Chapter 3

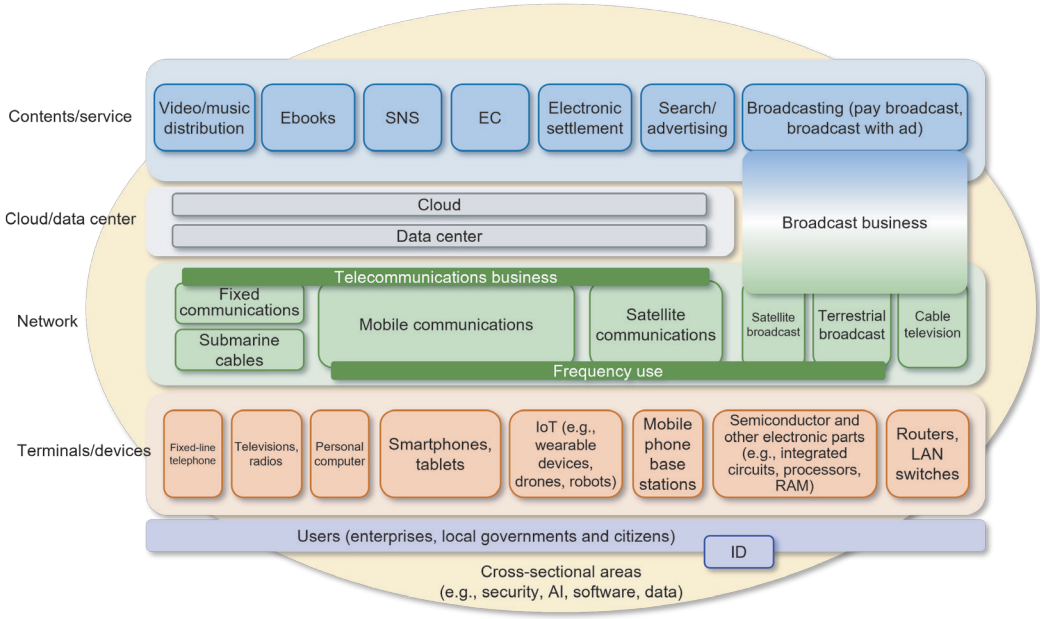
Trends in the ICT Market

Section 1 Trends in ICT Industry

1. Size of the ICT market

ICT market includes: equipment/terminals that are interfaced with users; networks provided by telecommunication carriers, broadcasters, etc.; cloud/data centers; content services including video/music distribution; security, and; AI.

Figure 3-1-1-1 Layered market structure around ICT



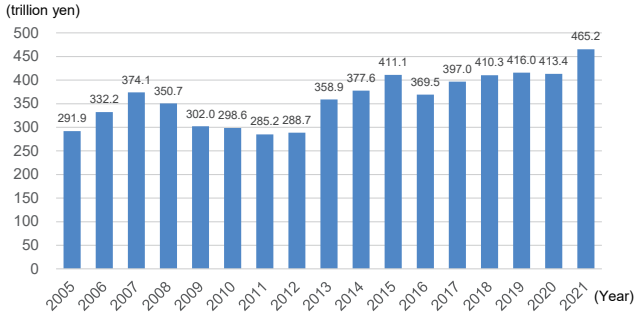
(Source) MIC

Due to the spread of smartphones, cloud service and other factors, the global ICT market (in terms of expenditure) has been on the increase since 2016: it was valued at 465.2 trillion yen[1] (12.5% increase from the previous year) in 2021[2] **(Figure 3-1-1-2)**.

The domestic ICT market (ICT investment by private sector) was valued at 12.970 trillion yen (0.6% increase from the previous year). Although many enterprises, mostly mid-sized enterprises, suspended or postponed ICT investment due to poor business performance in the context of the COVID-19 pandemic, big companies invested in ICT largely as planned, and enterprises understanding the need of environmental improvement, digitalization and business reform for implementation of telework accelerated ICT investment **(Figure 3-1-1-3)**.

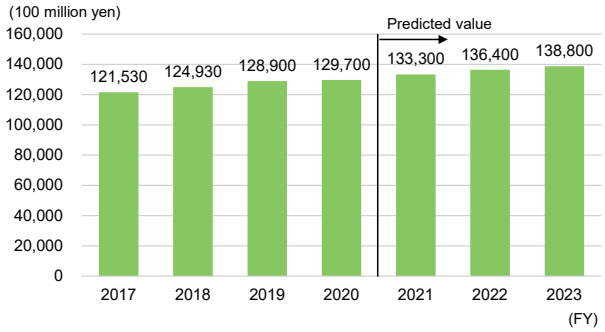
[1] Converted to Japanese yen using the average exchange rate of each year (the same hereinafter)
[2] MIC (2022) "Survey Study on the Trends in the Market Environment Surrounding ICT" (the same hereinafter)

Figure 3-1-1-2 Changes in the size of the global ICT market (in terms of expenditure)[3]



(Source) Statista (Gartner)[4]

Figure 3-1-1-3 Changes and forecasts for the ICT market (ICT investment by private sector) in Japan[5]

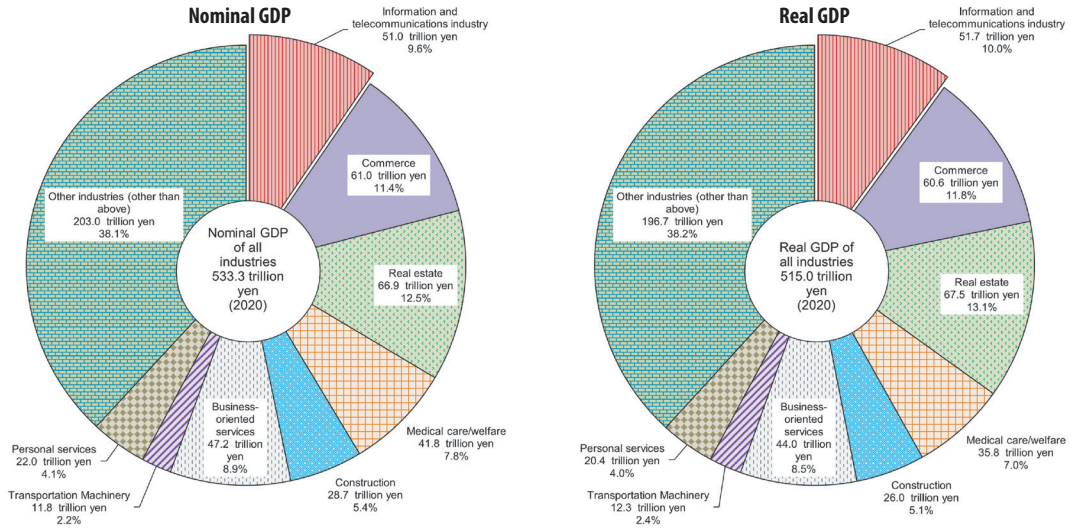


(Source) Yano Research Institute, "IT Investment by Domestic Companies 2021" released on November 18, 2021[6]

2. Gross Domestic Product (GDP) of the information and telecommunications industry[7]

Nominal GDP of the information and telecommunications industry in 2020 was 51 trillion yen decreasing 2.5% from 52.3 trillion yen in the previous year **(Figure 3-1-2-1 and Figure 3-1-2-2)**.

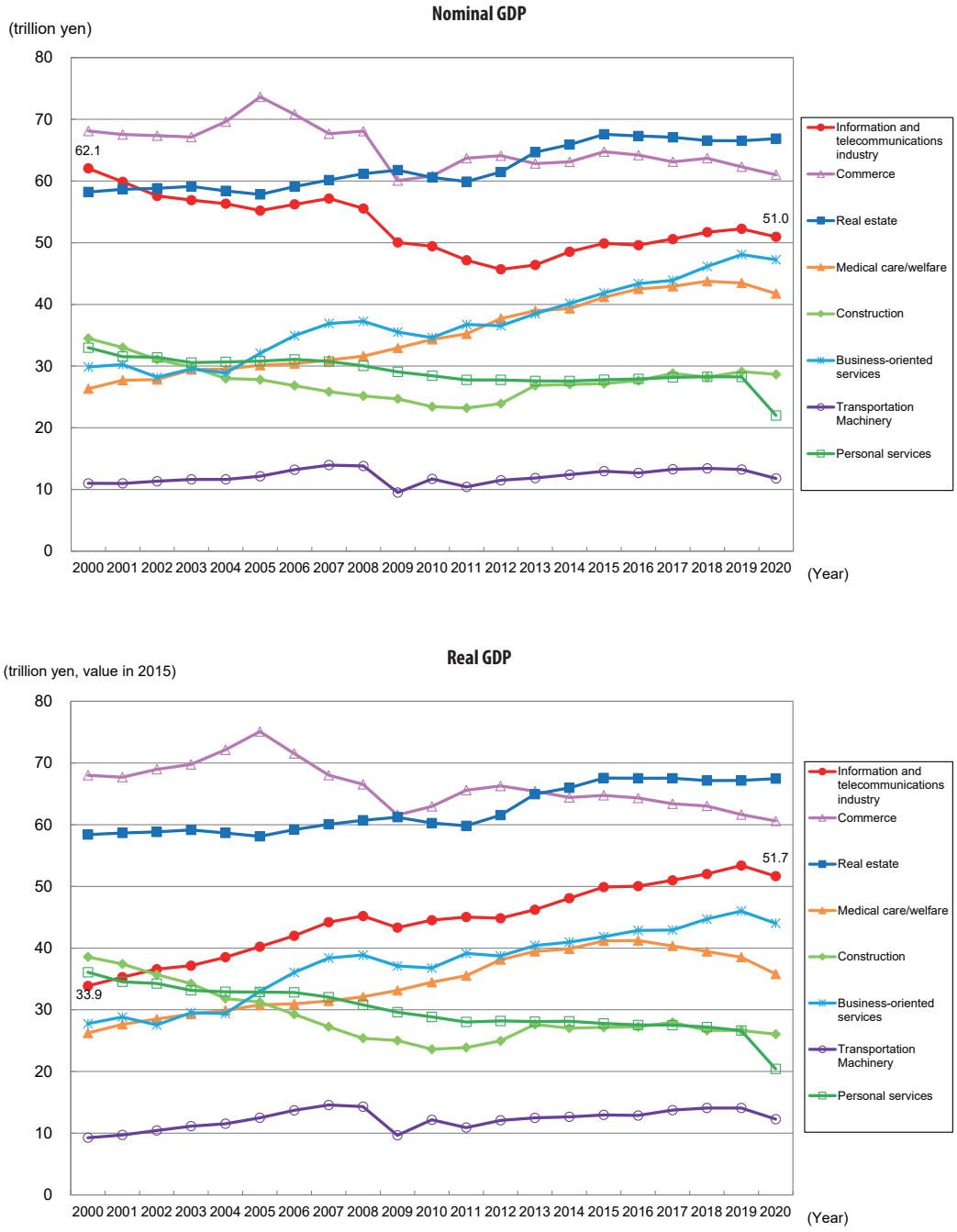
Figure 3-1-2-1 GDP of major industries (nominal and real)



(Source)MIC (2022), "2021 Survey on economic analysis of ICT"

[3] ICT market includes data center systems, enterprise software, devices, ICT service and communications service.
[4] https://www.statista.com/statistics/203935/overall-it-spending-worldwide/
[5] ICT market includes ICT investment by domestic private enterprises (e.g. hardware, software including scratch development and package (including customized packages) introduction, services including maintenance, operations management and outsourcing, ASP, cloud and other online services, access fees and consulting)
[6] https://www.yano.co.jp/press-release/show/press_id/2856
[7] Information and telecommunications industry includes 9 sectors: "telecommunications," "broadcasting, "information service," "services incidental to the Internet," "video/sound/character information production," "manufacturing related to information and telecommunication," "services related to information and telecommunication," "construction related to information and telecommunications" and "research."

Figure 3-1-2-2 Changes in GDP of major industries (nominal and real)

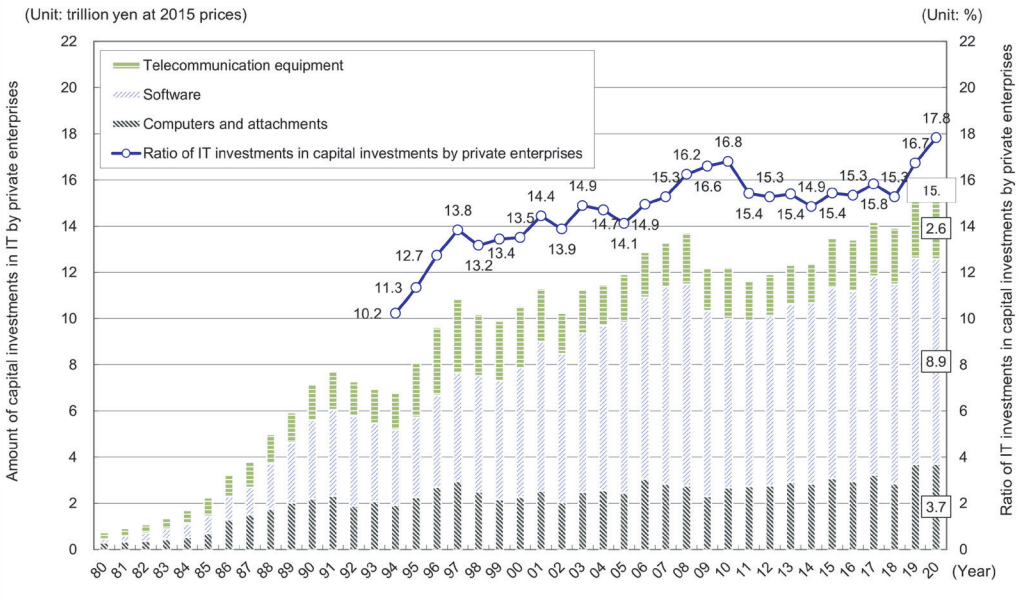


(Source)MIC (2022), "2021 Survey on economic analysis of ICT"

3. IT investments[8]

In 2020, IT investments by private companies were 15.2 trillion yen (0.4 % decrease year-on-year) in terms of 2015 prices. In breakdown, investments in software (entrusted development and packaged software) accounted for about 60% at 8.9 trillion yen. The ratio of IT investments to capital investment by private companies in 2020 was 17.8% (1.1 point increase from the previous year). IT investments account for a certain part of the capital investment **(Figure 3-1-3-1)**.

Figure 3-1-3-1 Changes in IT investments in Japan



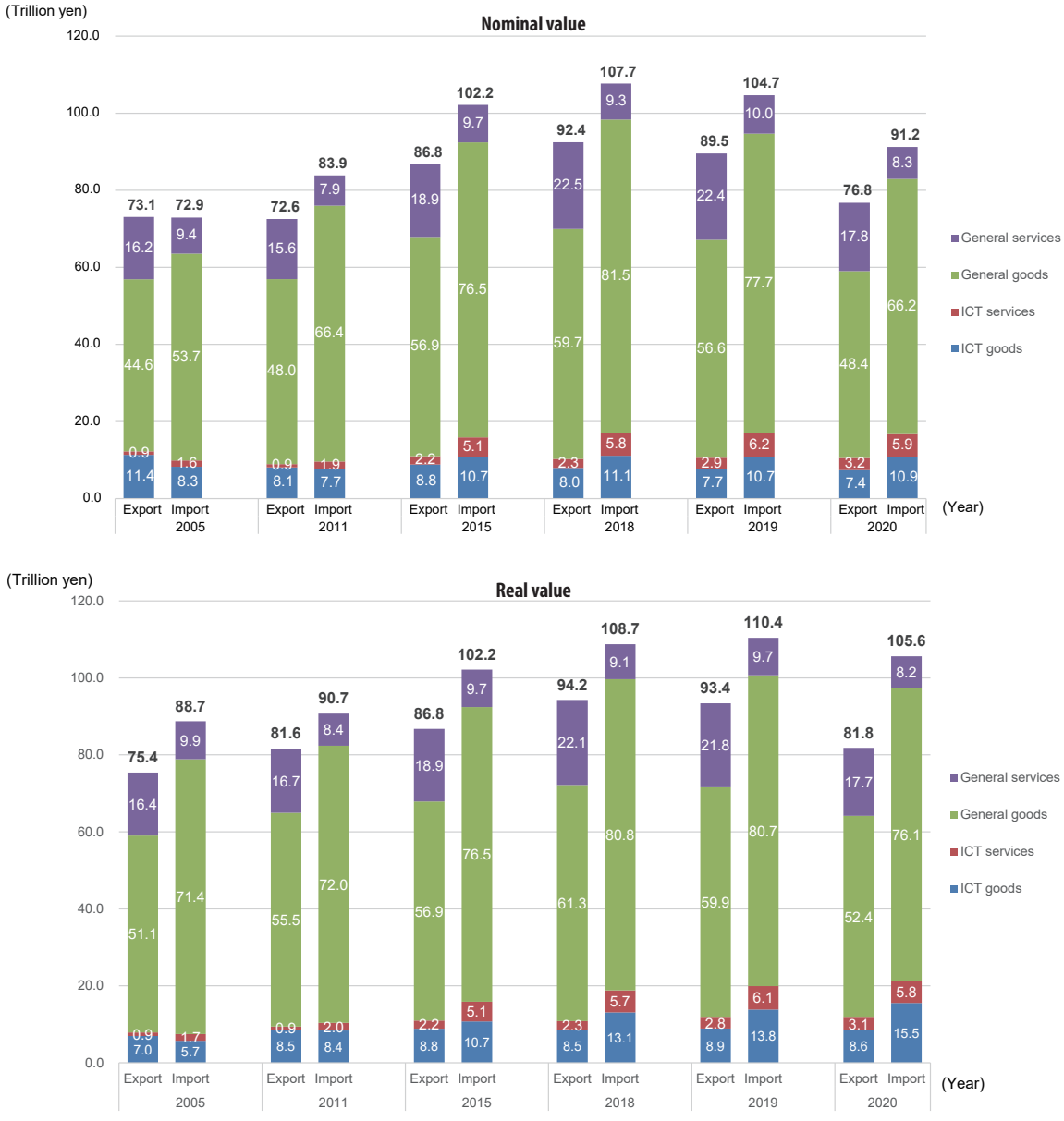
(Source)MIC (2022), "2021 Survey on economic analysis of ICT"

[8] Here, the term refers to investment in information and telecommunications capital goods (computers and attachments, telecommunication equipment, software). Use of cloud services that have spread drastically in recent years is not purchase of capital goods and therefore not included in IT investment here.

4. Exports and imports in the ICT field

In 2020, exports of goods/services (nominal) were 76.8 trillion yen, while imports were 91.2 trillion yen. Of the above, exports of ICT goods/services were 10.6 trillion yen (13.7% of all exports), while imports were 16.8 trillion yen (18.4% of all imports). Import surplus of ICT goods was 3.5 trillion yen (16.6% increase year-on-year) and import surplus of ICT services was 2.7 trillion yen (20.0% decrease year-on-year). The increase in the import surplus of ICT goods is significant (**Figure 3-1-4-1**).

Figure 3-1-4-1 Changes in exports/imports of goods/services



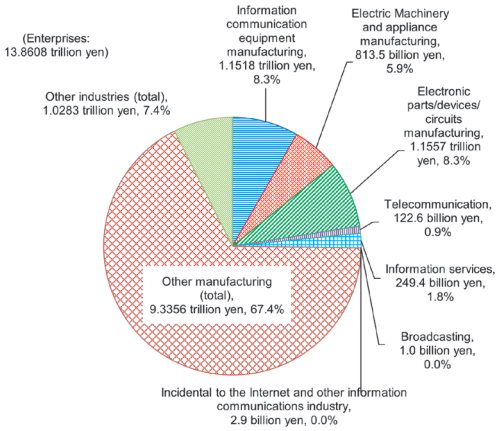
(Source) MIC annual "Input-Output Table of the Information Communications Industry
https://www.soumu.go.jp/johotsusintokei/link/link03_01.html

5. Trend of R&D in the ICT field

(1) State of research and development expenses

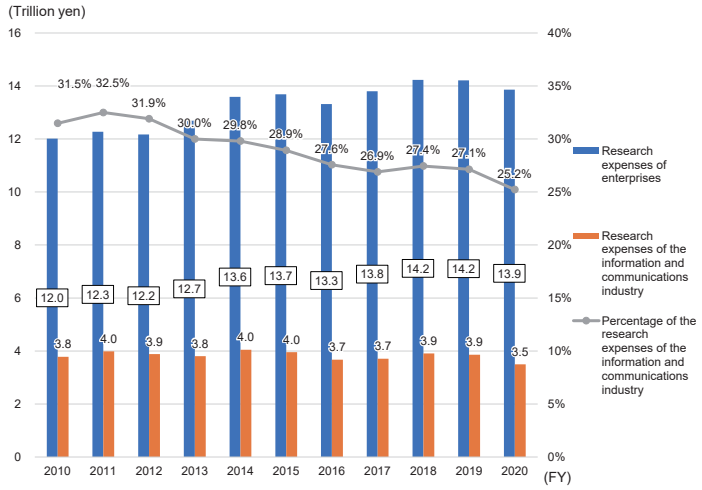
In fiscal 2020, total expenses for science and technology R&D in Japan (hereinafter "research expenses") were 19.2365 trillion yen (sum of the research expenses of enterprises, NGOs, public institutions, universities, etc.) which include 13.8608 trillion yen expenses by enterprises. Research expenses of the ICT industry[9] were 3.497 trillion yen (25.2% of research expenses of all enterprises) (**Figure 3-1-5-1**). Research expenses of the ICT industry have been declining or flat in recent years (**Figure 3-1-5-2**).

Figure 3-1-5-1 Enterprise research expenses by industry (fiscal 2020)



(Source) Prepared based on MIC, "2021 Survey of Science and Technology Research"
https://www.stat.go.jp/data/kagaku/kekka/index.html

Figure 3-1-5-2 Changes in research expenses of enterprises



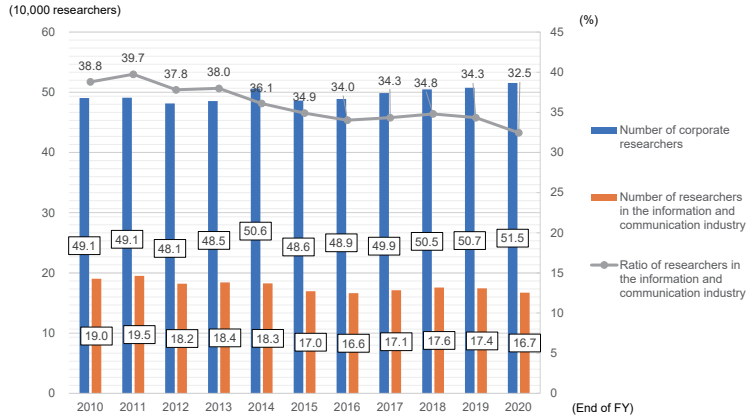
(Source) Prepared based on MIC "Survey of Science and Technology Research" (annual)
https://www.stat.go.jp/data/kagaku/kekka/index.html

(2) State of R&D human resources

At the end of fiscal 2020, the number of researchers in Japan (total of the researchers in enterprises, NGOs, public institutions, universities, etc.) was 890,548, of which 515,469 were in enterprises. Among the corporate researchers, the number of researchers in the ICT sector was 167,283 (32.5%) in fiscal 2020. The number has remained almost unchanged in recent years (**Figure 3-1-5-3**).

[9] Here, the term refers to information communication equipment manufacturing, electric machinery and appliance manufacturing, electronic parts/devices/circuits manufacturing, information communication (information services, telecommunications, broadcasting, incidental to the Internet and other information communication industries).

Figure 3-1-5-3 Changes in the number of corporate researchers



(Source) Prepared based on MIC, "Survey of Science and Technology Research" (each year)
https://www.stat.go.jp/data/kagaku/kekka/index.html

Related data
Percentage of corporate researchers by industry (as of March 31, 2021)
Source: Prepared from MIC, "2021 Survey of Science and Technology Research"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-1-38 (Data Collection)

Section 2 Trends in the Telecommunication Sector

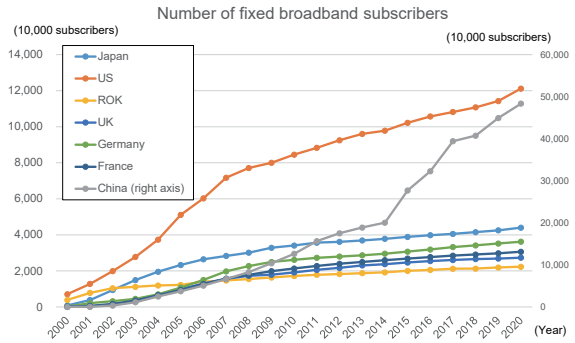
1. Trends of the domestic and overseas communications markets

Since 2000, the number of fixed-line broadband subscriptions[10] has been increasing in major countries (**Figure 3-2-1-1**). By country, China rose to the top position overtaking the United States in 2008 and has been sharply increasing the number since 2015. Compound annual growth rate (CAGR) of China from 2000 to 2020 is 65%, which is by far higher than 15% of the United States and 22% of Japan

The number of mobile phone subscriptions[11] has also been on the increase in major countries. The number sharply increased especially in China (**Figure 3-2-1-2**). CAGR of China from 2000 to 2020 is 16%, which is higher th an 6% of the United States and Japan. In 2020, the ratio of the number of mobile communication subscriptions to the population was 154.5% (57.4 point increase from 2010) in Japan, 106.0% (16.3 point increase from 2010) in the United States and 121.7% (53.8 point increase from 2010) in China.[12]

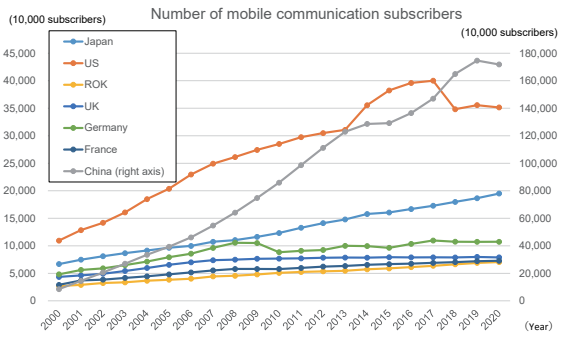
[10] According to "fixed-broadband subscriptions" of ITU statistics. Fixed-broadband refers to high-speed lines providing communication speed over 256kbps either or both of uplink and downlink. High-speed lines include cable modem, DSL, optical fiber and satellite communications, fixed wireless access and WiMAX, but do not include subscriptions of data communication using mobile networks (cellular systems).
[11] According to "Mobile-cellular subscriptions" of ITU Statistics. 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.
[12] Number of mobile subscriptions includes prepaid-based subscriptions.

