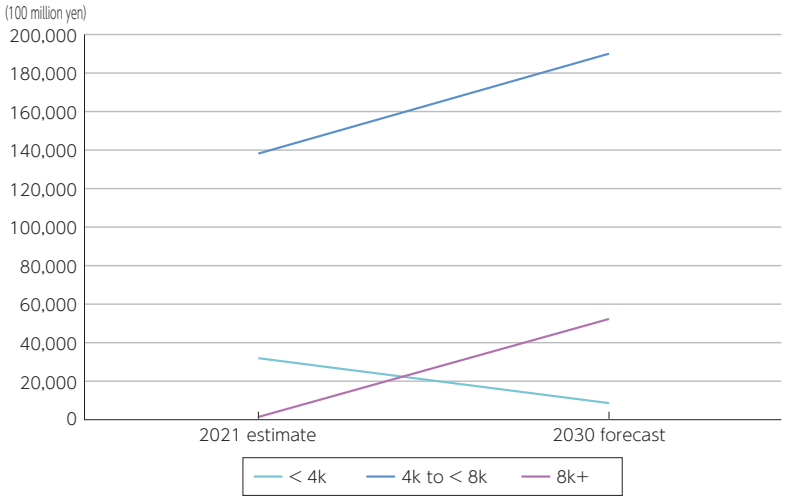
(Source) CIAJ "Medium-Term Demand Forecast for Communications Devices [Fiscal 2022 to Fiscal 2027]"

b 4K and 8K televisions

Regarding the value of global shipments of 4K and 8K televisions, in 2021 it is expected to be a large 13.9 trillion yen for televisions that are 4K or higher but less than 8K, and this is forecasted to increase to 19 trillion yen by 2030. For televisions that are less than 4K, it is expected to be 3.17 trillion yen in 2021, and is forecasted to shrink to 770 billion yen in 2030. In comparison, for televisions that are 8K or higher, it is expected to be a small 140 billion yen in 2021, but is forecasted to increase to 5.2 trillion yen in 2030 **(Figure 4-5-2-4)**.

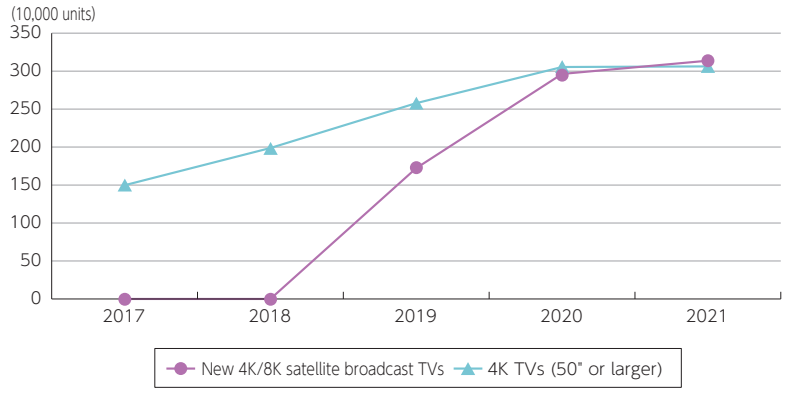
In 2021 in Japan, the number of 4K televisions (50-inch or larger) shipped was 3.06 million units (up 0.3% year on year), and the number of new 4K and 8K satellite broadcast televisions shipped was 3.14 million units (up 5.9% year on year), with growth decelerating for both types in 2021 (**Figure 4-5-2-5**).

Figure 4-5-2-4 Value of global shipments of 4K and 8K televisions



(Source) Fuji Chimera Research Institute, Inc. "5G/8K business future outlook survey 2022"

Figure 4-5-2-5 Number of 4K and 8K televisions shipped in Japan



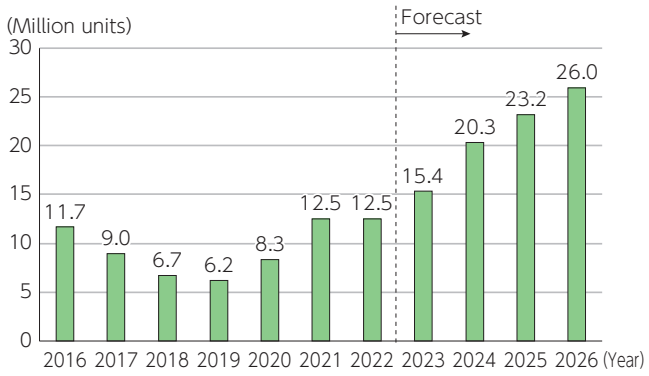
(Source) JEITA "Domestic Shipments of Consumer Electronic Devices"

c VR•AR

Global shipments of VR headsets have continued to increase since 2020, reaching 12.53 million units in 2022 (up 0.3% year on year), and are forecasted to grow 4.2x to 25.98 million units in 2026 compared to 2019 (**Figure 4-5-2-6**).

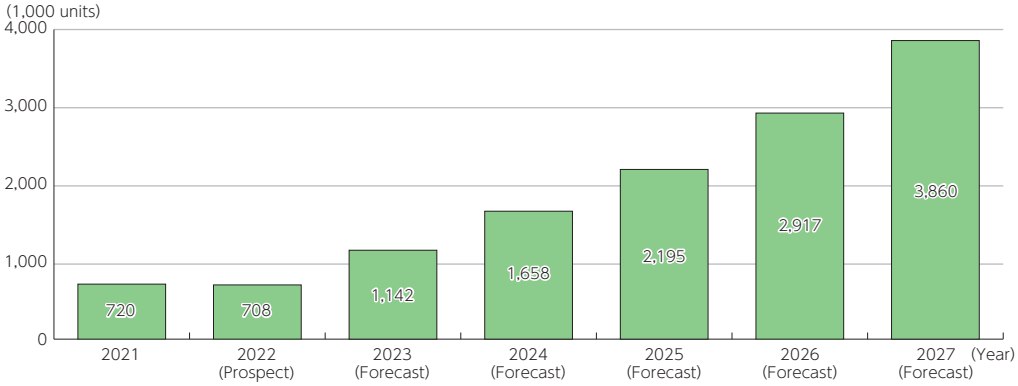
In Japan, the number of XR (Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR)) and 360° video-compatible head-mounted display (HMD) units shipped in Japan was 720,000 in 2021, and is forecasted to reach 3.86 million in 2027 (**Figure 4-5-2-7**).

Figure 4-5-2-6 Changes and forecast in global VR headset shipments



(Source) Omdia

Figure 4-5-2-7 Forecast on Domestic Shipment Volume of HMDs for XR (VR/AR/MR) & 360-Degree Videos



*1 Based on the shipment volume at manufacturers.

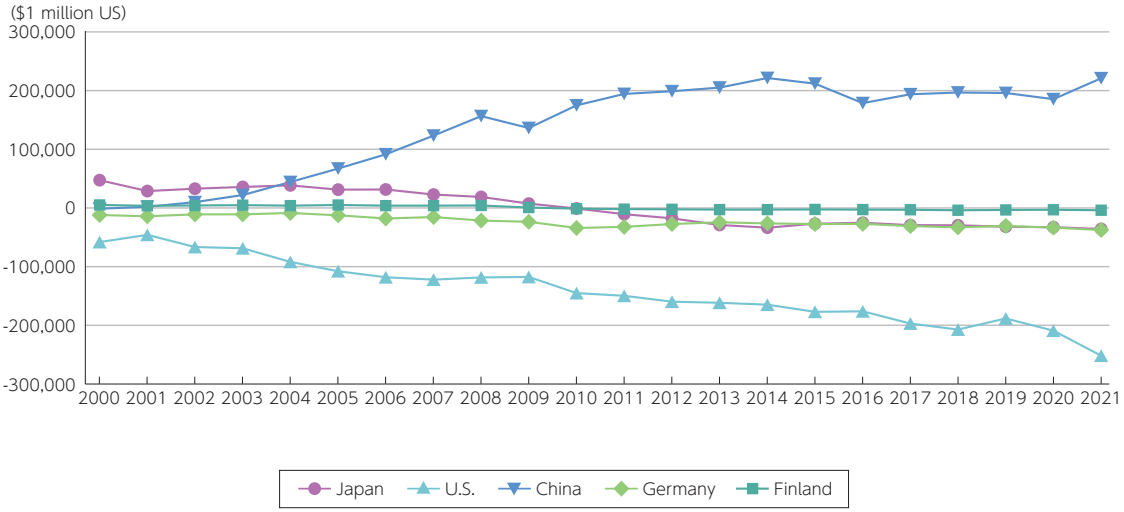
*2 The value in 2022 was the prospect, and the values in and after 2023 are the forecasts.

(Source) Yano Research Institute Ltd., "The Market of HMDs (Head Mounted Displays) for XR (VR/AR/MR) and 360-Degree Videos: Key Research Findings 2021" , May 11, 2022

3. Trends in the import and export of ICT equipment and devices by country

Japan has had an import surplus since 2010, and while the value of Japan's exports of ICT equipment and devices[11] increased to 7.1562 trillion yen (up 17.6% from the previous year) in 2021 due to the progress of the shift to digitalization resulting from the spread of COVID-19 globally, the value of imports was 11.0829 trillion yen (up 15.7% increase the previous year), resulting in an import surplus of 3.9267 trillion yen (up 12.4% from the previous year). In addition, in 2021 the U.S. had an import surplus of 27.6249 trillion yen (up 23.8% from the previous year), while the China had an export surplus of 24.2585 trillion yen (up 22.6% from the previous year) **(Figure 4-5-3-1)**.

Figure 4-5-3-1 Changes in the value of the export surplus of ICT equipment and devices by country



(Source) UNCTAD "UNCTAD STAT"[12]

Figure (related data) Changes in the value of exports of ICT equipment and devices by country
(Source) UNCTAD "UNCTAD STAT"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00189
(Data collection)

Figure (related data) Changes in the value of imports of ICT equipment and devices by country
(Source) UNCTAD "UNCTAD STAT"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00190
(Data collection)

[11] Computers, communications equipment, consumer electronics, electronic components, etc.
[12] https://unctadstat.unctad.org/EN/Index.html

4. Trends in the semiconductor[13] market

The global semiconductor market (value of shipments) has been on an upward trend since 2015, reaching 12.5493 trillion yen in 2022 (up 32.1% from the previous year). Looking at the breakdown, discrete semiconductors account for the largest share. Imaging sensors and MCUs have experienced significant growth in recent years, with a Japanese company (Sony Semiconductor Solutions) accounting for 48.3% of the market share.

The Japanese semiconductor market (value of shipments) had been decreasing since 2018, but it started to increase in 2021, and in 2022 it increased to 1.0145 trillion yen (up 36.9% from the previous year). Looking at the breakdown, as per the global market, discrete semiconductors account for the largest share of the market.

Figure (related data) Changes in global semiconductor market (value of shipments)
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00191
(Data collection)

Figure (related data) Changes in Global imaging sensor market share (value of shipments in 2022)
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00192
(Data collection)

Figure (related data) Changes in Japan's semiconductor market (value of shipments)
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00193
(Data collection)

[13] In this section, this means the discrete semiconductors used for the imaging sensors, MCUs, MEMS sensors and indispensable power sources that are positioned as key devices in the electronic equipment implementing IoT and AI, which are being introduced as part of the digital transformation (DX).

Section 6 Trends with platforms

1. Market trends

Looking at the market capitalization of the major players in the global ICT-related market in 2023, Meta Platforms (Facebook), which was in 5th place in 2022, declined significantly in market capitalization and retreated due to a decline in advertising revenue and the rise of latecomer social media such as TikTok. Other top companies have not changed significantly from the previous fiscal year and companies involved in cloud services, social media, security, etc. are being evaluated on the stock market (**Figure 4-6-1-1**).

Figure 4-6-1-1 Change in the top 15 companies by market capitalization in the global ICT market

2022					2023			
Company name	Major business	Country	"Market capitalization (100 million dollars)"		Company name	Major business	Country	"Market capitalization (100 million dollars)"
Apple	Hardware, software, services	US	28,282		Apple	Hardware, software, services	US	25,470
Microsoft	Cloud service	US	23,584		Microsoft	Cloud service	US	20,890
Alphabet/Google	Search engine	US	18,215		Alphabet/Google	Search engine	US	13,030
Amazon.com	Cloud service, e-commerce	US	16,353		Amazon.com	Cloud service, e-commerce	US	10,270
Meta Platforms/ Facebook	SNS	US	9,267	↑	NVIDIA	Semiconductor	US	6,650
NVIDIA	Semiconductor	US	6,817	↓	Meta Platforms/ Facebook	SNS	US	5,370
Taiwan Semiconductor Manufacturing	Semiconductor	Taiwan	5,946	↑	Tencent	SNS		4,690
Tencent	SNS		5,465	↑	Visa	Payment	US	4,600
Visa	Payment	US	4,588	↓	Taiwan Semiconductor Manufacturing	Semiconductor	Taiwan	4,530
Samsung Electronics	Hardware	Korea	4,473	↑	Mastercard	Payment	US	3,440
Mastercard	Payment	US	3,637	↓	Samsung Electronics	Hardware	Korea	3,280
Alibaba	e-commerce		3,589	↑	Broadcom	Hardware, semiconductor	US	2,610
Walt Disney	Media	US	2,811	↓	Alibaba	e-commerce		2,570
Cisco Systems	Hardware, security	US	2,578	new	Oracle	Cloud service	US	2,450
Broadcom	Hardware, semiconductor	US	2,557	↓	Cisco Systems	Hardware, security	US	2,100

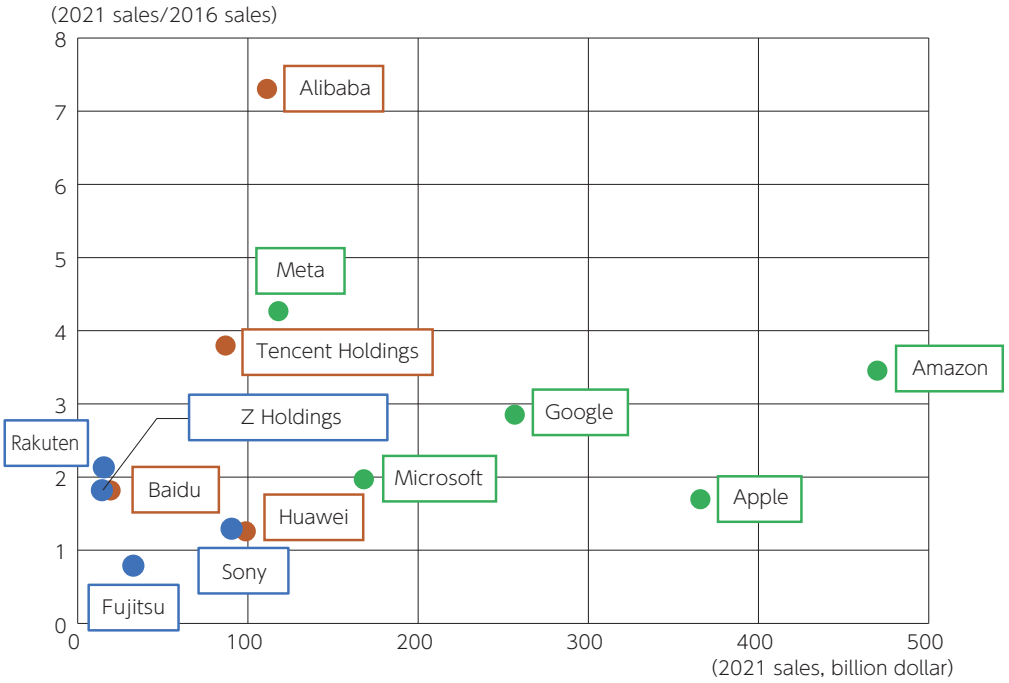
*The figures for 2022 are as of January 14, 2022, and the figures for 2023 are as of March 31, 2023.

(Source) Acquired from Wright Investors' Service, Inc.[1]

Comparing the sales[2] of major platform providers in Japan, the U.S. and China in 2021, the largest was Amazon, with sales of about 51.5648 trillion yen, 3.5x higher than in 2016 (**Figure 4-6-1-2**). China's Alibaba (12.2080 trillion yen) has grown very quick with sales 7.3x higher than in 2016. In comparison, Japanese companies are smaller in scale, and also inferior in terms of growth with Rakuten at 2.1x, Z Holdings at 1.8x, Sony at 1.3x, and Fujitsu at 0.8x.

[1] https://www.corporateinformation.com/#/tophundred
[2] Sales of Japanese and Chinese companies were converted to dollars by using the average rate of the respective year.

Figure 4-6-1-2 Sales of platform providers in Japan, the U.S. and China



(Source) Prepared based on Statista data

2. Trends with major platform providers

Leading US and Chinese platform providers are leveraging their strengths and focusing on new fields and businesses, including generative AI and metaverses. In particular, several platform providers are focusing on the development of generative AI, and competition for leadership is expected to intensify in the future (**Figure 4-6-2-1**).

Figure 4-6-2-1 Trends with major platform providers in the U.S. and China

<U.S.>

Key areas	Company	Business overview and areas	New areas and businesses
Advertising, search	Alphabet (Google)	Provides the largest search engine service in the world, and is developing a massive economic sphere including cloud and devices focused mainly insearch advertising.	Recognizing the threat of generative AI to search engines, the company has been strengthening its search engine using AI technology, including the launch of the "Bard" chat AI linked with Google search.
E-commerce	Amazon	One of the largest e-commerce operators in the world, with a huge economic sphere centered on cloud services (AWS).	The company is strengthening its cloud services and advertising services on e-commerce sites.
Social media, apps	Meta (Facebook)	The company provides one of the world's largest social media services, and in 2021 changed its name to Meta Platforms to promote its metaversebusiness.	The company is focusing on its metaverse business as a pillar of its future amid a slight slowdown in advertising revenue on social media.
Communications devices and terminals	Apple	The world's largest manufacturer and retailer of Internet and digital home appliances, the company has developed a massive economic sphere centered on iPhones and other devices.	The company is expanding its business with the iPhone at its core, and in recent years has focused on expanding in the healthcare area with Apple Watch.
Terminals, cloud	Microsoft	One of the largest software vendors in the world, the company has a massive economic sphere centered on software and cloud services such as Windows and Office.	The company is focusing on using generative AI, including expanding its partnership with OpenAI.

<China>

Key areas	Company	Business overview and areas	New areas and businesses
Advertising, search	Baidu	The largest search engine operator in China, the company is now focusing on artificial intelligence (AI) technology based on search engines and expanding into areas such as deep learning, autonomous driving, and AI chips.	On March 16, 2023, the company announced the "ERNIE Bot" generative AI technology based on the latest large language model. It now plans to implement generative AI to own products and other's.
E-commerce	Alibaba	The world's largest e-commerce operator based on gross merchandise volume, the company is now leveraging data technology to provide services ranging from marketing to logistics and payments.	On April 11, 2023, Alibaba Cloud, a group company, announced "Tongyi Qianwen," a new AI language model for companies, and is currently developing its AI business.
Social media, apps	Tencent	China's largest social media app platformer, the company has built a massive ecosystem to provide payment services, games, and other service based on "WeChat."	On November 30, 2022, the company announced the "Kurumazukumo" cloud solution specializing in smart mobility, and then began providing mapping services necessary for autonomous driving, in order tofocus on the mobility field.
Communications devices and terminals	Huawei	A leading global communications device vendor with operations in four key areas: telecom networks, IT, smart devices, and cloud services.	In June 2021, Huawei Digital Power Technologies, a subsidiary providing digital energy products and solutions, was established to expand into the energy field, including green power generation.

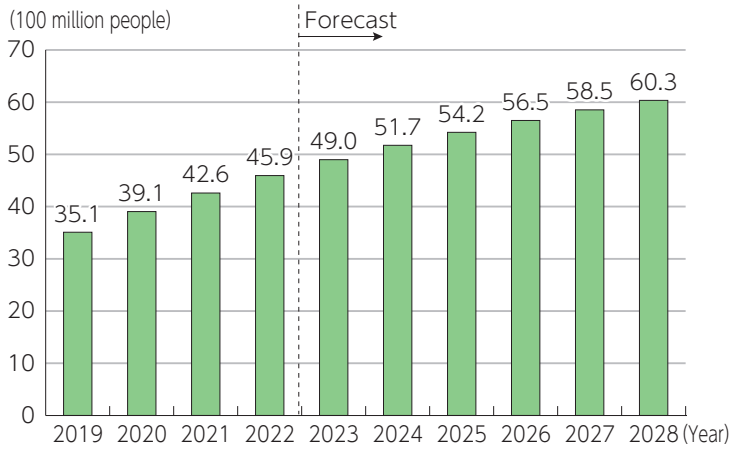
Figure (related data) Sales of major platform providers in the U.S. and China by business
Source: Prepared based on financial results material released by each company
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00219
(Data collection)

Section 7 Trends in the ICT services and contents & application services markets

1. Social media

The number of social media users globally[1] is forecasted to increase from 4.59 billion in 2022 to 6.03 billion in 2028, and besides its use as a communication tool, its use for social commerce, which combines social media and e-commerce, and the demand for e-commerce, such as live commerce, which expanded due to the COVID-19 pandemic, are driving the expansion of its use. In addition, short video content, such as TikTok and Instagram stories and reels, has become popular, and by extension, AR and VR content on social media is expected to become popular (**Figure 4-7-1-1**).

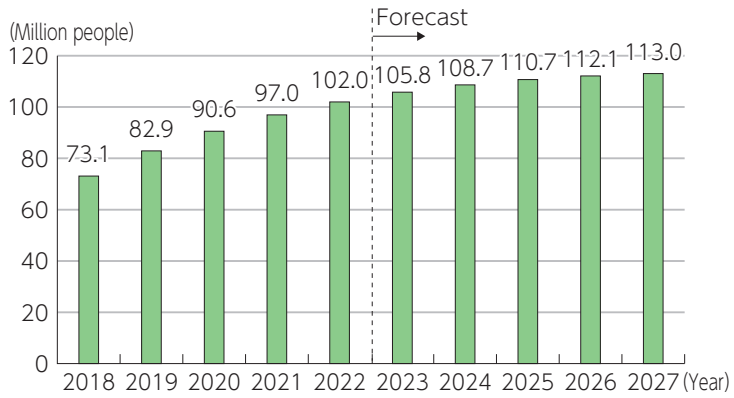
Figure 4-7-1-1 Changes and forecast in the number of global social media users



(Source) Statista[2]

The number of social media users in Japan is forecasted to increase from 102 million in 2022 to 113 million in 2027 (**Figure 4-7-1-2**).

Figure 4-7-1-2 Changes and forecast in the number of social media users in Japan



*Number of people who use social media sites and applications at least once a month, with or without an account

(Source) Statista[3]

2. EC

Sales in the global EC market have been on an upward trend and are forecasted to increase to 751.8 trillion yen (up 31.4% from the previous year) in 2022.

By country, the compound annual growth rate from 2023 to 2027 will be high in Brazil and India, followed by China, the U.S. and Japan. European countries (UK, France and Germany) are forecasted to grow by 8%, while South Korea is forecasted to grow by as little as 3.5%.

[1] Internet users who use social media sites through some kind of device at least once a month
[2] https://www.statista.com/forecasts/1146659/social-media-users-in-the-world
[3] https://www.statista.com/statistics/278994/number-of-social-network-users-in-japan/

Figure (related data) Changes and forecast in sales in the global EC market
Source: Statista (eMarketer)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00222
(Data collection)

Figure (related data) Growth rate of EC market by country (2023 to 2027)
Source: Statista [Statista Digital Market Insights]
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00223
(Data collection)

3. Search services

While Google has a strong share of the global desktop search engine market, it has gradually declined in recent years and in December 2022 its share was 84.1%, with Bing growing to 9.0%. Google also maintains a very high share of the global mobile search engine market, and all other search engines remain at less than 2%.

In Japan, as of September 2022, Google has the highest share for personal computers, and as of December 2022, its share is 70% or higher for both smartphones and tablets. There are also differences between devices, with Bing's share of the PC market in excess of 15% and Yahoo!'s share of the smartphone and tablet market at around 20%.

Figure (related data) Changes in global market share of search engines (Desktop)
Source: Statista (StatCounter)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00226
(Data collection)

Figure (related data) Changes in global market share of search engines (mobile)
Source: Statista (StatCounter)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00227
(Data collection)

Figure (related data) Market share of search engines in Japan
Source: Statista (StatCounter)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00228
(Data collection)

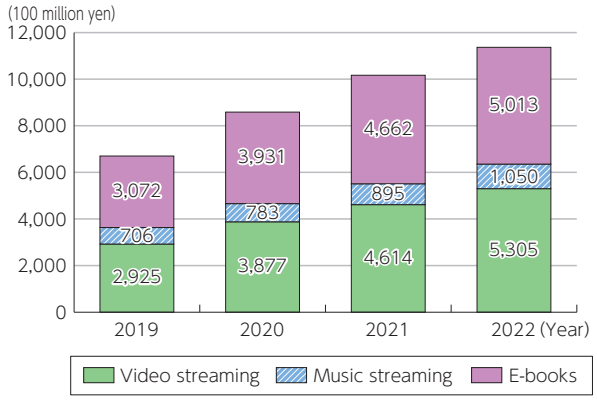
4. Video streaming, music streaming and e-books

The global video streaming, music streaming, and e-book markets have maintained and expanded demand captured by the spread of flat-rate services and the increase in the number of hours spent at home due to the spread of COVID-19, and in 2022, the markets totaled 19.865 trillion yen (up 37.3% from the previous year).

Figure (related data) Changes and forecast in size of global video streaming, music streaming and E-book market
Source: Omdia, Statista
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00229
(Data collection)

In addition, like the global market, the markets in Japan also grew, and in 2022 the video streaming market was 530.5 billion yen (up 15.0% from the previous year), the music streaming market was 105.0 billion yen (up 17.3% from the previous year), and the e-book market was 501.3 billion yen (up 7.5% from the previous year) (**Figure 4-7-4-1**).

Figure 4-7-4-1 Changes in the size of the Japanese video streaming, music streaming, and e-book markets



(Source) Prepared based on GEM Partners' "Video Streaming (VOD) Market Forecast for Five Years (2022 - 2026) Report,"[4] the Recording Industry Association of Japan's "Japan Recording Industry 2023,"[5] and the All Japan Magazine and Book Publisher's and Editor's Association and Research Institute for Publications' (2023) "Publishing Monthly Report."[6]

5. New trends in ICT services and content and application services markets

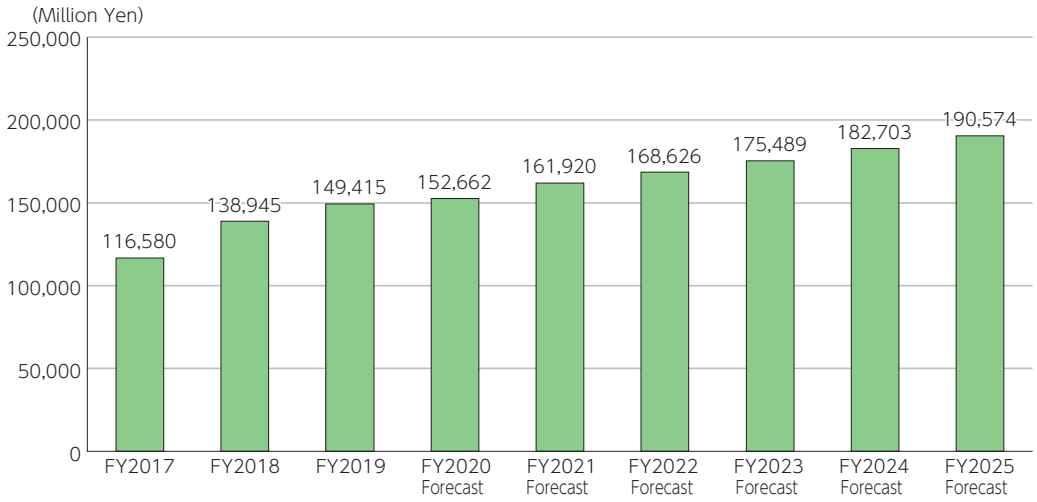
(1) Services using location information (spatial information)

Services that utilize location information (spatial information) are widely used, and include map apps, car navigation, marketing, people flow tracking, taxi dispatch apps, games that utilize location information, and apps that share location information with family and friends.

The size of the market for (outdoor) location and geographic information in Japan was 152.7 billion yen in fiscal 2020 and is forecasted to increase to 190.6 billion yen in fiscal 2025 (**Figure 4-7-5-1**).

In addition, driven by office demand due to the spread of hot-desking and other work style reforms, the size of indoor positioning solutions market is forecasted to increase to approximately 7.6 billion yen in fiscal 2024, and although the size of the market is smaller than the outdoor market, it is expected to grow by approximately 20% annually from fiscal 2021 onward (**Figure 4-7-5-2**).

Figure 4-7-5-1 Transition and Forecast of Domestic Location and Geographic Information Service Market Size



*1 Based on sales by business operators.

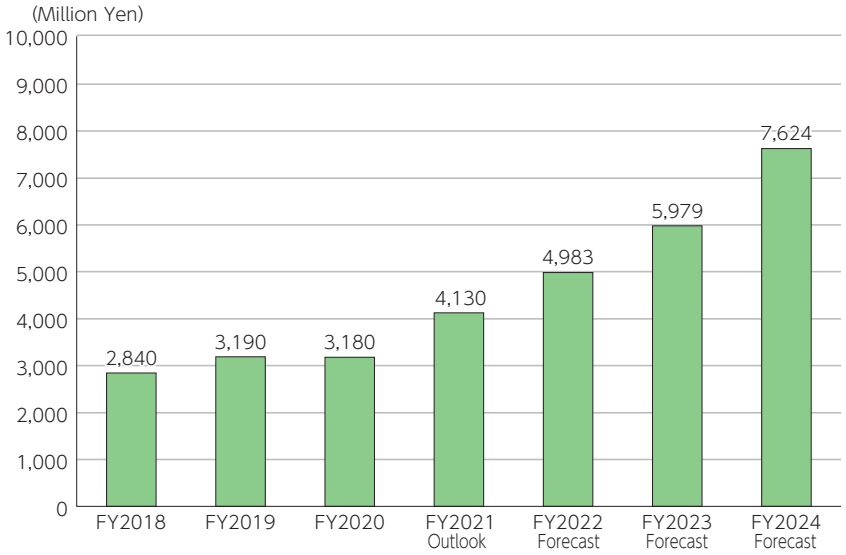
*2 The values for fiscal 2020 and later are forecasts.

*3 Market size was calculated based on (1) map databases, (2) GIS engines, and various GIS applications ((3) traffic related location applications, (4) store development/location advertisements, (5) spot store information/coupons/check-in, (6) location game applications, (7) IoT location applications, (8) delivery/logistics related location applications, (9) Industrial location applications, (10) location applications for infrastructure development, (11) traffic jam prevention location applications, (12) disaster prevention location applications).

(Source) Yano Research Institute Ltd., "Location and Geographic Information Service Market in Japan: Key Research Findings 2020" , November 5, 2020

[4] https://gem-standard.com/columns/674
[5] https://www.riaj.or.jp/f/pdf/issue/industry/RIAJ2023.pdf
[6] https://shuppankagaku.com/wp/wp-content/uploads/2023/01/%E3%83%8B%E3%83%A5%E3%83%BC%E3%82%B9%E3%83%AA%E3%83%AA%E3%83%BC%E3%82%B92301%E3%80%80.pdf

Figure 4-7-5-2 Transition and Forecast of Indoor Positioning Solutions Market Size



*1 Based on the sales of indoor location information service and solution providers

*2 Market size was calculated based on services and solutions that utilize indoor location information utilization using indoor positioning technology and indoor map information.

*3 The value for fiscal 2021 is an estimate, and the values for fiscal 2022 and later are forecasts.

(Source) Yano Research Institute Ltd., "Indoor Positioning Solutions Market in Japan: Key Research Finding 2021", January 7, 2022

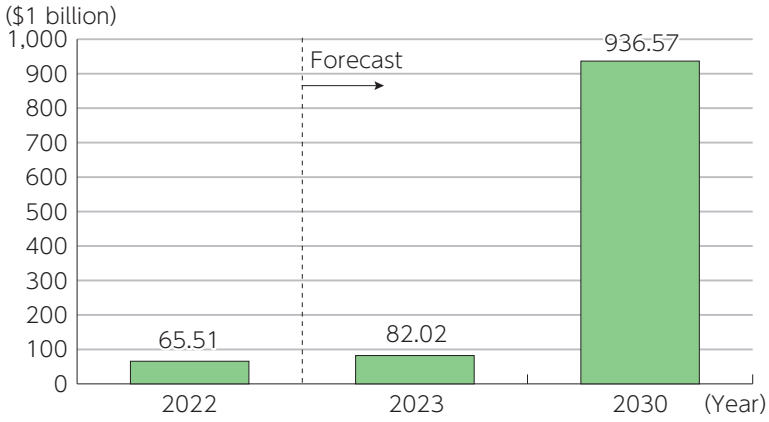
(2) Metaverses

As the speed of communications and the rendering performance of computers have improved, virtual spaces on the Internet called metaverses,[7] where users can communicate, have started to spread, and economic activities such as the purchasing of goods in metaverses are attracting considerable attention.

The global metaverse market (total of infrastructure, hardware, software, and services) is forecasted to expand from 8.6144 trillion yen in 2022 to 123.9738 trillion yen[8] in 2030 **(Figure 4-7-5-3)**.

The Japanese metaverse market (total for metaverse platforms, non-platforms (content, infrastructure), and XR (VR, AR, MR) devices) is expected to reach 182.5 billion yen in fiscal 2022 (up 145.3% from the previous fiscal year) and is forecasted to expand to 1.0042 trillion yen in fiscal 2026 **(Figure 4-7-5-4)**. Due to the continuation of the COVID-19 pandemic, its use is expanding for purposes such as virtual exhibitions that provide virtual spaces for corporations, online events such as in-house events, education and training, and customer service and shopping experiences in online shopping.

Figure 4-7-5-3 Changes and forecast in the size of the global metaverse market



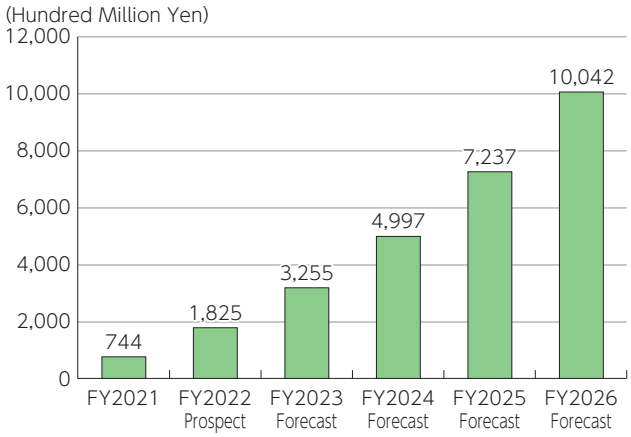
(Source) Statista[9]

[7] Interim Summary of the MIC Study Group on the Utilization of Metaverse Towards Web3 Era (summary of discussions so far) https://www.soumu.go.jp/main_content/000860618.pdf

[8] Calculated using the average exchange rate for January to March 2023.

[9] https://www.statista.com/statistics/1295784/metaverse-market-size/

Figure 4-7-5-4 Domestic Metaverse Market Size Forecast



*1 Based on sales by business operators.

*2 The value for fiscal 2022 is an estimate, and the values for fiscal 2023 and later are forecasts.

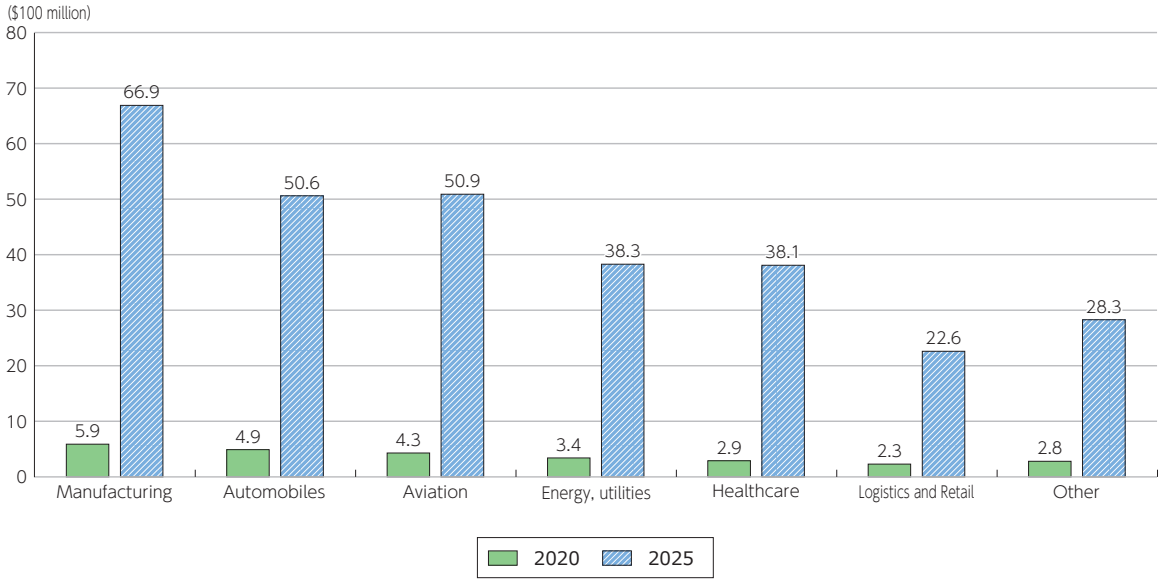
*3 The total market size is the sum of metaverse platforms, non-platforms (content, infrastructure, etc.), and XR (VR, AR, MR) equipment. Note that XR (VR, AR, MR) equipment is calculated on a sales price basis.

(Source) Yano Research Institute Ltd., "Metaverse Market in Japan: Key Research Findings 2022, September 21", 2022

(3) Digital twins

A digital twin is a virtual twin of an object or situation in real space recreated in a virtual space.[10] Digital twins are increasingly being used for simulation, optimization, and evaluation of effects, impacts, and risks in a variety of fields including manufacturing and healthcare, and the size of the global digital twin market is forecasted to grow from 283.0 billion yen in 2020 to 3.9142 trillion yen[11] in 2025 (**Figure 4-7-5-5**).

Figure 4-7-5-5 Size of the global digital twin market (by industry)



(Source) Statista (BIS Research)[12]

[10] Interim Summary of the MIC Study Group on the Utilization of Metaverse Towards Web3 Era (summary of discussions so far) https://www.soumu.go.jp/main_content/000860618.pdf

[11] Calculated using the average exchange rate for January to March 2023.

[12] https://www.statista.com/statistics/1296187/global-digital-twin-market-by-industry/

Section 8 Trends in the data center market and cloud services market

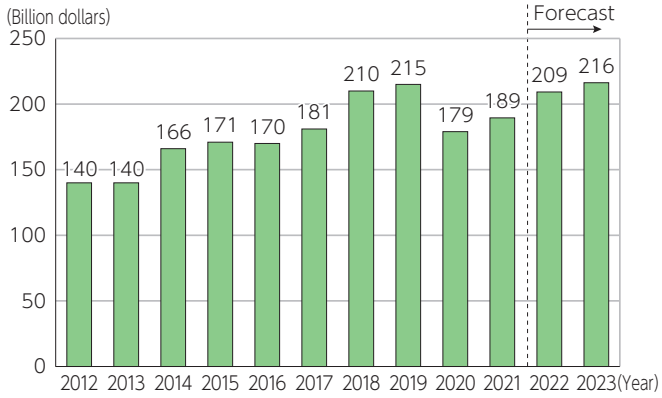
1. Data centers

The number of large data centers globally exceeded 800 at the end of the second quarter of 2022[1] and continues to grow. Regarding the share of the global data center capacity, the U.S. accounts for over half at 53%, followed by Europe, the Middle East and Africa (16%), China (15%) and the Asia Pacific Region excluding China (11%).

The size (in terms of expenditure) of the global data center systems market was 27.5081 trillion yen (up 32.3% from the previous year) in 2022 (**Figure 4-8-1-1**). After a brief decline in 2020 due to the spread of COVID-19, it has been on an upward trend since then and is forecasted to grow larger than it was in 2019 in 2023.