Figure 3-2-1-1 Changes in the number of fixed-line broadband service subscriptions in major companies[13]



(Source) ITU[14]

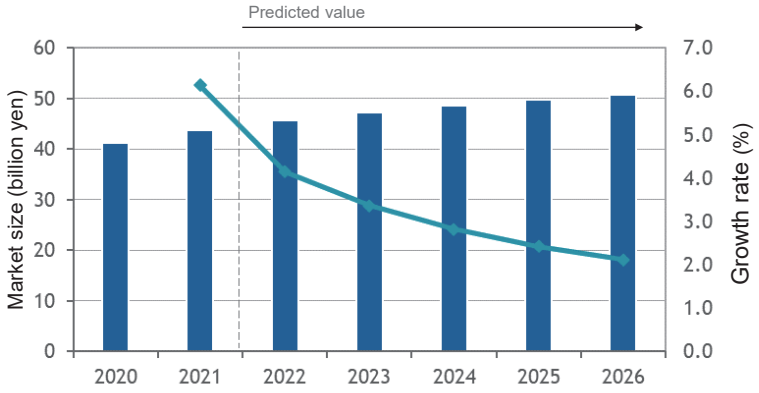
Figure 3-2-1-2 Changes in the number of mobile communication subscriptions in major countries



(Source) ITU[15]

In 2021, the market size of network virtualization was 2.8942 trillion yen (18.3% increase year-on-year) in the world. With the spread of server virtualization, reduction in cost of its ownership and flexible extensibility of networks, network virtualization technologies have been gradually introduced. The size of Japan's network virtualization/automation market (sum of the markets for data centers and corporate networks)[16] was 43.8 billion yen in 2021 and expected to grow at a compound annual growth rate of 3.0% from 2021 to 2026 (**Figure 3-2-1-4**). Background factors of the gradual growth include: its establishment as the method for infrastructure construction and operation at data centers; and rising need for network construction in corporate LAN and for speeding up and efficient improvement of network operations.

Figure 3-2-1-4 Changes and forecasts of the size (in terms of sales)of Japan's network virtualization/automation market



(Source) IDC Japan[17]

Regarding RAN (Radio Access Network) of carriers, progress is being made in Open RAN[18] to realize multi-venders and vRAN[19] to realize virtualization and other initiatives to innovate the composition of network equipment. Regarding virtualization of core networks, for example, it is AT&T's policy to transfer the core network for mobile communication services operated by the company to Microsoft Azure that is a public cloud of Microsoft and to develop 5G network.[20] In Japan, Rakuten Mobile adopted the world's first open and fully virtualized architecture albeit on 4G network, procured equipment from multiple venders and implemented a virtual-

[13] In addition to the subscriptions with FTTH, DSL, CATV and FWA, subscriptions with VPN and broad area Ethernet services, which are provided mainly for businesses are also included.
[14] https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx
[15] https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx
[16] Total of the network virtualization/automation markets of datacenter networks and corporate networks. Network virtualization and automation refer to the function to virtualize and automate networks by using software and hardware. The market consists of network infrastructure and network automation/virtualization platforms.
[17] https://www.idc.com/getdoc.jsp?containerId=prJPJ49092722
[18] 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 communication network equipment by various vendors and at the same time facilitate area building and lower equipment procurement costs.
[19] Virtual Radio Access Network. Virtualization technology deploys communication software on virtualization layers installed on general hardware and activates the software independent of hardware characteristics.
[20] businessnetwork.jp, "The plan to 'Move 5G networks to Azure' started to gather momentum: what will carriers gain from move to cloud?" (M ay 23, 2022) https://businessnetwork.jp/Detail/tabid/65/artid/9133/Default.aspx

ized network.[21]

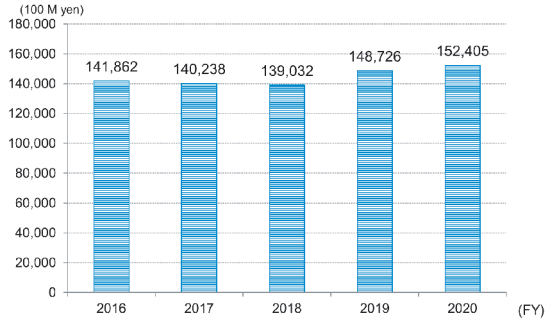
Regarding the development of NTN (Non-Terrestrial Network), Internet connectivity services using outer space have begun in earnest overseas. For example, the US Space X is providing Starlink that is a broadband Internet service using satellite constellation.[22] In Japan, mobile operators are leading initiatives to construct NTN.[23] For example, SoftBank and its affiliate HAPS Mobile Inc. participate in "HAPS Alliance," an industry group aiming to construct High Altitude Platform Station, and take the initiative in earnest. For implementation of satellite constellation using low-orbit satellites, KDDI signed a contract with Space X to use Starlink as backhaul line of au base stations in September 2021. KDDI plans sequential introduction starting from around 1,200 sites across Japan in 2022.[24] NTT and SKY Perfect JSAT announced a plan to establish the Space Compass Corporation in July 2022. The joint venture is expected to play a central role in the space satellite projects including a space data center project to deploy satellites with data center functions on a geostationary satellite orbit and the space RAN[25] project.[26] Furthermore, Rakuten Mobile together with AST SpaceMobile of the United States is working on "Rakuten Mobile Space Project" to build a mobile broadband network for transmission from outer space by using low-orbit satellites and thereby expand the area of its mobile communication service on Earth.[27]

2. Current status of telecommunications in Japan

(1) Market size

In fiscal 2020, sales in the telecommunication sector continued to grow to 15.2405 trillion yen (2.5% increase year-on-year) (**Figure 3-2-2-1**).

Figure 3-2-2-1 Changes in telecommunications sector sales



*Sales are total of the sales of all responding business operators. Comparison must be made carefully because the number of respondents varies depending on the year.

(Source) Prepared from MIC / METI "Basic Survey on the Information and Communications Industry" https://www.soumu.go.jp/johotsusintokei/statistics/statistics07.html

(2) Number of carriers

The number of telecommunication carriers at the end of fiscal 2021 was 23,111 (330 registered carriers and 22,781 notified carriers). The number continued to increase following the previous fiscal year (**Figure 3-2-2-2**).

Figure 3-2-2-2 Changes in the number of telecommunication carriers

End of FY	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of telecommunication carriers	16,321	16,723	17,519	18,177	19,079	19,818	20,947	21,913	23,111

(Source) Information & Communications Statistics Database https://www.soumu.go.jp/johotsusintokei/field/tsuushin04.html

[21] Nikkei XTECH, "Qualcomm and others challenge the unchallenged position of Intel for leadership in virtualization base station vRAN" (April 1, 2022) https://xtech.nikkei.com/atcl/nxt/column/18/01273/00028/

[22] As of March 2022, beta tests were conducted in 29 countries including Ukraine. Nikkei XTECH, "Satellite network covering the globe delivers videos from Ukraine" (May 9, 2022) https://xtech.nikkei.com/atcl/nxt/column/18/02040/00002/

[23] R&D to realize NTN (Non-Terrestrial Network) is advanced. NICT, for example, is working on R&D on "generic technologies of satellite flexible network".

[24] KDDI, "Agreed to sign a contract of business alliance with SpaceX to adopt its satellite broadband Starlink to au communication network" (September 13, 2021) https://news.kddi.com/kddi/corporate/newsrelease/2021/09/13/5392.html

[25] Radio Access Network

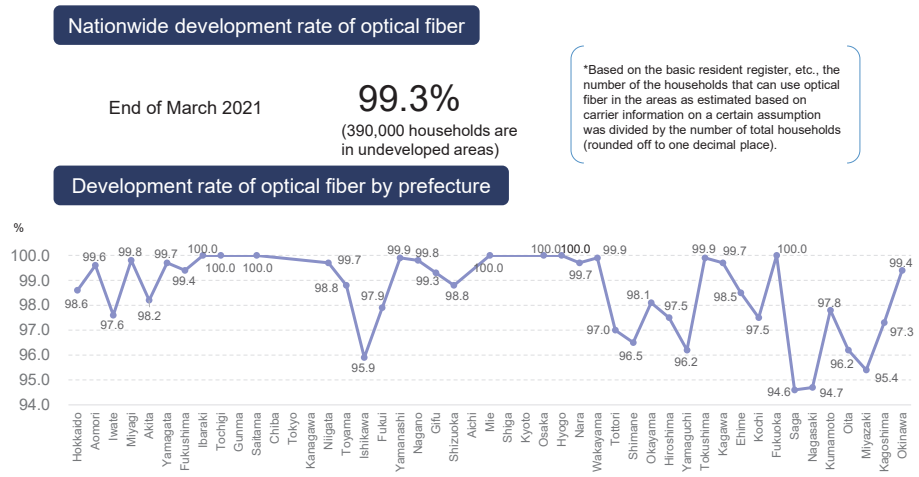
[26] Nippon Telegraph and Telephone and SKY Perfect JSAT, "NTT and SKY Perfect JSAT agreed to establish Space Compass Corporation – toward a new space computing network business for realization of a sustainable society" (April 26, 2022) https://group.ntt/jp/newsrelease/2022/04/26/220426a.html

[27] Rakuten, "Rakuten invests in AST & Science of the U.S. and signed a strategic partnership" (March 3, 2020) https://corp.rakuten.co.jp/news/press/2020/0303_02.html

(3) State of infrastructure development

The Development rate of optical fiber (household coverage) was 99.3% in Japan at the end of fiscal 2020 (**Figure 3-2-2-3**).

Figure 3-2-2-3 State of optical fiber development (estimation) at the end of March 2021



As of the end of fiscal 2020, 5G infrastructure deployment rate[28] was 16.5% and the number of 5G base stations was approximately 21,000.[29] There are regional differences in the development. For example, the number of 5G base stations per 10km² in November 2021 was 1.0 in national average but around 41.3 in Tokyo (**Figure 3-2-2-4**).

According to OECD, Japan is at the world's top level in terms of the ratio of optical fiber to the fixed broadband. Spread of digital infrastructure in Japan is advanced in international comparison.

Figure 3-2-2-4 The number of 5G base stations per 10km² in November 2021

National average	Approx. 1.0 stations
Tokyo	Approx. 41.3 stations
Osaka prefecture	Approx. 16.2 stations
Kanagawa Prefecture	Approx. 6.6 stations
Hiroshima Prefecture	Approx. 1.1 stations

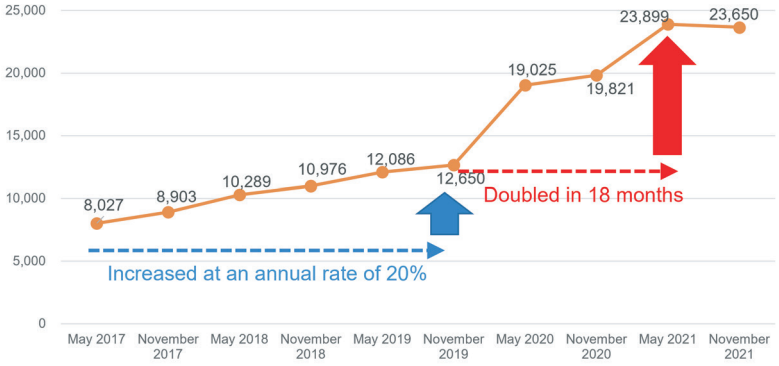
(3.7GHz band, 4.5GHz band, 28GHz band)

(Source) Excerpt from MIC (2021) "Special Commission on Digital Administrative Reform (2nd session)" Material 3

(4) State of traffic

The download traffic of fixed-line broadband in Japan increased rapidly after COVID-19 began to spread (**Figure 3-2-2-5**).

Figure 3-2-2-5 Changes in internet traffic (fixed-line broadband download traffic)



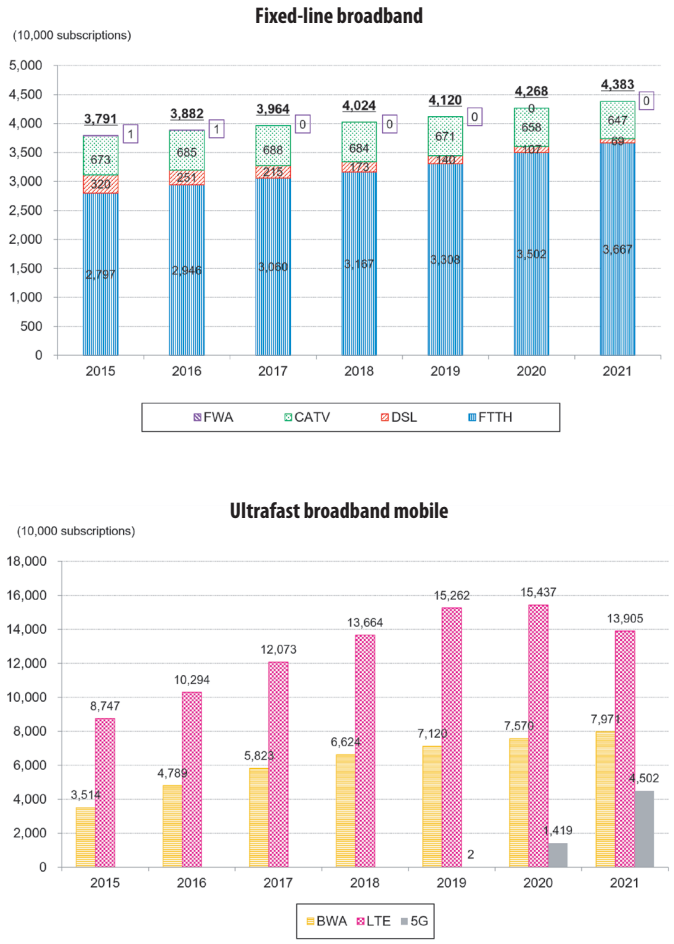
(Source) MIC (2022), "Aggregate results of Internet traffic in Japan (in November 2021)"[30]

[28] Development rate of master station (advanced specified base station) in 10km-square area (around 4500 areas nationwide)
[29] https://www.soumu.go.jp/main_content /000803507.pdf
[30] https://www.soumu.go.jp/joho_tsusin/eidsystem/market01_05_03.html

(5) State of broadband utilization

At the end of fiscal 2021, the number of fixed-line broadband subscriptions[31] reached 43.83 million (2.7% increase from the previous fiscal year). The breakdown of the number of ultrafast mobile broadband subscriptions is: 139.05 million (9.9% decrease) for 3.9/4G mobile phones (LTE); 45.02 million (by 30.83 million from the year before) for 5G mobile phones; and 79.71 million (5.3% increase) for BWA (**Figure 3-2-2-6**).

Figure 3-2-2-6 Changes in the number of fixed-line broadband subscriptions[32]



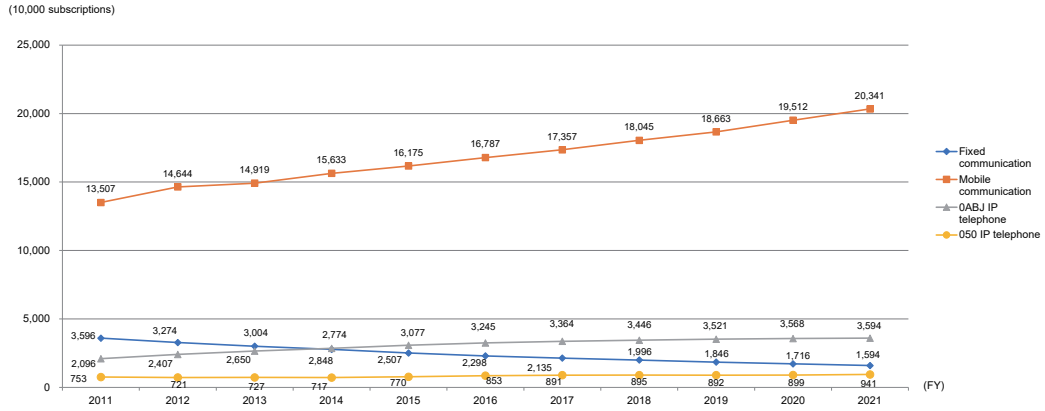
(Source) MIC, "Quarterly data on the number of subscribers and the market share of telecommunications services (the 4th quarter of fiscal 2021 (at the end of March))"
https://www.soumu.go.jp/menu_news/s-news/01kiban04_02000206.html

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

In recent years, while the number of fixed communication subscriptions (NTT East/West subscribed telephone, chokushu (dedicated line) telephone[33]and CATV telephone, excluding 0ABJ IP telephone) has been declining, the number of subscriptions with mobile communication (mobile phone, PHS and BWA) and 0ABJ IP telephones has been steadily increasing. The number of mobile communication subscriptions was about 12.8 times the number of fixed communication subscriptions in fiscal 2021. The number of subscriptions of 050 IP telephone has been almost unchanged in recent years (**Figure 3-2-2-7**).

[31] The number of fixed-line broadband subscriptions is the sum of the subscriptions of FTTH, DSL, CATV (coaxial, JFC) and FWA.
[32] This is the number of subscriptions with 5G, LTE and BWA and does not include subscriptions with 3G or PHS.
[33] Chokushu telephone is 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 3-2-2-7 Changes in the number of subscriptions with voice communication services



*1 Mobile communication is the sum of mobile phones, PHS and BWA.
*2 Values of mobile communication since fiscal 2013 are "after adjustment of intra-group transactions," namely, when an MNO as MVNO received a mobile-phone or BWA service from other M NO of the group and provided the service combined with its own service through one mobile phone, etc., this is counted as one subscription.

(Source) MIC, "Quarterly data on the number of subscribers and the market share of telecommunications services (the 4th quarter of fiscal 2021 (at the end of March))"
https://www.soumu.go.jp/menu_news/s-news/01kiban04_02000206.html

(7) International comparison of telecommunication charge

In comparison of the communication charge of six cities—Tokyo (Japan), New York (US), London (UK), Paris (France), Düsseldorf (Germany) and Seoul (Korea)—, smartphone bills in Tokyo (new 4G contracts with the top MNO share operator) are at a medium level for plans with a monthly data volume of 2GB and 5GB, and at a low level for plans with 20GB.

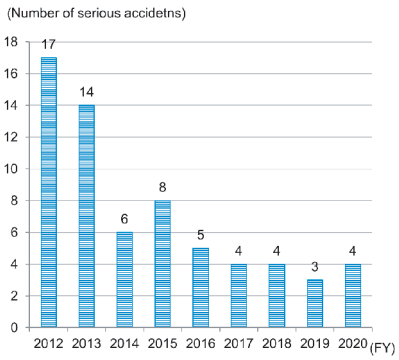
Regarding fixed-telephone bills, the basic rate and local-call rate for three minutes at 12:00 on weekday are at a medium level.

Related data
International comparison of fixed telephone charge based on individual charge (FY2021)
International comparison of mobile phone bill based on model
Source: MIC, "FY2021 Survey on domestic-overseas price difference of telecommunication service"
URL: https://www.soumu.go.jp/menu_news/s-news/01kiban03_02000789.html

(8) Occurrences of telecommunication service accidents

The number of reported accidents that require quarterly reporting was 6,610 in fiscal 2020. Among them, four were serious accidents.[34] The number has been almost unchanged since fiscal 2017 (**Figure 3-2-2-8**).

Figure 3-2-2-8 Changes in the number of serious accidents



(Source) MIC, "Occurrences of telecommunication service accidents (Fiscal 2020)"
https://www.soumu.go.jp/menu_news/s-news/01kiban05_02000229.html

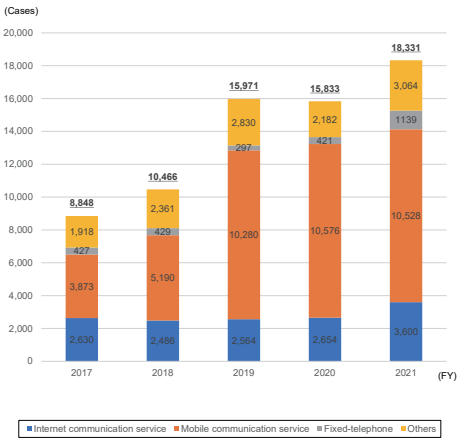
[34] Accidents falling under "if -snip - any other serious accident specified by Order of the Ministry of Internal Affairs and Communications has occurred with respect to its telecommunications operations, it must report without delay to the Minister for Internal Affairs and Communications to that effect including its reason or cause" of Article 28 of the Telecommunications Business Act

(9) Complaints/requests for consultation on telecommunication service, and requests for consultation on illegal/harmful information

i Complaints/requests for consultation on telecommunication service

The number of complaints/requests for consultation on telecommunication service sent to MIC increased to 18,331 in fiscal 2021 from the previous year (**Figure 3-2-2-9**).

Figure 3-2-2-9 Changes in the number of complaints/requests for consultation sent to MIC

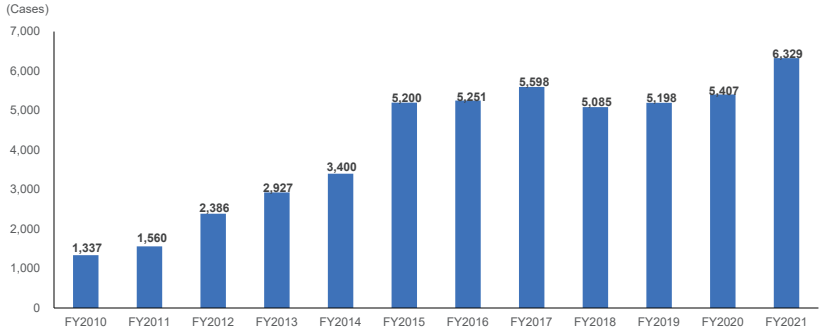


(Source) Prepared by MIC

ii Request for consultation on illegal/harmful information

The number of consultations provided at the Illegal Harmful Hotline operated by MIC increased about five-fold to 6,329 from fiscal 2010, when consultation started (**Figure 3-2-2-10**). The top five operators involved were Twitter, Google, Meta, 5 Channel and LINE.

Figure 3-2-2-10 Changes in the number of requests for consultation on illegal/harmful information



Related data
Breakdown of the number of consultations provided at the Illegal Harmful Hotline by business operator
Source: MIC, "2021 Report on consultations on illegal harmful information on the internet and other contract operations (summary)" p8
URL: https://www.soumu.go.jp/main_content/000814645.pdf

3. New technology development

(1) IOWN (Innovative Optical and Wireless Network) Concept

NTT is leading an initiative toward technical innovation by introducing optical technologies to all networks, computing and semiconductors. It is expected to bring about a paradigm shift and become a game changer in the near future.[35]

(2) IoT network using low earth orbit satellites

Rakuten Mobile and the University of Tokyo began joint research and development into "IoT ultra-coverage utilizing low Earth orbit (LEO) satellites" in November 2021.[36] The project aims at IoT ultra-coverage by using communication satellites to expand the area coverage to 100% of the national land and to realize long-distance communication with the existing narrowband IoT (telecommunications standard for IoT equipment with advanced narrowband and low power consumption) and IoT terminals.

[35] https://www.soumu.go.jp/main_content/000781800.pdf
[36] https://corp.mobile.rakuten.co.jp/news/press/2021/1129_01/

Section 3 Trends in the Broadcasting and Content Sectors

1. Broadcasting

(1) Size of the broadcasting market

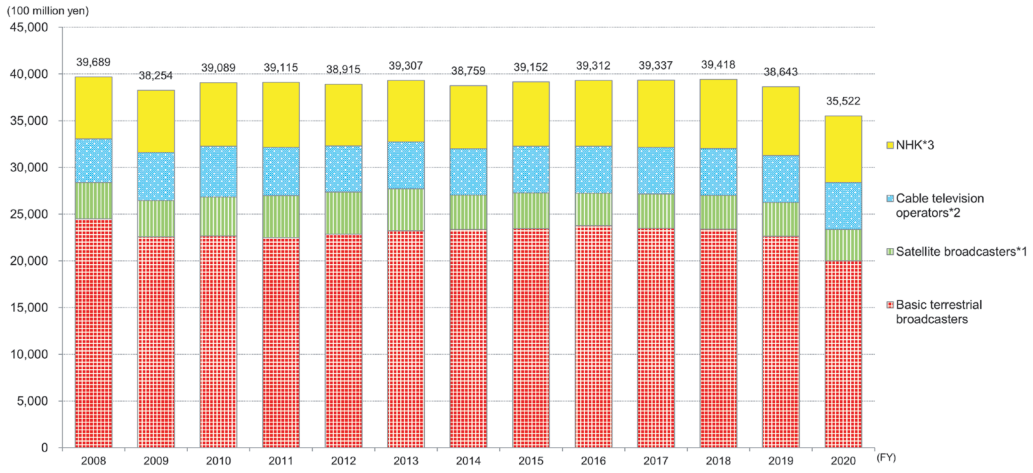
i Sales of broadcasters

In Japan, broadcasting is operated by NHK based on subscription fee income and private broadcasters based on advertising revenue or broadcast fee. In addition, the Open University of Japan operates broadcasting for education.

Total sales of all broadcasters including broadcasting business income and other income decreased to 3.5522 trillion yen (8.1% decrease year-on-year) in fiscal 2020.

In detail, total sales of private basic terrestrial television broadcasters were 1.9993 trillion yen (11.7% decrease year-on-year), total sales of private satellite broadcasters were 338.6 billion yen (6.5% decrease year-on-year), total sales of cable television operators were 500.6 billion yen (almost unchanged from the previous year) and ordinary business income of NHK was 713.7 billion yen (3.2% decrease year-on-year) (**Figure 3-3-1-1**).