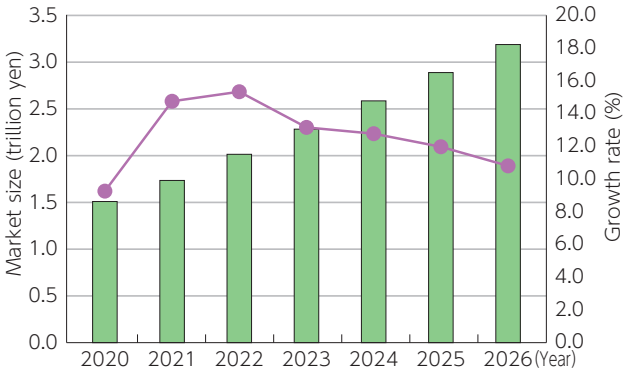
The size (in terms of sales) of the Japanese data center services market is expected to reach 2.0275 trillion yen in 2022 (up 15.3% from the previous year), and exceed 2 trillion yen for the first time (**Figure 4-8-1-2**).

Figure 4-8-1-1 Changes and forecast in the size of the global data center systems market (in terms of expenditure)



(Source) Statista (Gartner)[2]

Figure 4-8-1-2 Changes and forecast in the size (in terms of sales) of the Japanese data center services market



*2022 is an estimate, and 2023 and beyond are forecasts.

(Source) IDC "Japan Datacenter Services Forecast" (August 29, 2022)[3]

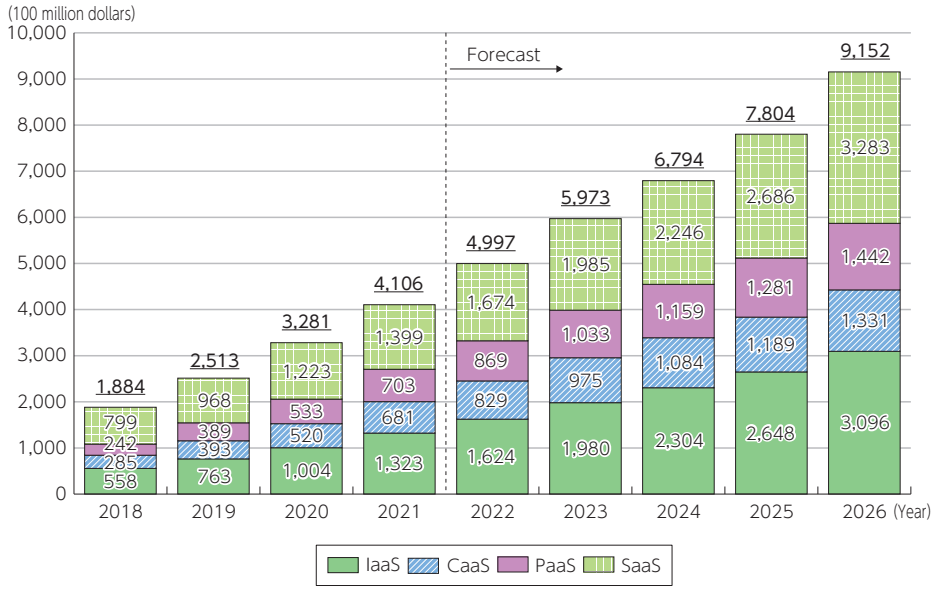
Figure (related data) Share of global large-scale data center market by region (data capacity)
Source: Synergy "Virginia Still Has More Hyperscale Data Center Capacity Than Either Europe or China"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00245
(Data collection)

[1] https://www.srgresearch.com/articles/virginia-still-has-more-hyperscale-data-center-capacity-than-either-europe-or-china
[2] https://www.statista.com/statistics/268938/global-it-spending-by-segment/
[3] https://www.idc.com/getdoc.jsp?containerId=prJPJ49623222

2. Cloud services

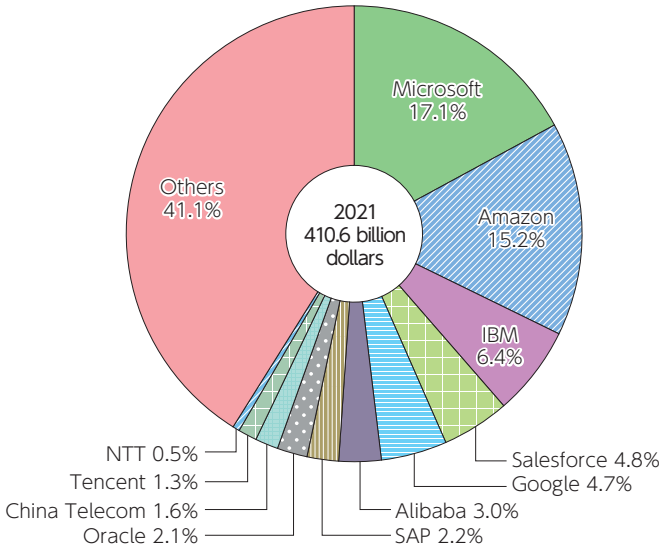
The global public cloud services market[4] was 45.0621 trillion yen in 2021, up 28.6% from the previous year. For example, PaaS is expected to continue to grow rapidly as service providers continue improving convenience and users tend to continue to use it (**Figure 4-8-2-1**). Looking at market share, the top five U.S. companies (Microsoft, Amazon, IBM, Salesforce, Google) account for about half of the total, so the market is in an oligopoly situation (**Figure 4-8-2-2**).

Figure 4-8-2-1 Changes and forecast in the size (in terms of sales) of the global public cloud service market



(Source) Omdia

Figure 4-8-2-2 Share of the global public cloud services market



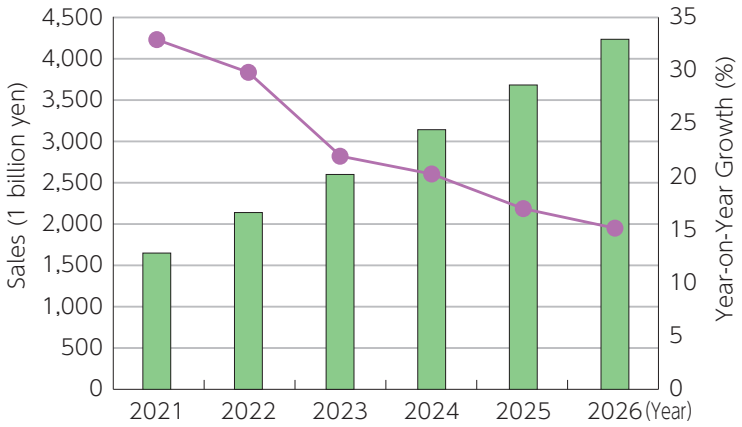
(Source) Omdia

The Japanese public cloud services market[5] is expected to increase to 2.1594 trillion yen in 2022 (up 29.8% from the previous year) mainly due to the shift from on-premises environments to the cloud due to the continuing impact of COVID-19 (**Figure 4-8-2-3**).

In Japan's PaaS and IaaS markets, the high usage rate of major cloud services (AWS (Amazon), Azure (Microsoft), GCP (Google)) stands out. In particular, AWS accounts for more than half of PaaS/IaaS enterprises, up more than 10 percentage points from the previous year.

[4] Services provided by third parties via a public or private network, such as computer and other hardware, software, databases, storage, etc.
[5] Cloud services that specialize in IT-related functions provided to a wide range of users without special regulations or restrictions.

Figure 4-8-2-3 Changes and forecast in the size (in terms of sales) of the Japanese public cloud service market



(Source) IDC "Japan Public IT Cloud Services Forecast" (September 15, 2022)[6]

3. Edge computing and edge infrastructure

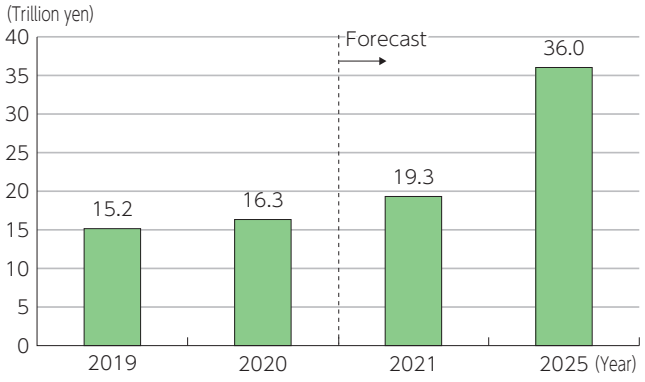
The size (revenue) of the global edge computing market was 16.3 trillion yen in 2020, and is forecasted to grow to 36 trillion yen in 2025 (**Figure 4-8-3-1**).

The size (in terms of expenditure) of the Japanese edge infrastructure (hardware[7]) market was 429.5 billion yen in 2021 and is forecasted to expand to 729.3 billion yen in 2026 (**Figure 4-8-3-2**).

Use cases by enterprises include applications that require instantaneous decision making utilizing AR/VR or AI, such as machine control and monitoring in manufacturing operations, video streaming, drone control, autonomous driving, and remote surgery, and it is also expected to be used for the primary processing of large volumes of data in areas that are physically far from data centers.

In recent years, a system called edge AI that performs AI processing using edge computing to reduce communications with the cloud as much as possible is attracting attention. In the past, AI processing has mainly been done by sending data to an on-premises environment or the cloud for processing on the cloud side, but benefits include (1) reduced communication costs, (2) realization of low latency processing, and (3) reduced privacy risks. The Japanese products and services market (in terms of sales) in the edge AI field is expected to be 7.66 billion yen in fiscal 2021, an increase of 70.8% from the previous year, and 11.7 billion yen in fiscal 2022, an increase of 52.7% from the previous year. The annual growth rate is forecasted to be 41.3% until fiscal 2026 to reach 43.1 billion yen in fiscal 2026.

Figure 4-8-3-1 Changes and forecast in the size of the global edge infrastructure market (revenue)

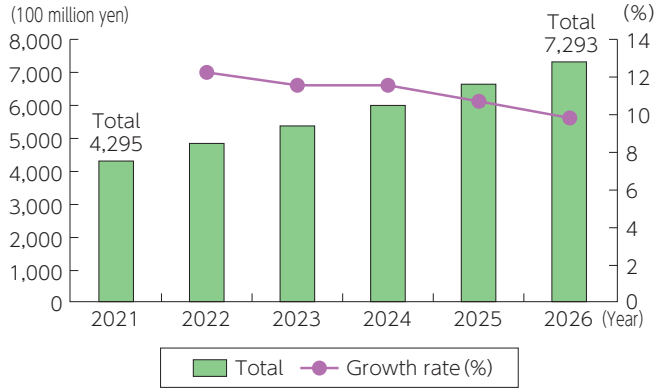


*2025 is calculated at the 2022 exchange rate.

(Source) Statista (IDC)[8]

[6] https://www.idc.com/getdoc.jsp?containerId=prJPJ49684222
[7] Applies to servers, storage, gateways, and network equipment.
[8] https://www.statista.com/statistics/1175706/worldwide-edge-computing-market-revenue/

Figure 4-8-3-2 Changes and forecast in the size (in terms of expenditure) of the Japanese edge infrastructure market



(Source) IDC "Japan Edge Infrastructure Forecast" (January 18, 2023)[9]

Figure (related data) Changes and forecast in the size (in terms of sales) of the Japanese edge AI solutions market
Source: Deloitte Tohmatsu MIC Research Institute "Reality and Future Prospects of Edge AI Computing Market" (October 24, 2022)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00255
(Data collection)

[9] https://www.idc.com/getdoc.jsp?containerId=prJPJ50045223

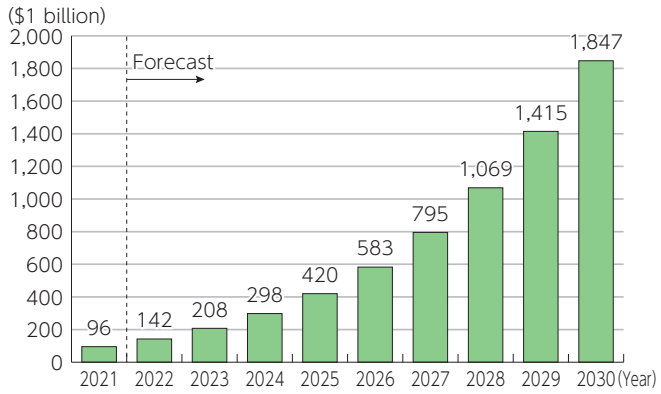
Section 9 Trends in AI

1. Market overview

The size (in terms of sales) of the global AI market is expected to grow to 18.7148 trillion yen in 2022, up 78.4% from the previous year, and is then forecasted to grow at a moderately accelerating pace until 2030 (**Figure 4-9-1-1**).

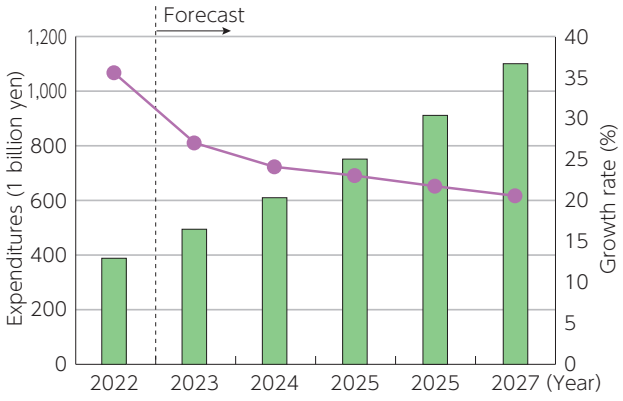
The size (in terms of expenditure) of the Japanese AI systems[1] market was 388.367 billion yen in 2022 (up 35.5% from the previous year), and is forecasted to continue to grow and expand to 1,103.477 billion yen in 2027 (**Figure 4-9-1-2**).

Figure 4-9-1-1 Changes and forecast in the size (in terms of sales) of the global AI market



(Source) Statista (Next Move Strategy Consulting)[2]

Figure 4-9-1-2 Size (in terms of expenditure) of the Japanese AI systems market and forecast



(Source) IDC "Japan Artificial Intelligence Systems Forecast" (April 27, 2023)[3]

2. Trends in AI in various countries

Thundermark Capital's AI Research Ranking, which is published annually, lists the countries, companies and universities that are leading research based on the number of papers published. Looking at countries, since 2020 the top three countries are the U.S., China, and the UK in that order, and while Japan has been in the top 10 every year, its ranking has been declining year by year.

Looking at organizations, Google topped the list in 2022, ahead of universities and companies around the world, with Microsoft and Facebook also ranking in the top 10. The private companies ranked lower than top 10 include Amazon (U.S.), IBM (U.S.), Huawei (China), Alibaba (China), NVIDIA (U.S.), Tencent (China), Samsung (South Korea), Baidu (China), NTT (Japan), Apple U.S.), and OpenAI (U.S.), and while companies with large sales are at the top of the ICT market, OpenAI, which specializes in AI, is making rapid progress.

[1] Hardware and software platforms for using AI functions and IT services related to the construction of AI systems
[2] https://www.statista.com/statistics/1365145/artificial-intelligence-market-size/
[3] https://www.idc.com/getdoc.jsp?containerId=prJPJ50603323

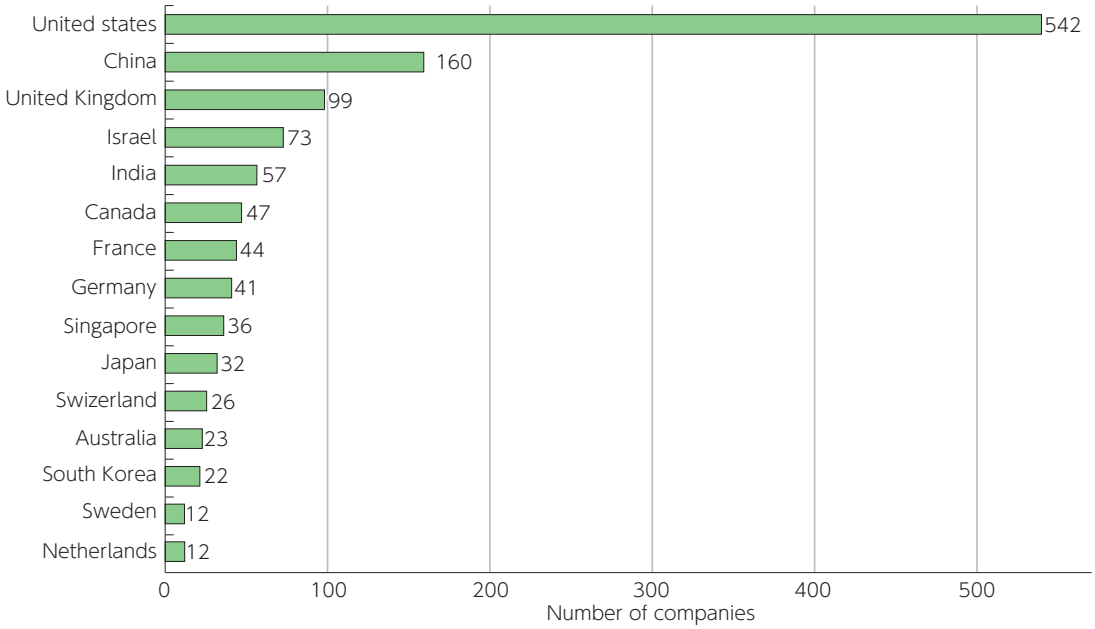
Figure (related data) Changes in AI rankings by country (top 10)
Source: Prepared based on Thundermark Capital's AI Research Ranking 2022
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00259
(Data collection)

Figure (related data) Changes in AI rankings by organization (top 10)
Source: Prepared based on Thundermark Capital's AI Research Ranking 2022
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00260
(Data collection)

Figure (related data) China's AI market expenditure forecast
Source: IDC "China's Artificial Intelligence Market Will Exceed US$26.7 Billion by 2026, according to IDC" (October 4, 2022)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00261
(Data collection)

In recent years, social implementation of AI has advanced, and so-called generative AI, which generates sentences, images, sounds, etc., such as ChatGPT, Stable Diffusion, CeVIO AI, etc., is attracting attention. Investments in AI-related companies are increasingly active, and according to the "Artificial Intelligence Index Report 2023" published by Stanford University, the U.S. leads the number of newly funded AI companies in 2022 with 542, followed by China with 160, and Japan is 10th with 32 (**Figure 4-9-2-1**).

Figure 4-9-2-1 Number of newly funded AI companies by country (2022)



(Source) Stanford University "Artificial Intelligence Index Report 2023"[4]

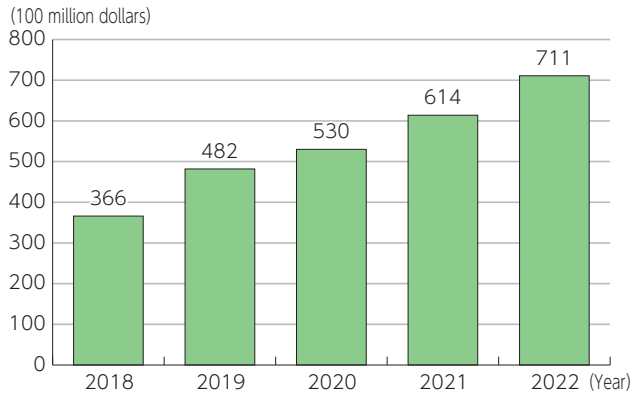
[4] https://aiindex.stanford.edu/wp-content/uploads/2023/04/HAI_AI-Index_Report_2023.pdf

Section 10 Cybersecurity Trends

1. Market overview

The global cybersecurity market (sales) continues to be strong and is expected to grow by 9.3495 trillion yen (38.7% increase) in 2022 (**Figure 4-10-1-1**). By security product category, network security spending was the highest as of the fourth quarter of 2022, accounting for 27.6% of total spending.

Figure 4-10-1-1 Changes in global cybersecurity market size (sales)



(Source) Based on Canalys estimates[1]

Figure (related data) Global cybersecurity market size (by product category)
Source: Based on Canalys "Strong channel sales propel the cybersecurity market to US$20 billion in Q4 2022"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00263
(Data collection)

Cisco, Palo Alto Networks, Check Point, Symantec, and Fortinet were the top five companies in the cybersecurity market in the world from 2018 to 2019, but Trellix replaced Symantec in 2020 and took 3.1% of the market in 2022. Palo Alto Networks has the largest share at only 8.2% of the market, and its share of the global cybersecurity market remains dispersed.