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



FY			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Private broadcasters	Basic terrestrial broadcasters		24,493	22,574	22,655	22,502	22,870	23,216	23,375	23,461	23,773	23,471	23,396	22,640	19,993
		(community broadcasters of the above*4)	150	123	116	120	115	124	127	126	136	136	143	145	130
	Satellite broadcasters*1		3,905	3,887	4,185	4,490	4,510	4,491	3,661	3,809	3,463	3,697	3,619	3,623	3,386
	Cable television operators*2		4,667	5,134	5,437	5,177	4,931	5,030	4,975	5,003	5,031	4,992	5,030	5,008	5,006
NHK*3			6,624	6,659	6,812	6,946	6,604	6,570	6,748	6,879	7,045	7,177	7,373	7,372	7,137
Total			39,689	38,254	39,089	39,115	38,915	39,307	38,759	39,152	39,312	39,337	39,418	38,643	35,522

*1 Business income pertaining to satellite broadcasting is counted.
*2 Up to fiscal 2010: corporations for profit that had facilities that were approved under the former Cable Television Broadcasting Act and conducted independent broadcasting (including facilities registered under the Act on Broadcast on Telecommunications Services and with broadcasting method equivalent to the said facilities) are counted. From fiscal 2011: registered general commercial broadcasters conducting independent broadcasting using wire telecommunication equipment (excluding business operators using IP multicast method in either case) are counted.
*3 The values of NHK are ordinary business income.
*4 Excluding community broadcasters combining cable television business, etc.

(Source) Prepared from MIC "Income and Expenditure of Private Broadcasters" of each fiscal year and NHK financial statements for each fiscal year

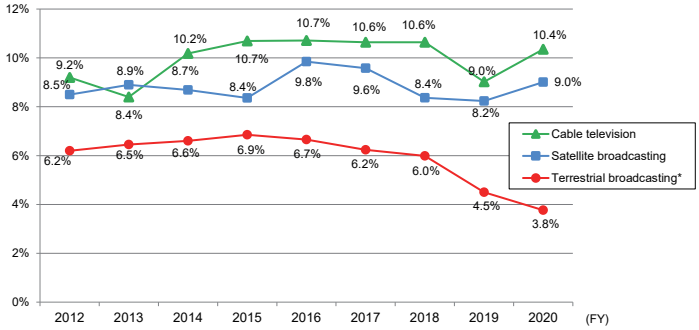
Advertising expenditures of basic terrestrial broadcasters was 1.829 trillion yen. In detail, 1.7184 trillion yen pertaining to terrestrial television broadcasting and 110.6 billion yen pertaining to radio broadcasting.[37]

ii Financial status of private broadcasters

Private basic terrestrial broadcasters (operating profit on sales was 3.8% in fiscal 2020), private satellite broadcasters (9.0%) and cable television operators (10.4%) all continued to post profits following fiscal 2019 (**Figure 3-3-1-2**).

[37] For the entire advertising market, see Chapter 3, Section 3-2 "2 Advertisement".

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



*Basic terrestrial broadcast excluding community broadcast

(Source) Prepared from MIC, "Income and Expenditure of Private Broadcasters "of each fiscal year, etc.

(2) Number of business operators

At the end of fiscal 2021, breakdown of private broadcasters was: 534 private basic terrestrial broadcasters (including 338 broadcasters conducting community broadcasting) and 42 private satellite broadcasters (**Figure 3-3-1-3**).

Figure 3-3-1-3 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
Terrestrial	Television broadcast (Single operation)	VHF	16	93	93	94	94	98	94	94	95	95	95	96
		UHF	77											
	Radio broadcast (single operation)	Medium -wave (AM) broadcasting	13	13	13	14	14	14	14	14	15	15	15	16
		Ultrashort wave (FM) broadcasting	298	307	319	332	338	350	356	369	377	384	384	388
		Community broadcasting of the above	246	255	268	281	287	299	304	317	325	332	334	338
		Short wave	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
	Text broadcasting (single operation)		1	1	0	0	0	0	0	0	0	0	0	0
	Multimedia broadcasting				1	1	1	4	4	4	6	6	2	2
	Subtotal		440	449	461	475	481	500	502	515	526	533	529	534
Satellite	Basic satellite broadcasting	BS broadcasting	20	20	20	20	20	20	19	19	22	22	20	22
		110 degrees east longitude CS broadcasting	13	13	22	23	23	23	23	20	20	20	20	20
	General satellite broadcasting		91	82	65	45	7	5	4	4	4	4	4	4
	Subtotal		113	108	92	72	46	44	41	39	41	41	39	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	-
		Broadcasting using former cable services	26											
		IP multicast broadcasting of the above	5	5	4	3	3	3	5	5	5	5	5	-
	Subtotal		528	556	545	539	520	510	508	504	492	471	464	-

*1 The number of television broadcasters (single operation) at the end of fiscal 2015 includes five operators conducting basic terrestrial broadcasting for mobile reception (one of them combined basic terrestrial broadcasting)

*2 Regarding satellite broadcasters, 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 based on the Broadcast Act amended and enforced in June 2011.

*3 Because some of the satellite broadcasters combine more than two of "BS broadcasting, "110 degrees east longitude CS broadcasters" and "general satellite broadcasting," sum of the values of the columns does not agree with the value of subtotal. Only operating broadcasters are included in fiscal 2011 and after.

*4 Cable television operators include: former approved facility operators under the former Cable Television Broadcasting Act and registered operators under the former Act on Broadcast on Telecommunications Services up to fiscal 2010, and: registered general broadcasters conducting independent broadcasting using wire telecommunication equipment under the Broadcast Act in fiscal 2011 and after (IP multicast broadcasting is included in former broadcasting using cable service up to fiscal 2010, and; in registered general broadcasters conducting independent broadcasting using wire telecommunications equipment in fiscal 2011 and after)

(Source) Prepared from MIC, "Current State of Cable Television"[38] (only the values of cable television operators)

(3) State of the provision of broadcasting services

i Terrestrial television broadcasting

Nationwide 127 companies (including 31 combined operation) were providing private terrestrial television broadcasting at the end of fiscal 2021.

ii Terrestrial radio broadcasting

Medium-wave (AM) broadcasting service is provided by local private basic terrestrial broadcasters (47 companies at the end of fiscal 2021)

Ultrashort wave (FM) broadcasting is provided by local private basic terrestrial broadcasters (388 companies at the end of fiscal 2021). Of them, 338 are community broadcasters for some districts of a municipality in principle.

Short wave broadcasting was conducted by one private basic terrestrial broadcaster at the end of fiscal 2021.

iii Multimedia broadcasting

V-Low multimedia broadcasting using 99MHz-108MHz spectrum that has become available through the digitali-

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

zation of terrestrial television broadcasting is conducted by two private basic broadcasters (as of the end of fiscal 2021).

iv Satellite broadcasting

A Basic satellite broadcasting

BS broadcasting is conducted by NHK, the Open University of Japan and 22 private broadcasters (as of the end of fiscal 2021) by using satellites of the Broadcasting Satellite System Corporation. 110 degrees east longitude CS broadcasting is conducted by 20 private broadcasters (as of the end of fiscal 2021) by using satellites of Sky Perfect JSAT (**Figure 3-3-1-5**).

Since December 2018, new 4K8K satellite broadcasting has been 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 4 private broadcasters (as of the end of fiscal 2021) by using satellites of Sky Perfect JSAT Corporation (**Figure 3-3-1-5**).

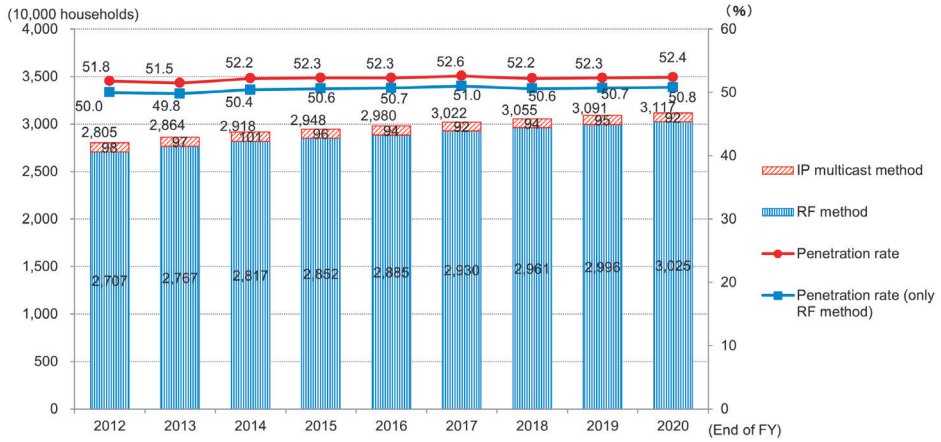
Figure 3-3-1-5 Major satellites used for satellite broadcasting in Japan (at the end of fiscal 2021)

Broadcasting type	Satellites	Orbit (east longitude)	Start of operation
Basic satellite broadcasting	BSAT-3a	110 degrees	Oct. 2007
	BSAT-3b	110 degrees	Jul. 2011
	BSAT-3c/JCSAT-110R	110 degrees	Sep. 2011
	JCSAT-110A	110 degrees	Apr. 2017
	BSAT-4a	110 degrees	Dec. 2018
	BSAT-4b	110 degrees	Sep. 2020
General satellite broadcasting	JCSAT-4B	124 degrees	Aug. 2012
	JCSAT-3A	128 degrees	Mar. 2007

v Cable television

The number of cable television operators was 464 at the end of fiscal 2020. Cable television provides multichannel broadcasting including re-transmission of terrestrial and satellite broadcasting and independent broadcasting channels. The number of the subscribed households receiving service through wire telecommunications equipment (with more than 501 terminals) for independent broadcasting pertaining to registration is approximately 31.17 million and their ratio to all households is approximately 52.4% (**Figure 3-3-1-6**).

Figure 3-3-1-6 Changes in the number and ratio of the subscribed households receiving service through wire telecommunications equipment for independent broadcasting pertaining to registration



*1 Penetration ratio was calculated based on the number of households in the basic resident register.

*2 Number of the subscribed households and penetration ratio of: facilities that were authorized under the former Cable Television Broadcasting Act and conducted independent broadcasting (including facilities registered under the former Act on Broadcast on Telecommunications Services and with broadcasting method equivalent to the said facilities) up to fiscal 2010, and; wire telecommunications equipment for independent broadcasting pertaining to its registration in fiscal 2011 and after

*3 "Number of households" in RF method refers to the total number of households connected to wire telecommunications equipment pertaining to its registration (including the households with radio disturbance)

(Source) Prepared from MIC, "Actual State of Cable Television"[39]

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

(4) State of NHK

i State of domestic broadcasting by NHK

At the end of fiscal 2021, 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 3-3-1-7**).

Figure 3-3-1-7 Domestic broadcasting by NHK (end of fiscal 2021)

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 Number of broadcast waves of radio broadcasting is also listed as channels.
*2 With the end of analog television broadcasting on March 31, 2021, all television broadcasting has moved to digital broadcasting.

ii State of international television/radio broadcasting by NHK

NHK is broadcasting international television/radio programs for overseas Japanese and foreigners almost all over the world (**Figure 3-3-1-8**).

Figure 3-3-1-8 State of international television/radio broadcasting by NHK (as planned in April 2022)

	Television		Radio
	For overseas Japanese	For foreigners	For overseas Japanese and foreigners
Broadcasting hours	Around 5 hours a day	24 hours a day	56 hours 19 minutes in total per day
Budget	21.1 billion yen (FY2022 NHK budget)		5.2 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.

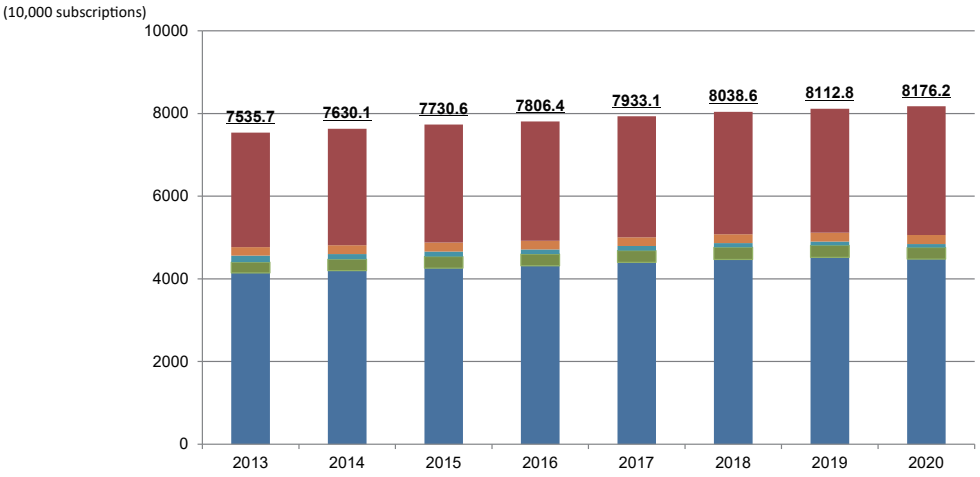
*Hours of international television broadcasting for foreigners include the hours of JIB (Japan International Broadcasting)

(5) Usage status of broadcasting services

i Number of subscribers

In fiscal 2020, the number of subscribers with 110 degrees east longitude CS broadcasting and cable television increased compared with the previous fiscal year, whereas subscribers with other broadcasting services decreased (**Figure 3-3-1-9**).

Figure 3-3-1-9 Number of subscribers with broadcasting services



(FY)	2013	2014	2015	2016	2017	2018	2019	2020
Cable television	2,767.0	2,817.0	2,852.0	2,885.0	2,930.3	2,960.7	2,995.9	3,117.1
110 degrees east longitude CS	205.6	212.0	219.5	209.3	208.4	213.7	215.8	218.3
124/128 degrees east longitude CS	157.1	125.4	120.3	114.4	109.4	102.7	93.1	84.4
WOWOW	264.8	275.6	280.5	282.3	287.6	290.1	285.5	279.1
NHK	4,141.2	4,200.1	4,258.3	4,315.4	4,397.4	4,471.4	4,522.5	4,477.3
Satellite contract, etc.	1,823.2	1,911.3	1,993.3	2,066.7	2,147.6	2,221.5	2,289.1	2,274.2

*1 The number of cable television subscribers is the number of the households subscribed: with former facilities that were approved under the former Cable Television Broadcasting Act and conducted independent broadcasting (including facilities registered under the former Act on Broadcast on Telecommunications Services and with broadcasting method equivalent to the said facilities) up to fiscal 2010; and with wire telecommunications equipment for independent broadcasting pertaining to registration in fiscal 2011 and after (excluding IP-multicast broadcasting in either case)

*2 The number of subscribers with 110 degrees east longitude CS is the number of contracts with SKY Perfect!

*3 The number of subscribers with 124/128 degrees east longitude CS is the number of contracts with SKY Perfect! Premium Service

*4 The number of subscribers with WOWOW is the number of contracts with WOWOW.

*5 Number of NHK terrestrial broadcasting is the number of all receiver contracts with NHK.

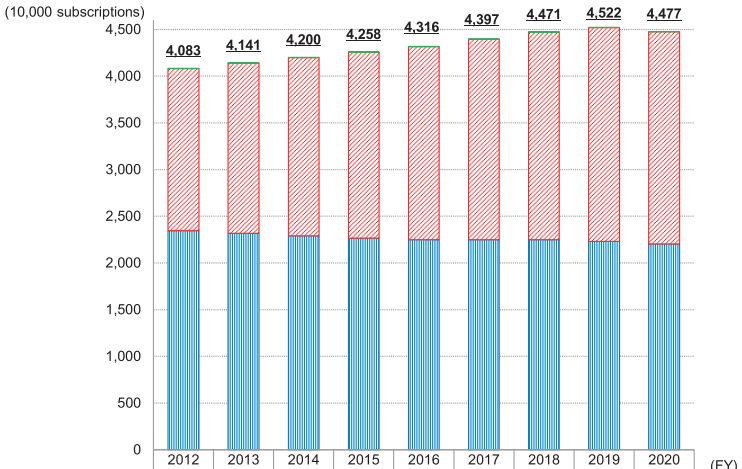
*6 The number of subscribers with satellite contract, etc. is the number of satellite contracts and special contracts with NHK.

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

ii Number of receiving contracts with NHK

In fiscal 2020, the number of receiving contracts with NHK was 44.77 million, consisting of about 22.03 terrestrial contracts (ordinary and color), 22.73 million satellite contracts and 10,000 special contracts (**Figure 3-3-1-10**).

Figure 3-3-1-10 Changes in the number of receiving contracts with NHK



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Special contract	1	1	1	1	1	1	1	1	1
Satellite contract	1,736	1,822	1,910	1,992	2,066	2,146	2,220	2,288	2,273
Terrestrial contract	2,346	2,318	2,289	2,265	2,249	2,250	2,250	2,233	2,203
Total	4,083	4,141	4,200	4,258	4,316	4,397	4,471	4,522	4,477

(Source) Prepared from NHK material

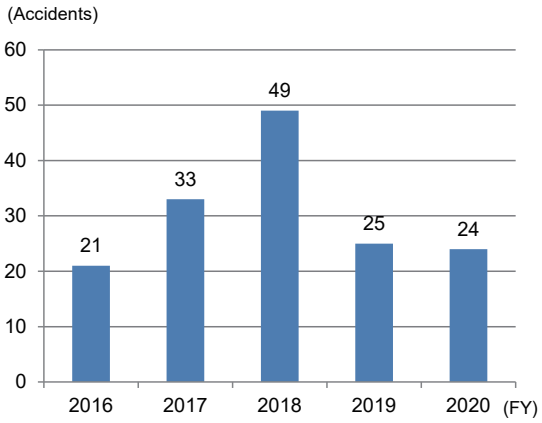
(6) Ensuring of security and reliability of broadcasting equipment

Because broadcasting is of a highly public nature as a means to broadly and instantly transmit information necessary for daily life, including disaster information, high safety and reliability is required from broadcasting equipment.

In fiscal 2020, the number of off-the-air accidents was 384, of which 24 (about 6%) were serious accidents.[40] 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 (**Figure 3-3-1-11**).

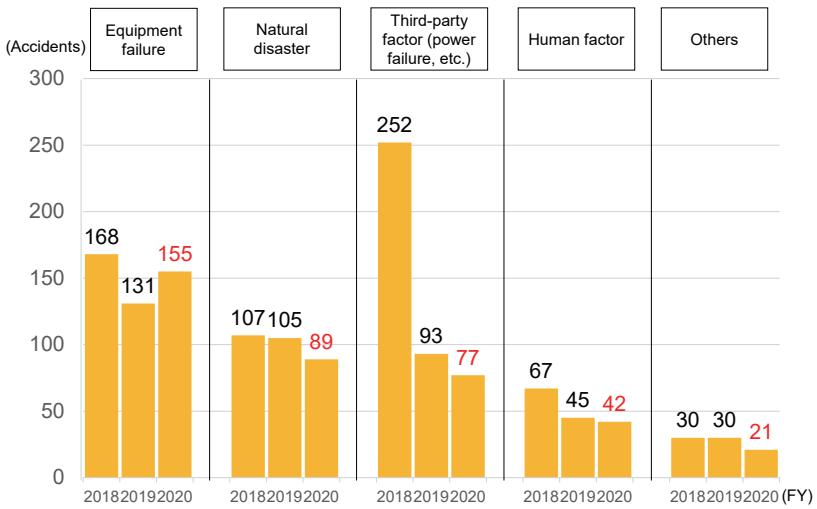
The number of off-the-air accidents of terrestrial/satellite broadcasting was 291, the smallest number since fiscal 2011 when aggregation started. The number of accidents of general cable broadcasting decreased from the number of fiscal 2019, but still higher than the average of the period from fiscal 2016 to 2017. The top cause of the off-the-air accidents in fiscal 2020 was equipment failure followed by natural disaster (**Figure 3-3-1-12**).

Figure 3-3-1-11 Changes in the number of serious accidents*



*Some of the values of the last edition are corrected.
(Source) Prepared from MIC, "Occurrences of off-the-air accidents" (fiscal 2020)[41]

Figure 3-3-1-12 Changes in the number of off-the-air accidents by cause*



*Some of the values of the last edition are corrected.
(Source) Prepared from MIC, "Occurrences of off-the-air accidents" (fiscal 2020)[42]

[40] Accidents falling under the Broadcast Act Articles 113, 122 and 137: "If the suspension of broadcasting caused by the facilities for basic broadcasting or other major accident which is stipulated in the provisions of Order 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 of Internal Affairs and Communications."
[41] https://www.soumu.go.jp/menu_news/s-news/01ryutsu08_02000250.html
[42] https://www.soumu.go.jp/menu_news/s-news/01ryutsu08_02000250.html

2. Content market

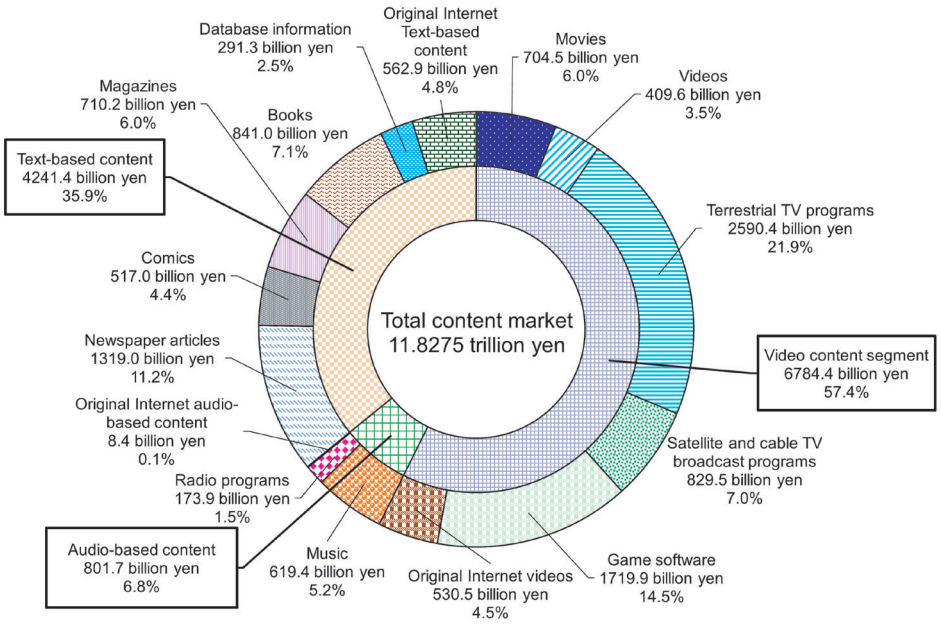
(1) Size of the Japanese content market

i Market overview

The Japanese content market was valued at 11.8275 trillion yen in 2020. By content segment, video-based content accounted for nearly 60% of the market. Text-based content and audio-based content accounted for about 36% and 7% respectively[43] (**Figure 3-3-2-1**).

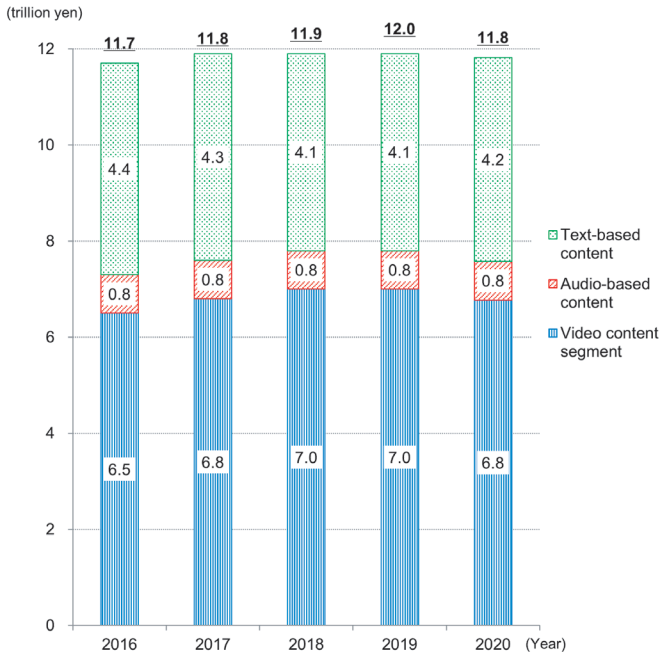
The content market, which had been on the increase in recent years, decreased compared with the previous year. By content segment, video content, which had expanded in recent years, decreased compared with the previous year (**Figure 3-3-2-2**).

Figure 3-3-2-1 Breakdown of Japan's content market (2020)



(Source) Institute for Information and Communications Policy, MIC, "Survey on the Production and Distribution of Media Content"

Figure 3-3-2-2 Changes in the size of the content market of Japan (by content segment)



(Source) Institute for Information and Communications Policy, MIC, "Survey on the Production and Distribution of Media Content"

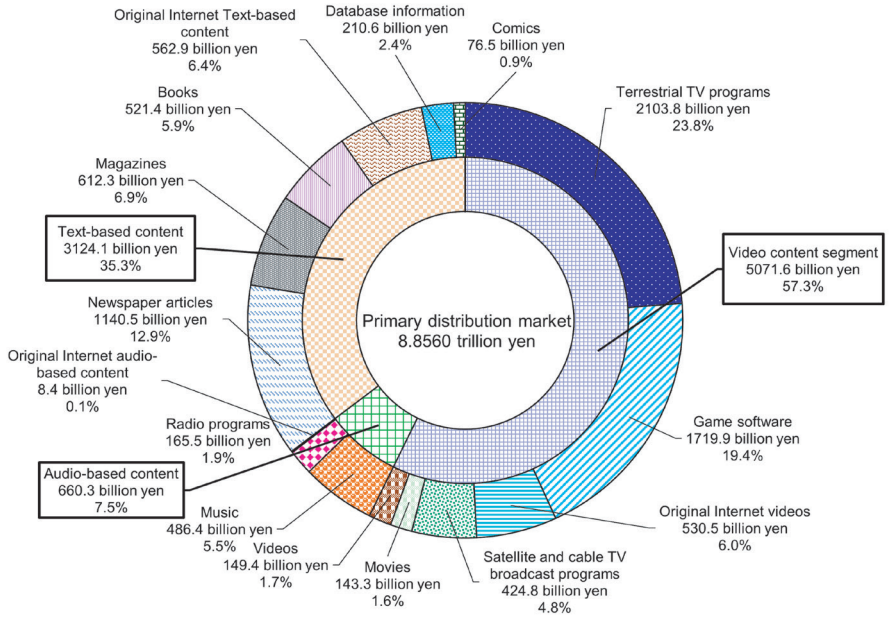
[43] Market size was calculated and analyzed after recounting by distribution stage such as primary distribution and multi-use with focus on the original nature of the content rather than aggregation by media.

ii State of multi-use[44]

In 2020, the primary distribution market was valued at 8.856 trillion yen accounting for about 75% of the entire market. The value is broken down to 5.0716 trillion yen of video-based content, 3.1241 trillion yen of text-based content and 660.3 billion yen of audio-based content (**Figure 3-3-2-3**).

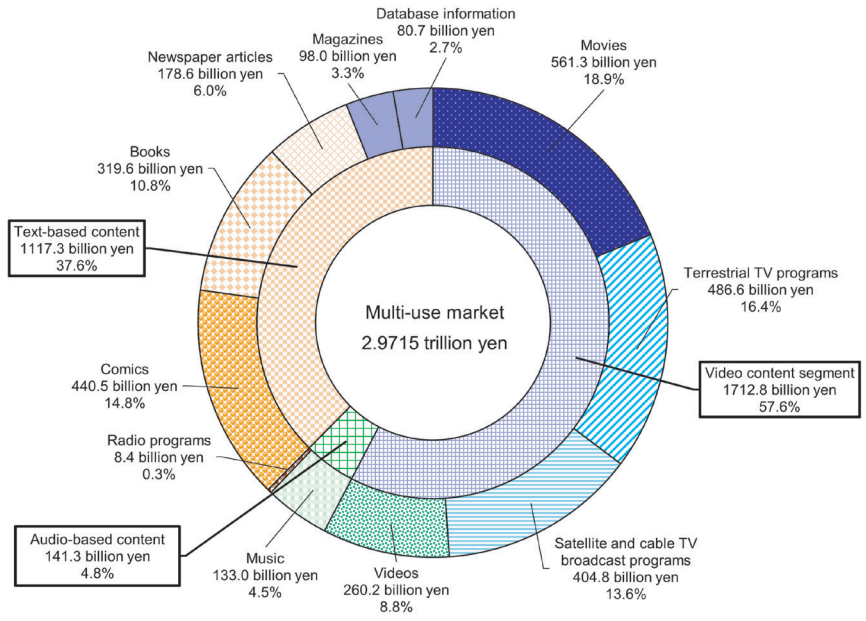
In the same year, the multi-use market was valued at 2.9715 trillion yen accounting for about 25% of the entire market. It is broken down to 1.7128 trillion yen of video-based content, 1.1173 trillion yen of text-based content and 141.3 billion yen of audio-based content (**Figure 3-3-2-4**).

Figure 3-3-2-3 Breakdown of the primary distribution market (2020)



(Source) Institute for Information and Communications Policy, MIC, "Survey on the Production and Distribution of Media Content"

Figure 3-3-2-4 Breakdown of the multi-use market (2020)



(Source) Institute for Information and Communications Policy, MIC, "Survey on the Production and Distribution of Media Content"

iii Communication content market

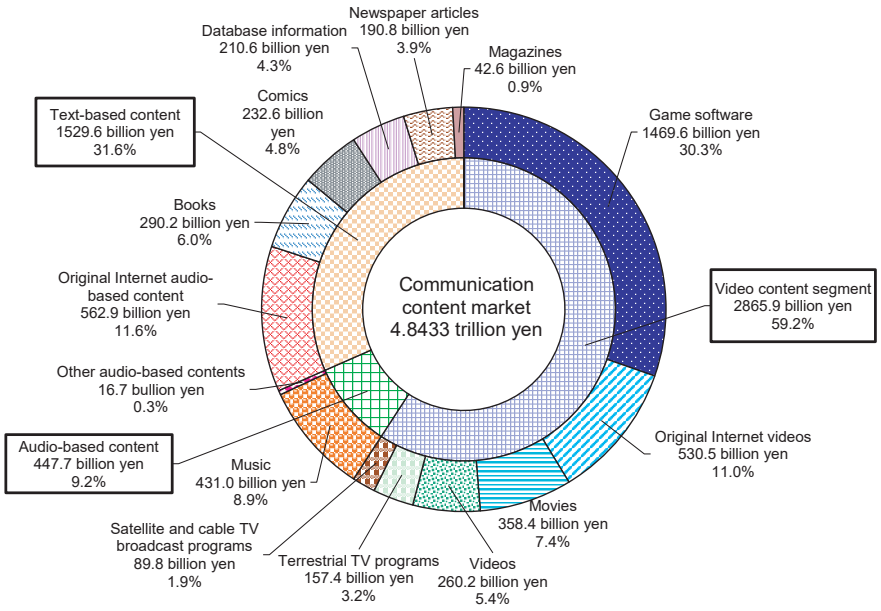
Among the content markets, the market size of communication content for personal computers, mobile phones, etc. via the internet is valued at 4.8433 trillion yen. In composition ratio by content segment, video-based content, text-based content and audio-based content account for

[44] Distribution of software in multiple media in secondary use and after, while maintaining its identical content.

59.2%, 31.6% and 9.2% respectively (**Figure 3-3-2-5**).

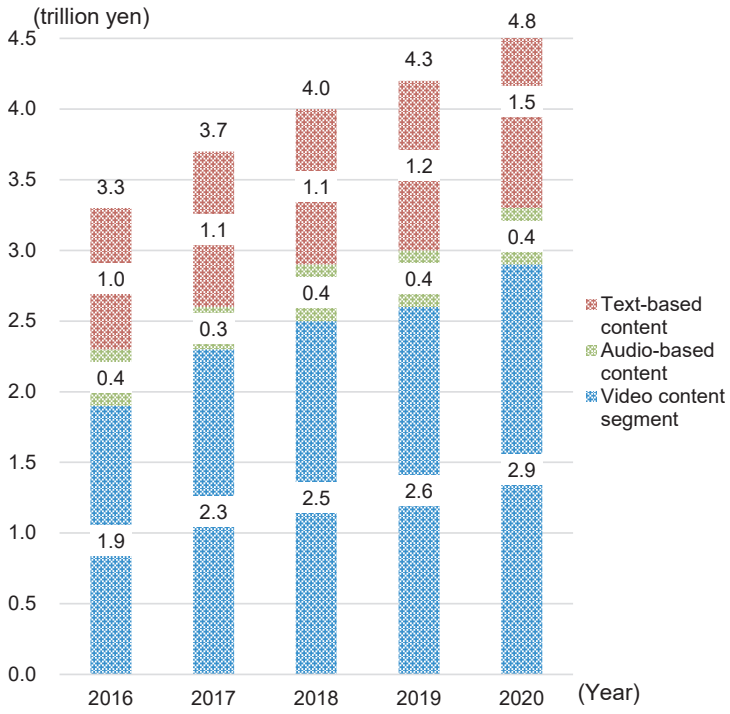
The market size of the communication content has been growing in recent years. By content segment, video content continues to increase due to the growth in movies, net originals, game software, etc., while text-based content is also increasing thanks to the growth in books, comics and original internet content, which contributes to the expansion of the communication content market (**Figure 3-3-2-6**).

Figure 3-3-2-5 Breakdown of the communication content market (2020)



(Source) Institute for Information and Communications Policy, MIC, "Survey on the Production and Distribution of Media Content"

Figure 3-3-2-6 Changes in the market size of communication content (by content segment)



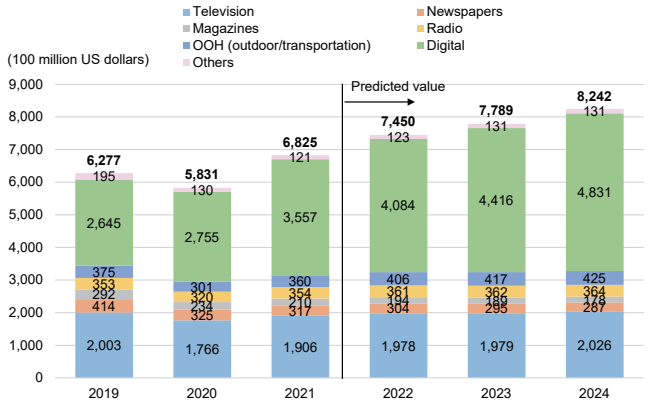
(Source) Institute for Information and Communications Policy, MIC, "Survey on the Production and Distribution of Media Content"

(2) Advertisement

With the penetration of digitalization triggered by the COVID-19 pandemic, digital advertisements led the growth of the entire advertising market of the world and grew to 39.0396 trillion yen (32.7% increase year-on-year) in 2021 (**Figure 3-3-2-7**). The digital advertisement market is substantially growing in Japan also,

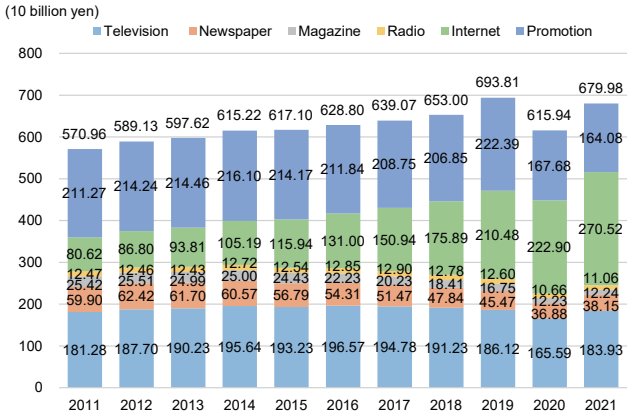
where internet advertising expenditures (2.7052 trillion yen) exceeded the four traditional media[45] advertising expenditures (2.4538 trillion yen) for the first time in 2021 (**Figure 3-3-2-8**).

Figure 3-3-2-7 Changes in and projections of advertisement expenses by media in the world



(Source) Prepared from Dentsu Group, "Projection of the growth rate of the advertisement expenses in the world (2021-2024)"[46]

Figure 3-3-2-8 Changes in advertising expenditures by media in Japan[47]



(Source) Prepared from Dentsu, "Advertisement Expenses in Japan (annual)"[48]

Related data
Changes in and projections of total global advertisement expenses
Source: Dentsu Group, "Global advertisement spend growth rate forecast (2021-2024)"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-3-31 (Data Collection)

(3) Trends of exports of broadcasting content of Japan

Among the types of the broadcast programs produced by enterprises doing a business that falls under "broadcast program production", the ratio of "information programs (including publicity)" is highest at 69.6% (1.3 point decrease from the previous fiscal year), followed by "CM" at 55.0% (2.8 point decrease from the previous fiscal year) and "variety" at 50.5% (0.9% decrease from the previous fiscal year) in fiscal 2020.

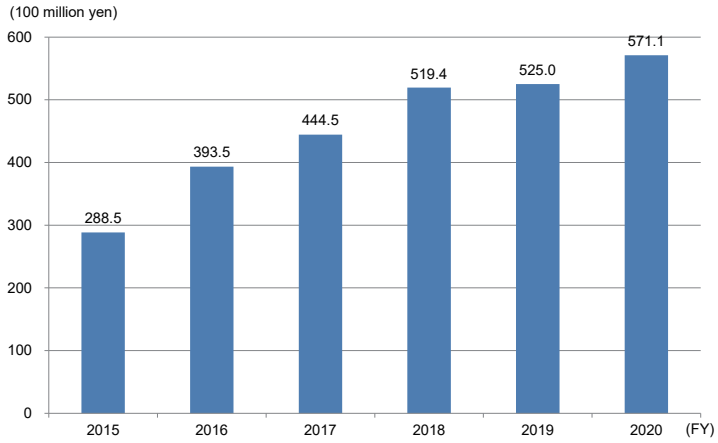
Related data
Ratio of the types of broadcast programs produced (multiple answers)
Source: MIC/METI "2021 Basic Survey on the Information and Communications Industry"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-3-32 (Data Collection)

In fiscal 2020, export of broadcast content continued to increase and reached 57.11 billion yen (**Figure 3-3-2-9**).

With the growth of video distribution services, value of program broadcasting right, video release right, etc. decreased, while the ratio of Internet distribution right increased (**Figure 3-3-2-10**).

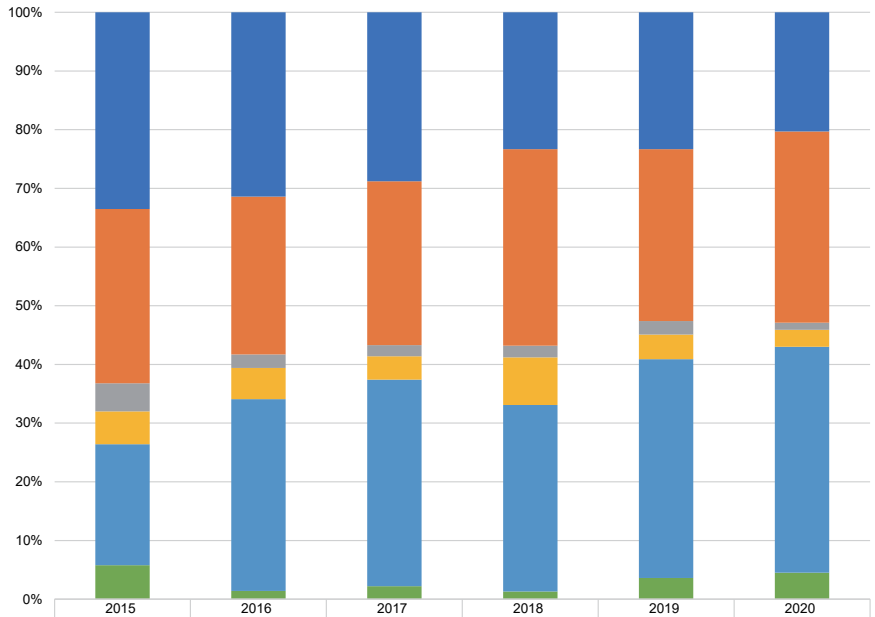
[45] Television, newspapers, magazines and radio
[46] https://www.group.dentsu.com/jp/news/release/000643.html
[47] Since 2019, "advertisement on EC platform for sales of goods" and "event field" are included in the advertisement expenses of Japan to estimate the advertisement market. Data of 2018 and before are not retroactively adjusted.
[48] https://www.dentsu.co.jp/knowledge/ad_cost/index.html

Figure 3-3-2-9 Changes in the export value of Japanese broadcast content



*1 Export value of broadcast content: total of the overseas sales of program broadcasting right, internet distribution right, video/DVD release right, TV formatting/remaking right and merchandizing right
*2 Calculated based on questionnaire surveys of NHK, key private stations, sub key private stations in Osaka, local stations, satellite broadcasters, CATV operators, productions, and others.
*3 After fiscal 2016, there have been changes such as clear inclusion of right to turn into a game in calculation.
(Source) Prepared from MIC, annual "Present Data Analysis on Overseas deployment of broadcast content"[49]

Figure 3-3-2-10 Changes in the ratio of the export value of Japanese broadcast content by type of right



	2015	2016	2017	2018	2019	2020
Program broadcasting right	33.5	31.4	28.8	23.3	23.3	20.3
Internet distribution right	29.7	26.9	27.9	33.5	29.3	32.6
Video/DVD release right	4.8	2.3	1.9	2.0	2.3	1.2
TV formatting/remaking right	5.6	5.3	4.0	8.1	4.2	2.9
Merchandizing right	20.6	32.7	35.2	31.8	37.3	38.5
Others	5.8	1.4	2.2	1.3	3.6	4.5

(FY)

*1 Merchandizing right and video/DVD release right do not include overseas sales of characters and other merchandise and medium itself such as videos and DVDs.
*2 In cases where clear division is not possible, for example, when multiple rights including program broadcasting right were sold or the question on category was not answered, the sales are classified as program broadcasting right.
*3 After fiscal 2016, there have been changes such as clear inclusion of right to turn into a game in calculation.
(Source) Prepared from MIC, annual "Present Data Analysis on Overseas deployment of broadcast content"[50]

Related data
Changes in ratio of Japan's exports of broadcast content by entity
Source: Prepared from MIC, annual "Analysis of Current Situation of Overseas Export of Broadcasting Content"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-3-35 (Data Collection)

[49] https://www.soumu.go.jp/menu_news/s-news/01ryutsu04_02000185.html
[50] https://www.soumu.go.jp/menu_news/s-news/01ryutsu04_02000185.html

Section 4 Trends of Radio Spectrum Use in Japan

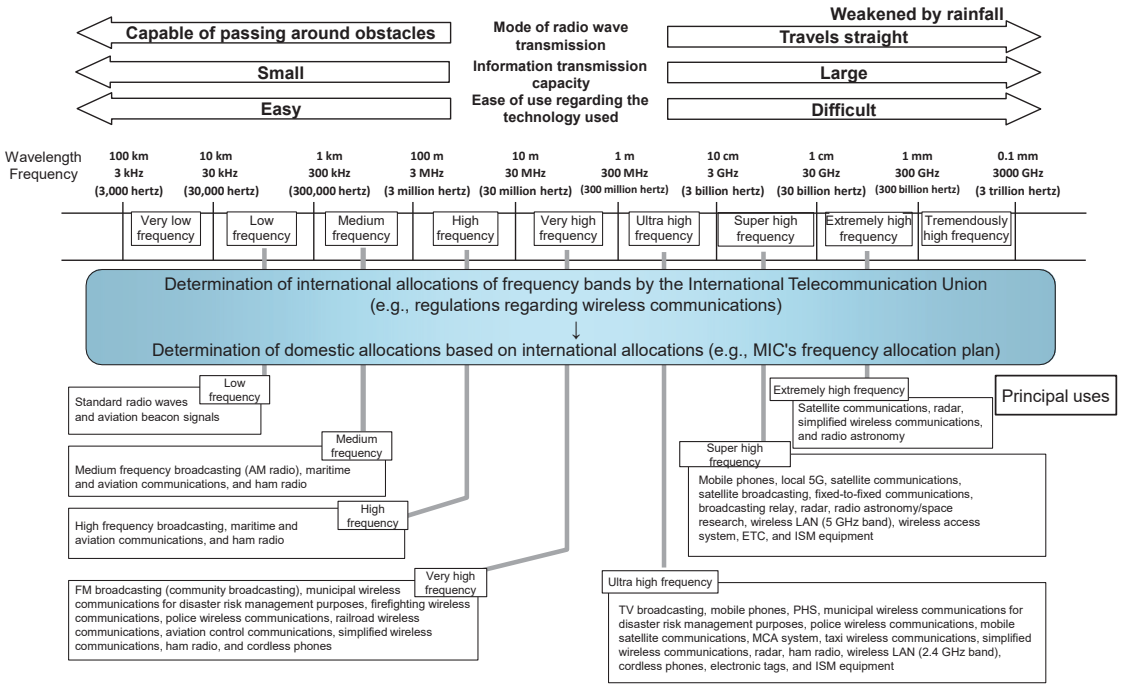
1. Principal use by spectrum

Radio Regulations stipulated in the International Telecommunication Union (ITU) Constitution and Convention have established the international frequency allocation that divides the world into three regions and defines the category of operations for each spectrum.

In order to help application for license of radio stations, MIC has established the Frequency Assignment Plan[51] based on the international allocation and the Radio Act which defines the frequencies that can be assigned, category of operations, purposes, conditions, etc. When establishing or changing the plan, the Radio Regulatory Council is consulted.

Major usage and characteristics of each spectrum in Japan are shown in **Figure 3-4-1-1**.

Figure 3-4-1-1 Major usages and radio wave characteristics in Japan by spectrum



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	1 to 10m	Waves of this spectrum propagate rather straight and are not easily reflected off the ionosphere, but are capable of reaching the 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, but are capable of reaching the 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	1 to 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	1 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.
Trem endously high frequency	0.1 to 1mm	The spectrum has nature similar to light. It is rarely used for communication but used for radio telescopes for astronomical observation as is the case of Extremely high frequency.

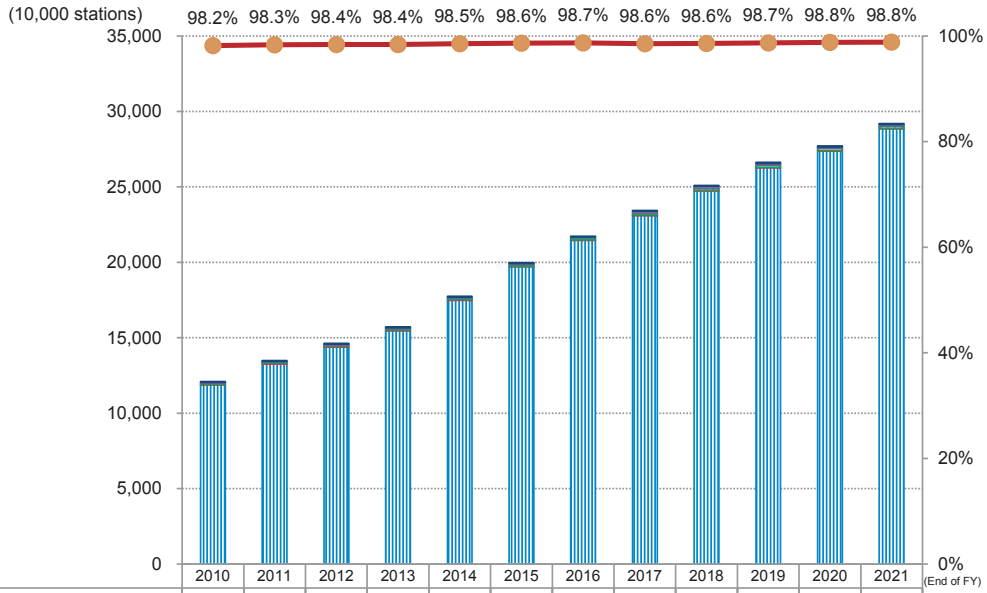
[51] Frequency Assignment Plan: https://www.tele.soumu.go.jp/j/adm/freq/search/share/index.htm

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 2021 was 291.98 million, an increase by 5.4% from the previous year, including 288.59 million mobile phones and other land mobile stations (increase by 5.2% from the previous year). The ratio of mobile phones and other land mobile stations is at a high level of 98.8%.

Simplicity radio stations have also increased to 1.42 million (increase by 3.9% from the previous year) (**Figure 3-4-2-1**).

Figure 3-4-2-1 Changes in the number of radio stations



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Other	46	43	46	50	50	55	49	49	55	59	61	51
Base stations	54	58	63	68	71	70	73	125	132	117	95	108
Convenience stations*2	74	77	84	90	97	105	112	118	125	132	137	142
Amateur stations	45	44	44	44	44	44	43	43	41	40	39	38
Land mobile stations*1	11,879	13,266	14,388	15,472	17,493	19,711	21,457	23,109	24,748	26,278	27,379	28,859
Percentage of land mobile stations	98.2%	98.3%	98.4%	98.4%	98.5%	98.6%	98.7%	98.6%	98.6%	98.7%	98.8%	98.8%

*1 Land mobile station: radio stations operated when moving on land or stopping at unspecified points (e.g. mobile phone terminals)
*2 Simplicity radio station: radio stations for simple radio communication

3. Satellites

In the field of satellite communication, Japan is working to powerfully advance social implementation and international standardization of the results of the development that will realize expansion of communication coverage for seamless connection of land, sea and air (Non-Terrestrial Network (NTN) technology including satellite 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, communication with mountainous regions/isolated islands where use of terrestrial channels is difficult, mobile satellite communication services for ships and aircraft, and communication at the time of disaster. Some communication satellites are used for satellite broadcasting (CS broadcasting).

(1) Geostationary satellite

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

(2) Non-geostationary satellite

Non-geostationary satellites travel in an orbit other than geostationary orbit that is generally higher than non-geostationary orbit. For this reason, their transmission delay is shorter and terminal output is smaller, which makes smaller and mobile terminals possible. Communication in polar regions is possible, which is difficult in a geostationary orbit on the equator. On the other hand, because 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.

Related data
Major geostationary satellites used for communication services in Japan (at the end of fiscal 2021)
Major non-geostationary satellites used for communication services in Japan (at the end of fiscal 2021)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-4-3 (Data Collection)

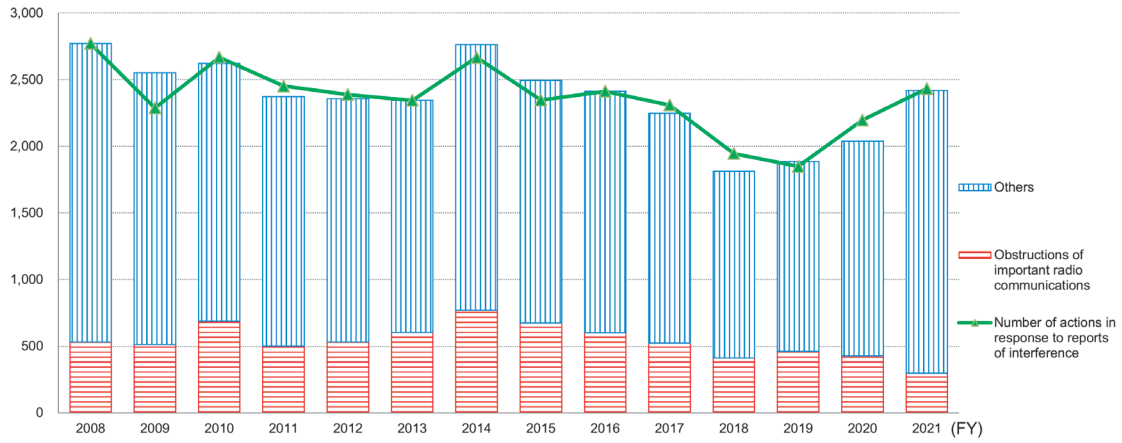
4. Radio wave monitoring to eliminate obstruction of important radio communications, etc.

Using sensor station facilities installed on steel towers and building rooves in major cities across the country and vehicles for search of unlicensed radio stations, MIC is investigating sources of radio emission jamming important radio communications including fire/emergency radio, aeronautical/maritime radio and mobile phones and is cracking down on unlicensed radio stations. In addition, MIC is monitoring radio waves by establishing DEURAS, which is a system to detect emission sources of radio waves including unlicensed radio stations disturbing radio usage environment.[52]

In fiscal 2020, the number of reports of radio interference or obstructions increased 153 to 2,039 (increase by 8.1% from the previous year), 439 of which are obstructions of important radio communications (decrease by 32 cases or 6.9% from the previous year). The number of actions taken against interference or obstructions was 2,198[53] in fiscal 2020 (**Figure 3-4-4-1**).