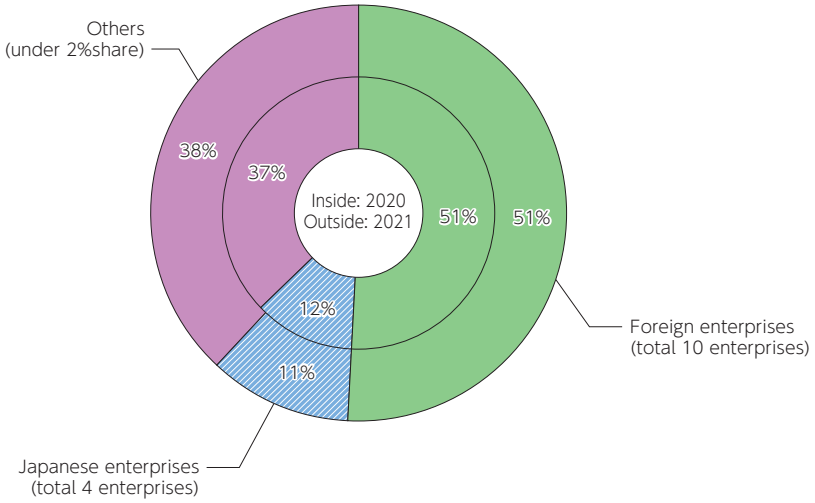
Figure (related data) Major global cybersecurity companies
Source: Based on Canalys data
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00264
(Data collection)

In 2021, the domestic information security products market (sales) increased 16% from the previous year to 436.015 billion yen. By security product function market segment, the security software market (which includes endpoint security software and network security software) accounted for 84.1% of the total sales at 315.942 billion yen in 2021, while the security appliance market (which includes content management, UTM, and VPN) accounted for 15.9% of the total at 349 million yen.

We divided enterprises with over 2% share (in sales) in the domestic information security products market in 2021 into foreign enterprises and domestic enterprises, and totalized their sales in 2020 and 2021. Foreign enterprises account for more than 50% of sales both in 2020 and 2021. Japan continues to heavily rely on overseas enterprises for cybersecurity products **(Figure 4-10-1-2)**.

[1] https://www.canalys.com/newsroom/cybersecurity-market-grows-9-in-2018-to-reach-us37-billion
https://canalys.com/newsroom/cybersecurity-investment-2020
https://canalys.com/newsroom/cybersecurity-market-2022

Figure 4-10-1-2 Domestic information security products market share (sales), 2020-2021



(Source) Based on IDC Japan, July 2022 "Japan IT Security Products Market Shares, 2021: External Threat Measures and Internal Threat Measures" (JPJ47880222)

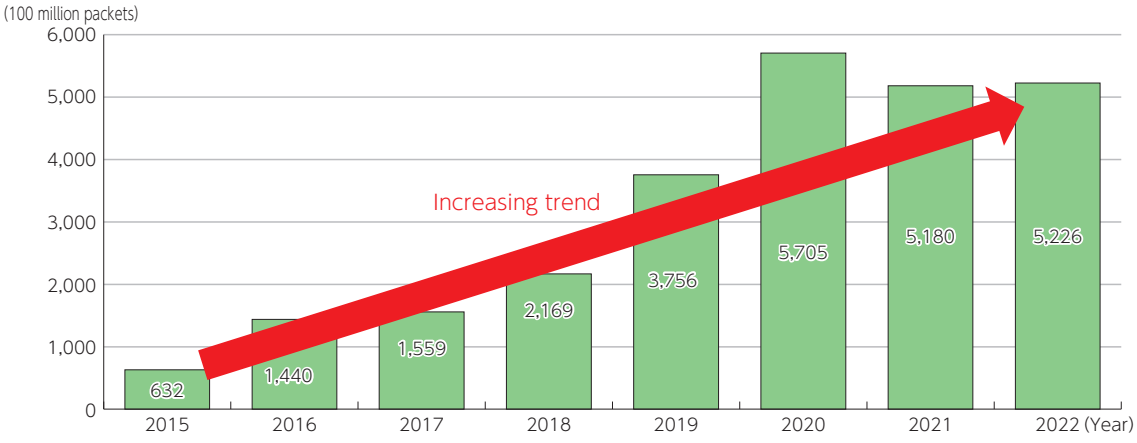
2. State of cybersecurity

(1) Increasing threat to cybersecurity

The number of cyberattack-related communications (about 522.6 billion packets) observed by the Network Incident analysis Center for Tactical Emergency Response (NICTER) operated by NICT in 2022 was 8.3 times higher than in 2015 (about 63.2 billion packets), and many attack-related communications are still being observed (**Figure 4-10-2-1**). The number of cyberattack-related communications observed in 2022 is equivalent to one attack per 17 seconds on each IP address.

The number observed decreased from 2020. The factors include the absence of specific phenomena (large-scale backscatter[2] and a huge quantity of concentrated communications that is thought to be sent from specific senders for the purpose of survey) found in 2022.

Figure 4-10-2-1 Changes in the number of cyberattack-related communications detected by NICTER

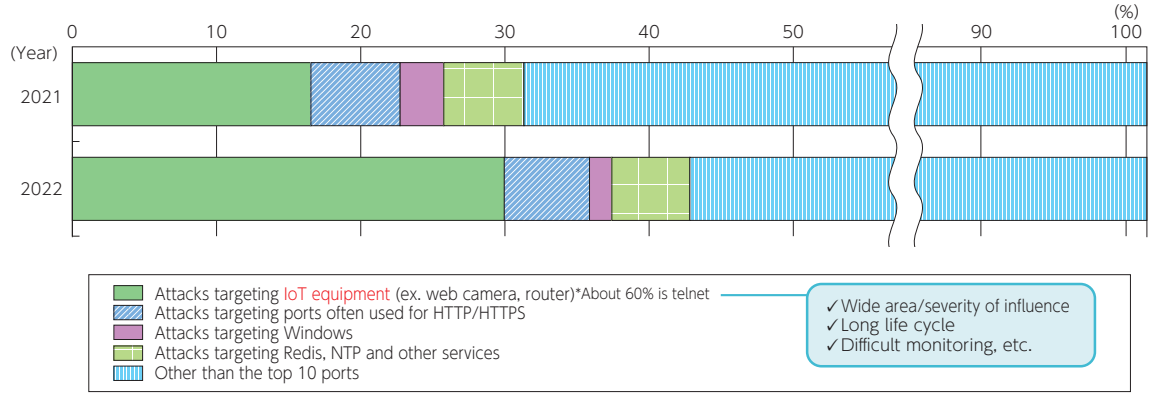


(Source) Based on NICT "NICTER Observation Report 2022"

With regard to cyberattack-related communications in NICTER, communications targeting IoT devices increased significantly from 2021, accounting for 30% of all cyberattack-related communications. Attacks on ports used for HTTP and HTTPS have been observed at a similar rate to last year **(Figure 4-10-2-2)**.

[2] An answer (SYN-ACK) packet from a server that is under DoS attack (SYN-flood attack) with a spoofed send-side IP address. Because a large quantity of response packets reaches the darknet from the servers targeted by DoS attack if IP addresses are randomly spoofed, the DoS attack can be detected.

Figure 4-10-2-2 Targets of cyberattack-related communications detected by NICTER



(Source) Based on "NICTER Observation Report 2022" of National Institute of Information and Communications Technology

There were 522 arrests for violation of the Act on Prohibition of Unauthorized Computer Access (hereinafter referred to as "Unauthorized Access Prohibition Act") in 2022, an increase of 93 compared with the previous year.

Figure (related data) Changes in arrests for violation of the Unauthorized Access Prohibition Act
Source: Based on NPA/MIC/METI "Unauthorized Access Activities and Status of Research and Development of Access Control Technology"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00270
(Data collection)

In recent years, cyberattacks caused by ransomware have continued to target various companies and medical institutions in Japan and overseas, affecting people's lives and the social economy. In March 2023, the resumption of Emotet activities was confirmed, and in the same month, the Information-Technology Promotion Agency (IPA) and JPCERT/CC issued an alert. Recently, DDoS attacks targeting the websites of Japanese government agencies, local governments, and companies have had an impact on business continuity. Everyone is now facing concerns with cyberattacks.

In light of the cybersecurity risks posed by major holidays, METI, MIC, the NPA, and NISC issued a warning in April 2023 about the measures they would like to see implemented in preparation for the spring holidays.

(2) Economic losses caused by cybersecurity issues

Various organizations have published studies and analyses of the economic losses caused by cybersecurity issues (**Figure 4-10-2-3**). The figures vary depending on the scope of losses considered. For example, according to a survey conducted by Trend Micro, the average annual damage per organization caused by security incidents in Japan over the course of fiscal 2021 is estimated to be approximately 328.5 million yen.

Figure 4-10-2-3 Economic losses caused by cybersecurity issues

Investigation/ analysis entity	Target area	Period covered	Overview of economic loss	Loss amount
Trend Micro	Japan	Fiscal 2021	Average annual damage per organization resulting from security incidents	328.5 million yen
National Police Agency	Japan	First half of 2022	Total investigation and recovery costs associated with ransomware damage	20%: < 1 million yen 14%: 1 million to < 5 million yen 10%: 5 million to < 10 million yen 37%: 10 million yen to < 50 million yen 18%: 50 million yen or more
FBI	U.S.	2021	Total amount of damage reported for cybercrime incidents	$6.9 billion
NFIB	UK	2022	Total amount of damage reported for cybercrime	£6.3 million
Sophos	31 countries	2021	Average annual cost per organization to recover from most recent ransomware attack	$1.4 million
IBM	World	2022	Global average cost of single data breach for an organization	$4.35 million
Cybersecurity Ventures	World	2023 [expected]	Cost of cybercrime	$8 trillion
McAfee, CSIS	World	2020	Cost of cybercrime	$945 billion

(Source) Based on the published materials of each company

(3) Wireless LAN security trends

According to an attitude survey conducted by MIC in November 2022 to understand the security awareness of wireless LAN users, most respondents are aware of the existence of public wireless LAN (approximately 94%), but only about half of them are actually using it. "Security concerns" was the leading reason for not using public wireless LAN far ahead of other reasons. About 90% of public wireless LAN users feel anxiety about security, but half of them answered that they feel a "vague sense of unease."

(4) Introduction of sender domain authentication technologies

With regard to introducing sender domain authentication technologies for preventing spoofed emails in JP domains, SPF and DMARC accounted for approximately 77.2% and 2.7% of technologies introduced, respectively, as of December 2022, and both of them are slightly increasing.

Figure (related data) Introduction of sender domain authentication technologies for JP domains
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00277
(Data collection)

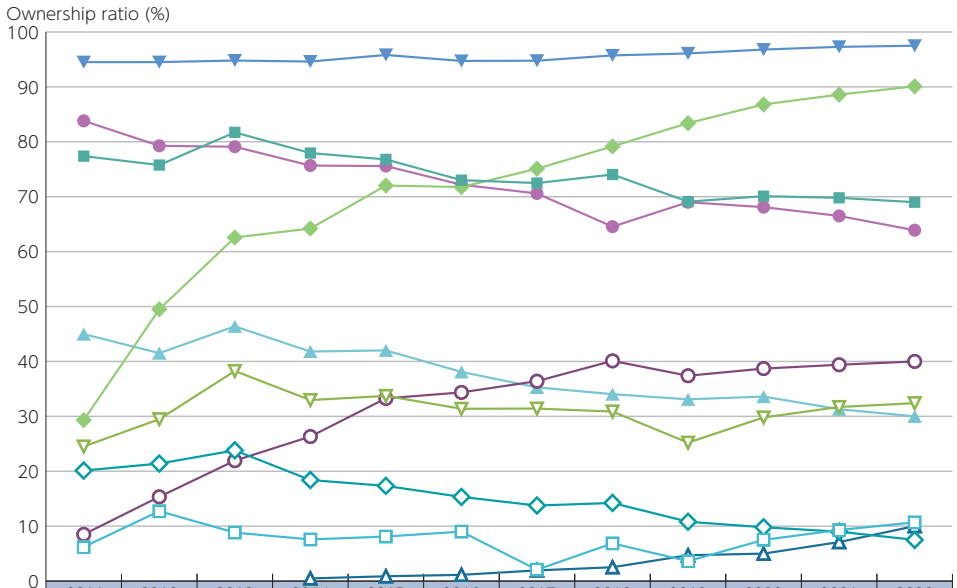
Section 11 Digital Usage Trends

1. Digital usage trends in the daily life of the public

(1) ICT devices and terminals

The Internet is now crucial in order to make use of digital technologies. In 2022, the household ownership rate of ICT devices for connecting to the Internet was 97.5% for "mobile devices" including 90.1% for "smartphones." The rate was 69.0% for PCs (**Figure 4-11-1-1**).

Figure 4-11-1-1 Changes in household ownership of ICT devices



	2011 (n=16,530)	2012 (n=20,418)	2013 (n=15,599)	2014 (n=16,529)	2015 (n=14,765)	2016 (n=17,040)	2017 (n=16,117)	2018 (n=16,255)	2019 (n=15,410)	2020 (n=17,345)	2021 (n=17,365)	2022 (n=15,951)
Fixed-line telephone	83.8	79.3	79.1	75.7	75.6	72.2	70.6	64.5	69.0	68.1	66.5	63.9
FAX	45.0	41.5	46.4	41.8	42.0	38.1	35.3	34.0	33.1	33.6	31.3	30.0
Mobile devices (overall)	94.5	94.5	94.8	94.6	95.8	94.7	94.8	95.7	96.1	96.8	97.3	97.5
Smartphones	29.3	49.5	62.6	64.2	72.0	71.8	75.1	79.2	83.4	86.8	88.6	90.1
Computers	77.4	75.8	81.7	78.0	76.8	73.0	72.5	74.0	69.1	70.1	69.8	69.0
Tablets	8.5	15.3	21.9	26.3	33.3	34.4	36.4	40.1	37.4	38.7	39.4	40.0
Wearable devices	–	–	–	0.5	0.9	1.1	1.9	2.5	4.7	5.0	7.1	10.0
Home game consoles	24.5	29.5	38.3	33.0	33.7	31.4	31.4	30.9	25.2	29.8	31.7	32.4
Portable music players	20.1	21.4	23.8	18.4	17.3	15.3	13.8	14.2	10.8	9.8	9.0	7.5
Smart appliances	6.2	12.7	8.8	7.6	8.1	9.0	2.1	6.9	3.6	7.5	9.3	10.7

(Source) MIC "Communications Usage Trend Survey"[1]

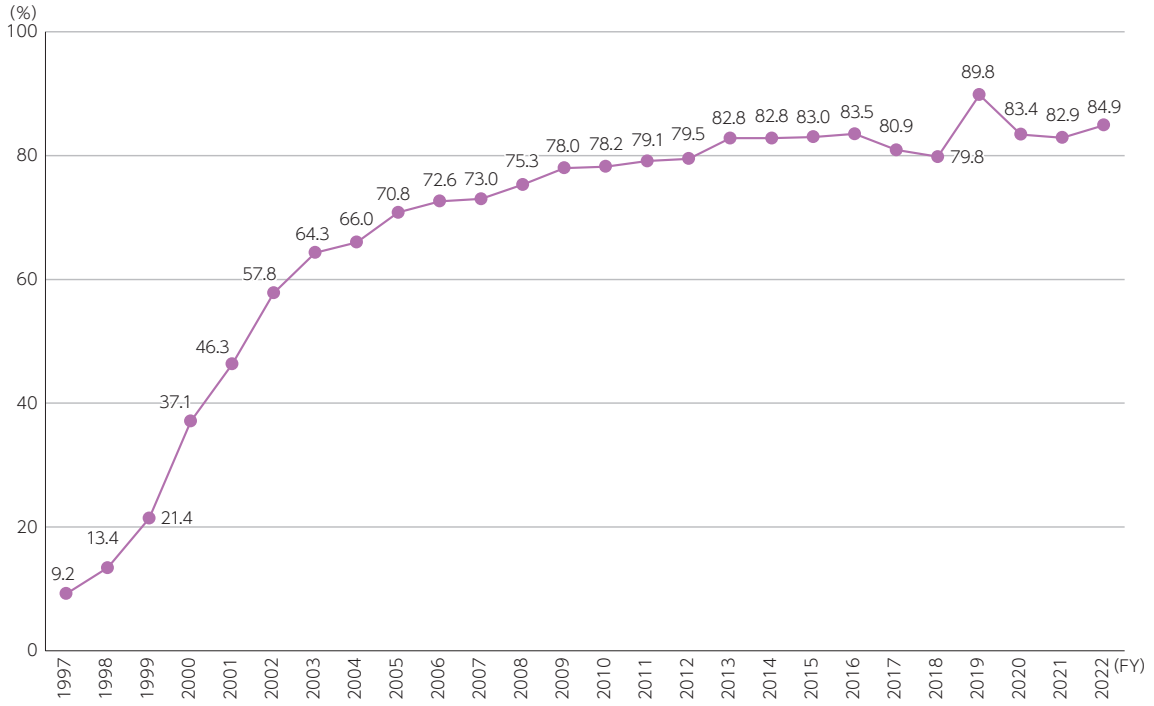
[1] https://www.soumu.go.jp/johotsusintokei/statistics/statistics05.html

(2) Internet

a Usage

In 2022, the Internet usage rate for individuals was 84.9% (**Figure 4-11-1-2**), and the Internet usage rate for individual devices was 22.6 percentage points higher for smartphones (71.2%) than for PCs (48.5%).

Figure 4-11-1-2 Changes in Internet usage rate (individuals)[2]



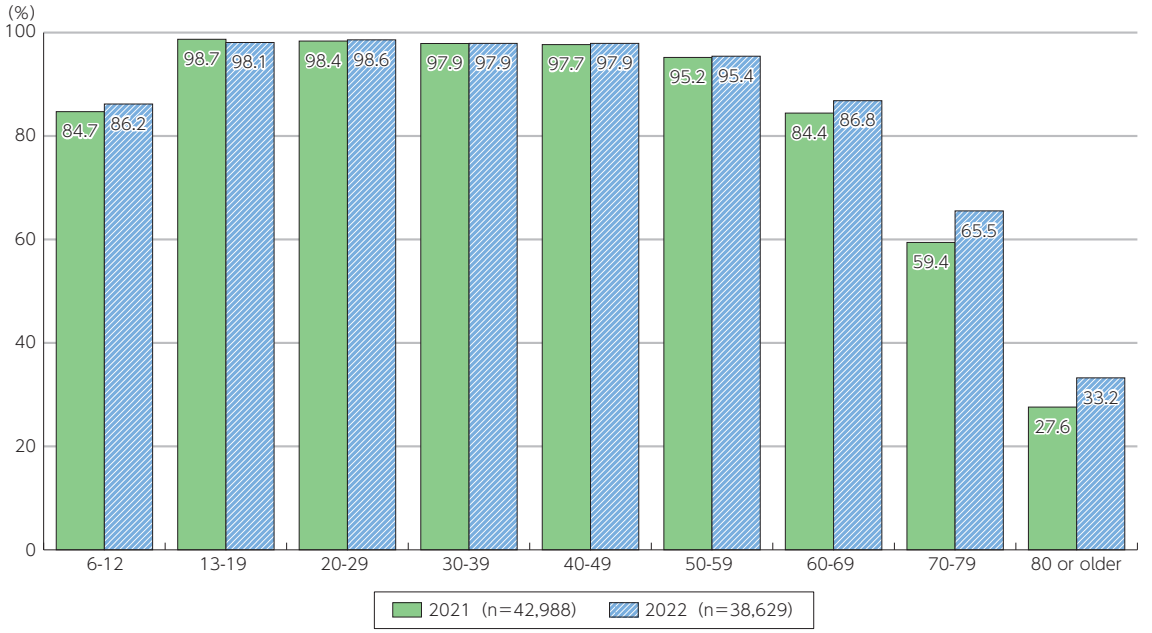
(Source) MIC "Communications Usage Trend Survey"

Figure (related data) Types of Internet devices (individual)
Source: MIC "Communications Usage Trend Survey"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00281
(Data collection)

Looking at Internet usage by age group of individuals reveals that the rate exceeds 90% in each age group from 13 to 59 years old, but tends to decrease after 60 years old **(Figure 4-11-1-3)**. Internet usage by annual household income also exceeded 80% in each category of four million yen or more **(Figure 4-11-1-4)**. By prefecture, Internet usage exceeds 80% in 34 prefectures, and smartphone usage exceeds 50% in all prefectures.