The number of unlicensed radio stations found in fiscal 2020 increased 228 (3.5% increase) to 6,765. The number of actions taken2 decreased by 304 to 643 (48.4% decrease from the previous year), which is broken down to 62 prosecutions (9.6% of all actions) and 581 guidance (90.4% of all actions) (**Figure 3-4-4-2**).

Figure 3-4-4-1 Changes in the number of reports of and actions against interference or obstructions to radio stations



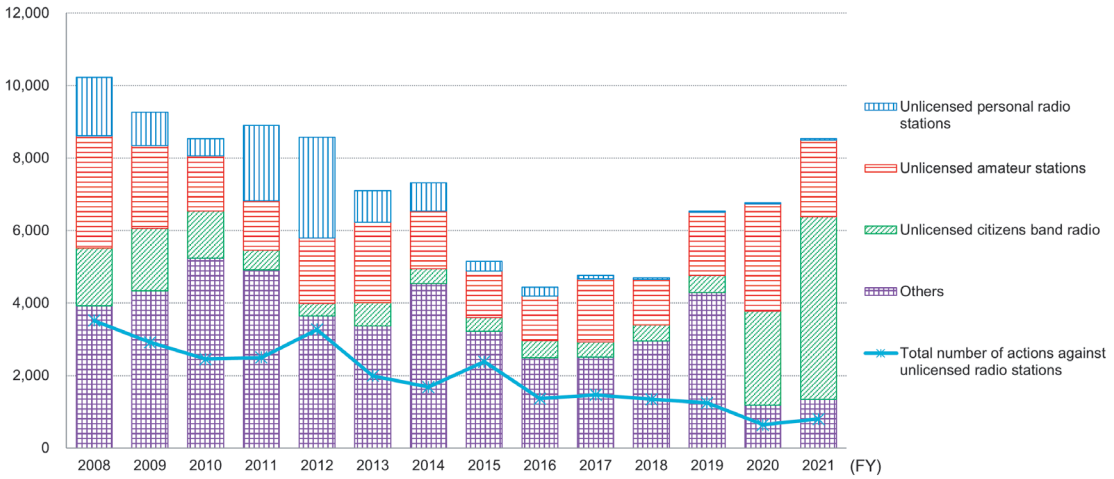
Number of reports of interference or obstruction

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Obstructions of important radio communications	532	513	689	501	532	605	771	676	603	522	412	461	429	298
Others	2,241	2,041	1,934	1,873	1,826	1,740	1,995	1,821	1,811	1,727	1,401	1,425	1,610	2,121
Total	2,773	2,554	2,623	2,374	2,358	2,345	2,766	2,497	2,414	2,249	1,813	1,886	2,039	2,419
Number of actions in response to reports of interference or obstructions														
Number of actions in response to reports of interference	2,772	2,289	2,669	2,453	2,389	2,346	2,667	2,348	2,414	2,310	1,946	1,850	2,198	2,434

[52] In fiscal 2010, DEURAS established a 24-hour system to receive obstruction reports and have been working to promptly eliminate obstructions to important radio communications. 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.

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

Figure 3-4-4-2 Changes in the number of unlicensed radio stations found and the number of actions taken



Number of unlicensed radio stations found		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Stations found	Unlicensed personal radio stations	1,617	920	479	2,081	2,788	865	784	265	245	99	40	28	25	32
	Unlicensed amateur stations	3,097	2,283	1,525	1,367	1,803	2,225	1,592	1,291	1,229	1,749	1,253	1,739	2,959	2,126
	Unlicensed citizens band radio	1,592	1,729	1,295	538	342	642	404	375	478	414	443	477	2,594	5,035
	Others	3,926	4,338	5,239	4,917	3,648	3,369	4,541	3,221	2,489	2,508	2,958	4,293	1,187	1,341
	Total	10,232	9,270	8,538	8,903	8,581	7,101	7,321	5,152	4,441	4,770	4,694	6,537	6,765	8,534
Number of actions against unlicensed radio stations															
Number of actions	Prosecution	330	340	262	249	231	228	215	230	168	168	208	189	62	49
	Guidance	3,190	2,578	2,190	2,247	3,038	1,764	1,465	2,156	1,196	1,300	1,136	1,058	581	752
	Total	3,520	2,918	2,452	2,496	3,269	1,992	1,680	2,386	1,364	1,468	1,344	1,247	643	801

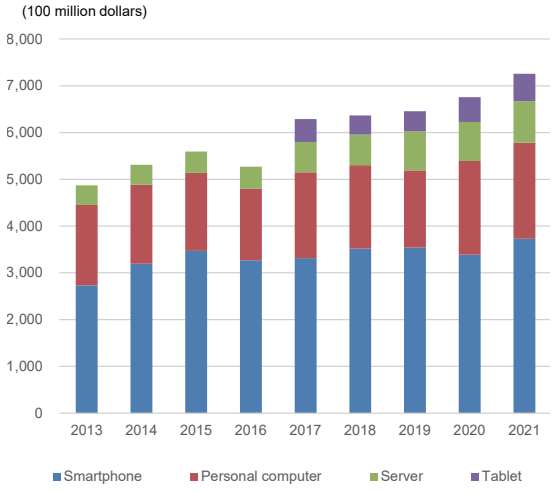
Section 5 Trends Related to Equipment and Terminals

1. Trends in the Information Terminals Market

Global shipments of information terminals have been increasing since 2016 and reached 79.6625 trillion yen (10.4% increase year-on-year) in 2021 (**Figure 3-5-1-1**). In breakdown, smartphones and personal computers account for a major part.

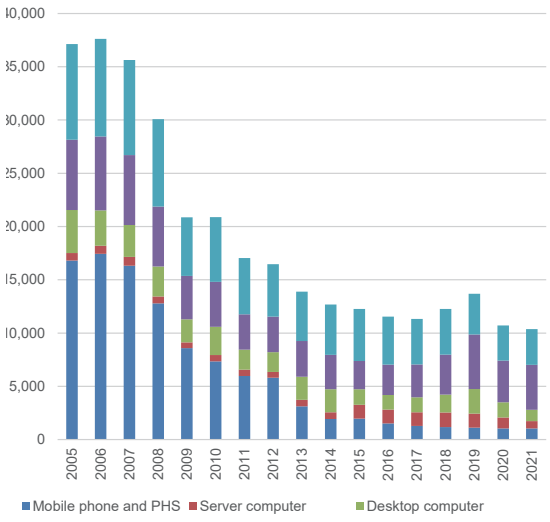
Japan's production of information terminals was on the decrease up to 2017, turned to increase in 2018, but decreased again in 2020 and fell to 1.0370 trillion yen (3.2% decrease year-on-year) in 2021 (**Figure 3-5-1-2**). In breakdown, mobile phones and PHS[54] accounted for a major part up to the mid-2010s, but their ratio decreased later. Now, desktop computers, laptop computers and information terminals[55] take a leading part.

Figure 3-5-1-1 Changes in shipment of information terminals in the world[56]



(Source) Omdia

Figure 3-5-1-2 Changes in Japan's production of information terminals



(Source) METI "Current Survey of Production – Machinery"[57]

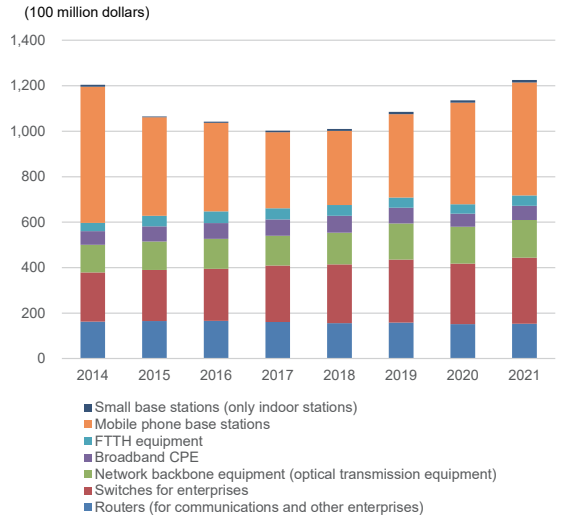
2. Trends in the network equipment market

Global shipments of network equipment have been increasing since 2017 and reached 13.4520 trillion yen (10.9% increase year-on-year) in 2021 (**Figure 3-5-2-1**). Mobile phone base stations and switches for enterprises accounted for a major part of the shipments.

Japan's production of network equipment had been decreasing from the first half of the 2000s, started to gradually increase in 2018, but again decreased to 774.3 billion yen (0.5% decrease year-on-year) in 2021 (**Figure 3-5-2-2**). In detail, telephone application equipment[58] and exchangers decreased with the shift from fixed telephone to mobile/IP telephones. Today, wireless application devices[59] and other wireless communication equipment[60] are major segments. Production of base station communication equipment has greatly fluctuated. It had stagnated since 2016 when investments in 4G had completed, but turned to increase in 2020. Network connection devices[61] used for IP communication turned to increase in 2019 but decreased in 2021. Carrier devices[62] have been increasing since 2019 mainly with the contribution of digital transmission devices.

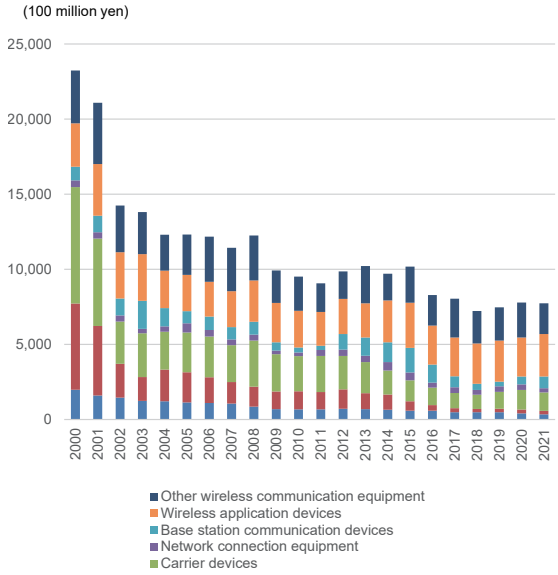
[54] Because production of mobile phones and PHS is not disclosed since fiscal 2019, the values of radio communication equipment (including satellite communication equipment) are used after deducting the values of broadcasting equipment, fixed communication equipment (satellite and terrestrial), other terrestrial mobile communication equipment, maritime/aeronautical mobile communication equipment, base station communication equipment, other radio communication equipment and associated radio equipment.
[55] External memories, printers, monitors, etc. Information kiosk terminal devices are excluded because their production was not disclosed in some years.
[56] Tablets have been included since 2017.
[57] https://www.meti.go.jp/statistics/tyo/seidou/index.html
[58] Key telephone systems and interphones
[59] Maritime/aeronautical radars, wireless location measuring devices, telemeter/telecontrol apparatus, etc.
[60] Satellite/terrestrial fixed communication equipment, maritime/aeronautical communication equipment, transceivers, etc.
[61] Routers, hubs, gateways, etc.
[62] Digital transmission devices, power line carrier devices, CATV carrier devices, optical transmission devices, etc.

Figure 3-5-2-1 Changes in the global shipments of network equipment



(Source) Omdia

Figure 3-5-2-2 Changes in Japan's production of network equipment



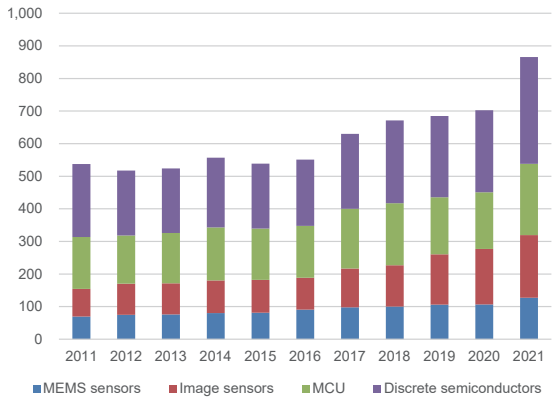
(Source) MIC "Current Survey of Production – Machinery[63]"

3. Trends in the semiconductor[64] market

The global shipments of semiconductors have been increasing since 2015 and reached 9.4999 trillion yen (26.7% increase year-on-year) in 2021 (**Figure 3-5-3-1**). In detail, discrete semiconductors accounted for the largest part of the shipments, while image sensors have grown greatly in recent years.

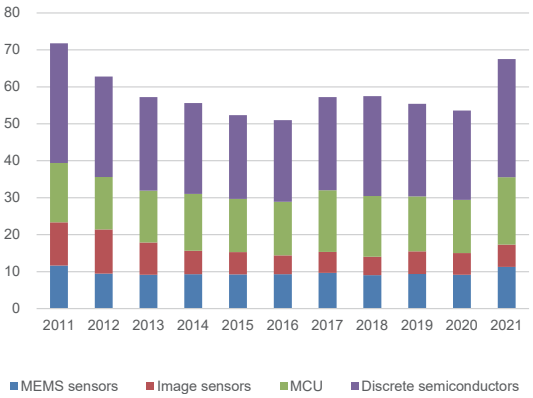
Japan's shipments of semiconductors had been decreasing from 2018 but turned to increase to 741.2 billion yen (29.6% increase year-on-year) in 2021 (**Figure 3-5-3-2**). In detail, discrete semiconductors accounted for the largest part (nearly half) of the production as is the case with the world market.

Figure 3-5-3-1 Changes in global semiconductor shipments



(Source) Omdia

Figure 3-5-3-2 Changes in Japan's semiconductor shipments



(Source) Omdia

[63] https://www.meti.go.jp/statistics/tyo/seidou/index.html

[64] In this section, the term refers to discrete semiconductors that are used for image sensers, MCU, MEMS sensors and indispensable power sources. These are key devices of IoT and electronic equipment mounted with AI, introduction of which is advancing toward digital transformation.

4. Changes in exports/imports of ICT equipment

China's exports of ICT equipment[65] are rapidly increasing. Exports of the United States and Japan turned to increase after the decrease in the early 2000s and remained almost unchanged before decreasing again in 2009. After 2010, the United States maintained a high level, whereas Japan experienced a decreasing trend. Imports of ICT equipment significantly increased in China and the US. Imports increased only slightly in Japan: the difference between China and the US has increased.

In 2020, Japan's exports of ICT equipment were 6.0871 trillion yen (1.1% decrease year-on-year), while imports were 9.5804 trillion yen (0.5% decrease year-on-year), resulting in a 3.4932 trillion yen import surplus (0.5% increase year-on-year). The excess of imports over exports of the United States was 22.3201 trillion yen (8.8% increase year-on-year), while the excess of exports over imports of China was 19.8044 trillion yen (7.8% decrease year-on-year).

Related data
Changes in ICT exports/imports of various countries
Source: UNCTAD, "UNCTAD STAT"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-5-7 (Data Collection)

5. Global and Japanese market share by business operator

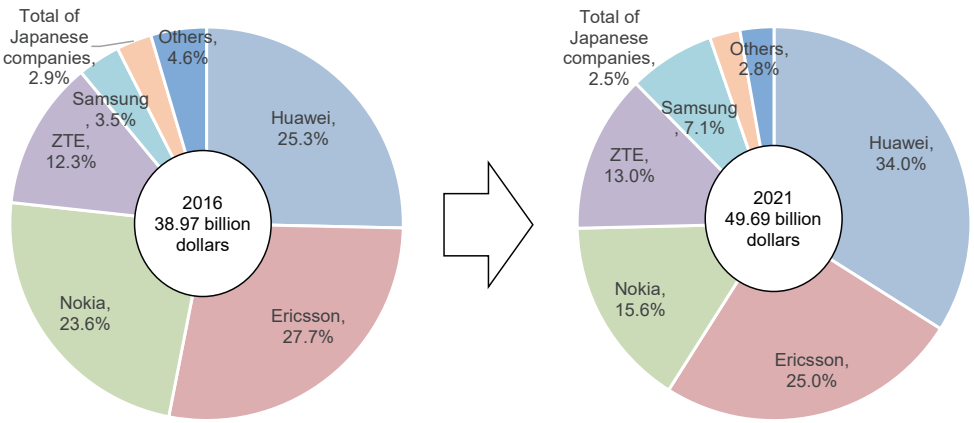
(1) Global market

In the 2021 global market, Samsung had the top smartphone market share (20.3%: number of sales), followed by Apple (17.5%) and Xiaomi (14.2%).

Huawei (34.0%) had the top share in macro cell base stations in value of shipment, followed by Ericsson (25.0%) and Nokia (15.6%) (**Figure 3-5-5-1**). Cisco (64.6%) had the top share in routers for enterprises (in value of shipments) followed by H3C (8.3%) and Huawei (6.3%).

In semiconductor shipment value, Intel had the top share (13.0%) followed by Samsung Electronics (12.8%) and SK Hynix (6.3%).

Figure 3-5-5-1 Changes in macro cell base station share in the global market



(Source) Omdia

Related data
Changes in global share of the smartphone, router for enterprises and semiconductor markets
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-5-9 (Data Collection)

[65] Computers, communicators, electric appliances for consumers, electronic components, etc.

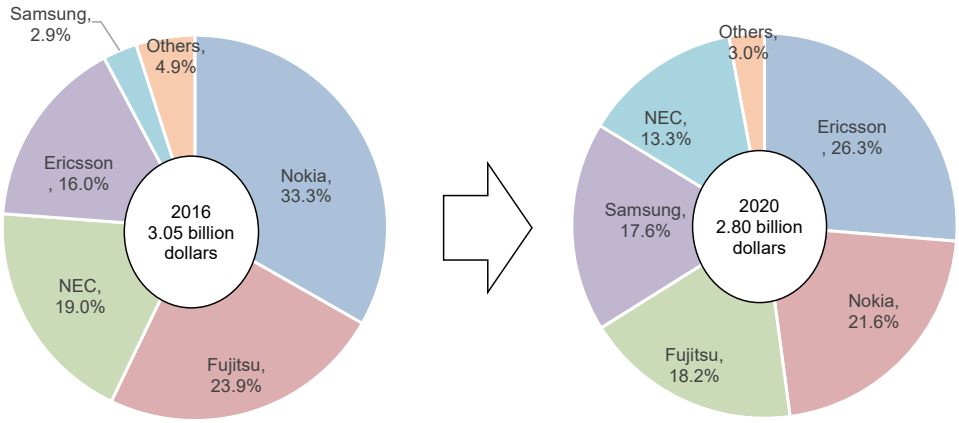
(2) Japanese market

In the 2020 Japanese market, Apple had the top smartphone share (67.4%: number of sales) followed by Samsung (9.4%) and Sharp (9.0%).

In the network equipment segment, Ericsson (26.3%) had the top share in macro cell base stations (in value of shipments), followed by Nokia (21.6) and Fujitsu (18.2%) (**Figure 3-5-5-2**). Cisco (28.8%) had the top share in routers for enterprises followed by Yamaha (28.1%) and NEC (27.1%).

In terms of semiconductor shipment, Intel had the top share (8.6%) followed by Renesas Electronics (8.3%) and Samsung Electronics (6.5%).

Figure 3-5-5-2 Changes in the macro cell base station share in the Japanese market



(Source) Omdia

Related data
Changes in share of the smartphone, router for enterprises and semiconductor markets in Japan
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-5-13 (Data Collection)

Section 6 Trends of Services and Applications

1. Platform trends

(1) Market trends

In terms of market capitalization of the major players of the global ICT market, GAFAM[66] occupy the top positions. In July 2021, the total of GAFA's market capitalization exceeded the total of all Japanese stocks. Market capitalization of the top 15 companies sharply increased from 408.1724 trillion yen in 2017 to 1,586.8443 trillion yen[67] in 2022 (**Figure 3-6-1-1**).

Figure 3-6-1-1 Changes in the top 15 companies in terms of market capitalization in the global ICT market

2017

Company name	Major business	Country	Market capitalization (100 million dollars)
Apple	Hardware, software, services	US	8,010
Alphabet/Google	Search engine	US	6,800
Amazon.com	e-commerce	US	4,760
Facebook	SNS	US	4,410
Tencent	SNS	China	3,350
Alibaba	e-commerce	China	3,140
Priceline Group	Online booking	US	920
Uber	Mobility	US	700
Netflix	Media	US	700
Baidu China	Search engine	China	660
Salesforce	Cloud service	US	650
Paypal	Payment	US	610
Ant Financial	Payment	China	600
JD.com	e-commerce	China	580
Didi Kuaidi	Mobility	China	500

2022

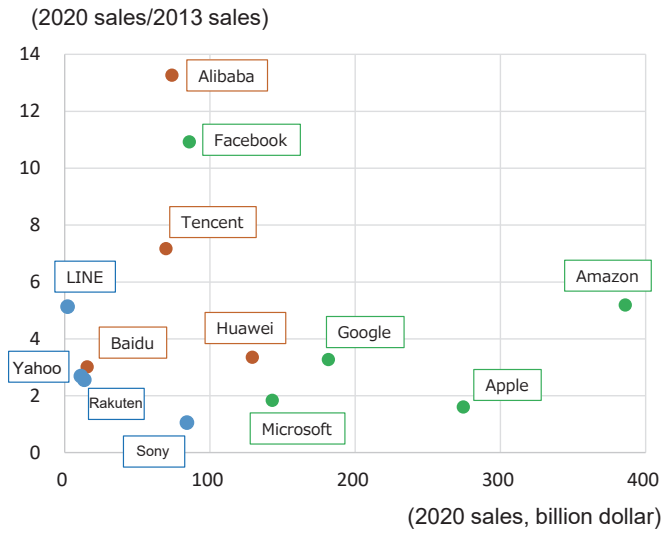
Company name	Major business	Country	Market capitalization (100 million dollars)
Apple	Hardware, software, services	US	28,282
Microsoft	Cloud service	US	23,584
Alphabet/Google	Search engine	US	18,215
Amazon.com	Cloud service, e-commerce	US	16,353
Meta Platforms /Facebook	SNS	US	9,267
NVIDIA	Semiconductor	US	6,817
Taiwan Semiconductor Manufacturing	Semiconductor	Taiwan	5,946
Tencent	SNS	China	5,465
Visa	Payment	US	4,588
Samsung Electronics	Hardware	Korea	4,473
Mastercard	Payment	US	3,637
Alibaba	e-commerce	China	3,589
Walt Disney	Media	US	2,811
Cisco Systems	Hardware, security	US	2,578
Broadcom	Hardware, semiconductor	US	2,557

(Source) For 2017, MIC (2018) "Current State and Challenges of Platform Services "[68]; for 2022, Wright Investors' Service, Inc[69] (as of January 14, 2022)

In comparison with the 2020 sales[70] of the biggest platformers of Japan, the United States and China, Amazon's sales were largest (41.2214 trillion yen), increasing 5.2 fold from its sales in 2013 (**Figure 3-6-1-2**). Alibaba (7.8924 trillion yen) of China grew 13.3 fold compared with 2013. By contrast, Japanese companies are smaller and do not bear comparison in terms of growth: 5.1 fold of LINE, 2.7 fold of Yahoo, 2.6 fold of Rakuten and 1.1 fold of Sony.

[66] Google, Amazon, Facebook, Apple and Microsoft
[67] Converted to yen using the average exchange rate of January 2022.
[68] https://www.soumu.go.jp/maincontent/000579804.pdf
[69] https://startup-db.com/magazine/category/research/marketcap-global-2022
[70] Sales of Japanese and Chinese companies were converted to dollar by using average rate of the respective year.

Figure 3-6-1-2 Sales of platformers of Japan, the US and China



*Sales of 2019 for LINE

(Source) Prepared from Statista data

(2) Trends of platformer regulation in Japan and abroad

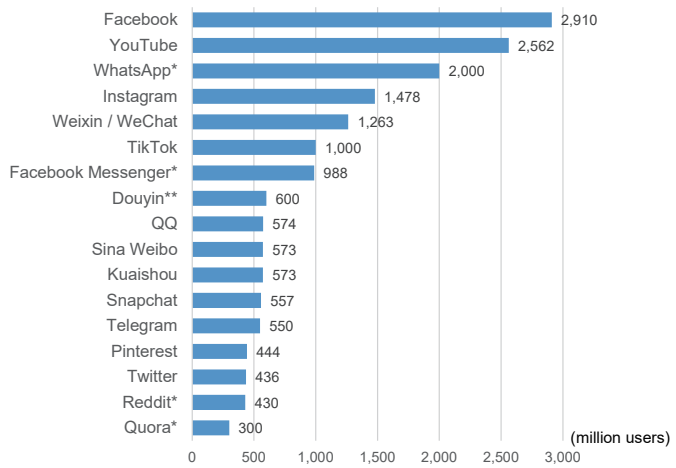
In recent years, in order to ensure fair competition environment in the market, there are moves to strengthen regulations on huge platformers who are increasing market power.

Also in recent years, there is a challenge of distribution of illegal/harmful information including slander and disinformation through social media, etc. To address this situation, Japan and other countries are taking various measures including consideration of new regulations on platformers and promotion of their voluntary responses.[71]

2. Social media

As of January 2022, the monthly number of active Facebook users was approximately 2.9 billion, the largest number in the world, followed by video-based social media YouTube and WhatsApp.

Figure 3-6-2-1 Monthly number of active users of major social media in the world (January 2022)



*The latest data is data from over one year ago
** Number of daily active users

(Source) Statista (We Are Social; Hootsuite; DataReportal)[72]

[71] For detail of the initiatives in Japan, see Chapter 2, Section 2 and Chapter 4, Section 2.
[72] https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/

3. EC

Total sales in the global EC market sharply increased in 2020 due to the COVID-19 pandemic and remained high at 542.0 trillion yen (19.5% increase year-on-year) in 2021. By country, China accounted for the largest part at 178.4 trillion yen followed by the United States at 101.7 trillion yen, Japan at 28.0 trillion yen, Germany at 17.2 trillion yen, the UK at 16.6 trillion yen and Korea at 13.7 trillion yen.