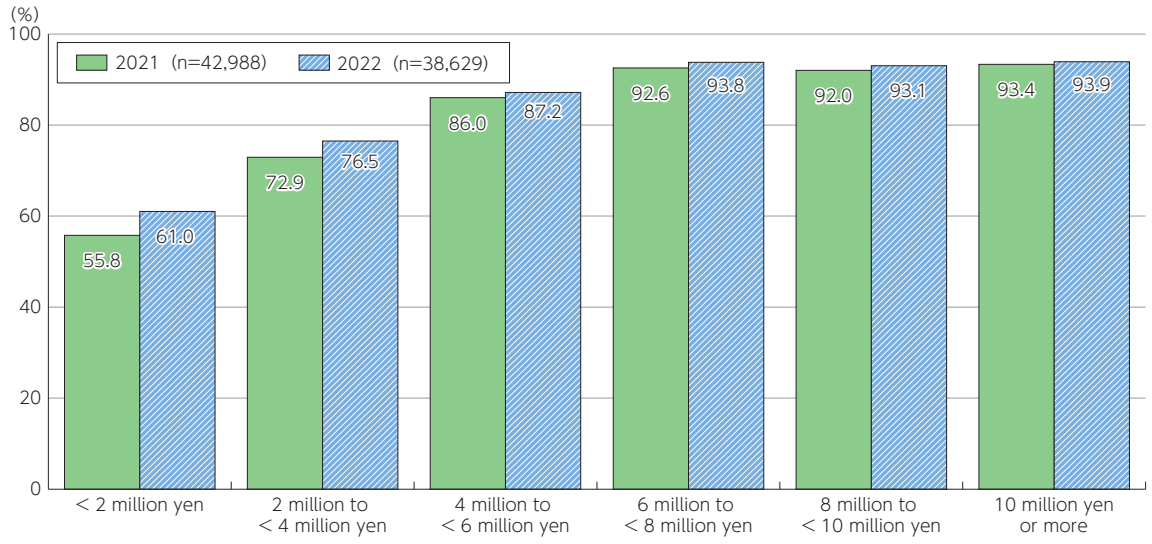
[2] The design of the questionnaire in the 2019 survey was partially different from that in previous years, so care should be taken when comparing over the years.

Figure 4-11-1-3 Internet usage by age group



(Source) MIC "Communications Usage Trend Survey"

Figure 4-11-1-4 Internet usage by annual household income



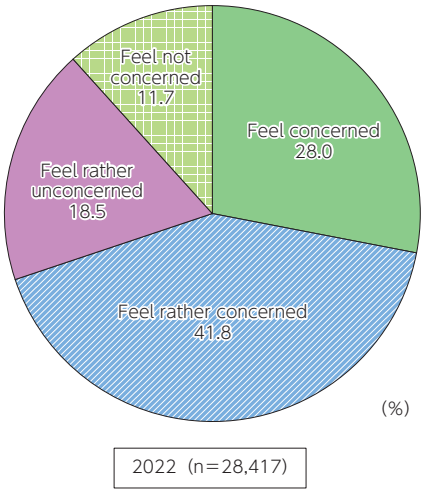
(Source) MIC "Communications Usage Trend Survey"

Figure (related data) Internet usage by prefecture and usage by device (individual) (2022)
Source: MIC "Communications Usage Trend Survey"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00284
(Data collection)

b Anxiety over using the Internet

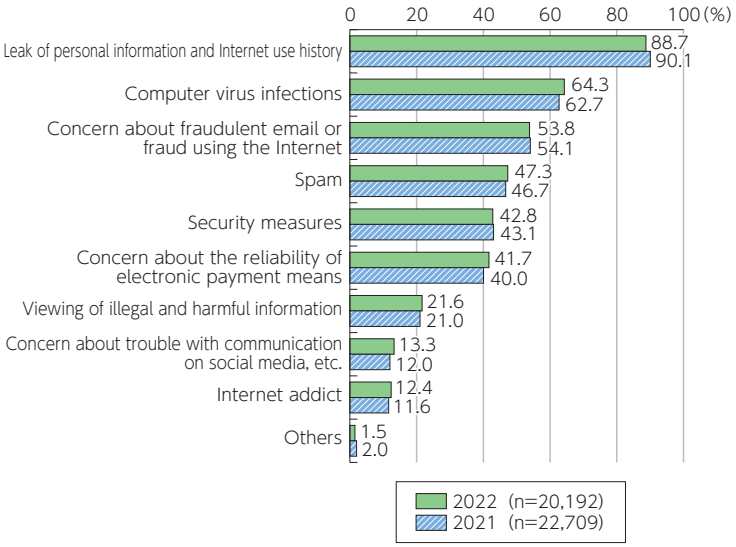
Approximately 70% of Internet users feel some kind of anxiety when using the Internet (**Figure 4-11-1-5**). When asked why, the largest number of chose "leaks of personal information and internet usage history" at 88.7%, followed by "computer virus infections" (64.3%) and "fraudulent billing or fraud using Internet" (53.8%) (**Figure 4-11-1-6**).

Figure 4-11-1-5 Percentage of individuals who feel anxiety when using the Internet



(Source) MIC "Communications Usage Trend Survey"

Figure 4-11-1-6 Anxiety felt when using the Internet (multiple answers allowed)



(Source) MIC "Communications Usage Trend Survey"

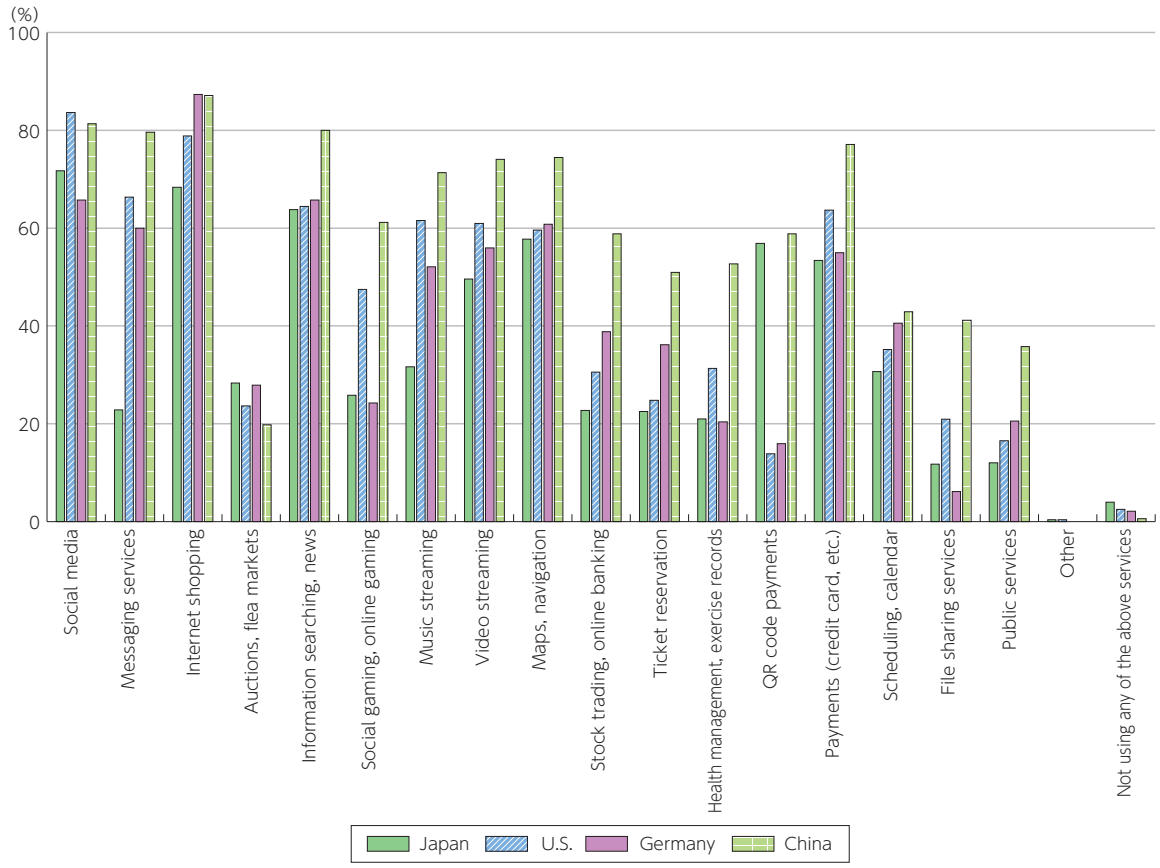
(3) Utilization of digital services (international comparison)

a Overall usage of digital services

Questionnaire surveys conducted in Japan, the U.S., Germany, and China on digital services regularly being used found that respondents in China were overall more likely to use each service than those in other countries.

In Japan, more than 60% of respondents use services such as "social media," "Internet shopping," and "information searching and news," which is higher than that of other services **(Figure 4-11-1-7)**.

Figure 4-11-1-7 Overall usage of digital services

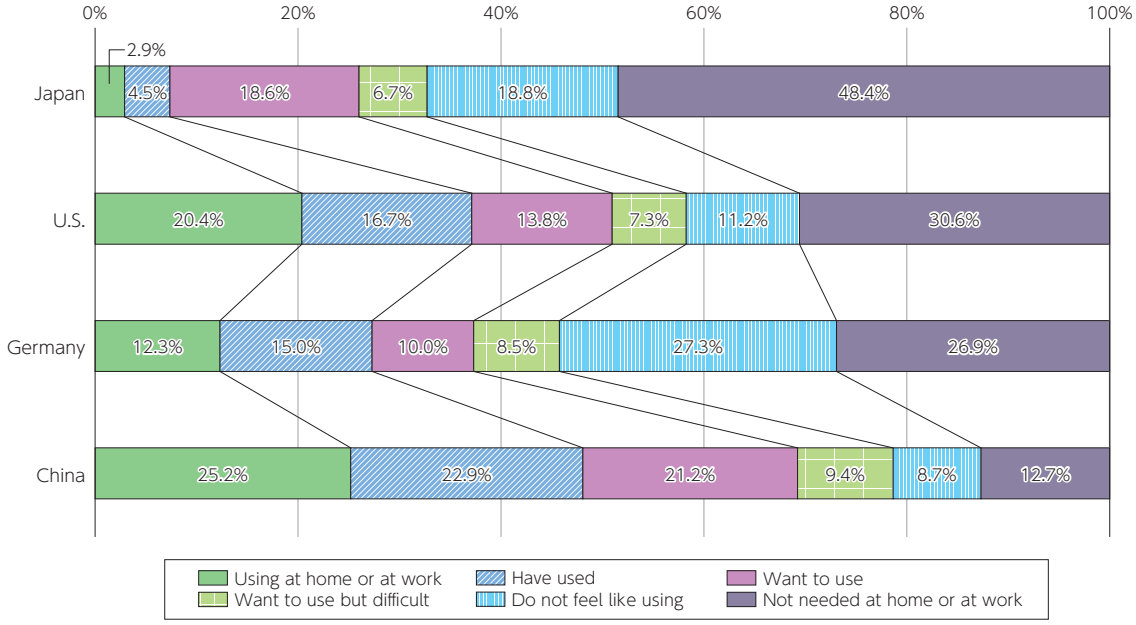


(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

b Digital service usage in virtual spaces (XR content)

Between 20% and 30% of respondents in the U.S. and Germany, more than 50% of respondents in China, and only 7.4% of respondents in Japan answered that they had used XR content[3] (**Figure 4-11-1-8**). Looking at usage in Japan by age group reveals that those in their 20s had the highest usage (12.6%) and also the highest rate responding with "want to use" (30.6%).

Figure 4-11-1-8 Usage of interactive entertainment services in virtual spaces (comparison by country)



(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

Figure (related data) Usage of interactive entertainment services in virtual spaces (by age)
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00289
(Data collection)

Figure (related data) Reasons why entertainment services in virtual spaces are unavailable
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00290
(Data collection)

[3] XR content (interactive entertainment services in virtual space) is a type of service in which users have interactive relationships with others in real-time, such as online games and virtual events.

c Media usage time

Since 2012, the MIC Institute for Information and Communications Policy has conducted research studies on the usage time, time slots of usage, purpose, and reliability of information and communications media, as joint research with Professor Yoshiaki Hashimoto (School of Arts and Science, Tokyo Woman's Christian University) and others.[4][5] Below is an overview of the usage time, etc. of information and communications media based on the survey result[6] of fiscal 2022.

(a) Average usage time for major media[7] and user ratio[8]

The average usage time and user ratio for "television viewing (real-time)," "television viewing (recorded program)," "Internet use," "newspaper reading," and "radio listening" are shown in (**Figure 4-11-1-9**).

The average usage time for "television viewing (real-time)" and "Internet use" tended to be long on both weekdays and holidays for all ages, but "Internet use" exceeded "television viewing (real-time)" for the third year in a row on weekdays and (for the first time) on holidays. The user ratio for "television viewing (real-time)" is lower than the ratio of "Internet use," on both weekdays and holidays.

By age group, average usage time for "Internet use" decreased or remained almost unchanged on weekdays except for those in their 30s, and increased on holidays except for those in their 30s and 40s. The user ratio for "Internet use" among users in their teens to 50s (weekdays) and teens to 40s (holidays) exceeds the user ratio for "television viewing (real-time)." For "newspaper reading," the user ratio increases with age.

[4] Professor Satoshi Kitamura (Faculty of Communication Studies, Tokyo Keizai University) and Project Assistant Professor Daisuke Kawai (Center for Integrated Disaster Information Research (CIDIR), Interfaculty Initiative in Information Studies, the University of Tokyo).
[5] "Survey on Usage Time of Information and Communications Media and Information Behavior": 1,500 men and women aged 13 to 69 (selected by sex and age group [in 10 year increments] in proportion to the actual situation in the Basic Resident Register; the register of January 2022 was used for the fiscal 2022 survey) were visited and received questionnaires based on random location quota sampling.
[6] The fiscal 2022 survey was conducted from November 5 to November 11, 2022.
[7] The total number of hours of all people surveyed for a particular information behavior per survey day, divided by the number of people surveyed. The average time is calculated by including the respondents who did not do the activity throughout the day.
[8] For weekdays, the ratio of people who performed a particular information behavior for each day of the two survey days was calculated and averaged over the two days. For holidays, this is the ratio of survey days.
[9] Television viewing (real-time): Real-time television viewing with any device not limited to TV receiver
[10] Internet use: The use of services over an Internet connection, including email, websites, social media, video sites, and online games, regardless of device.

Figure 4-11-1-9 Average usage time for major media and user ratio

<Weekday (one day)>

		Average usage time (minute)					Doers' ratio				
		Television viewing (real-time)	Television viewing (recorded program)	Internet use	Newspaper reading	Radio listening	Television viewing (real-time)	Television viewing (recorded program)	Internet use	Newspaper reading	Radio listening
All age groups	2018	156.7	20.3	112.4	8.7	13.0	79.3	18.7	82.0	26.6	6.5
	2019	161.2	20.3	126.2	8.4	12.4	81.6	19.9	85.5	26.1	7.2
	2020	163.2	20.2	168.4	8.5	13.4	81.8	19.7	87.8	25.5	7.7
	2021	146.0	17.8	176.8	7.2	12.2	74.4	18.6	89.6	22.1	6.2
	2022	135.5	18.2	175.2	6.0	8.1	73.7	17.5	90.4	19.2	6.0
10s	2018	71.8	12.7	167.5	0.3	0.2	63.1	15.2	89.0	2.5	1.1
	2019	69.0	14.7	167.9	0.3	4.1	61.6	19.4	92.6	2.1	1.8
	2020	73.1	12.2	224.2	1.4	2.3	59.9	14.8	90.1	2.5	1.8
	2021	57.3	12.1	191.5	0.4	3.3	56.7	16.3	91.5	1.1	0.7
	2022	46.0	6.9	195.0	0.9	0.8	50.7	10.0	94.3	2.1	1.8
20s	2018	105.9	18.7	149.8	1.2	0.9	67.5	16.5	91.4	5.3	0.7
	2019	101.8	15.6	177.7	1.8	3.4	65.9	14.7	93.4	5.7	3.3
	2020	88.0	14.6	255.4	1.7	4.0	65.7	13.6	96.0	6.3	3.1
	2021	71.2	15.1	275.0	0.9	7.0	51.9	13.7	96.5	2.6	3.0
	2022	72.9	14.8	264.8	0.4	2.1	54.4	11.8	97.7	2.8	2.3
30s	2018	124.4	17.4	110.7	3.0	9.4	74.1	19.1	91.1	13.0	4.3
	2019	124.2	24.5	154.1	2.2	5.0	76.7	21.9	91.9	10.5	2.2
	2020	135.4	19.3	188.6	1.9	8.4	78.2	19.4	95.0	8.8	6.0
	2021	107.4	18.9	188.2	1.5	4.8	65.8	20.9	94.9	5.9	3.2
	2022	104.4	14.6	202.9	1.2	4.1	67.1	14.9	95.7	4.1	3.9
40s	2018	150.3	20.2	119.7	4.8	16.6	79.2	18.8	87.0	23.1	7.4
	2019	145.9	17.8	114.1	5.3	9.5	84.0	18.9	91.3	23.6	6.0
	2020	151.0	20.3	160.2	5.5	11.7	86.2	23.0	92.6	24.1	6.0
	2021	132.8	13.6	176.8	4.3	12.9	77.8	15.3	94.6	17.9	5.4
	2022	124.1	17.2	176.1	4.1	5.5	75.7	18.0	91.5	16.5	6.3
50s	2018	176.9	20.8	104.3	12.9	17.2	88.5	20.6	82.0	43.9	9.3
	2019	201.4	22.5	114.0	12.0	18.3	92.8	21.9	84.2	38.5	12.2
	2020	195.6	23.4	130.0	11.9	26.9	91.8	20.7	85.0	39.4	13.4
	2021	187.7	18.7	153.6	9.1	23.6	86.4	20.9	89.4	33.8	11.1
	2022	160.7	18.6	143.5	7.8	14.0	84.0	19.5	88.8	29.6	8.6
60s	2018	248.7	27.3	60.9	23.1	22.8	91.6	19.7	59.0	52.8	11.7
	2019	260.3	23.2	69.4	22.5	27.2	93.6	21.2	65.7	57.2	13.4
	2020	271.4	25.7	105.5	23.2	18.5	92.9	22.3	71.3	53.7	12.1
	2021	254.6	25.8	107.4	22.0	14.4	92.0	23.0	72.8	55.1	10.0
	2022	244.2	30.5	103.2	17.7	16.7	92.8	25.2	78.5	46.1	9.9

<Holiday (one day)>

		Average usage time (minute)					Doers' ratio				
		Television viewing (real-time)	Television viewing (recorded program)	Internet use	Newspaper reading	Radio listening	Television viewing (real-time)	Television viewing (recorded program)	Internet use	Newspaper reading	Radio listening
All age groups	2018	219.8	31.3	145.8	10.3	7.5	82.2	23.7	84.5	27.6	5.1
	2019	215.9	33.0	131.5	8.5	6.4	81.2	23.3	81.0	23.5	4.6
	2020	223.3	39.6	174.9	8.3	7.6	80.5	27.6	84.6	22.8	4.7
	2021	193.6	26.3	176.5	7.3	7.0	75.0	21.3	86.7	19.3	4.2
	2022	182.9	30.2	187.3	5.6	5.5	72.2	22.7	88.5	17.7	4.1
10s	2018	113.4	28.6	271.0	0.9	0.7	67.4	27.7	91.5	3.5	2.1
	2019	87.4	21.3	238.5	0.1	0.0	52.8	17.6	90.1	0.7	0.0
	2020	93.9	29.8	290.8	0.9	0.0	54.9	25.4	91.5	1.4	0.0
	2021	73.9	12.3	253.8	0.0	0.0	57.4	14.9	90.8	0.0	0.0
	2022	69.3	17.4	285.0	1.0	2.8	46.4	19.3	92.9	2.1	2.1
20s	2018	151.0	32.8	212.9	2.1	2.1	66.5	24.9	95.7	6.2	2.4
	2019	138.5	23.0	223.2	0.9	1.2	69.7	19.9	91.0	3.3	1.9
	2020	132.3	26.5	293.8	2.0	1.9	64.3	20.2	97.7	6.6	2.3
	2021	90.8	17.2	303.1	0.7	1.8	49.3	14.0	97.2	2.3	1.4
	2022	89.6	25.1	330.3	0.5	1.0	48.4	16.1	96.8	2.3	1.4
30s	2018	187.2	26.6	150.2	3.5	3.9	79.8	19.1	92.6	11.7	3.5
	2019	168.2	31.0	149.5	2.5	2.0	78.3	23.3	90.1	9.9	2.0
	2020	198.1	45.0	191.3	1.6	7.4	77.2	31.6	91.2	5.6	3.2
	2021	147.6	30.3	212.3	1.5	3.2	69.6	22.7	92.3	4.0	1.2
	2022	152.5	25.9	199.9	0.8	6.9	63.3	19.6	92.7	3.3	4.1
40s	2018	213.9	39.0	145.3	6.4	8.2	82.7	25.9	90.4	25.3	3.4
	2019	216.2	37.5	98.8	6.0	5.0	83.7	25.5	84.7	20.2	3.7
	2020	232.7	41.5	154.5	5.2	4.2	85.3	28.5	89.3	19.9	3.1
	2021	191.1	28.5	155.7	4.9	6.3	79.0	21.0	91.0	14.8	3.4
	2022	191.0	29.7	157.5	4.6	4.8	76.5	22.9	89.0	16.3	2.8
50s	2018	260.8	22.9	115.0	15.3	10.4	91.9	21.5	80.7	42.2	7.0
	2019	277.5	48.0	107.9	12.9	6.6	90.3	30.6	77.3	37.4	6.5
	2020	256.5	49.8	127.8	12.5	16.3	91.6	31.4	81.5	36.6	7.7
	2021	242.6	28.9	119.0	9.2	14.2	84.8	24.9	82.2	29.6	8.1
	2022	220.5	33.0	134.9	7.6	5.6	85.7	24.8	85.3	24.4	4.6
60s	2018	315.3	34.6	64.3	26.1	14.1	93.0	24.4	63.2	56.9	10.0
	2019	317.6	28.1	56.1	21.8	18.5	94.5	19.0	60.7	51.7	10.3
	2020	334.7	37.2	83.7	22.0	10.9	91.8	25.9	63.1	50.4	9.2
	2021	326.1	31.4	92.7	22.3	11.2	93.5	25.4	71.0	50.4	8.0
	2022	291.4	42.2	105.4	15.0	10.1	92.3	29.8	78.7	45.2	8.5

(Source) MIC Institute for Information and Communications Policy "Fiscal 2022 Survey on Information and Communications Media Usage Time and Information Behavior"

(b) Positioning of the Internet as media

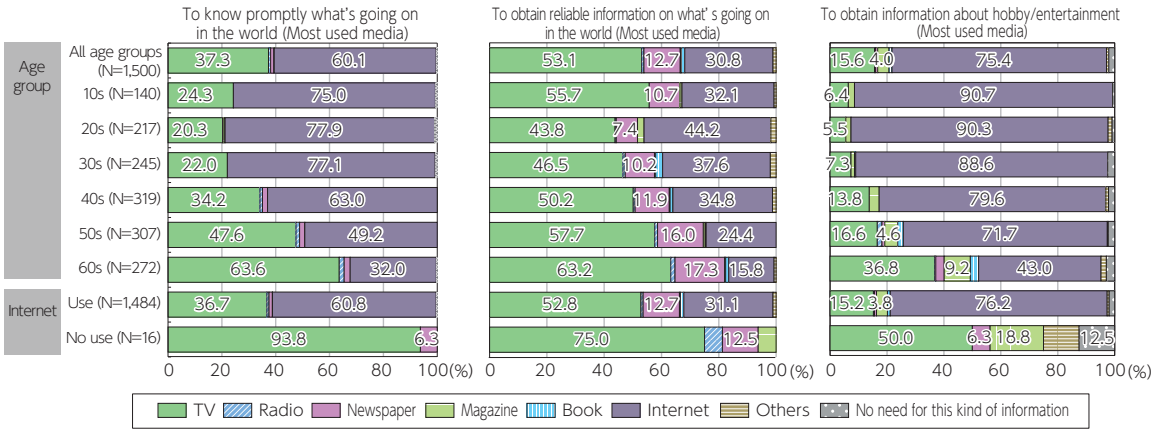
A comparison of the use of Internet as media with other media for each purpose of use is provided in (**Figure 4-11-1-10**).

The most used media "to know promptly what's going on in the world" of all respondents is "Internet." By age group, those in their teens to 50s use the "Internet" the most, while those in their 60s use "television" the most.

The most used media "to obtain reliable information on what's going on in the world" is "television" for all age groups in total, and this is also true for each age group excluding those in their 20s. "Newspapers" are used by people in their 60s more than the "Internet."

The most used media "to obtain information about hobby/entertainment" is the "Internet" in all age groups in total, as well as in each age group. The ratio is around 90% among respondents in their teens through 30s.

Figure 4-11-1-10 Media used by purpose (most used media; for all age groups, by age group, and by using or not using the Internet)



(Source) MIC Institute for Information and Communications Policy "Fiscal 2022 Survey on Information and Communications Media Usage Time and Information Behavior"

2. Trends in utilization in corporate activities

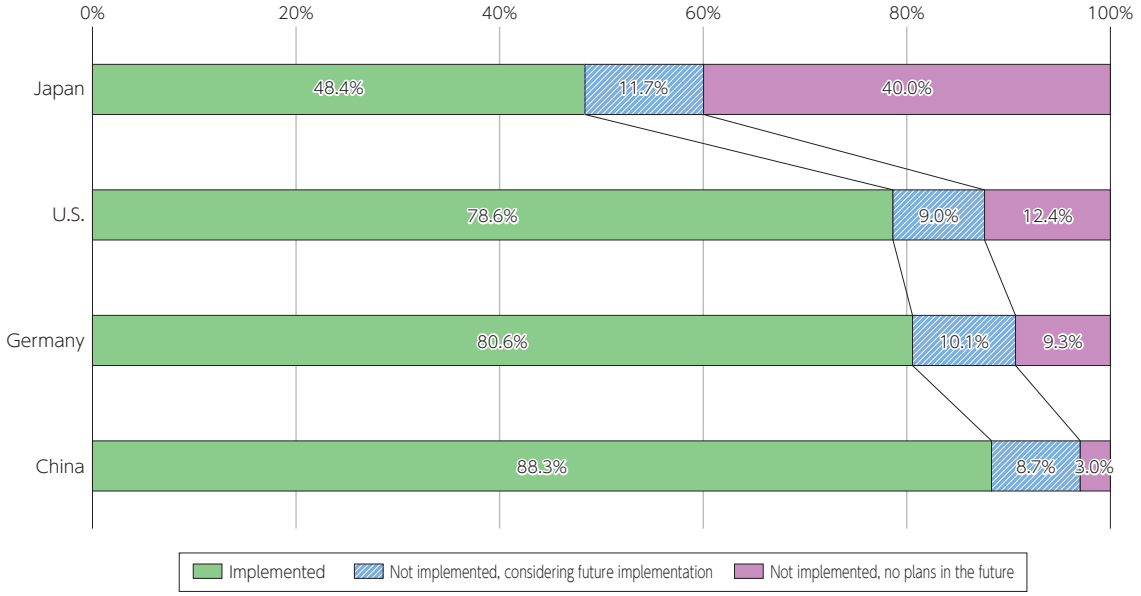
(1) Status of digitalization among enterprises in each country

a Digitalization

Regarding the ratio of digitalization implementation among enterprises in Japan, the U.S., Germany, and China, more than 50% of Japanese companies answered that they had not yet begun to implement digitalization. Looking at the status of initiatives in Japan by enterprise size reveals that approximately 25% of large enterprises and more than 70% of small-to-medium-sized enterprises answered that they had not implemented such initiatives, indicating that digitalization efforts vary depending on the size of the enterprise **(Figure 4-11-2-1)**.

With regard to specific measures taken to promote digitalization, the most common responses in Japan were "improving/reforming business processes," "reducing labor," and "realizing new work styles." In other countries, the most common responses were "creating/improving customer experiences" and "enhancing added value of existing products/services," in addition to reforming work styles and businesses **(Figure 4-11-2-2)**.

Figure 4-11-2-1 Status of digitalization (comparison by country)

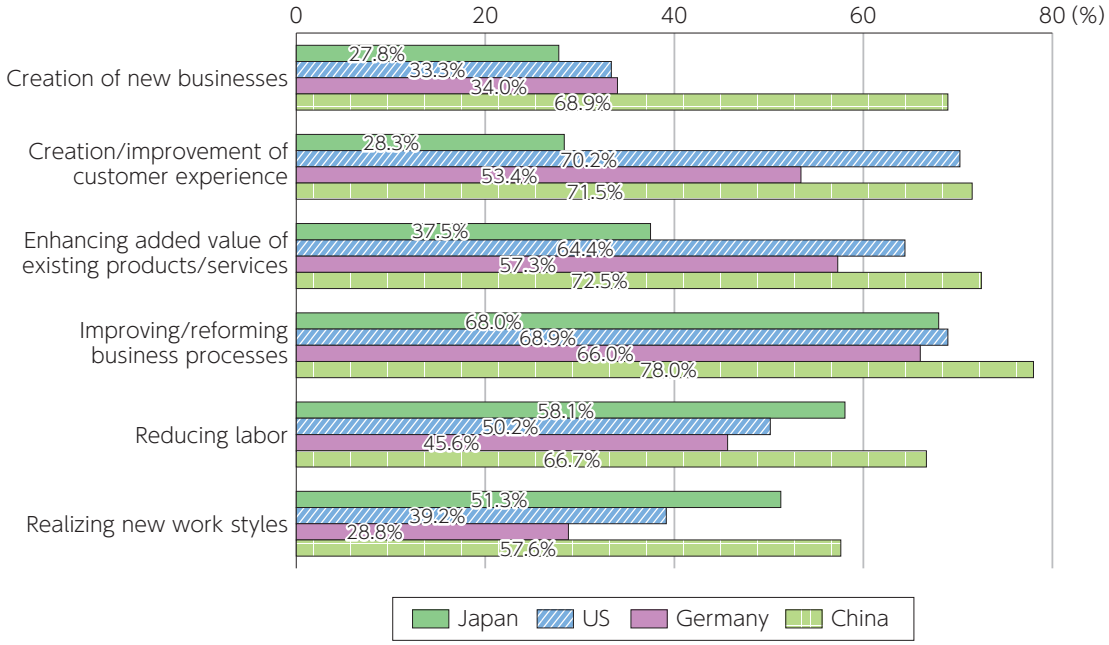


*Based on the results of a screening survey conducted to identify companies engaged in digitalization

(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

Figure (related data) Status of digitalization (Japan: Comparison by company size)
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00304 (Data collection)

Figure 4-11-2-2 Initiatives to promote digitalization (comparison by country)



(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

b Results of digitalization

Surveying the results of promoting digitalization from the viewpoints of "creating new business," "creating/improving customer experiences," "enhancing added value of existing products/services," "improving/reforming business processes," "reducing labor," and "realizing new work styles" reveals that Japanese respondents selected "greater than expected" the least and "not having the desired effect" the most for all viewpoints, among the four countries.

Figure (Related Data) Results of digitalization in creating new business
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00306
(Data collection)

Figure (related data) Results of digitalization in creating/improving customer experiences
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00307
(Data collection)

Figure (related data) Results of digitalization in enhancing added value of existing products/services
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00308
(Data collection)

Figure (related data) Results of digitalization in improving/reforming business processes
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00309
(Data collection)

Figure (related data) Results of digitalization in reducing labor
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00310
(Data collection)

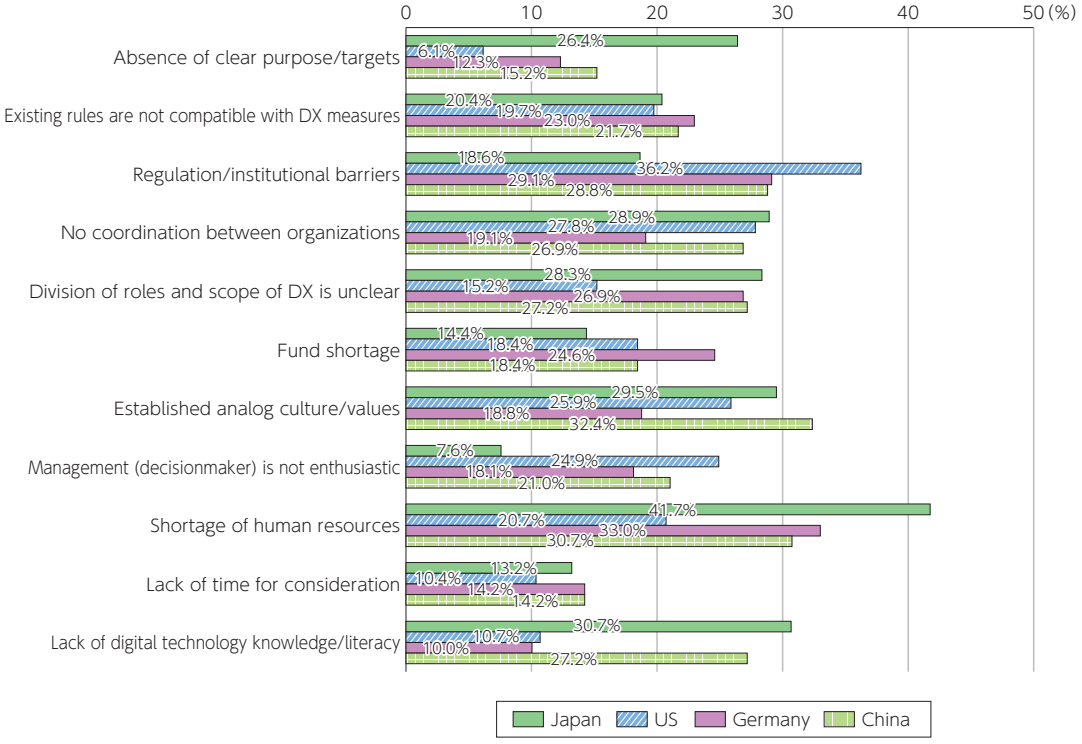
Figure (related data) Results of digitalization in realizing new work styles
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00311
(Data collection)

c Challenges in promoting digitalization

As for the challenges and barriers in the way of digitalization, many more Japanese companies indicated "shortage of human resources" (41.7%) compared to respondents in the U.S., China, and Germany, followed by "lack of digital technology knowledge/literacy" (30.7%).

As in the survey conducted for the 2022 White Paper on Information and Communications in Japan, there were many challenges and barriers related to human resources **(Figure 4-11-2-3)**.

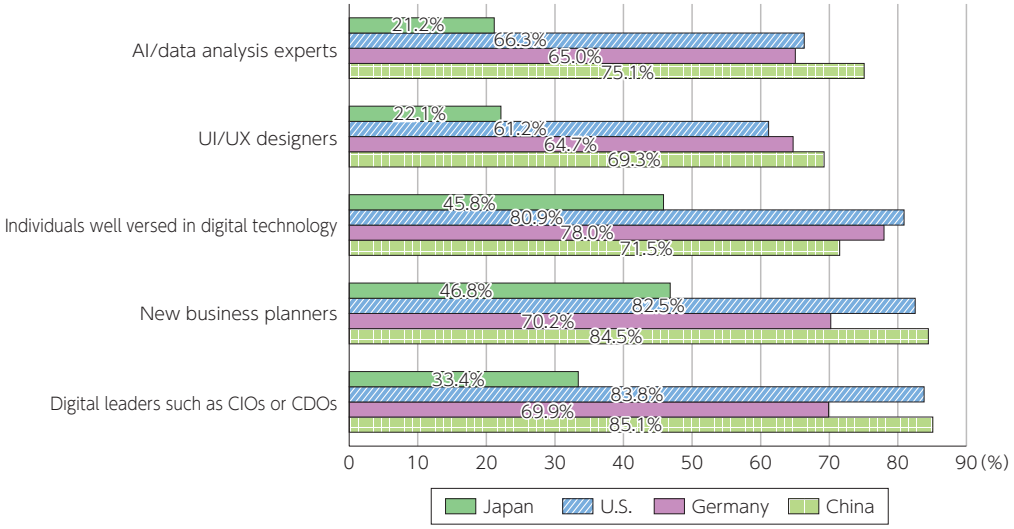
Figure 4-11-2-3 Challenges in promoting digitalization (comparison by country)



(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

Companies in Japan actually have an overall shortage of digital human resources (such as CIOs, CDOs, and other digital technology leaders) compared to companies in other countries. In particular, only 21.2% of companies have "AI/data analysis experts" on staff, and the shortage is serious compared to the other three countries with more than 60% of companies **(Figure 4-11-2-4)**. Among the companies that responded that they use personal data or information other than personal data, 26.8% and 29.2% of the companies, respectively, indicated that they have "AI/data analysis experts" on staff, which is much lower than in the other three countries.

Figure 4-11-2-4 Specialized digital human resources on staff



(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

Figure (related data) "AI/data analysis experts" in companies making use of personal data
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00314
(Data collection

Figure (related data) "AI/data analysis experts" in companies making use of information other than personal data
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00315
(Data collection)

Figure (related data) Initiatives to secure digital human resources (by country; individuals capable of integrating digital human resources with business division personnel to build systems for DX)
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00320 (Data collection)

Figure (related data) Initiatives to secure digital human resources (by country; AI/data analysis experts)
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00321
(Data collection)

When asked about the status of in-house system development, about 44% of Japanese companies indicated that they are developing their own systems, while approximately 80% of companies in other countries are, which make a big difference. As stated in the 2019 White Paper on Information and Communications in Japan, Japan is highly dependent on external vendors, and user companies are unlikely to be able to develop and secure ICT human resources within their organizations.

Figure (related data) In-house development of systems (comparison by country)
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00316
(Data collection)

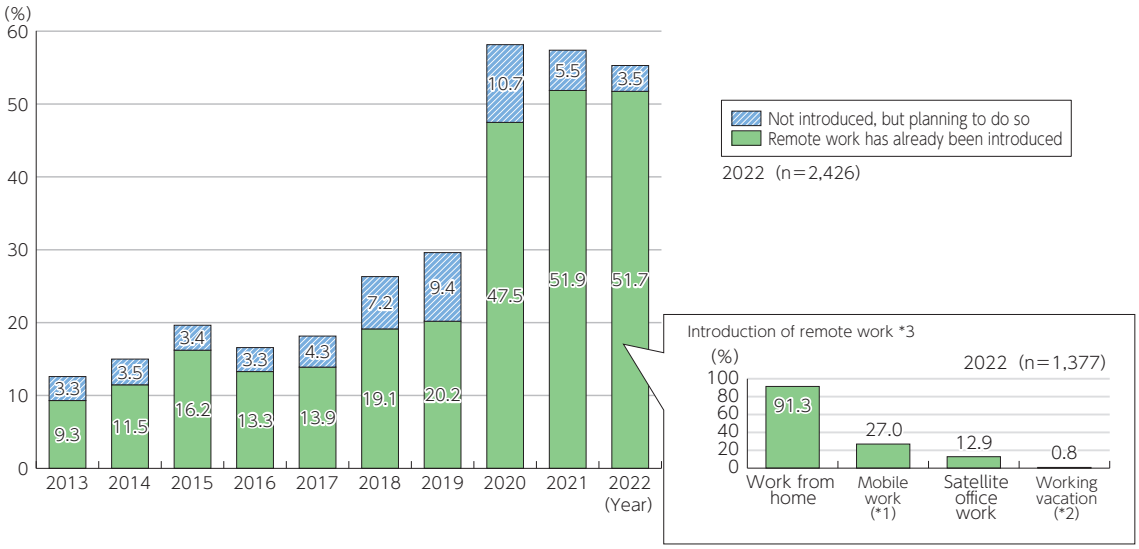
(2) Remote work and online meetings

a Remote work in Japanese companies

Private companies began to rapidly introduce remote work following the COVID-19 outbreak in 2020.

According to the Communications Usage Trend Survey conducted by MIC in 2022, more than 50% of companies have introduced remote work **(Figure 4-11-2-5)**.

Figure 4-11-2-5 Changes in introducing remote work



*1 Working outside of the office for sales activities and other similar work, including work such as checking email and writing daily reports during commutes or at locations such as cafes.

*2 Remote work performed in a location other than the usual workplace or the home, combined with personal time.

*3 Total includes entities that provided no response to introduction type.