Related data
Changes and forecasts for the global EC market sales, Forecasts for the EC market sales by country (2022)
Source: Statista (eMarketer), Statista, "Digital Market Outlook"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-6-6 (Data Collection)

4. Electronic payment[73]

Total global mobile transactions (mobile wallet) reached 214.4 trillion yen in 2020[74] and are expected to further expand as a result of infection control measures, issuance of coupons and points in response to the COVID-19 pandemic. By country, China has an overwhelming share followed by the United States. Japan is at the same level as some European countries.

Related data
Changes and forecasts for transaction values of global mobile payment, Transaction values of mobile payment in each country (2020)
Source: Statista, "Digital Payments report 2021", etc
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-6-8 (Data Collection)

5. Search services

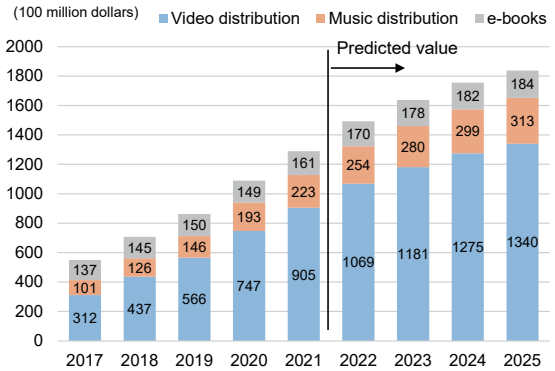
In the global search engine market, Google's share is at over 85%, but is gradually decreasing in recent years and BING is slightly increasing its share. In Japan, Google has the top share both for personal computers and smartphones. Yahoo! has around a 20% share for smartphones.

Related data
Changes in the global share of search engines, Search engine share in Japan (by terminal used)
Source: Statista (StatCounter)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-6-10 (Data Collection)

6. Video distribution, music distribution and e-books

In 2021, the global markets of video distribution, music distribution and e-books were14.1452 trillion yen in total (21.7% increase year-on-year) due to the spread of flat rate services and expansion of stay-at-home demand during the COVID-19 pandemic (**Figure 3-6-6-1**). In Japan, the market was 1.0171 trillion yen (18.4% increase year-on-year) in total.

Figure 3-6-6-1 Changes and forecasts for the size of the global video distribution, music distribution and e-book markets



(Source) Omdia, Statista "Digital Market Outlook"[75]

[73] Payment method by sending/receiving electronic data rather than cash
[74] Because 2020 is the first year of the survey, there is no year-on-year comparison.
[75] https://www.statista.com/forecasts/1294207/ebookmarket-revenue-worldwide

Each market also grew in 2021: the global video distribution market was 9.9310 trillion yen (24.5% increase from the previous year); the music distribution market was 2.4462 trillion yen (18.6% increase from the previous year); and the e-book market was 1.7680 trillion yen (11.5% increase from the previous year). The markets grew in Japan as well: the video distribution market was 461.4 billion yen (19.0% increase from the previous year); the music distribution market was 89.5 billion yen (14.3% increase from the previous year); and the e-book market was 466.2 billion yen (18.6% increase from the previous year).

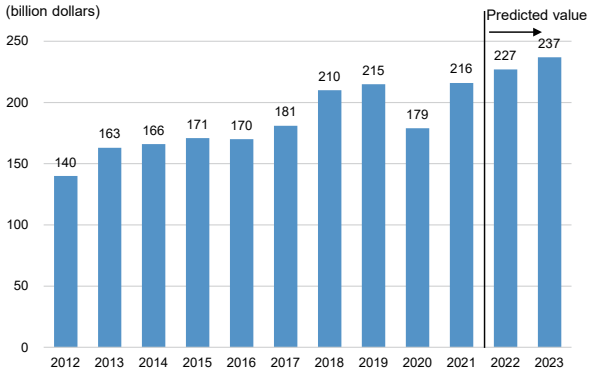
Related data
Changes in the music distribution market in Japan, Changes in the e-book market in Japan
Source: The Recording Industry Association of Japan,The All Japan Magazine and Book Publisher's and Editor's Association/The Research Institute for Publications, etc
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-6-14 (Data Collection)

7. Trends in the data center market

The number of large-scale data centers in the world continued to increase and reached around 700 at the end of the third quarter of 2021. Regarding the share of the global data center capacity, the United States account for nearly half at 49%, followed by Europe, Middle East and Africa (19%), China (15%) and Asia Pacific Region excluding China (13%).

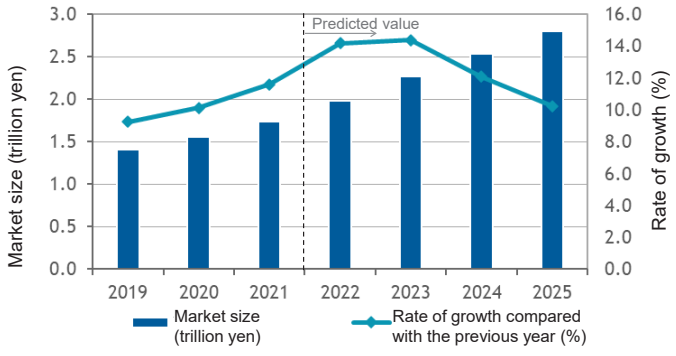
The global market size (expenditure) of data center systems was 23.7069 trillion yen (24.0% increase year-on-year) in 2021 (**Figure 3-6-7-1**). The sales temporarily decreased in 2020 due to the COVID-19 pandemic, but recovered to the level of 2019 in 2021. The market size (sales) of data center services in Japan was 1.7341 trillion yen (11.6% increase year-on-year) in 2021 (**Figure 3-6-7-2**).

Figure 3-6-7-1 Changes and forecasts for the size (expenditure) of the global data center system market



(Source) Statista (Gartner)[76]

Figure 3-6-7-2 Changes and forecasts for the size (sales) of the data center service market in Japan



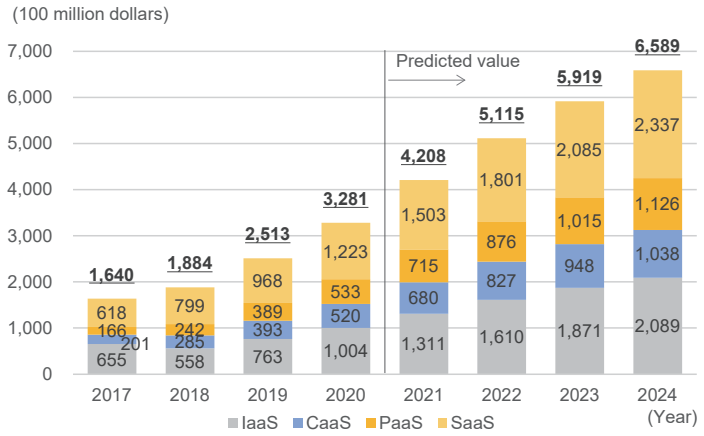
(Source) IDC Japan[77]

[76] https://www.statista.com/statistics/314596/total-data-center-systems-worldwide-spending-forecast/
[77] https://www.idc.com/getdoc.jsp?containerId=prJPJ48272821

8. Trends in the cloud service market

The size of the global public cloud service market (sales) was 35.0315 trillion yen in 2020 (27.9% increase year-on-year) (**Figure 3-6-8-1**). Particularly, growth of the PaaS market is significant. It is thought to have played an important role in corporate activities influenced by the COVID-19 pandemic.

Figure 3-6-8-1 Changes and forecasts for the size (sales) of the global public cloud service market[78]



(Source) Omdia

In the first half of 2021, the top five companies (Microsoft, Amazon, IBM, Salesforce and Google) accounted for 48.1% of the market. Oligopoly has further progressed.

Related data
Market shares of the global public cloud service, Changes and forecasts for the market size (sales) of public cloud service in Japan
Source: Omdia, IDC Japan
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-6-20 (Data Collection)

9. AI

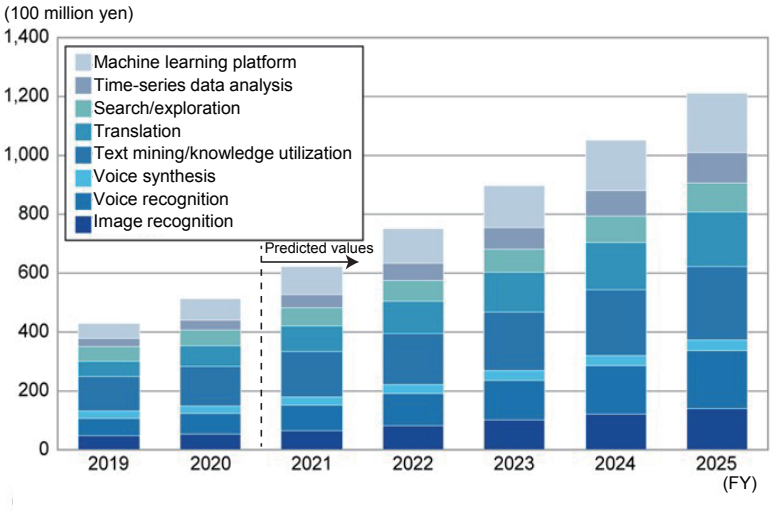
(1) Market overview

The global sales of AI-related software are expected to increase 55.7% from 382.7 billion yen of 2021 to 595.7 billion yen in 2022.[79]

Use cases and functions of AI include image/voice recognition and text mining. According to ITR survey, the sales of Japan's eight major AI markets (machine learning platform, time-series data analysis, search/exploration, translation, text mining/knowledge utilization, voice synthesis, voice recognition and image recognition) reached 51.3 billion yen (19.9% increase year-on-year) in fiscal 2020 and are expected to reach 120 billion yen in fiscal 2025 (**Figure 3-6-9-1**). By market segment, the machine learning platform that supports self-creation of an AI environment is expected to increase most.

[78] IaaS (Infrastructure as a Service) provides hardware and ICT infrastructure via the Internet.
CaaS (Cloud as a Service) provides services of other clouds on a cloud.
PaaS (Platform as a Service) provides platform to run applications via the Internet.
SaaS (Software as a Service) provides software packages via the internet.
[79] https://www.statista.com/statistics/941835/artificial-intelligence-market-size-revenue-comparisons/

Figure 3-6-9-1 Changes and forecasts for the size of Japan's eight major AI markets



*Sales of venders as converted on fiscal year base

(Source) ITR, "ITR Market View: 2021 AI Market"[80]

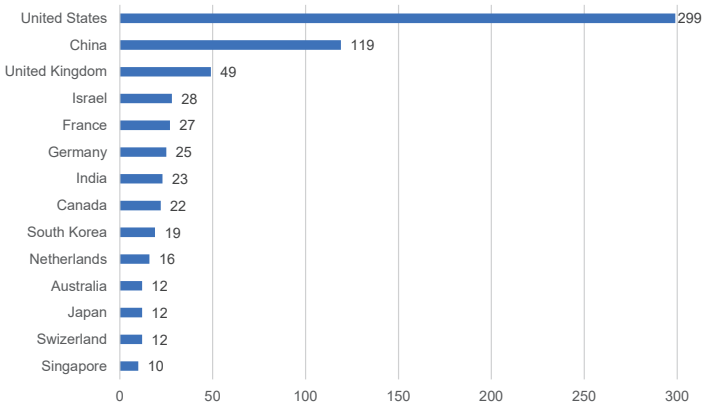
(2) Changes in key players

Key players in AI-related markets include businesses providing AI system /software and businesses providing AI chip sets such as NVIDIA. In recent years, there are new changes including entry by Microsoft, Google and other major platformers and entry from other business areas such as chip set manufacturing.

Most of the AI-related businesses have head offices in the United States or Europe.

Investments in AI-related companies are increasingly active. According to "Artificial Intelligence Index Report 2022" that is a report published by Stanford University, the United States leads in the number of newly funded companies (299) in 2021, followed by China (119) (**Figure 3-6-9-2**).

Figure 3-6-9-2 Number of newly funded AI companies (by country in 2021)



(Source) Stanford University, "Artificial Intelligence Index Report 2022"[81]

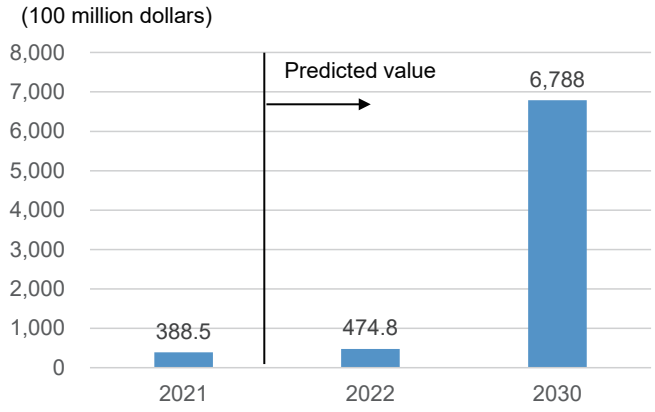
Related data
Major AI-related enterprises in the world, Forecasts for the AI market in China (in terms of spending)
Source: MIC (2022), "Survey Study on the Trends in the Market Environment Surrounding ICT",
IDC's Worldwide Artificial Intelligence Spending Guide Taxonomy, 2022: Release V1, 2022
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-6-27 (Data Collection)

[80] https://www.itr.co.jp/company/press/210826PR.html
[81] https://aiindex.stanford.edu/wp-content/uploads/2022/03/2022-AI-Index-Report_Master.pdf

10. Virtual space, etc.

Metaverse is a virtual space on the internet, where users operate their avatars to interact with other users. There are also experimental services such as product purchase in a virtual space. Thanks to the technology advancement and service development, sales of the global metaverse market reached 4.2640 trillion yen in 2021 and are expected to rapidly increase to 78.8705 trillion yen by 2030 **(Figure 3-6-10-1)**. Beyond media and entertainment, the use of metaverse is expected in various fields including education and retail.

Figure 3-6-10-1 Changes and forecasts for the size (sales) of the global metaverse market



(Source) Statista (Grand View Research)[82]

Block chain is based on cryptographic, P2P, distributed consensus and other technologies. Its features include information sharing without risk of alteration, construction of a value distribution system and guarantee of value traceability. In recent years, new digital economic zones where independent users are directly connected without depending on a specific platform are about to be constructed on distributed networks based on block chain. This is called Web 3.0, a next-generation frontier following Web 1.0 that was led by e-mail and websites and Web 2.0 that was characterized by smartphone and social media. Non Fungible Token (NFT) that is a unique digital token issued on block chain is thought to spark powerful expansion of the digital economic zone in the era of Web 3.0.

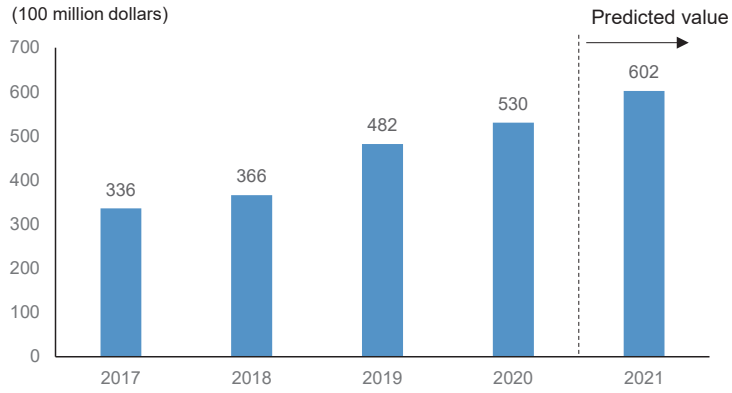
[82] https://www.statista.com/statistics/1295784/metaverse-market-size/

Section 7 Cyber Security Trends

1. Overall condition of the global market

Due to the rapid increase of targeted cyber-attacks including ransomware and other factors, the global cyber security market increased to 5.6591 trillion yen in 2020 and is expected to reach 6.6072 trillion yen in 2021 (16.8% increase year-on-year) (**Figure 3-7-1-1**).

Figure 3-7-1-1 Changes and forecasts for the size of the global cyber security market



(Source) Prepared from Estimation by Canalys[83]

Five major players - Cisco, Palo Alto Networks, Check Point, Symantec and Fortinet – have been ranked high in market share since 2017 (**Figure 3-7-1-2**). However, the top share of Cisco is around 10%. Shares are dispersed in the global cyber security market.

Figure 3-7-1-2 Major global cyber security operator

Operators	Global market share			
	2017	2018	2019 (Q1)	2020 (Q1)
Cisco	9.4%	9.9%	10%	9.1%
Palo Alto Networks	5.9%	6.9%	7%	7.8%
Check Point	6.4%	6.1%	6%	5.4%
Symantec	7.5%	6.1%	6%	4.7%
Fortinet	5.1%	5.5%	5%	5.9%

(Source) Prepared from Estimation by Canalys[84]

[83] 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/canalys-cybersecurity-2021-forecast

[84] https://www.canalys.com/newsroom/cybersecurity-market-grows-9-in-2018-to-reach-us37-billion
https://www.canalys.com/newsroom/cybersecurity-market-q1-2019
https://www.canalys.com/newsroom/canalys-cybersecurity-market-q1-2020

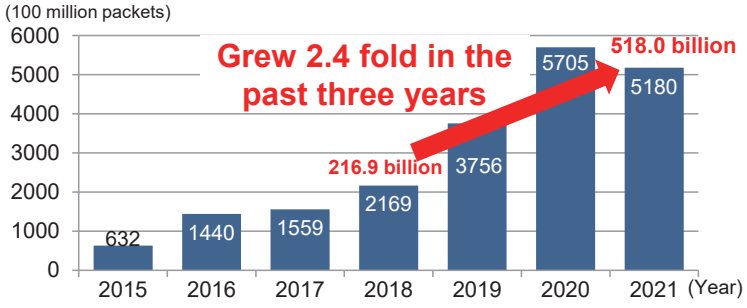
2. Present state of cyber security in Japan

i Increasing threat to cyber security

The number of cyber-attack-related communications (approximately 518.0 billion packets) as observed by Network Incident analysis Center for Tactical Emergency Response (NICTER) that is operated by NICT increased 2.4-fold in 2021 compared with three years ago (216.9 billion packets in 2018), and 3.7-fold compared with five years ago (144.0 billion packets in 2016). Huge quantities of cyber-attack-related communications are still observed (**Figure 3-7-2-1**). The number of cyber-attack-related communications observed in 2021 is equivalent to one attack per 18 seconds on each IP address.

The number decreased from 2020 to 2021. The factors include the absence of specific phenomena (large-scale backscatter[85] and a huge quantity of concentrated communications that is thought to be sent from specific senders for the purpose of survey) found in 2020.

Figure 3-7-2-1 Changes in the number of cyber-attack-related communications detected by NICTER



(Source) NICT, NICTER Observation Report 2021

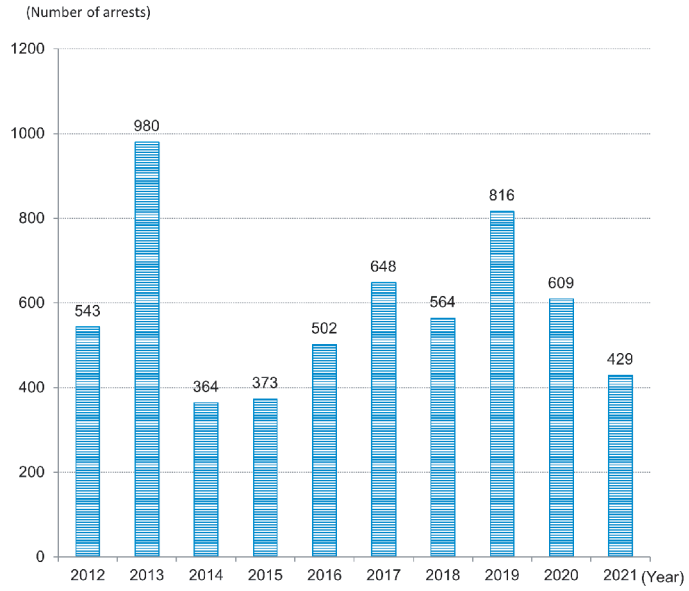
By content of cyber-attack-related communications detected by NICTER, communications targeting IoT equipment account for the largest part. The ratio of the attacks targeting Windows that was second last year decreased, while the ratio of communications to ports used for various services, which were not in the top places last year, and the ratio of other increased. Targets of attacks continued to diversify.

Related data
Targets of cyber-attack-related communications detected by NICTER
Source: Prepared from the National Institute of Information and Communications Technology, "NICTER Observation Report 2021"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-7-4 (Data Collection)

The number of arrests for violation of the Act on Prohibition of Unauthorized Computer Access (hereinafter "Unauthorized Access Prohibition Act") was 429, decreasing 180 compared with the previous year (**Figure 3-7-2-2**).

[85] Refers to answer (SYN-ACK) packet from a server that is under DoS attack (SYN-flood attack) with 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 3-7-2-2 Changes in the number of arrests for violation of the Unauthorized Access Prohibition Act



(Source) Prepared from NPA/MIC/METI,
"State of Occurrence of Unauthorized Access and R&D of Technologies related to Access Control Functions"

Since November 2021, there have been signs of resumption of Emotet attack activities. In February 2022, in response to its rapid spread, the Information-technology Promotion Agency (IPA) and JPCERT/CC called attention to the attack.

Considering the increased risk of cyber-attack cases, an alert calling for strengthening of cyber security measures was sent out by METI on February 23, 2022, by METI, MIC, MHLW, MLIT, NPA and Cabinet Secretariat Center for CyberSecurity (NISC) on March 1, 2022, and by METI MIC, NPA and NISC on March 24. On April 25 of the same year, METI, MIC, NPA and NISC advised to take countermeasures toward the long vacation.

ii Wireless LAN security trends

According to an attitude survey conducted by MIC in March 2021 to understand security awareness of wireless LAN users, most respondents know the existence of public wireless LAN (approx. 96%), but only about half of them are actually using it. "Security concern" is the top reason for not using public wireless LAN, way ahead of other reasons. About 90% of public wireless LAN users feel anxiety about security, but half of them answered that this is "vague sense of unease."

iii Introduction state of sender domain authentication technologies

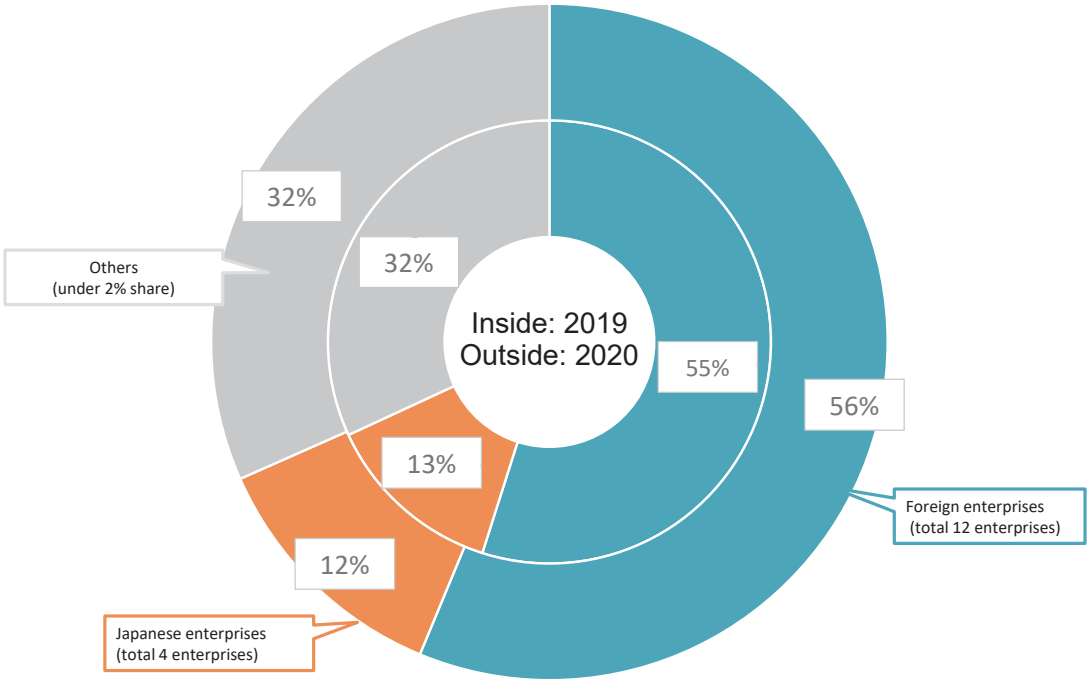
Introduction rate of "sender domain authentication technologies" to prevent spoofed e-mails is slightly increasing: about 67.5% for SPF and about 2.1% for DMARC in December 2021.

Related data
State of introduction of sender domain authentication technologies to IP domains
Source: MIC, "State of setting sender domain authentication technology in IP domain names
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-7-13 (Data Collection)

iv Dependence on overseas cyber-security products

We divided enterprises with over 2% share (in sales) in the domestic information security product market in 2020 into foreign enterprises and domestic enterprises, and totalized their sales in 2019 and 2020. Foreign enterprises have a large share of sales both in 2019 and 2020. Japan continues to heavily rely on overseas operators for cyber-security products (**Figure 3-7-2-3**).

Figure 3-7-2-3 Domestic information security product market share (sales) (2019 to 2020)



(Source) Prepared from IDC Japan, July 2021, "Japan IT Security Products Market Shares, 2020: External Threat Measures and Internal Threat Measures Drive the Market" (JPJ46567421)

Section 8 Digital Usage Trends

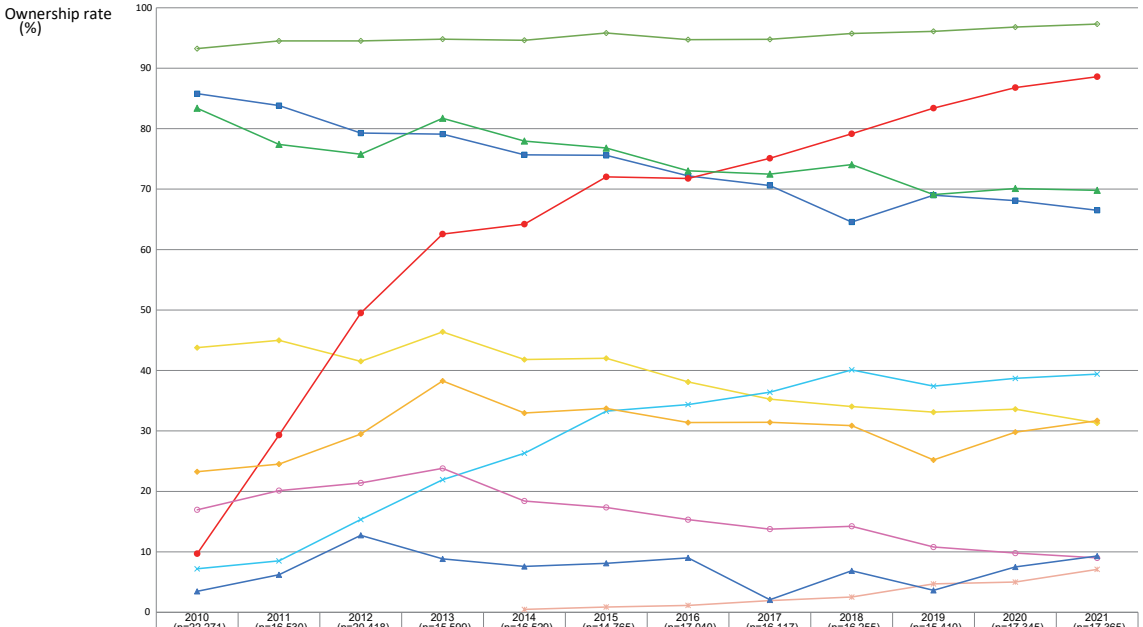
1. Digital usage trends in the daily life of the public

(1) Overview

i Ownership of information communication equipment

Regarding terminals for internet connection necessary to use digital technologies, the rate of household ownership of any "mobile terminal" is 97.3%: rates of "smartphone" and "personal computer" are 88.6% and 69.8% (included in the total) respectively (**Figure 3-8-1-1**).

Figure 3-8-1-1 Changes in the rate of household ownership of information communication equipment



	2010 (n=22,271)	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)
Fixed-line telephone	85.8	83.8	79.3	79.1	75.7	75.6	72.2	70.6	64.5	69.0	68.1	66.5
FAX	43.8	45.0	41.5	46.4	41.8	42.0	38.1	35.3	34.0	33.1	33.6	31.3
Mobile devices (overall)	93.2	94.5	94.5	94.8	94.6	95.8	94.7	94.8	95.7	96.1	96.8	97.3
Smartphones	9.7	29.3	49.5	62.6	64.2	72.0	71.8	75.1	79.2	83.4	86.8	88.6
Computers	83.4	77.4	75.8	81.7	78.0	76.8	73.0	72.5	74.0	69.1	70.1	69.8
Tablets	7.2	8.5	15.3	21.9	26.3	33.3	34.4	36.4	40.1	37.4	38.7	39.4
Wearable devices	—	—	—	—	0.5	0.9	1.1	1.9	2.5	4.7	5.0	7.1
Home game consoles	23.3	24.5	29.5	38.3	33.0	33.7	31.4	31.4	30.9	25.2	29.8	31.7
Portable music players	17.0	20.1	21.4	23.8	18.4	17.3	15.3	13.8	14.2	10.8	9.8	9.0
Smat appliances	3.5	6.2	12.7	8.8	7.6	8.1	9.0	2.1	6.9	3.6	7.5	9.3

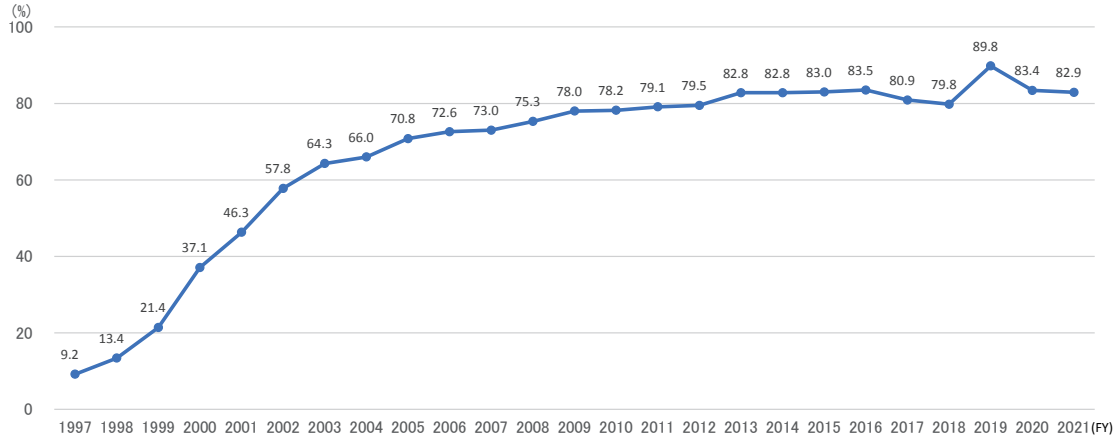
(Source) MIC, "Communications Usage Trend Survey"[86]

ii Internet usage trend

The internet usage rate (individuals) was 82.9% in 2021 (**Figure 3-8-1-2**). By terminal, rate of "smartphone" (68.5%) is higher than that of "personal computer" (48.1%) by 20.4 points.

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

Figure 3-8-1-2 Changes in the internet usage rate (individuals)[87]



(Source) MIC, "Communications Usage Trend Survey"

Related data
Type of terminals for using the internet (individuals)
Source: MIC, "Communications Usage Trend Survey"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-8-4 (Data Collection)

iii Media usage time

Since 2012, the Institute for Information and Communications Policy of MIC has surveyed the usage time, time slots of usage, purpose and reliability of information and communications media and information behavior as joint research with Professor HASHIMOTO Yoshiaki at the School of Arts and Science, Tokyo Woman's Christian University, and others[88]. [89] Below is an overview of the usage time, etc. of information and communication media based on the survey result of fiscal 2021.[90]

(i) Average usage time[91] and doers' ratio[92] of major media

Figure 3-8-1-3 shows average usage time and doers' ratio of "television viewing (real-time)",[93] "television viewing (recorded program)", "Internet use"[94], "newspaper reading" and "radio listening."

Average usage time of "television viewing (real-time)" and "Internet use" of all respondents is long for both weekdays and holidays. On weekdays, "Internet use" is longer than "television viewing (real-time)" for the second straight year. Doers' ratio of "television viewing (real-time)" is lower than the doers' ratio of "Internet use" for both weekdays and holidays.

By age group, average usage time of Internet increased or remained almost flat except among teens on weekdays and teens and fifties on holidays. "Television viewing (real-time)" is longer with older age groups, and longest among sixties. On holidays, doers' ratio of "Internet use" is highest in the 10s, 20s, 30s and 40s age groups, while doers' ratio of "television viewing (real-time)" is highest in the 50s and 60s age groups. On weekdays, doers' ratio of "Internet use" of fifties exceeded their doers' ratio of "television viewing (real-time)" for the first time. Doers' ratio of "newspaper reading" is also higher with older age.

[87] Because the design of questionnaire of the 2019 survey is partially different compared with other years, interannual comparison requires caution.
[88] Professor KITAMURA Satoshi at the Faculty of Communication Studies, Tokyo Keizai University, and Project Assistant Professor KAWAI Daisuke at the Center for Integrated Disaster Information Research (CIDIR), Interfaculty Initiative in Information Studies, the University of Tokyo.
[89] Survey on Usage Time of Information and Communication 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. Register of January 2021 was used for the 2021 survey.) were visited and received questionnaires based on random location quota sampling.
[90] FY2021 survey was conducted from November 30 to December 6. The values of 2017 in the figure show the result of the survey of 2017, while values of 2018 and after are results of the respective fiscal year.
[91] The total time of the referred information activity per a survey day is divided by the number of the survey subjects. Average time is calculated by including the respondents who did not do the activity throughout the day.
[92] For weekdays, a percentage of all persons who did the referred information activity during two surveyed days was calculated and the average value of the two days was obtained. Rate of holiday is the rate of the survey date.
[93] Television viewing (real-time): Real-time television viewing with any equipment not limited to TV receiver
[94] Internet use: regardless of equipment, the term refers to use of services enabled by internet connection, which include email, websites, social media, video sites, and online games.

Figure 3-8-1-3 Average usage time and doers' ratio of major media

[One weekday]

		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	2017	159.4	17.2	100.4	10.2	10.6	80.8%	15.9%	78.0%	30.8%	6.2%
	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%
10s	2017	73.3	10.6	128.8	0.3	1.5	60.4%	13.7%	88.5%	3.6%	1.4%
	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%
20s	2017	91.8	13.9	161.4	1.4	2.0	63.7%	14.4%	95.1%	7.4%	3.0%
	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%
30s	2017	121.6	15.3	120.4	3.5	4.3	76.5%	15.5%	90.6%	16.6%	2.3%
	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%
40s	2017	150.3	19.8	108.3	6.3	12.0	83.0%	17.3%	83.5%	28.3%	7.9%
	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%
50s	2017	202.0	19.1	77.1	16.3	19.5	91.7%	16.1%	76.6%	48.1%	9.1%
	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%
60s	2017	252.9	20.0	38.1	25.9	17.3	94.2%	16.6%	45.6%	59.9%	9.5%
	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%

[One holiday]

		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	2017	214.0	27.2	123.0	12.2	5.6	83.3%	22.2%	78.4%	30.7%	4.5%
	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%
10s	2017	120.5	20.6	212.5	0.5	3.6	66.2%	19.4%	92.1%	3.6%	1.4%
	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%
20s	2017	120.3	26.6	228.8	2.4	2.9	67.6%	24.5%	97.7%	7.9%	2.3%
	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%
30s	2017	166.9	26.4	136.0	3.8	2.8	79.4%	21.8%	90.5%	14.1%	1.9%
	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	69.8%	22.7%	92.3%	4.0%	1.2%
40s	2017	213.3	31.6	109.2	7.6	4.7	83.8%	25.2%	84.4%	29.6%	5.0%
	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%
50s	2017	265.7	30.8	82.4	16.1	7.4	93.4%	23.3%	73.3%	44.6%	5.8%
	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%
60s	2017	320.7	23.6	44.6	33.0	10.2	96.7%	18.1%	46.1%	62.8%	7.9%
	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%

(Source) Institute for Information and Communications Policy, MIC, "FY2021 Survey on Usage Time of Information and Communication Media and Information Behavior"

(ii) Positioning of the internet as media

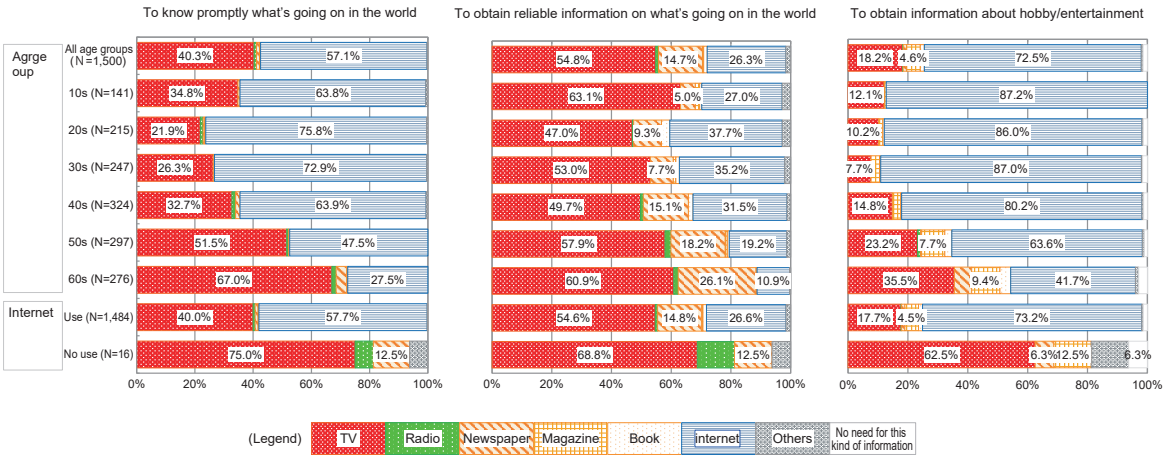
Figure 3-8-1-4 compares use of Internet as media with other media for each purpose of use.

The most used media "to know promptly what's going on in the world" of all respondents is "Internet". By age group, "Internet" is more used than "television" for this purpose by respondents in their 10s, 20s, 30s and 40s, while "television" is most used by respondents in their 50s and 60s.

The most used media "to obtain reliable information on what's going on in the world" is "television" in total of all age groups as well as in each age group. The ratio of "newspaper" increases with higher age and exceeds the ratio of "Internet" in the 60s bracket.

The most used media "to obtain information about hobby/entertainment" is "Internet" in all and each age groups. The ratio is over 80% among the respondents in their 10s, 20s, 30s and 40s.

Figure 3-8-1-4 Media use by purpose (most used media of all age groups, by age group and by use of the internet)



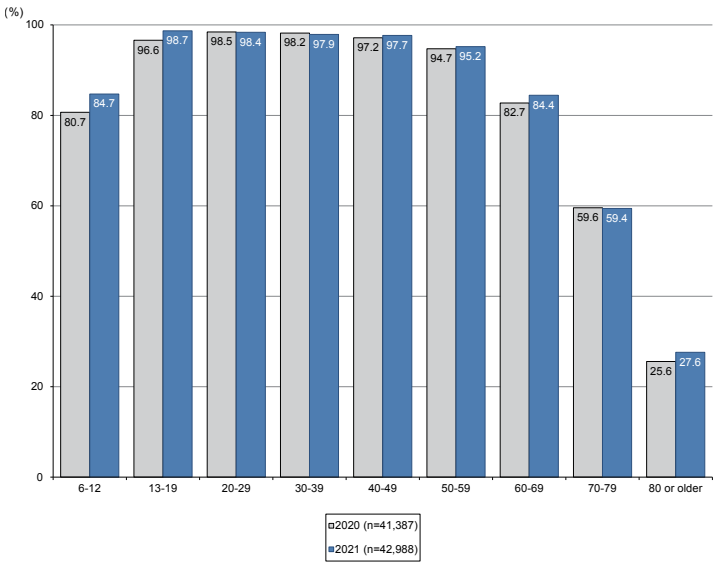
(Source) Institute for Information and Communications Policy, MIC, "FY2021 Survey on Usage Time of Information and Communication Media and Information Behavior"

(2) Challenges in utilization of digital technologies

i Digital divide due to age

According to "Communications Usage Trend Survey" conducted by MIC, Internet usage rate is over 90% in age groups from 13 to 59, but the usage rate decreases with older age groups starting from 60 (**Figure 3-8-1-5**).

Figure 3-8-1-5 Internet usage rate by age group

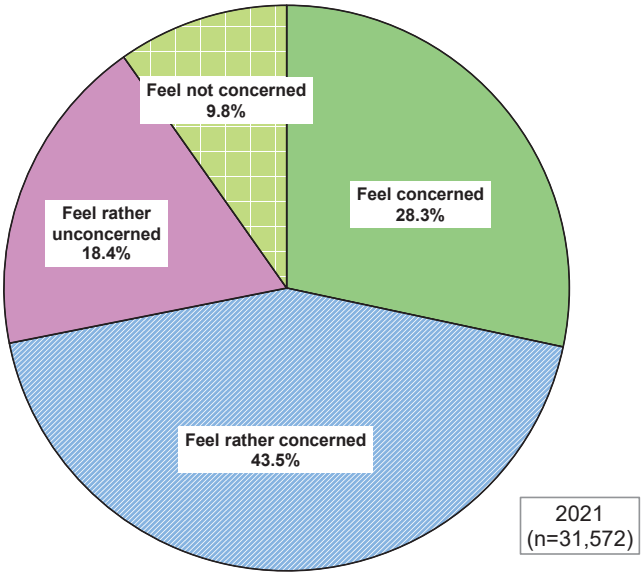


(Source) MIC "Communications Usage Trend Survey"

ii Concerns about and resistance to use of digital technologies

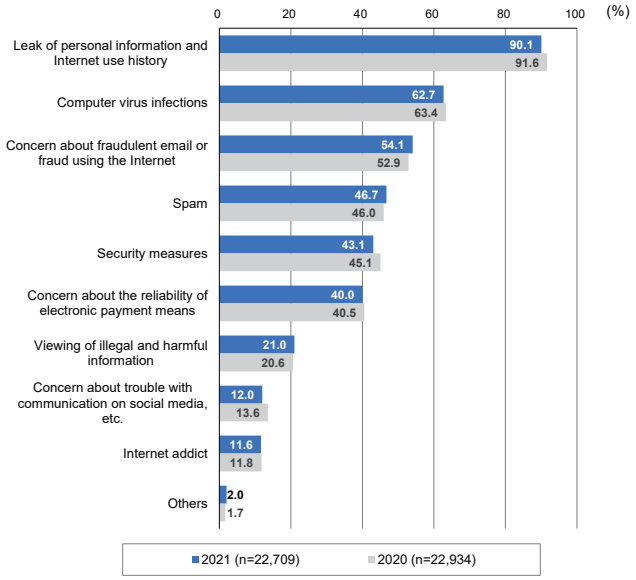
According to the "Communications Usage Trend Survey" conducted by MIC, about 75% of Internet users aged 12 or older have some concerns about using the Internet (**Figure 3-8-1-6**). The most common concern is in relation to "leaks of personal information and internet usage history" at 90.1%, followed by "computer virus infections" (62.7%) and "fraudulent email or fraud using internet" (54.1%) (**Figure 3-8-1-7**).

Figure 3-8-1-6 Responses of individuals regarding concerns about using the Internet



(Source) MIC "Communications Usage Trend Survey"

Figure 3-8-1-7 Content of the concern when using internet (multiple answers)



(Source) MIC "Communications Usage Trend Survey"

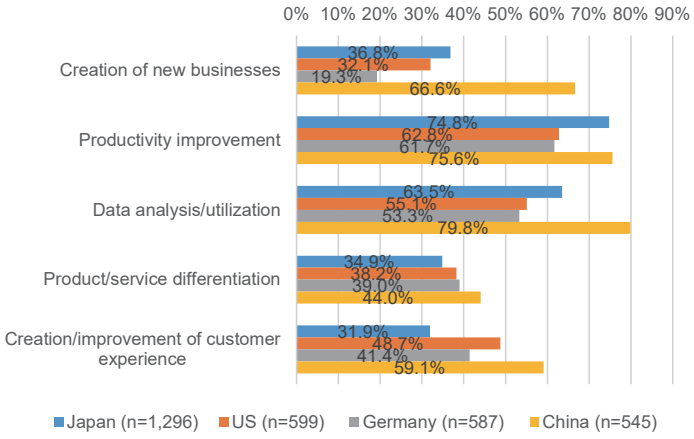
2. Trends in utilization in corporate activities

(1) Digital Transformation (DX)[95]

i Current status of digital transformation initiatives

Ratio of enterprises advancing initiatives for DX (total of "making company-wide efforts on DX based on a company-wide strategy", "some departments are working on DX based on a company-wide strategy" and "each department is separately working on DX") was about 56% in Japan, which is lower than about 79% in the United States.[96] The top purpose of DX efforts was "productivity improvement" among Japanese enterprises at 75%, while it was "data analysis/utilization" among Chinese companies at 80% (**Figure 3-8-2-2**).

Figure 3-8-2-2 Purpose of digitalization (bycountry)



(Source) MIC (2022), "Survey Research on R&D on the Latest Information and Communications Technologies and the Trends of Use of Digital Technologies in Japan and Abroad"

ii Effects of digital transformation

Effects of digitalization were investigated by aspects of "Creation of new businesses", "Productivity improvement", "Data analysis/utilization" and "Product/service differentiation.[97] In all aspects, the number of responding companies answering "more than expected" are smaller in Japan compared with the US, China and Germany, while the number of responses "effects did not come up to our expectation" of Japan is largest among four countries.

Related data
Effect of digitalization aimed at creation of new businesses (by country), Effect of digitalization aimed at productivity improvement (by country), Effect of digitalization aimed at data analysis/utilization (by country), Effect of digitalization aimed at product/service differentiation (by country)
Source: MIC (2022), "Survey Research on R&D on the Latest Information and Communications Technologies and the Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-8-27 (Data Collection)

iii Challenges in promoting digital transformation

As challenges/barriers for digitalization, the percentage of Japanese enterprises answering "shortage of human resources" (67.6%) is by far larger in comparison with enterprises of the United States, China and Germany. The next is "lack of digital technology knowledge/literacy (44.8%)". Challenges/barriers related to human resources account for a large part (**Figure 3-8-2-3**).

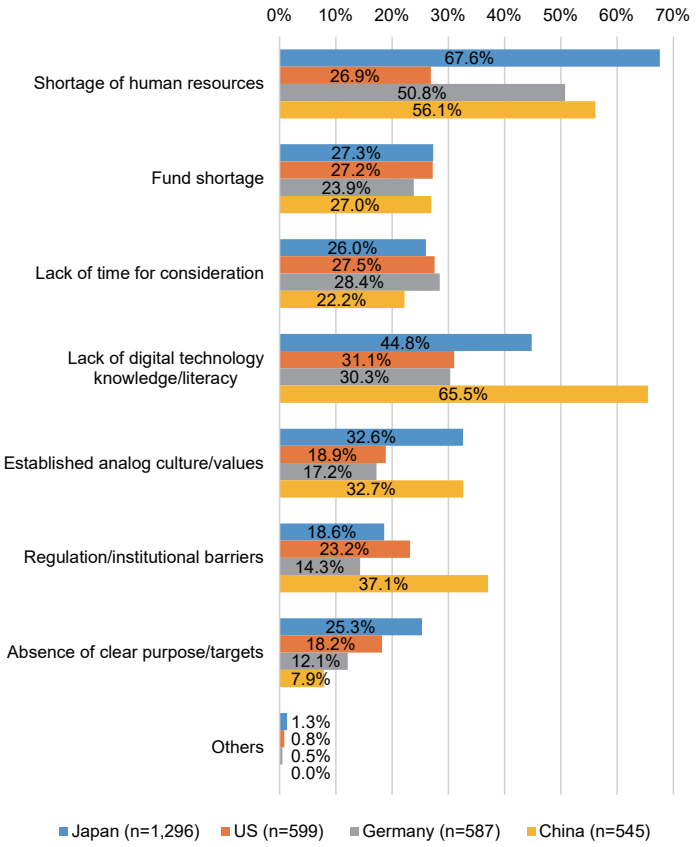
Regarding shortage of digital human resources held by enterprises ("CIO, CDO and other digitalization leaders" and "AI/data analysis experts"), the sum of "very much lacking" and "slightly lacking" is over 50% among Japanese enterprises. Overall, they are short of digital

[95] Here, "digital transformation" is defined as "while responding to drastic changes in external ecosystems (customers and markets), and leading transformation of the internal ecosystem (organization, culture and employees), enterprises create values and establish their competitive advantage by transforming both internet and real customer experiences through new products, services and business models taking advantage of the 3rd platform technologies (cloud, mobility, big data analytics and social). (Source) "Declaration to be the World's Most Advanced IT Nation - Basic Plan on the Advancement of Public and Private Sector Data Utilization" (Cabinet decision on July 17, 2020) (https://cio.go.jp/node/2413)
[96] https://www.ipa.go.jp/files/000093706.pdf
[97] The question is for the enterprises who chose any of the aspects as the purpose of digitalization and totaled the responses of each purpose.

human resources. In particular, "AI/data analysis experts" are "very much lacking" in more than 30% of the enterprises. The shortage is more serious in Japan compared with the US and Germany.

Regarding reasons for the shortage of digital human resources in enterprises, both "system to employ digital human resources is not yet established" and "system to develop digital human resources is not yet established" are about 40% for the two types of digital human resources among Japanese enterprises. The survey also investigated qualitative aspects (necessary skills) of the efforts to secure digital human resources by enterprises of each country: "new and mid-term hiring" is the most common answer of US enterprises, while "reshuffling and training of existing human resources" is the most frequent among Japanese enterprises.

Figure 3-8-2-3 Challenge/barrier of digitalization (by country)



MIC (2022), "Survey Research on R&D on the Latest Information and Communications Technologies and the Trends of Use of Digital Technologies in Japan and Abroad"

Related data
Questionnaire survey on the state of shortage in digital human resources, reason of the shortage and efforts for securing (by country and type of digital human resources)
Source: MIC (2022), "Survey Research on R&D on the Latest Information and Communications Technologies and the Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-8-35 (Data Collection)

(2) Telework[98]

i Use situation

Slightly under 60% of people in the United States and Germany, and over 70% of people in China have experienced telework, while the rate is around 30% in Japan (**Figure 3-8-2-4**). For reason of difficulty to implement telework, the environmental and cost side including internet connections are often cited in other countries, while "rules/systems are not established" is the most common answer at 35.7% in Japan.

Looking at telework usage in Japan by age group, younger people are more positive about telework. Usage rate of the 20-30 age group is highest at around 35%, while the ratio of the respondents who think "it is not necessary" is lowest in this age group (**Figure 3-8-2-5**).