(Source) MIC "Communications Usage Trend Survey"

Figure (related data) Purpose for introducing remote work (multiple answers allowed)
Source: MIC "Communications Usage Trend Survey"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00323
(Data collection)

Figure (related data) Challenges for introducing remote work (multiple answers allowed)
Source: Based on MIC "Fiscal 2022 Result of Survey on Actual Condition of Telework Security"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00328
(Data collection)

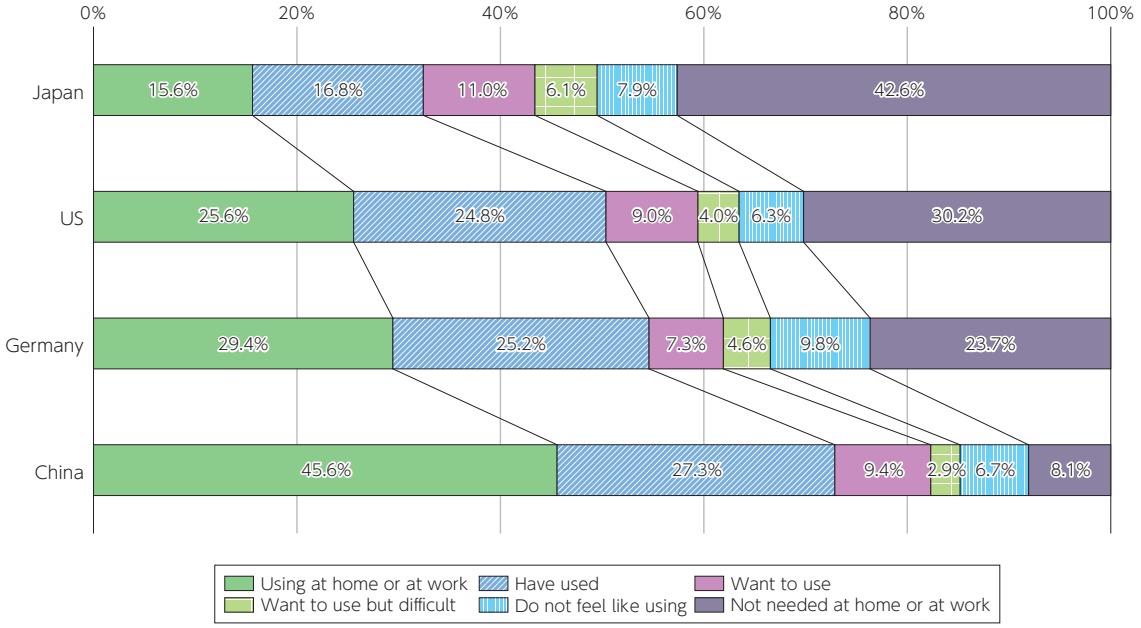
b Usage of remote work and online meetings (individuals; international comparison)

We conducted a questionnaire on the usage of remote work and online meetings ("remote work, etc.") among individuals in Japan, the U.S., China, and Germany.

More than 50% of respondents in the U.S. and Germany, more than 70% of respondents in China, and only around 30% of respondents in Japan answered that they had made use of remote work, etc. **(Figure 4-11-2-6)**. In Japan, the most frequently cited reason for difficulty introducing remote work, etc., was "not interested in any services" within the company" (35.7%).

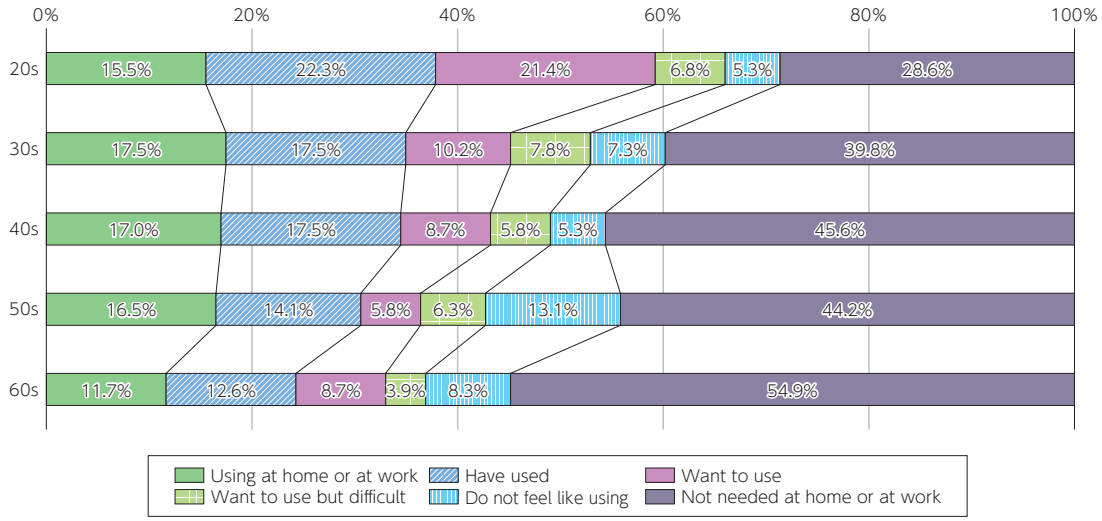
Looking at remote work usage in Japan by age group reveals that younger people tend to be more positive about remote work. The largest percentage of individuals with experience using remote work were those in their 20s (37.8%), while the same group made up the smallest percentage of respondents indicating that it was "not needed at home or at work" (28.6%) **(Figure 4-11-2-7)**.

Figure 4-11-2-6 Usage of remote work and online meetings (international comparison)



(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

Figure 4-11-2-7 Usage of remote work and online meetings (Japan; by age)



(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

Figure (related data) Reasons why remote work or online meetings are unavailable
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00326 (Data collection)

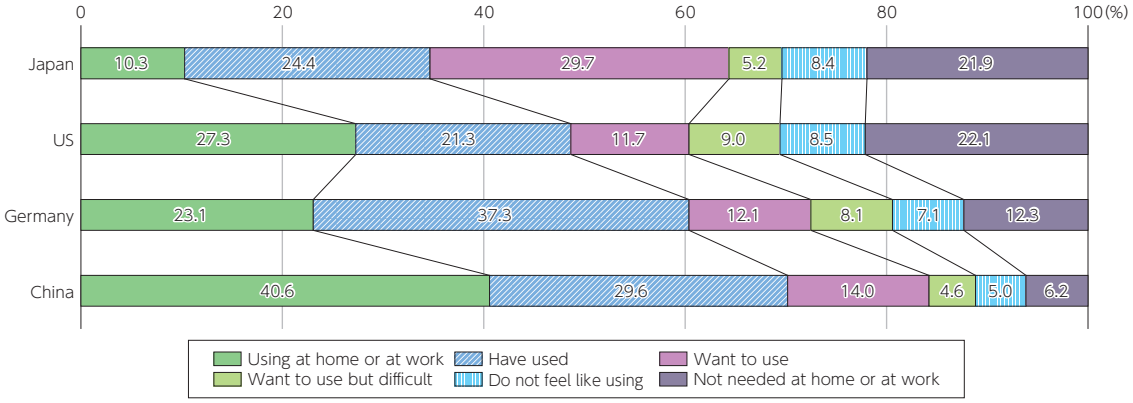
3. Trends in regard to digital usage in administration

(1) Usage of digital administrative services (electronic applications, electronic filing, and electronic notifications)

Only about 35% of individuals in Japan have used digital administrative services (electronic applications, electronic filing, and electronic notifications). Despite an increase over the previous survey (approximately 24%)[11], it is still lower than in the other three countries **(Figure 4-11-3-1)**. "Security concerns" was cited as a major reason for not using services in all four countries. Additionally, in Japan, many respondents indicated that they "do not know how to use the device or application" or are "not interested in any services." On the other hand, Japan had the lowest rate (9.2%) for "Internet connection slow or unstable" which was often cited in the other three countries.

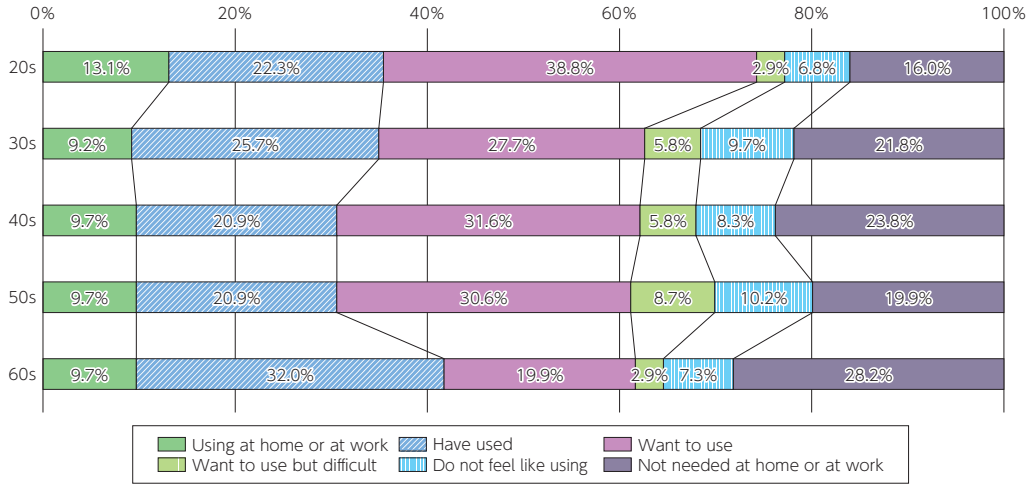
Looking at usage in Japan by age group reveals that the number of people who have used digital administrative services ranged from 30% to 40% in all age groups, up from 20% to 25% in all age groups in the previous survey. In particular, 41.7% of those in their 60s had experience using such services (highest among all age groups), while "not needed at home or at work" was most often selected at 28.2% **(Figure 4-11-3-2)**.

Figure 4-11-3-1 Usage of digital administrative services (by country)



(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

Figure 4-11-3-2 Usage of digital administrative services (Japan; by age)



(Source) MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"

Figure (related data) Reason why public digital services are unavailable (by country)
Source: MIC (2023) "Survey Research on R&D on the Latest Information and Communications Technologies and Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00331
(Data collection)

[11] 2022 White Paper on Information and Communications in Japan MIC (2022) "Survey Research on R&D on the Latest Information and Communications Developments and Trends of Use of Digital Technologies in Japan and Abroad"

(2) Promotion of digital government in Japan

a International indicators

This section provides an overview of Japan's global position on the use of digital technologies in the public sector based on international indicators.

(a) United Nations Department of Economic and Social Affairs (UNDESA) "World E-Government Ranking"

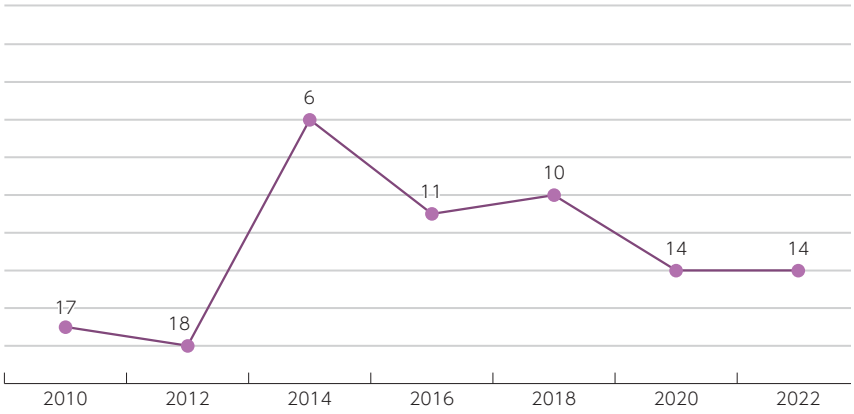
The United Nations Department of Economic and Social Affairs (UNDESA) began conducting e-government surveys in 2003, and has been conducting these surveys every two years since 2008. The goal of the survey is to improve the transparency and accountability of public policies through ICT in UN member countries and encourage public participation in public policies. The survey produces an averaged E-Government Development Index (EGDI) based on an Online Service Index, Human Capital Index, and Telecommunications Infrastructure Index, to determine rankings.

In the 2022 World E-Government Ranking, Denmark once again ranked first place (the same result from the previous survey of 2020), followed by Finland, South Korea, New Zealand, and Sweden. Japan ranked 14th place again, but with a higher score than the previous survey. Japan has generally ranked between 18th and 10th place in previous surveys **(Figure 4-11-3-3)**.

Japan ranked first place in the "e-Participation Index" category, up from fourth place last time. According to the e-Participation Index, Japan received high scores in all three areas: "e-information (0.9818)," "e-consultation (1.0000)," and "e-decision-making (1.0000)."

According to the Digital Agency of Japan,[12] Japan rapidly began promoting open government initiatives following the Great East Japan Earthquake in 2011, and had been highly rated even until then (between second to fifth place). This time, the government was highly praised for its efforts on open data, its use of a platform to collect opinions and ideas to create an entry point for dialogue with the public, its leadership, and the fact that it reflected the opinions it received in its plans.

Figure 4-11-3-3 Changes in Japan's ranking in the UN (UNDESA) "World E-Government Ranking"



(Source) Changes in Japan's individual indicator scores in the UN (UNDESA) "World E-Government Ranking" (data collection)

(b) Waseda University "World Digital Government Rankings"

In 2005, the Waseda University Institute of d-Government began publishing yearly "World Digital Government Rankings," which assess the progress of digital government in 64 leading ICT countries using 10 major indicators (and 35 sub-indicators). In 2022, Japan was ranked 10th place, down one place from the previous ranking, with the top three countries being Denmark, New Zealand, and Canada. Several issues and structural weaknesses in Japan were indicated, such as the vertical division of government offices revealed by the response to COVID-19; a lack of digital transformation (DX) and sense of urgency; the complexity of decision-making due to the legal separation of e-government (central) and e-local government (regional); and the widening of administrative, financial, and digital disparities between prefectures and municipalities.

Figure (related data) Changes to Japan's ranking in Waseda University's "World Digital Government Rankings"
Source: Waseda University Institute of d-Government
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00334
(Data collection)

[12] Digital Agency Data Strategy Team "Why Japan is No. 1 in the UN e-Participation Index" (October 4, 2022) (https://data-gov.note.jp/n/nb11a924f4f00)

b Development of data linkage and authentication infrastructure

(a) Individual Number Cards

With regard to spreading the use of Individual Number Cards, the "Basic Policy on Economic and Fiscal Management and Reform 2022 (Outline 2022)" and the "Priority Policy Program for Realizing Digital Society" of June 2022 state that the government aims to have Individual Number Cards available to nearly all citizens by the end of fiscal 2022. Since then, the government has been engaged in efforts to increase the convenience of citizens and conduct public relations, such as expanding the use of Individual Number Cards. As of the end of March 2023, 67.0% of all Individual Number Cards had been issued, a significant improvement from 42.4% at the end of March 2022.

Figure (related data) Individual Number Cards Delivery Status
Source: Based on MIC "Individual Number Card Delivery Status"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00337
(Data collection)

Figure (related data) Changes in registrations of Individual Number Cards for use as health insurance cards
Source: Based on Digital Agency "Policy Data Dashboard (Beta)" (data obtained May 30)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00338
(Data collection)

Figure (related data) Changes in public fund receipt account registrations
Source: Based on Digital Agency "Policy Data Dashboard (Beta)" (data obtained May 30)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00339
(Data collection)

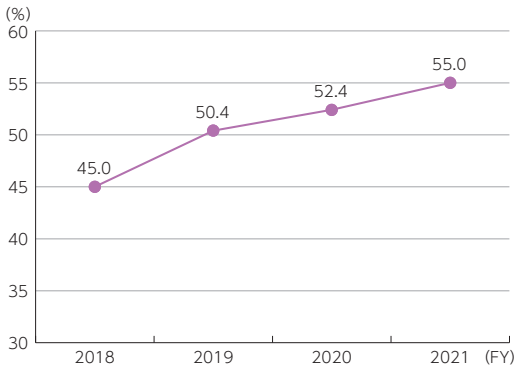
c Efforts to switch to digital at local governments

(a) Current status of online procedures

The "Priority Policy Program for Realizing Digital Society" (approved by the Cabinet on June 7, 2022) lists 59 procedures that local governments should prioritize in taking procedures online. Progress in this area is described below **(Figure 4-11-3-4)**.

Figure 4-11-3-4 Changes in online usage of 59 procedures local governments must prioritize taking online

FY	Annual numver of all procedures (10,000)	Number of online use (10,000)	Online usage (%)
2018	47,749	21,507	45.0
2019	47,635	24,007	50.4
2020	47,287	24,781	52.4
2021	50,595	27,810	55.0



*1 Online usage for fiscal 2020 and fiscal 2019 was calculated based on a resurvey of the 59 procedures that local governments should prioritize in taking procedures online as listed in the "Priority Policy Program for Realizing Digital Society" (approved by the Cabinet on June 7, 2022).

*2 Online usage rate (%) = Number of procedures used online / Total number of procedures per year × 100
The total number of procedures per year is a national estimate based on the total number of procedures and the population of organizations that have already gone online for these procedures.
The number of procedures used online is estimated in the same way as the total number of procedures per year, in order to more precisely calculate online usage.

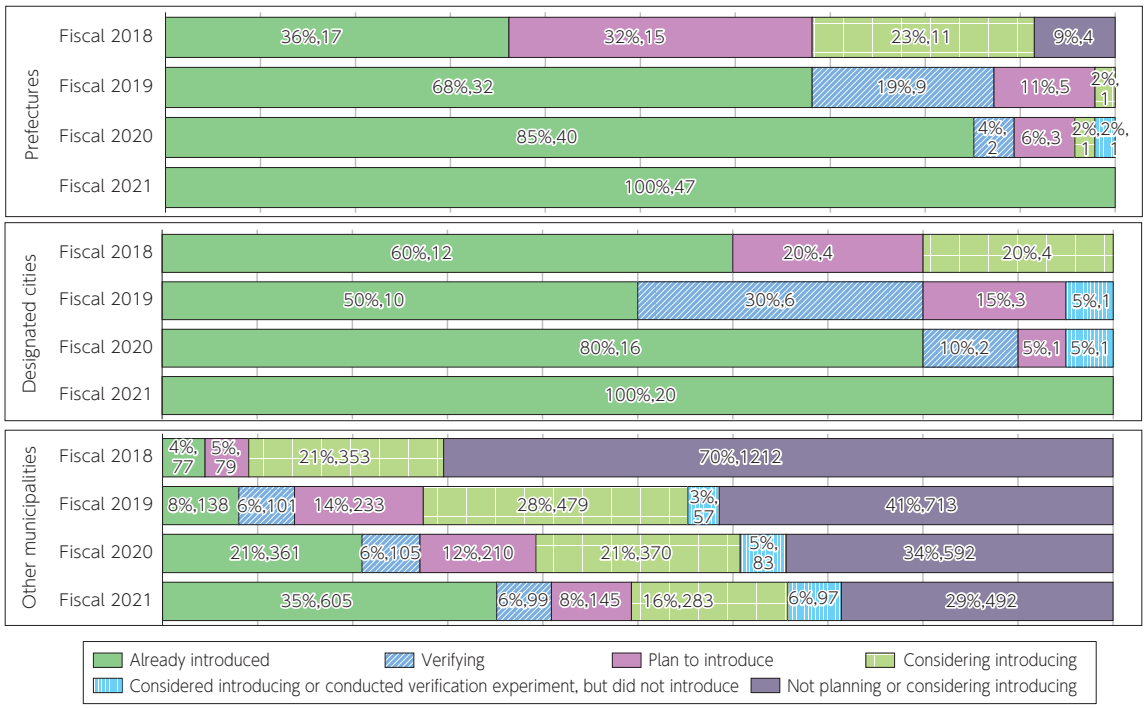
(Source) Based on MIC "Overview of Promotion of DX and Use of Information by Local Governments: Summary of Fiscal 2022 Survey on Promotion of Use of Administrative Information by Local Governments"[13]

[13] https://www.soumu.go.jp/denshijiti/060213_02.html

(b) Promotion of AI/RPA usage

As of fiscal 2021, 100% of prefectures and designated cities had already introduced AI. 35% of other municipalities had also introduced the technology, and roughly 66% of local governments were working toward doing so (including those verifying, planning to introduce, or considering introducing AI) **(Figure 4-11-3-5)**. Looking at functions reveals that the top three areas (voice recognition, character recognition, and chatbot support) are being introduced by local governments of all sizes. Although there were few cases in the bottom four categories (matching, optimal solution display, image/video recognition, and numerical forecasts) even at the prefectural level, the number has been increasing consistently since the survey began.