Figure 3-8-2-4 Telework use situation (by country)

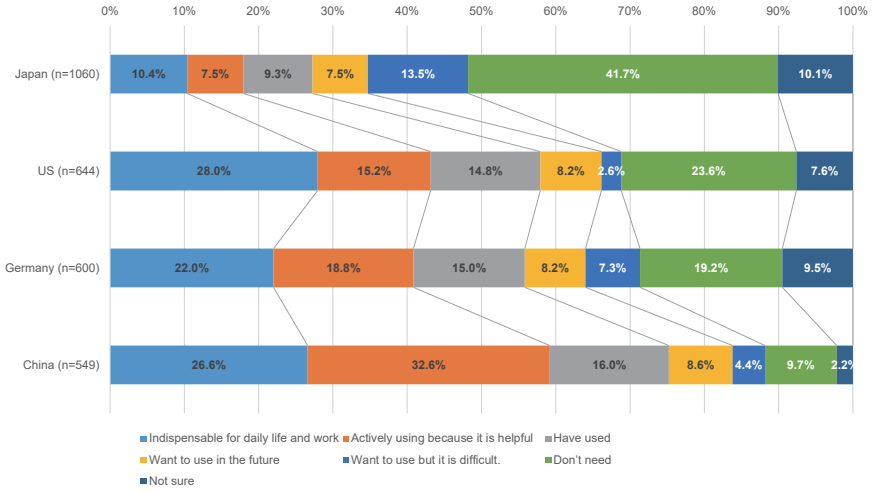
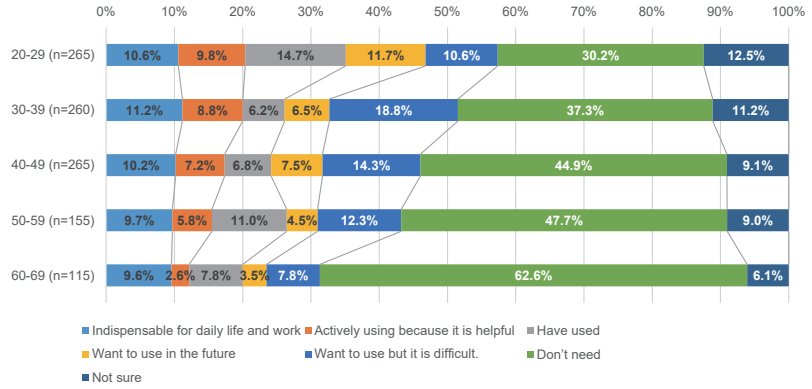


Figure 3-8-2-5 Telework use situation in Japan (by age group)



(Source) MIC (2022) "Survey Research on R&D on the Latest Information and Communications Technologies and the Trends of Use of Digital Technologies in Japan and Abroad"[99]

Related data
Questionnaire survey on reasons of difficulty to use telework (by country)
Source: MIC (2022), "Survey Research on R&D on the Latest Information and Communications Technologies and the Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-8-43 (Data Collection)

ii Trends of telework security in Japan

According to a survey conducted by MIC for the period from December 2021 to January 2022 to assess the actual state of telework security at enterprises and others, introduction of telework progressed triggered by the COVID-19 pandemic and over 75% of the enterprises plan to continue to use telework: it has been rooted in the implementing enterprises. In introduction of telework, "security of security" remains a big challenge of implementing enterprises.[100]

[98] For policy trends related to telework at MIC, see Chapter 4, Section 6-2.
[99] This survey research is based on web questionnaire of residents in Japan, the US, Germany and China in March 2022 to grasp the trends in digital technology use by the citizens. For this reason, the respondents may include more experienced digital users compared with mail survey and visit survey, which requires attention.
[100] Survey on actual condition of telework security (FY2021): https://www.soumu.go.jp/main_sosiki/cybersecurity/telework/

Related data
Telework usage status, Challenges for introducing telework (multiple answers)
Source: Prepared from MIC "Fiscal 2021 Result of Survey on Actual Condition of Telework Security"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-8-44 (Data Collection)

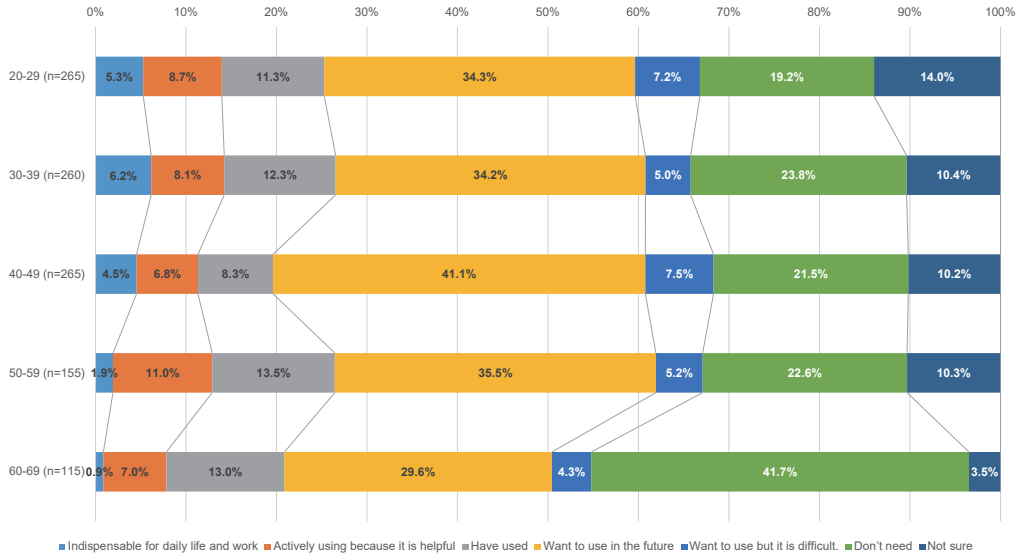
3. Trends in regard to digital usage in administration

(1) Use situation of electronic administrative services (electronic applications, filing and notifications)

The percentage of respondents who answered that they have used electronic administrative services (electronic applications, filing or notifications) is over 60% in other countries, whereas the percentage is as low as 23.8% in Japan. Intention to use is also lower compared with other countries. Cited reasons for the difficulty of use include insufficient speed and stability of Internet connection in foreign countries, while "security concern" is the most common answer in Japan.

By age group in Japan, use rate is from 20% to around 25% in all age groups. Intention to use is over 30% in age groups from the 20s to 50s, but the ratio of "not necessary" is large in the 60s (**Figure 3-8-3-1**).

Figure 3-8-3-1 Use situation of electronic administrative services in Japan (by age group)



(Source) MIC (2022) "Survey Research on R&D on the Latest Information and Communications Technologies and the Trends of Use of Digital Technologies in Japan and Abroad"

Related data
Questionnaire survey of Use situation of electronic administrative services (electronic applications, filing and notifications) and reasons for difficulty to use (by country)
Source: MIC (2022), "Survey Research on R&D on the Latest Information and Communications Technologies and the Trends of Use of Digital Technologies in Japan and Abroad"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-8-47 (Data Collection)

(2) Development status of data linkage and authentication infrastructure

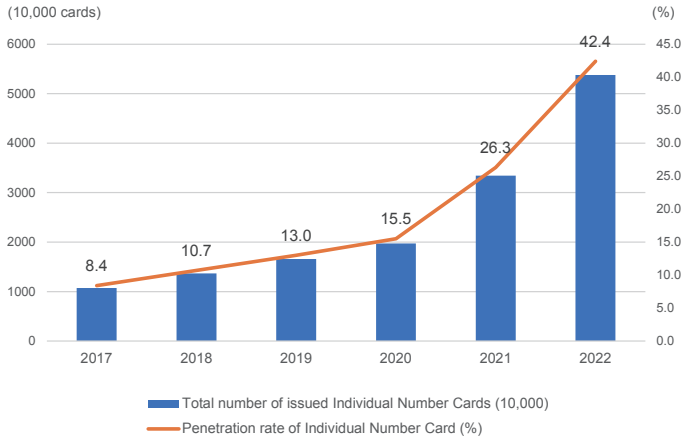
i Individual Number Card

Under the acts related to digital reform[101] promulgated in May 19, 2021, use of the individual number system is promoted, which includes: digitalization of the affairs regarding national qualifications including medical license using individual numbers; and establishment of a system to voluntarily register an account for receipt of public money and to use the account for receipt of emergency benefits.

Penetration rate of Individual Number Card was 26.3% in March 2021, but rose to 42.4% in March 2022 (**Figure 3-8-3-2**).

[101] the Basic Act on the Formation of a Digital Society (Act No.35 of 2021), the Act on the Establishment of the Digital Agency (Act No.36 of 2021), the Act on the Arrangement of Related Laws for the Formation of a Digital Society (Act No.37 of 2021), the Act on Registration of Saving Account for Prompt and Sure Implementation of Public Benefits, etc. (Act No.38 of 2021), the Act on the Management, etc. of Deposit Accounts by Using Individual Numbers Based on the Intention of Depositors (Act No. 39 of 2021), and the Act on the Standardization of Local Government Information Systems (Act No. 40 of 2021)

Figure 3-8-3-2 Penetration rate of Individual Number Card



*Number of issued card as of March of each year
(Source) Prepared from MIC, "issuance status of Individual Number Card"[102]

ii Base registry

Development of base registry[103] is indispensable for once-only administrative procedures and creation of Smart City and other new services. In Japan, actions have been taken according to the Base Registry Roadmap formulated in December 2020.[104] The roadmap sets the target year of data development at 2030 and plans to construct a system for this target within five years.

Digital Agency opened a demonstration site of "registry catalog" and "address base registry" which is a pilot project of base registry on April 22, 2022.[105] As of May, 6, 2022, 7,464 data sets are registered: addressing system/residence master data set of 721 entities and event data set of 128 entities are available.

EU positions "base registry" as one of its top priority policies and sets the goal of constructing "European Data Space" that is "single market of data" in "A European strategy for data "[106] published in February 2020 in order to realize "once-only principle" that is one of the goals of the Tallinn Declaration in 2017.

[102] https://www.soumu.go.jp/kojinbango_card/kofujokyo.html
[103] Data registry refers to "a database of basic social data, such as people, corporations, land, buildings, and qualifications, that is registered and published by public organizations and referenced in various situations, and serves as the foundation of a society that ensures accuracy and currency" (https://www.kantei.go.jp/jp/singi/it2/dgov/data_strategy_tf/dai4/siryou1-2.pdf).
[104] https://www.soumu.go.jp/main_content/000725147.pdf
[105] https://registry-catalog.registries.digital.go.jp/dataset
[106] "A European strategy for data" (European Commission, February 19, 2020) (https://ec.europa.eu/info/sites/info/files/com m unication-european-strategy-data-19feb2020_en.pdf)

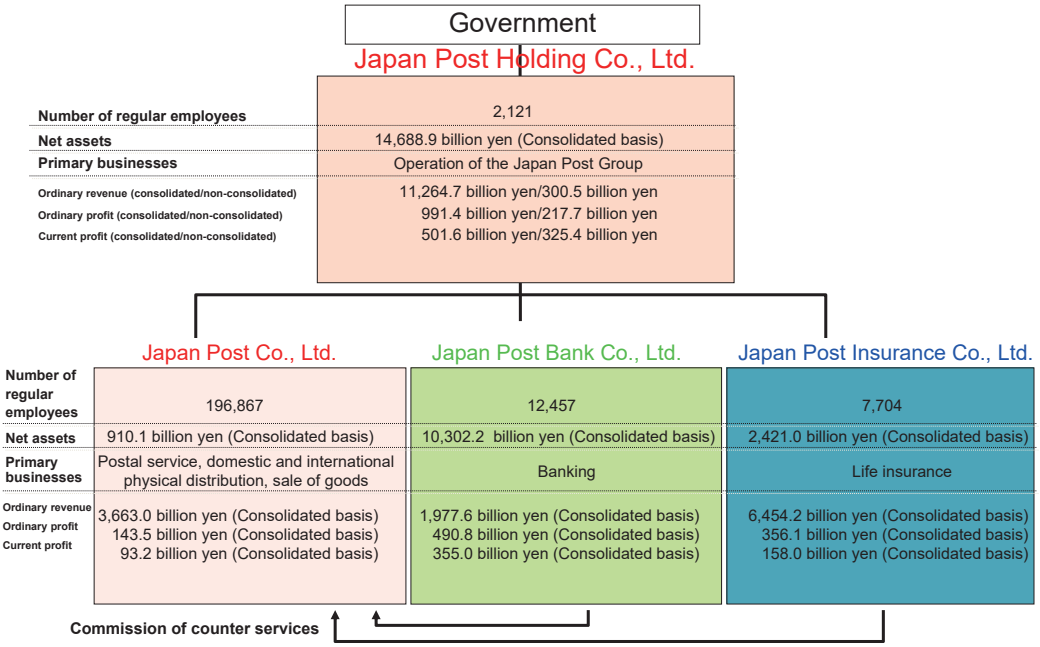
Section 9 Trends in Postal Service and Correspondence Delivery Business

1. Postal service

(1) Japan Post Group

Since October 1, 2012, Japan Post Group has a four-company structure under Japan Post Holdings Co., Ltd. (**Figure 3-9-1-1**). Japan Post Holdings holds 100% of the issued stocks of Japan Post, 89.0% of the issued stocks of Japan Post Bank and 59.9% of the issued stocks of Japan Post Insurance (as of the end of February 2022).

Figure 3-9-1-1 Organization of the Japan Post Group



*1 Numbers of (regular) employees, branch offices, etc. are as of September 20, 2021

*2 "Current profit" of the respective companies is "current profit belonging to the shareholders of the parent company" or "current loss belonging to the shareholders of the parent company"

(Source) Prepared from 2022 March settlement materials, 2021 disclosure document, etc.

In the fiscal 2021 consolidated statement of the Japan Post Group, ordinary revenue was about 11.3 trillion yen, while current profit was 501.6 billion yen (**Figure 3-9-1-2**).

Figure 3-9-1-2 Financial status of the Japan Post Group

(100 million yen)

Fiscal year	2016	2017	2018	2019	2020	2021
Ordinary revenue	133,265	129,203	127,749	119,501	117,204	112,647
Ordinary profit	7,952	9,161	8,306	8,644	9,141	9,914
Current profit	-289	4,606	4,794	4,837	4,182	5,016

(Source) Prepared from "Summary of Settlement of Accounts" of Japan Post Holding

(2) Japan Post Co., Ltd.

i Financial condition

In the fiscal 2021 consolidated statement of the Japan Post, operating revenue was about 3.6569 trillion yen, operating profit was 148.2 billion yen, ordinary profit was 143.5 billion yen, and current profit was 93.2 billion yen: both income and profit decreased.

By business segment, operating revenue of the postal service/physical distribution was 2.412 trillion yen, operating expenses were 1.9389 trillion yen, and operating profit was 102.2 billion yen decreasing 21.4 billion yen over the previous term, while operating revenue of the post office counter service was 1.517 trillion yen, operating expenses were 1.1272 trillion yen, and operating profit was 24.5 billion yen decreasing 13.1 billion yen over the previous term (**Figure 3-9-1-3**).

Figure 3-9-1-3 Changes in operating profit/loss of Japan Post (consolidated)

(100 million yen)

Fiscal year	2016	2017	2018	2019	2020	2021
Postal/physical distribution	120	419	1,213	1,475	1,237	1,022
Post office counter service	633	397	596	445	377	245
International physical distribution	56	102	103	-86	35	287
Japan Post (consolidated)	534	865	1,820	1,790	1,550	1,482

*The business segment "financial counter service" was renamed to "post office counter service" in the fiscal term ending March 2022.

(Source) Prepared from Japan Post Holdings, "Summary of Settlement of Accounts"

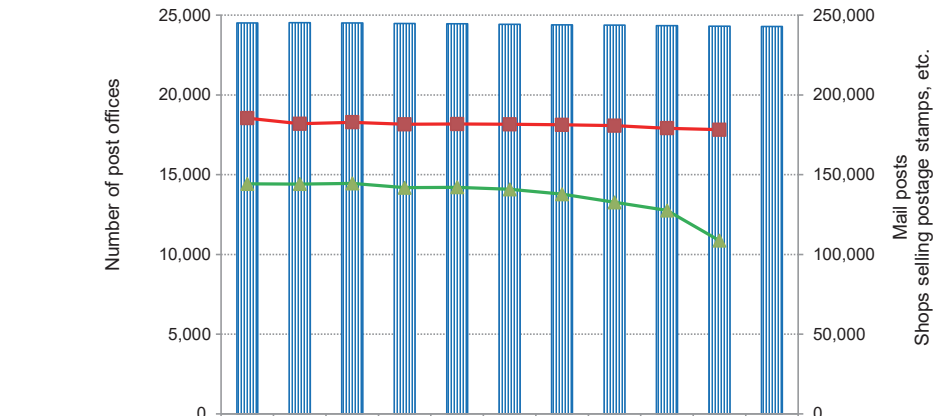
Operating profit of the postal service of Japan Post was 24.0 billion yen in fiscal 2020.

Related data
Balance of postal service
Source: Prepared from Japan Post Co., Ltd., "Status of postal service balance"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-9-3 (Data Collection)

ii Number of postal-service-related facilities

At the end of fiscal 2021, the Number of post offices was 24,284. The number has been almost flat (**Figure 3-9-1-4**).

Figure 3-9-1-4 Changes in the number of postal-service-related facilities



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Post offices	24,514	24,525	24,511	24,470	24,452	24,421	24,395	24,367	24,341	24,311	24,284
Mail posts	185,409	181,895	182,839	181,521	181,692	181,523	181,221	180,774	179,129	178,211	-
Shops selling postage stamps, etc. and places selling stamps	144,155	144,153	144,504	141,888	142,104	140,881	137,790	132,613	127,633	108,624	-

(Source) Prepared from materials disclosed by Japan Post Group, and Japan Post's website "Information on the number of postal offices (open data)"

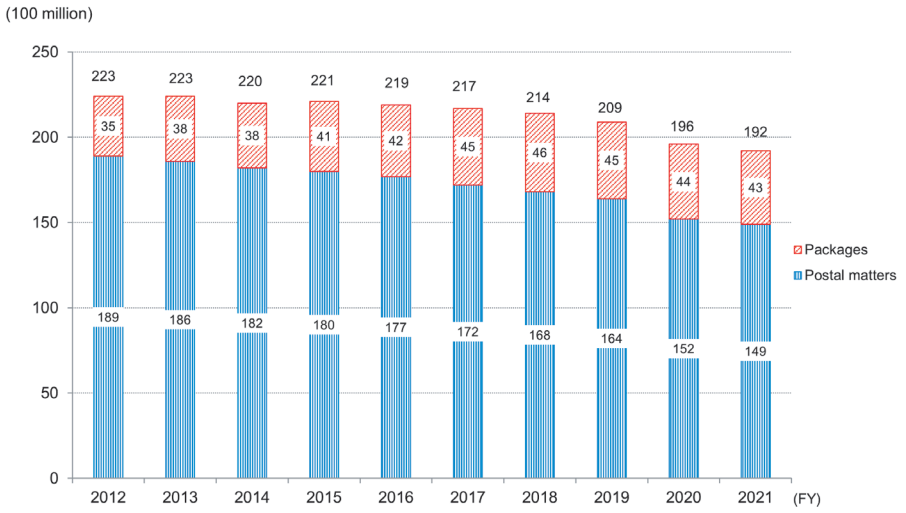
Looking at the details of the number of post offices at the end of fiscal 2021: the number of directly managed post offices (including satellite offices and currently closed offices) is 20,145, while the number of simple post offices (including currently closed simple post offices) was 4,139.

Related data
Breakdown of the number of post offices (end of fiscal 2021)
Source: Prepared from Japan Post Co., Ltd. Website, "Information on the number of postal offices (open data)"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-9-5 (Data Collection)

iii Number of accepted postal matters

The total number of accepted postal matters was 19.19273 billion in fiscal 2021 (**Figure 3-9-1-5**).

Figure 3-9-1-5 Changes in the total number of accepted postal matters



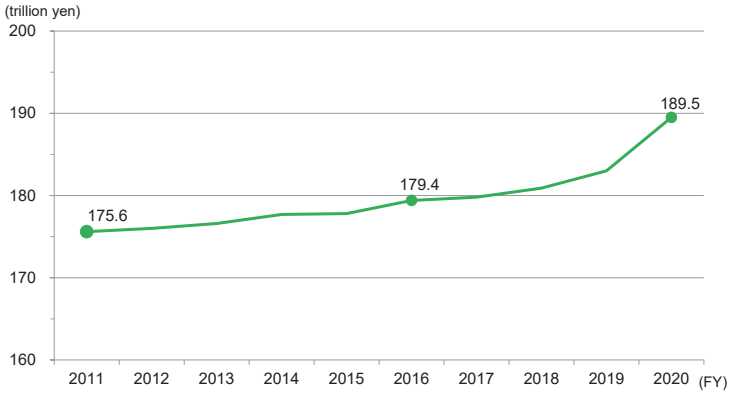
* Yu-pack and Yu-mail are not small parcels under the Postal Act, but freight under the Motor Truck Transportation Business Act
(Source) Japan Post material, annual "Number of accepted postal matters, etc."

(3) Japan Post Bank Co., Ltd.

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

The balance of deposits of Japan Post Bank (including postal savings since the time of the government management) was 189.5 trillion yen at the end of fiscal 2020. The balance decreased 70.5 trillion yen (27.1%) form the peak at 260.0 trillion yen at the end of fiscal 1999.

Figure 3-9-1-6 Changes in the balance of deposits with Japan Post Bank



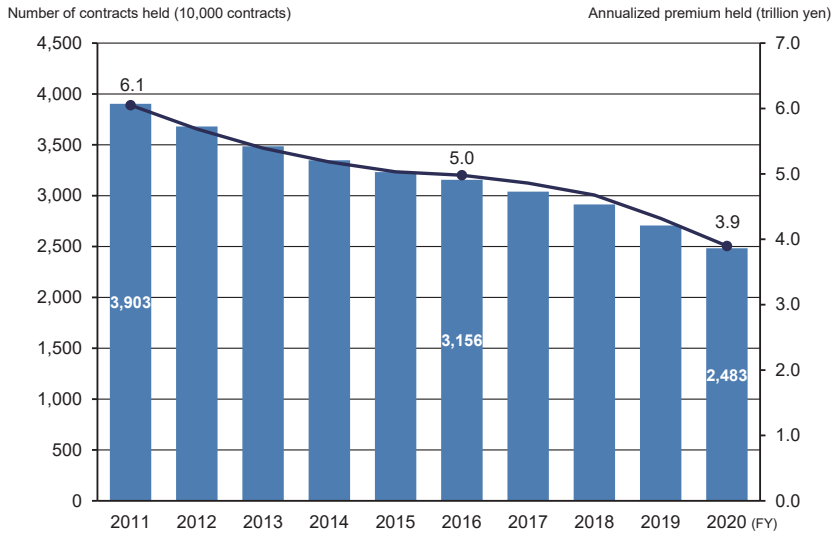
*Figures are sum of the deposits before and after the Japan Post privatization
(Source) Prepared from the statement of accounts of Japan Post Bank

(4) Japan Post Insurance Co., Ltd.

Japan Post Bank conducts business at 82 directly managed offices, while commissioning agency services to about 20,000 post offices.

The number of insurance contracts with Japan Post Insurance (including postal life insurance during the time of the government management) was 24.83 million at the end of fiscal 2020. The number decreased 59.49 million (70.5%) from the peak of 84.32 million at the end of fiscal 1996. Annualized premiums also decreased by 3.8 trillion yen (49.3%) from 7.7 trillion yen at the end of fiscal 2008 to 3.9 trillion yen at the end of fiscal 2020.

Figure 3-9-1-7 Changes in the number of contracts with and annualized premium held by Japan Post Insurance



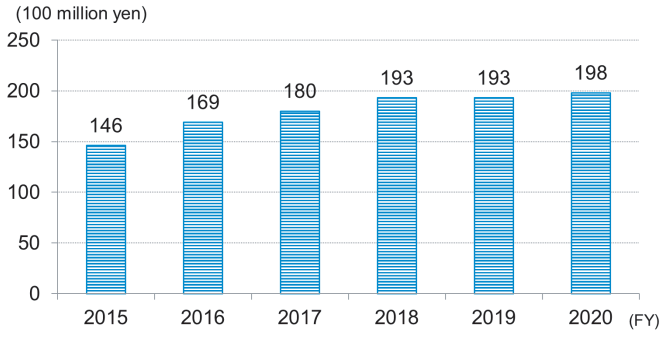
(Source) Prepared from the statement of accounts of Japan Post Insurance

2. Correspondence delivery service

(1) Sales of correspondence delivery service

In fiscal 2020, sales of specified correspondence delivery service was 19.8 billion yen, increasing 2.6% from the previous fiscal year (**Figure 3-9-2-1**).

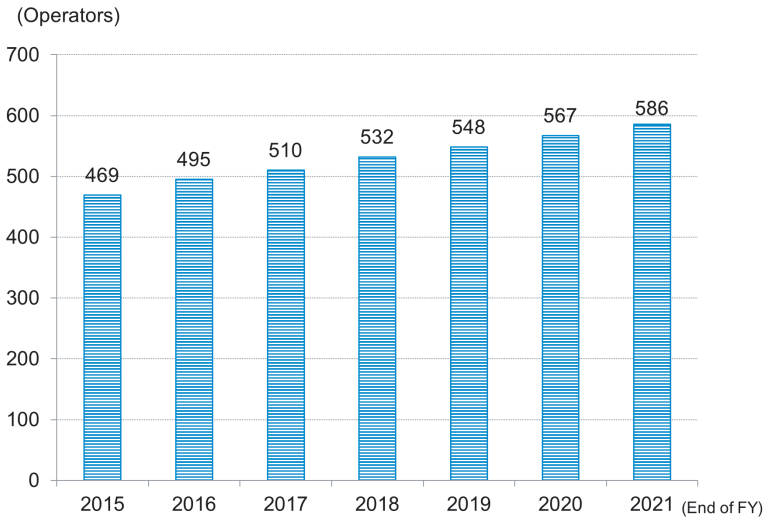
Figure 3-9-2-1 Changes in the sales of correspondence delivery service operators



(2) Number of correspondence delivery service operators

After the enforcement of the Act on Correspondence Delivery by Private Business Operators (Act No. 99 of 2002) in April 2003, there has been no entry into general correspondence delivery service[107], but entry into specified correspondence delivery service[108] is steadily increasing: there were 586 entries as of the end of fiscal 2021 (**Figure 3-9-2-2**). By type of provided service, providers of Class 1 and Class 3 services are increasing.

Figure 3-9-2-2 Changes in the number of correspondence delivery service operators



Related data
Changes in the number of business operators by type of service (specified correspondence delivery service)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-9-9 (Data Collection)

(3) Record of handled correspondences

In fiscal 2020, the number of accepted correspondences was 21.05 million, increasing 1.0% from the previous fiscal year.

Related data
Changes in the amount of accepted correspondence mail
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-9-10 (Data Collection)

Data related to Chapter3
Changes and forecasts for the size of ICT markets in the world (video distribution, music distribution, mobile application, Web conference, router/switch, optical transmission equipment, FTTH equipment, macro cell stations, indoor small cell, LPWA, smartphone, tablets, wearable terminals, domestic/consumer robots, AI speaker, AR/VR, IoT devices)
Source: Omdia
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-R-1 (Data Collection)

[107] "Nationwide full-scale entry" business that can deliver all types of correspondences on condition of providing general correspondence service across the country
[108] Innovative "specified service" business that needs to satisfy either of Specified Correspondences Service Class 1, 2 or 3.