Figure 4-11-3-5 Introduction of AI in local governments



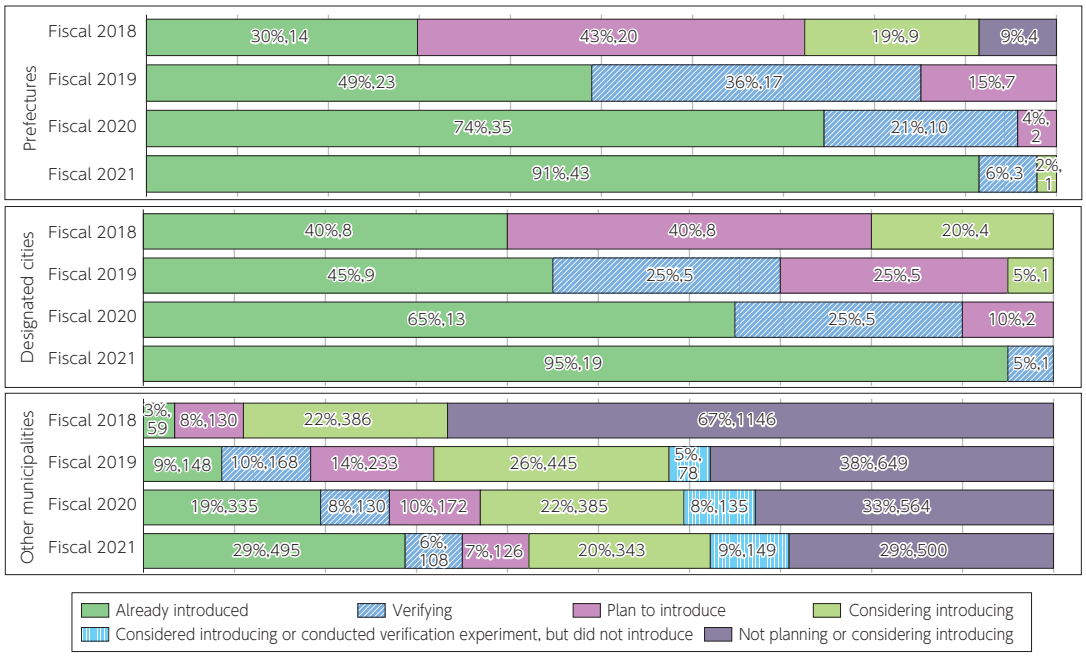
(Source) MIC "Promotion of AI/RPA Usage by Local Governments" (June 27, 2022)[14]

Figure (related data) Status of Introduction of AI in local governments (introduction by AI function)
Source: MIC "Promotion of AI/RPA Usage by Local Governments"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00341
(Data collection)

The number of organizations that have introduced RPA increased to 91% in prefectures and 95% in designated cities. 29% of other municipalities had also introduced the technology, and roughly 62% of local governments were working toward doing so (including those verifying, planning to introduce, or considering introducing RPA) **(Figure 4-11-3-6)**. Looking by field reveals that the technology was introduced mostly into "Finance, accounting, and financial affairs," "child welfare and child care," and "organizations ad employees (including administrative reform)."

[14] https://www.soumu.go.jp/main_content/000822108.pdf

Figure 4-11-3-6 Status of Introduction of RPA in local governments



(Source) MIC "Promotion of AI/RPA Usage by Local Governments" (June 27, 2022)[15]

Figure (related data) Status of Introduction of RPA in local governments (status of introduction by RPA field)
Source: MIC "Promotion of AI/RPA Usage by Local Governments"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00343
(Data collection)

(c) Status of remote work by employees

As of October 2022, this had been adopted by all organizations in prefectures and ordinance-designated cities and by 1,083 organizations in municipalities (62.9%), which represents a steady increase from 849 organizations (49.3%) in the previous year **(Figure 4-11-3-7)**. The most common reasons for not adopting this were "concerns over ensuring information security" and "many employees engaged in duties incompatible with remote work." Meanwhile, the most common benefit of introducing remote work was "ensuring business continuity in the event of an emergency" (76.5%), followed by "reducing/streamlining employee commutes" and "handling employees balancing work and family life."

Figure 4-11-3-7 Status of introducing remote work by employees

(Source) Based on MIC "Survey on Remote Work Initiatives by Local Governments"[16]

[15] https://www.soumu.go.jp/main_content/000822108.pdf
[16] MIC "Survey on Remote Work Initiatives by Local Governments" (October 1, 2019, October 1, 2020, October 1, 2021, and October 1, 2022) (https://www.soumu.go.jp/main_content/000853597.pdf)

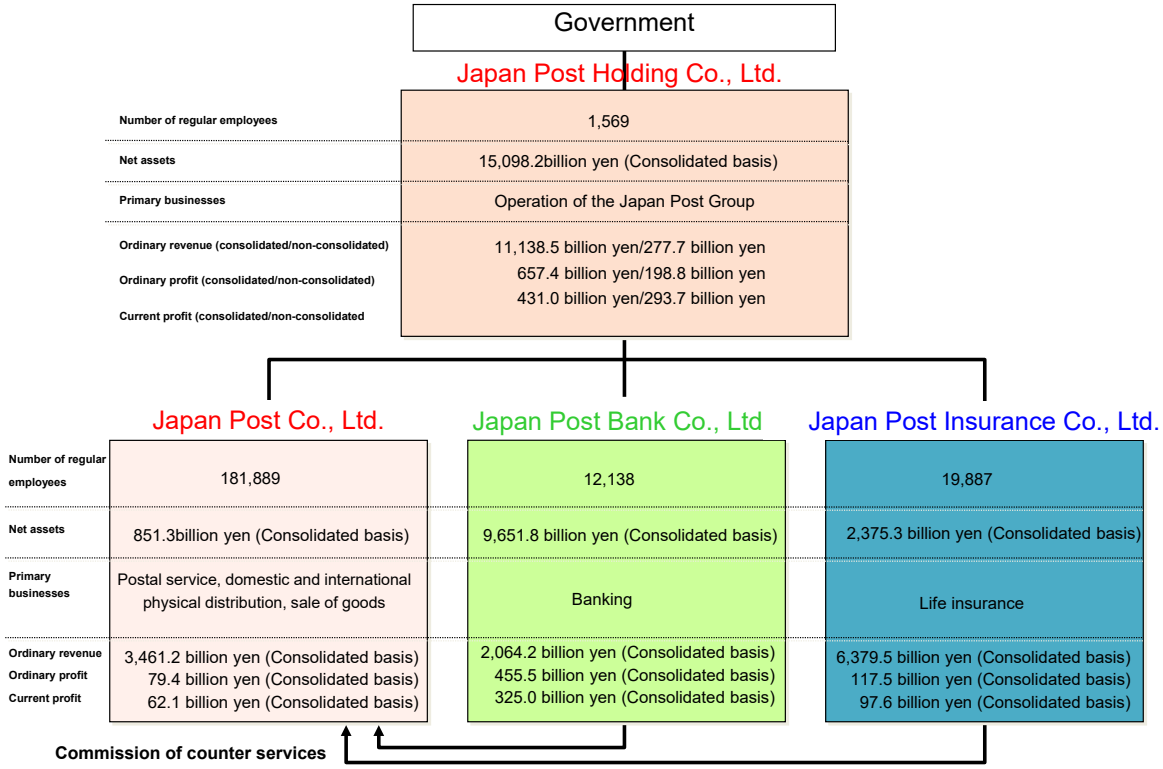
Section 12 Trends in Postal Service and Correspondence Delivery Business

1. Postal service

(1) Japan Post Group

On October 1, 2012, Japan Post Group switched to a four-company structure with Japan Post Holdings Co., Ltd. as a holding company **(Figure 4-12-1-1)**. Japan Post Holdings holds 100% of the issued stocks of Japan Post, 60.6% of proportion of voting rights held of Japan Post Bank, and 49.8% of proportion of voting rights held of Japan Post Insurance (as of the end of March 2023).

Figure 4-12-1-1 Japan Post Group organization chart



*1 Number of employees (regular employees) as of September 30, 2022.

*2 The "current net profit" of each company is the current net profit attributable to parent company shareholders.

(Source) Based on financial results for the period ending March 2023 and disclosure reports (2022)

In the fiscal 2022 consolidated statement of the Japan Post Group, ordinary revenue was about 11.1 trillion yen, while current net profit was 431 billion yen **(Figure 4-12-1-2)**.

Figure 4-12-1-2 Japan Post Group management

(100 million yen)

Fiscal year	2017	2018	2019	2020	2021	2022
Ordinary revenue	129,203	127,749	119,501	117,204	112,647	111,385
Ordinary profit	9,161	8,306	8,644	9,141	9,914	6,574
Current profit	4,606	4,794	4,837	4,182	5,016	4,310

(Source) Based on Japan Post Holdings Co., Ltd. "Overview of Financial Results"

(2) Japan Post Co., Ltd.

a Financial condition

In fiscal 2022, Japan Post (consolidated) operating revenue was 3.4515 trillion yen, operating profit was 83.7 billion yen, ordinary profit was 79.4 billion yen, and current net profit was 62.1 billion yen, for a decrease in both income and profit.

Looking by business reveals that operating revenue for postal service and physical distribution was 1.9978 trillion yen, operating expenses were 1.9649 trillion yen, and operating profit was 32.8 billion yen (a decrease of 69.3 billion yen over the previous term), and operating revenue for post office counter service was 1.74 trillion yen, operating expenses were 1.247 trillion yen, and operating profit was 49.3 billion yen (an increase of 24.7 billion yen over the previous term) **(Figure 4-12-1-3)**.

Figure 4-12-1-3 Changes in Japan Post's (consolidated) operating profit and loss

(100 million yen)

Fiscal year	2017	2018	2019	2020	2021	2022
Postal/physical distribution	419	1,213	1,475	1,237	1,022	328
Post office counter service	397	596	445	377	245	493
International physical distribution	102	103	△ 86	35	287	107
Japan Post (consolidated)	865	1,820	1,790	1,550	1,482	837

*The segment name was changed from "financial counter service" to "post office counter service" during the March 2022 term.

(Source) Based on Japan Post Holdings Co., Ltd. "Overview of Financial Results"

The operating profit for postal service of Japan Post was 7.8 billion yen in fiscal 2021.

Figure (related data) Postal service income and expenditures
Source: Based on Japan Post Co., Ltd. "Postal Service Income and Expenditures"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00348
(Data collection)

b Number of facilities related to postal services

As of the end of fiscal 2022, the number of facilities related to postal services remained almost unchanged at 24,251 post offices **(Figure 4-12-1-4)**.

Figure 4-12-1-4 Changes in the number of facilities related to postal services

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022 (End of FY)
Post offices	24,525	24,511	24,470	24,452	24,421	24,395	24,367	24,341	24,311	24,284	24,251
Mail posts	181,895	182,839	181,521	181,692	181,523	181,221	180774	179,129	178,211	176,683	—
Shops selling postage stamps, etc. and places selling stamps	144,153	144,504	141,888	142,104	140,881	137,790	132613	127,633	108,624	99,244	—

(Source) "Japan Post Group Disclosure Report" Based on Japan Post "Information on the number of postal offices (open data)" website

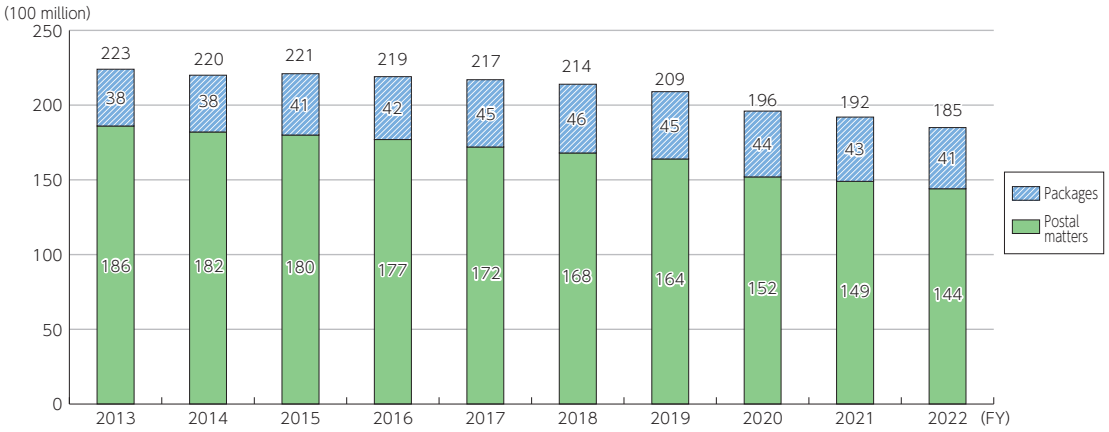
The breakdown of the number of post offices as of the end of fiscal 2022 reveals that there were 20,142 directly managed post offices (including satellite offices and closed locations) and 4,109 simple post offices (including closed locations).

Figure (related data) Breakdown of the number of post offices (as of the end of fiscal 2022)
Source: Based on Japan Post Co., Ltd. "Information on the number of postal offices (open data)" website
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00350
(Data collection)

c Number of postal items accepted

A total of 18.53832 billion postal items were accepted in fiscal 2022 **(Figure 4-12-1-5)**.

Figure 4-12-1-5 Changes in the total number of postal items accepted



*Following the privatization of postal services, Yu-Pack and Yu-Mail are now provided as packages as defined by the Trucking Business Act, and not as parcels as defined by the Postal Act.

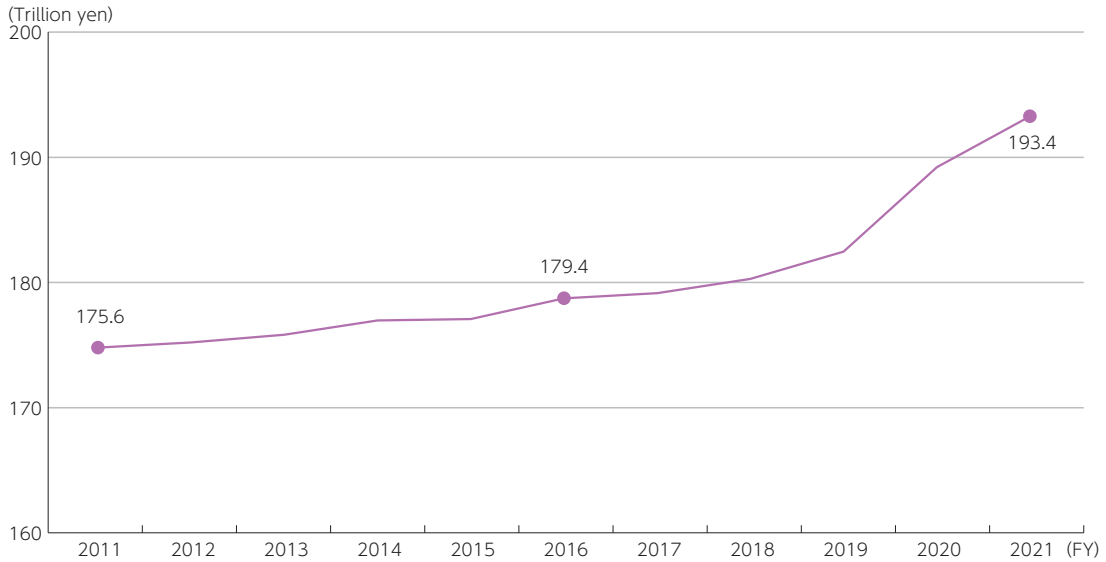
(Source) Based on Japan Post "Number of Postal Items Accepted" material released each fiscal year

(3) Japan Post Bank Co., Ltd.

Japan Post Bank conducts business at 233 directly managed offices, while commissioning bank agency services to about 20,000 post offices.

The balance of deposits of Japan Post Bank (including postal savings from when the organization was managed by the government) was 193.4 trillion yen at the end of fiscal 2021. The balance has decreased 66.6 trillion yen (25.6%) from the peak of 260.0 trillion yen at the end of fiscal 1999 **(Figure 4-12-1-6)**.

Figure 4-12-1-6 Changes in the balance of deposits of Japan Post Bank



*The figure is the sum of savings before and after postal service privatization.

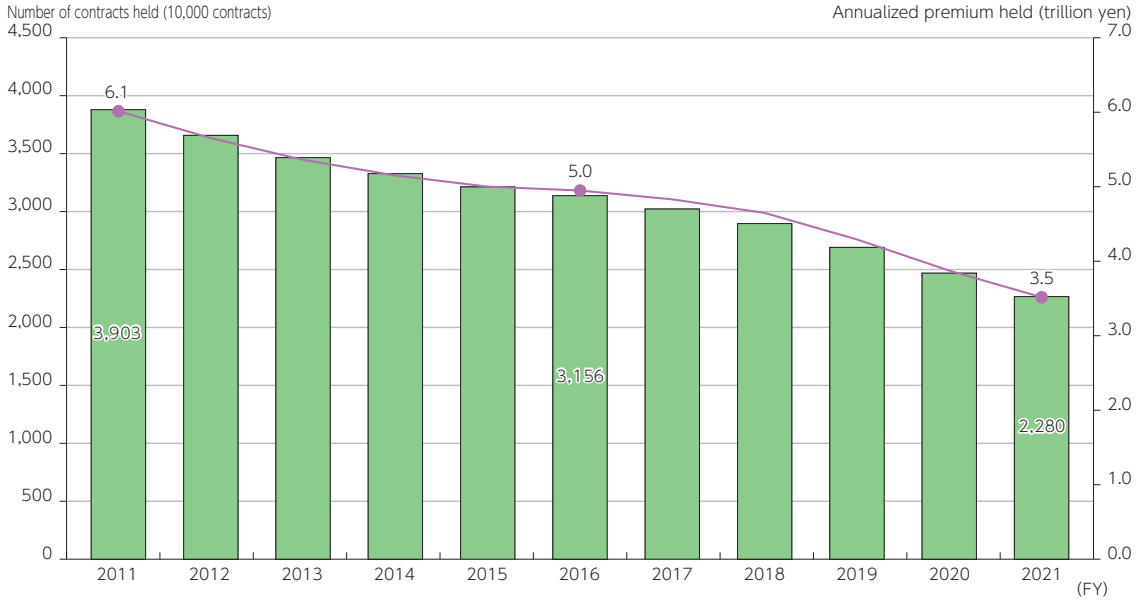
(Source) Based on Japan Post Bank Securities Report

(4) Japan Post Insurance Co., Ltd.

Japan Post Insurance conducts business at 82 branch offices, while commissioning insurance solicitation to about 20,000 post offices.

There were 22.8 million insurance contracts with Japan Post Insurance (including postal life insurance from when the organization was managed by the government) at the end of fiscal 2021. The number has decreased 61.52 million (72.9%) from the peak of 84.32 million at the end of fiscal 1996. Annualized premiums also decreased by 4.2 trillion yen (54.5%) from 7.7 trillion yen at the end of fiscal 2008, to 3.5 trillion yen at the end of fiscal 2021 **(Figure 4-12-1-7)**.

Figure 4-12-1-7 Changes in the number of insurance contracts and annualized premiums for Japan Post Insurance



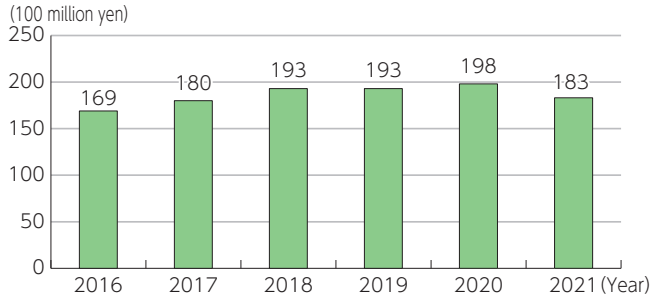
(Source) Based on Japan Post Insurance Securities Report

2. Correspondence delivery service

(1) Sales of correspondence delivery service

In fiscal 2021, sales of specified correspondence delivery service were 18.3 billion yen, a 7.6% decrease from the previous fiscal year **(Figure 4-12-2-1)**.

Figure 4-12-2-1 Changes in correspondence delivery service operator sales



(2) Number of correspondence delivery service operators

Although no operators have entered the general correspondence delivery service business[1] following the enforcement of the Act on Correspondence Delivery by Private Business Operators (Act No. 99 of 2002) in April 2003, 583 operators have entered the specified correspondence delivery service business[2] as of the end of fiscal 2022. Looking at type of provided service reveals that providers of Class 1 services are increasing.

Figure (related data) Changes in the number of specified correspondence delivery service operators
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00355
(Data collection)

Figure (related data) Changes in the number of business operators by type of service provided
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00356
(Data collection)

(3) Correspondence handling record

In fiscal 2021, 20.06 million correspondences were handled (a 4.7% decrease from the previous fiscal year).

Figure (related data) Changes in the number of correspondences accepted
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00357
(Data collection)

[1] "Nationwide full-scale entry" business that can deliver all types of correspondences on condition of providing general correspondence delivery service across the country.
[2] "Specific service type" business with ingenuity. The organization must perform one of three types of specified correspondence delivery service (Class 1 to 3).